Pennsylvania Statewide Act 129
2014 Non-Residential End Use & Saturation Study

Submitted to the Pennsylvania Public Utility Commission

Submitted By Nexant, Inc.
In partnership with: GDS Associates, Research Into Action, and Apex Analytics

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1 EXECUTIVE SUMMARY

1.1 OVERVIEW

Nexant, Inc. (Nexant), GDS Associates (GDS), Research Into Action, Inc.(Research Into Action), and Apex Analytics LLC (Apex Analytics) – collectively known as the Statewide Evaluation (SWE) Team – have been 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 (Met-Ed)
- Pennsylvania Electric Company (Penelec)
- Pennsylvania Power Company (Penn Power)
- West Penn Power Company (WPP)
- PPL Electric Utilities Corporation (PPL)
- PECO

The first step in this process is to establish baseline energy usage characteristics for the residential, commercial, industrial, and institutional sectors. This report documents the findings of that end use and saturation study in the non-residential sectors, and serves to provide baseline energy using characteristics for the subsequent energy efficiency (EE) potential assessment (see Residential End Use and Saturation Study developed by GDS for residential findings). Primary data was collected for this study from August to December of 2013.

This study evaluates the characteristics of the energy using equipment and building stock present in Pennsylvania for the seven EDC service territories. Nexant used its experience working with the Pennsylvania EDCs as a part of the SWE Team evaluating their current EE programs and performing previous EE potential studies to identify output parameters that will be integral to future resource planning and EE activities in Pennsylvania.

While this study aims primarily to provide inputs to the energy efficiency potential study, it is also designed to serve as a stand-alone end use study, supplying information useful for EE program development, TRM improvement, system planning, and obtaining a general understanding of the energy using equipment present in Pennsylvania. To accomplish these goals, the SWE conducted a survey of Pennsylvania non-residential customers to gather accurate data that is specific to Pennsylvania and the seven EDC service territories included in this study. In order to maximize the reliability of the survey, the SWE aimed to gather information through customer site visits. Therefore, the results of this study rely mainly upon primary research conducted in the form of on-site customer surveys. A review of available secondary sources was also performed in an effort to

streamline and compliment primary research efforts in addition to filling in gaps, either in the presence or quality of data.

1.2 METHODOLOGY

To accurately meet the objectives of this study, the SWE designed an approach which successfully melded the results of both primary and secondary data sources. The study began by analyzing the EDC customer billing data to provide a framework in which to gather additional primary and secondary data. This study evaluated the characteristics of Pennsylvania's building stock by performing 491 commercial and industrial on-site customer surveys in seven EDC territories. These surveys were designed to inventory the current energy using equipment with regards to type, fuel, efficiency, saturations, and operating conditions, as well as document the characteristics of the buildings themselves.

In anticipation of serving as a primary data source for the energy efficiency potential assessment, the SWE designed the study parameters and survey instruments around the anticipated structure and content of the EE potential assessment. On-site surveys were targeted at the customer segments, which provide a representative sample of Pennsylvania businesses. Likewise, the energy end uses included in this study were selected to encompass typical building energy-using equipment. Moreover, the end uses encompass the typical energy efficiency measures in common EE programs.

To provide statistically relevant results that can be reasonably applied to the non-residential population of Pennsylvania, the SWE designed the study sample to produce findings with a ±5% margin of error at the 95% confidence level (95/5) for the entire non-residential population (commercial, institutional, and industrial combined) across the state. Further levels of resolution were developed to characterize differences among EDCs, the commercial, institutional, and industrial sectors and segments within the commercial and institutional sectors. These groupings are based on building types and described in further detail in Section 3.2.1. In developing its sampling strategy, the SWE team used a stratified sampling approach based on "highest potential impact" with the targeted minimum confidence/precision criteria as follows:

- 95/5 for the statewide non-residential population
- 90/10 for each statewide sector: commercial, industrial, and institutional
- 90/10 for each EDC's non-residential sector
- 90/20 for major commercial and institutional segments at the statewide level

1.3 STATE WIDE FINDINGS RESULTS

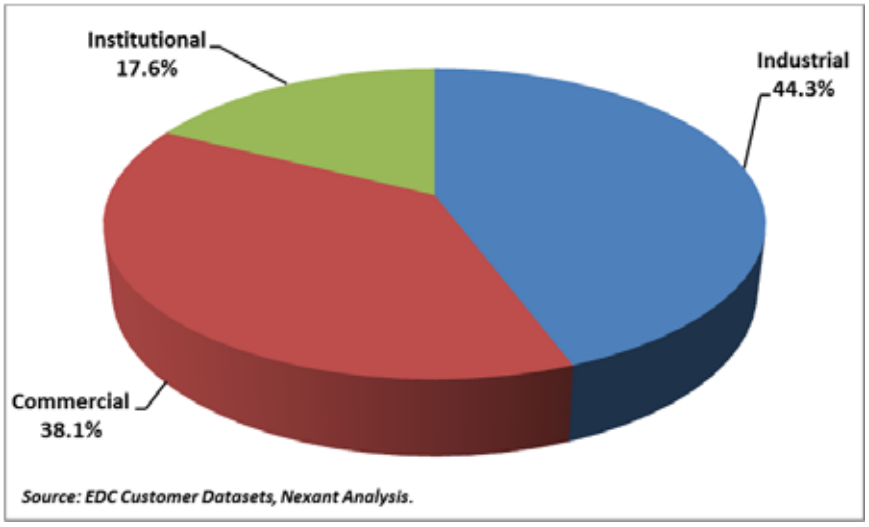
This study evaluates customers associated with the non-residential electric supply loads of the seven largest EDC territories. Because this study presents findings on building premises, energy findings

presented below do not include transmission, substation, irrigation, or lighting (street and non-building related exterior) rate classes.[1] Through analysis of EDC customer databases, on-site surveys, and secondary research, the SWE was able to break out the non-residential energy usage by sector, segment, end use, and EDC. Results are presented below.

1.3.1 Electricity Consumption by Sector

Figure 1-1, Figure 1-2, and Table 1-1 show the overview of the non-residential premise counts and electric sales by sector by EDC in Pennsylvania for calendar year 2012.[2] In the Phase I Baseline Study, the institutional and commercial sectors were combined as the commercial sector. However, this study has broken out the institutional sector. [3] Also, it should be noted that premise counts and consumptions listed below were divided into sectors and segments based on customer building type, and not by rate class. Thus, the sectors and segments listed for each EDC may not be equal in definition to the way each EDC defines them.

Figure 1-1: 2012 Statewide Electricity Sales by Sector



[1] "Transmission" and "substation" classes used in this context refer to non-premise accounts as defined in Section 3.2.2.

[2] The findings presented below represent total sales associated with all premises across each EDC. Many non-premise accounts (i.e., accounts that represent non-buildings such as street lights) were removed from the analysis. See Section 3.2.2 for more details on the SWE's definition of a "premise"

[3] The definition of institutional used for this study doesn't exactly align with Act 129's definition of institutional, which defines institutional as "government, including municipalities, school districts, institutions of higher education and nonprofit entities." Since "nonprofit" cannot be isolated as a building type, this study utilized health and religious facilities as a proxy.

Figure 1-2: 2012 Statewide Electricity Sales by Sector by EDC

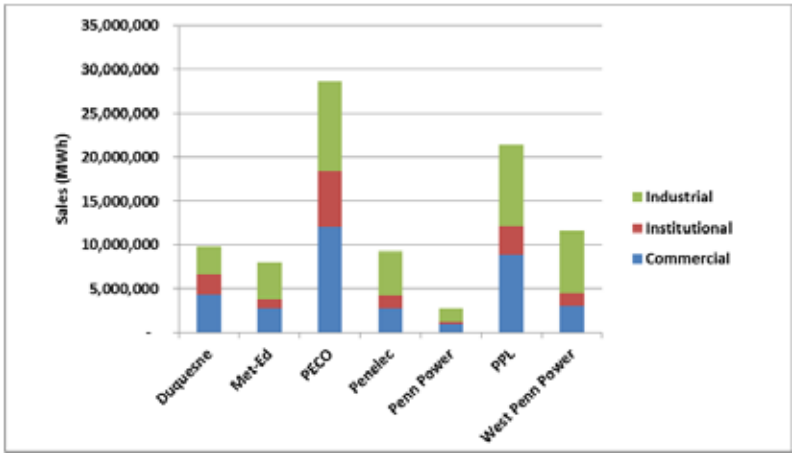


Table 1-1 shows that PECO is the largest EDC, both in terms of non-residential premises and sales, with 31.5% and 31.3%, respectively. Penn Power is the smallest EDC in both premises and sales, with 3.2% and 3.0%, respectively.

Table 1-1: 2012 Statewide Premise Counts and Sales by Sector by EDC

EDC	2012 Premises			
	Industrial	Commercial	Institutional	Total
Duquesne Light	1,552	32,745	6,013	40,310
Met-Ed	5,425	30,318	5,957	41,700
PECO	14,895	104,893	24,592	144,380
Penelec	6,862	41,144	6,910	54,916
Penn Power	1,791	10,620	2,114	14,525
PPL	11,351	81,916	7,082	100,349
West Penn Power	7,079	48,101	7,283	62,463
Statewide	**48,955**	**349,737**	**59,951**	**458,643**

EDC	2012 Sales (MWh)			
	Industrial	Commercial	Institutional	Total
Duquesne Light	3,197,591	4,335,423	2,298,897	9,831,911
Met-Ed	4,155,148	2,838,591	1,028,190	8,021,929
PECO	10,214,631	12,070,232	6,300,135	28,584,998
Penelec	5,061,669	2,825,353	1,398,932	9,285,954
Penn Power	1,551,502	927,210	290,162	2,768,874
PPL	9,242,444	8,854,211	3,268,817	21,365,473
West Penn Power [(1)]	7,069,183	2,997,566	1,502,194	11,568,943
Statewide	**40,492,169**	**34,848,579**	**16,087,326**	**91,428,074**

Source: EDC Customer Datasets, Nexant Analysis

[(1)] May 2012 through April 2013 was used for West Penn Power due to the company's acquisition by First Energy and subsequent customer account record transition

1.3.2 Electricity Consumption by Segment

Figure 1-3 and Table 1-2 show the breakdown of energy consumption and building stock by commercial segment. Figure 1-4 and Table 1-3 show the same breakdown by institutional segment and Figure 1-5 and Table 1-4 show a similar breakdown by industrial segment. In the commercial sector, the office segment consumes the largest share of electricity (29.3%). The office segment also comprises more than one billion square feet of floor space, which amounts to approximately 36% of the total commercial floor space.[1]

Figure 1-3: 2012 Statewide Electricity Consumption by Commercial Segment

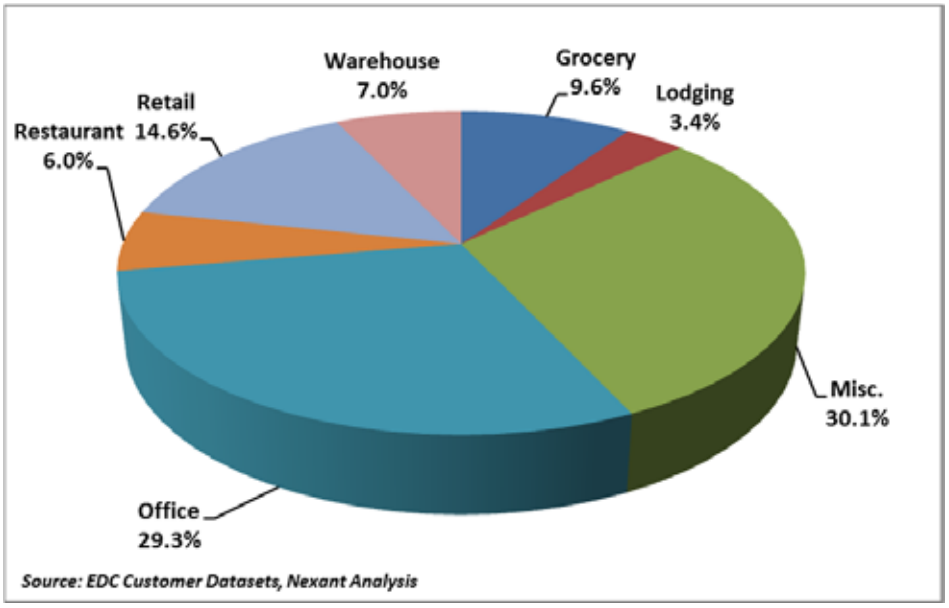


Table 1-2: 2012 Statewide Electricity Consumption by Commercial Segment

Segment	Building Stock (ft^2)	Consumption (MWh)	Electricity Share
Grocery	95,517,758	3,333,570	9.6%
Lodging	108,459,618	1,171,364	3.4%
Misc.	946,169,568	10,502,482	30.1%
Office	1,062,801,995	10,202,899	29.3%
Restaurant	77,214,860	2,100,244	6.0%
Retail	332,410,186	5,085,876	14.6%
Warehouse	335,910,359	2,452,146	7.0%
Total	**2,958,484,344**	**34,848,579**	**100%**

Source: EDC Customer Datasets, On-site Surveys, Nexant Analysis

[1] Square footages derived from EDC consumption data and building energy use intensities.

The education segment is the largest energy consumer in the institutional sector and also accounts for more than one half billion square feet or 38% of the institutional sector's floor space.

Figure 1-4: 2012 Statewide Electricity Consumption by Institutional Segment

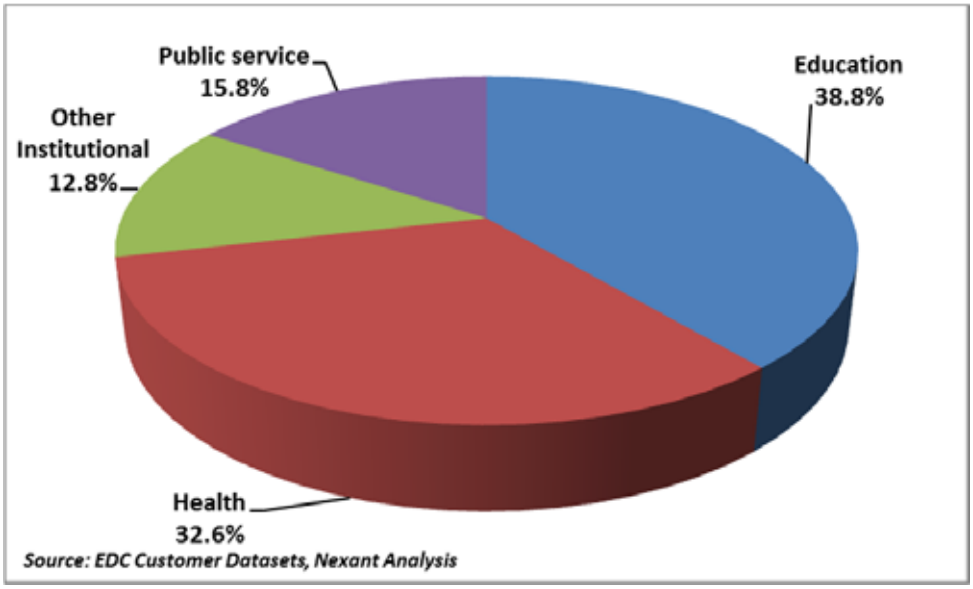


Table 1-3: 2012 Statewide Electricity Consumption by Institutional Segment

Segment	Building Stock (ft^2)	Consumption (MWh)	Electricity Share
Education	520,202,404	6,242,429	38.8%
Health	310,678,828	5,250,472	32.6%
Other Institutional	336,357,236	2,051,779	12.8%
Public Service	208,413,603	2,542,646	15.8%
Total	**1,375,652,071**	**16,087,326**	**100.0%**

Source: EDC Customer Datasets, Nexant Analysis

"Other manufacturing" leads the consumption in the industrial sector (26.1%) followed by the manufacturing of metals consuming the second largest share of electricity in the industrial sector (20.8%).[1]

[1] Other manufacturing consists of a variety of manufacturing types such as apparel, furniture, leather, lumber, textile, tobacco, and misc.

Figure 1-5: 2012 Statewide Electricity Consumption by Industrial Segment

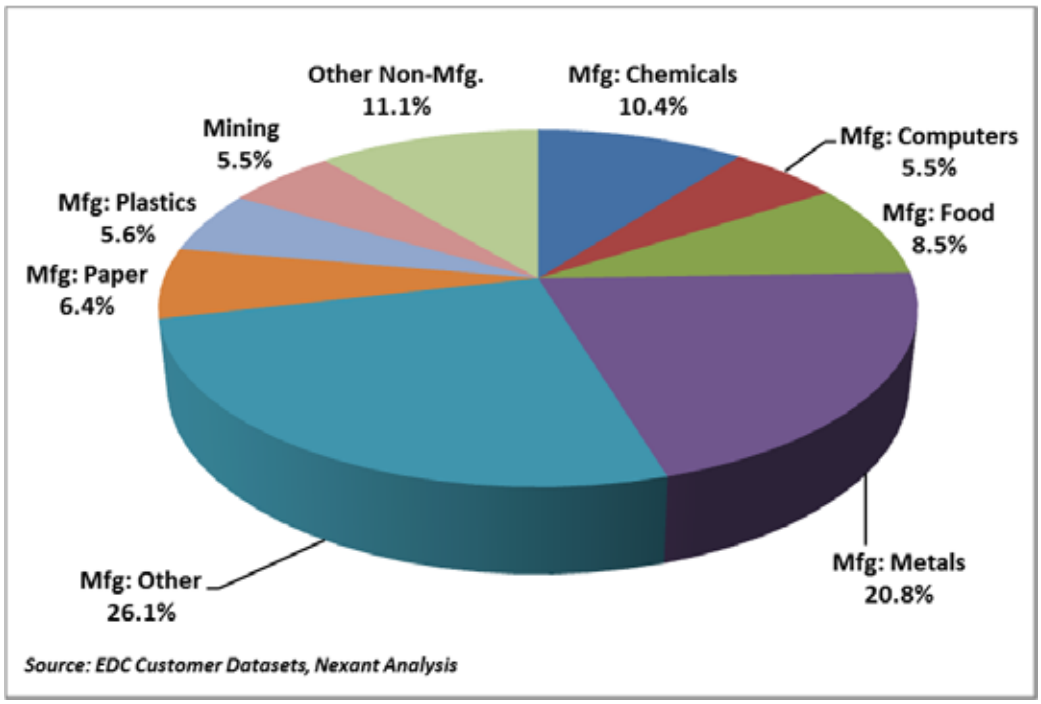


Table 1-4: 2012 Statewide Electricity Consumption, by Industrial Segment

Segment	Consumption (MWh)	Electricity Share
Mfg: Chemicals	4,220,720	10.4%
Mfg: Computers	2,244,176	5.5%
Mfg: Food	3,443,710	8.5%
Mfg: Metals	8,442,606	20.8%
Mfg: Other	10,556,491	26.1%
Mfg: Paper	2,582,251	6.4%
Mfg: Plastics	2,256,922	5.6%
Mining	2,236,866	5.5%
Other Non-Mfg.	4,508,426	11.1%
Total	**40,492,169**	**100.0%**

Source: EDC Customer Datasets, Nexant Analysis

1.3.3 Electricity Consumption by End Use

Figure 1-6 through Figure 1-8 show how energy is consumed by end use in the commercial, institutional, and industrial sectors, respectively. For commercial and institutional buildings, HVAC systems consumed the largest share of electricity in buildings (36% and 42%). The "Other" end use represents primarily pumps and other miscellaneous loads in buildings. In the industrial sector,

motors consume the largest share (40%) of all the electricity across the state. Process loads (heating, cooling and electro-chemical) make up another 24% of the electricity consumption in the industrial sector.

Figure 1-6: 2012 Statewide Commercial Sector System Electricity Usage by End Use

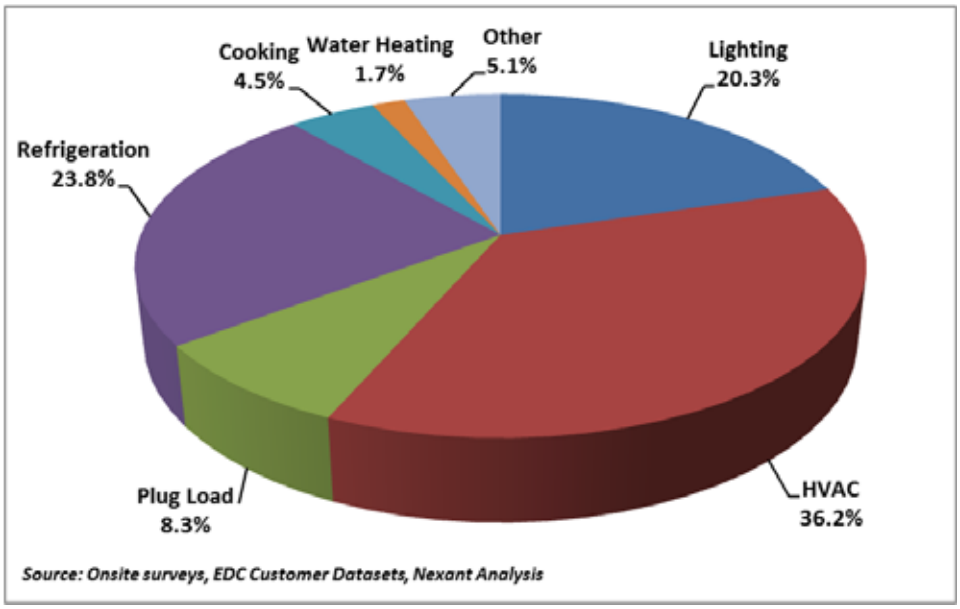


Figure 1-7: 2012 Statewide Institutional Sector System Electricity Usage by End Use

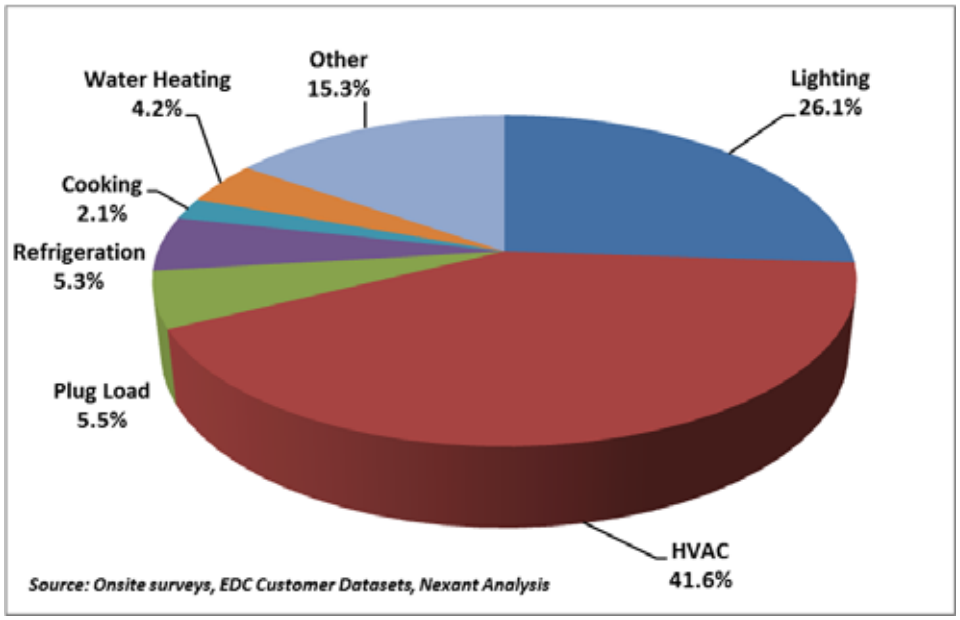
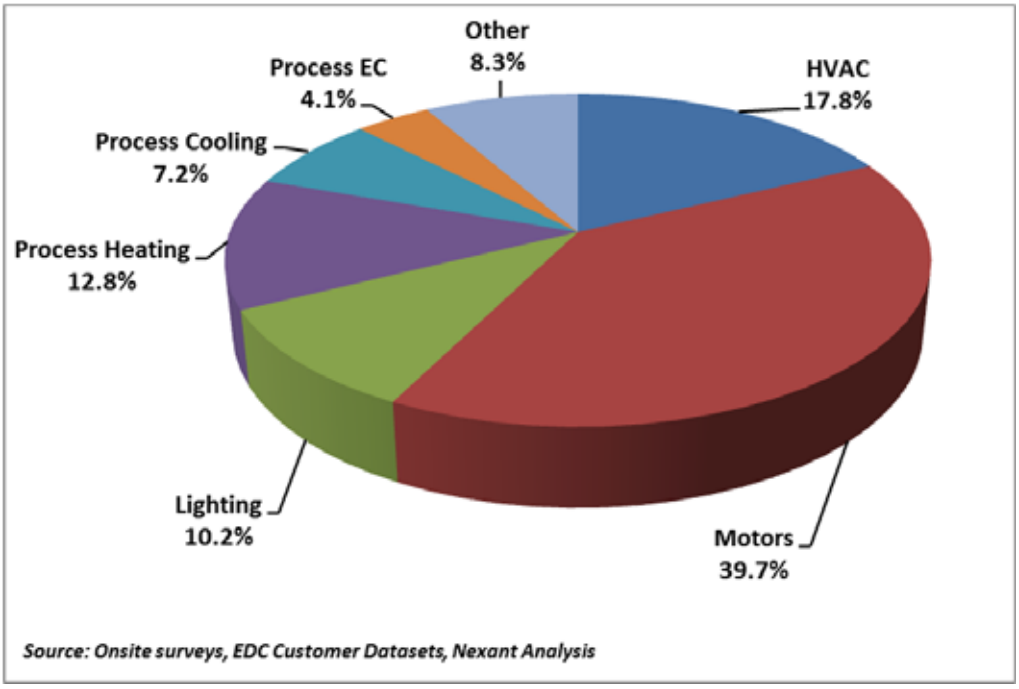


Figure 1-8: 2012 Statewide Industrial Sector System Electricity Usage by End Use



1.3.4 Penetration & Fuel Share

Table 1-5 shows the penetrations of different end uses in the non-residential sector along with fuel shares of those end uses. Penetration is defined as the percentage of buildings with a given end use present. In some cases penetration is also given for equipment types, in which case it refers to the percentage of buildings that have a specific equipment type present in buildings with the relevant end use.[1] Space cooling is present in 84.3% of the buildings surveyed with cooking and refrigeration present in 27.9% and 35.0% of the buildings, respectively. Fuel share is an important metric for energy efficiency program planning for the EDCs in Pennsylvania since they only provide electric service to their customers. Fuel share is calculated differently by end use to account for differences in end use characteristics. Please refer to the accompanying note under Table 1-5 for clarification.

[1] A full explanation of reporting terminology (e.g., "penetration" or "saturation") can be found in Section 3.5.3

Table 1-5: Non-Residential End Use Penetration and Fuel Shares

End Use	Penetration	Fuel Share				
		Electric	Natural Gas	Fuel Oil	Other [2]	n-values[4]
Lighting	100.0%	100.0%	0.0%	0.0%	0.0%	-
Space Heating[3]	100.0%	6.8%	84.4%	4.3%	4.5%	449
Space Cooling	84.3%	100.0%	0.0%	0.0%	0.0%	-
Plug Load	100.0%	100.0%	0.0%	0.0%	0.0%	-
Refrigeration	35.0%	100.0%	0.0%	0.0%	0.0%	-
Cooking	27.9%	53.3%	42.5%	0.0%	4.2%	659
Water Heating[3]	92.7%	37.8%	56.3%	1.9%	3.8%	540
Other [1]	100.0%	100.0%	0.0%	0.0%	0.0%	-

[1] "Other" End Use includes pumps, motors, and misc. equipment
[2] "Other" fuel share includes LPG, purchase HW or steam, wood, and misc. fuels
[3] Fuel shares for space heating and water heating are based on square footage served and tank capacity, respectively. All others are per premise
[4] n-values for fuel share only

1.3.5 Energy Use Intensity by End Use, by Commercial Segment

Energy use intensity (EUI) is a useful metric to measure how much electricity is consumed annually per square foot of building space and provides insight into how different building types and end uses consume electricity. The SWE calculated the EUI for each end use studied. These findings serve as crucial inputs into the market potential study for the commercial and institutional sectors and were calculated based on the findings from the on-site surveys, monthly billing data and secondary data. Table 1-6 shows the EUI by end use for segments in the commercial sector while Table 1-7 shows the EUI by end use for segments in the institutional sector. The grocery segment, with a large refrigeration load, is the most energy-intensive at 34.9 kWh/ft². On the other end of the spectrum, warehouse is the least energy-intensive segment in the commercial sector using only 7.3 kWh/ft².

Table 1-6: Energy Use Intensity (annual kWh/ft²) by End Use, Commercial Segment

End Use	Grocery	Lodging	Misc.	Office	Restaurant	Retail	Warehouse	Weighted Average [(1)]
Lighting	5.5	2.2	3.6	1.8	2.6	3.3	1.4	2.9
HVAC	5.5	5.5	4.4	4.6	7.2	8.0	2.6	5.2
Plug Load	0.7	0.5	0.6	2.5	0.5	0.5	0.3	1.2
Refrigeration	21.5	1.0	1.1	0.5	7.6	1.4	1.9	3.4
Cooking	0.5	0.7	0.3	0.0	8.0	0.0	0.0	0.6
Water Heating	0.2	0.0	0.2	0.1	0.3	0.9	0.2	0.2
Other	1.1	0.8	1.0	0.0	0.9	1.2	1.0	0.7
Total	**34.9**	**10.8**	**11.1**	**9.6**	**27.2**	**15.3**	**7.3**	**14.3**

Source: On-site Surveys, CBECS[1], Nexant Analysis
[(1)] Each end use average is weighted upon 2012 segment energy consumptions

Table 1-7: Energy Use Intensity (annual kWh/ft²) by End Use, Institutional Segment

End Use	Education	Government	Healthcare	Other Institutional	Weighted Average[(1)]
Lighting	2.1	2.1	5.3	1.7	3.1
HVAC	5.2	7.7	4.6	2.3	5.0
Plug Load	0.7	1.1	0.6	0.3	0.7
Refrigeration	0.8	1.2	0.3	0.4	0.6
Cooking	0.3	0.4	0.2	0.1	0.3
Water Heating	0.7	1.1	0.0	0.3	0.5
Other	2.2	3.4	1.0	1.0	1.8
Total	**12.0**	**16.9**	**12.2**	**6.1**	**12.0**

Source: On-site Surveys, CBECS, Nexant Analysis
[(1)] Each end use average is weighted upon 2012 segment energy consumptions

1.3.6 EDC Specific Findings

This section presents findings of the non-residential sector broken out by EDC. Non-residential is defined as the combined results of the commercial, industrial, and institutional sectors. While total statewide non-residential results are weighted by EDC premise counts, non-residential data presented by EDC in this section has not been weighted. Findings are generally presented on a per premise basis but also are presented on connected loads, capacities, and fixture counts as

[1] *Commercial Buildings Energy Consumption Survey*, Energy Information Administration

appropriate. Each table or figure denotes the basis for which the penetrations or saturations were calculated.

1.3.6.1 End Use Penetrations

Table 1-8 shows the end use penetrations observed by EDC. Space cooling ranged from 76.8% in PPL to 91.4% in West Penn Power with an average of 84%. Water heating showed a higher average penetration than space cooling at 86.4% while cooking and refrigeration averaged 28% and 35%, respectively.

Table 1-8: Non-Residential End Use Penetration by EDC

End Use	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Lighting	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Space Heating	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Space Cooling	82.9%	84.3%	88.7%	79.5%	86.8%	76.8%	91.4%
Plug Load	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Refrigeration	34.3%	30.0%	33.8%	38.4%	29.4%	29.0%	50.0%
Cooking	25.7%	24.3%	22.5%	37.0%	22.1%	23.2%	38.6%
Water Heating	87.1%	84.3%	81.7%	80.8%	88.2%	91.3%	91.4%
n-value	70	70	71	73	68	69	70

**** Penetrations calculated on a per premise basis***

1.3.6.2 Lighting

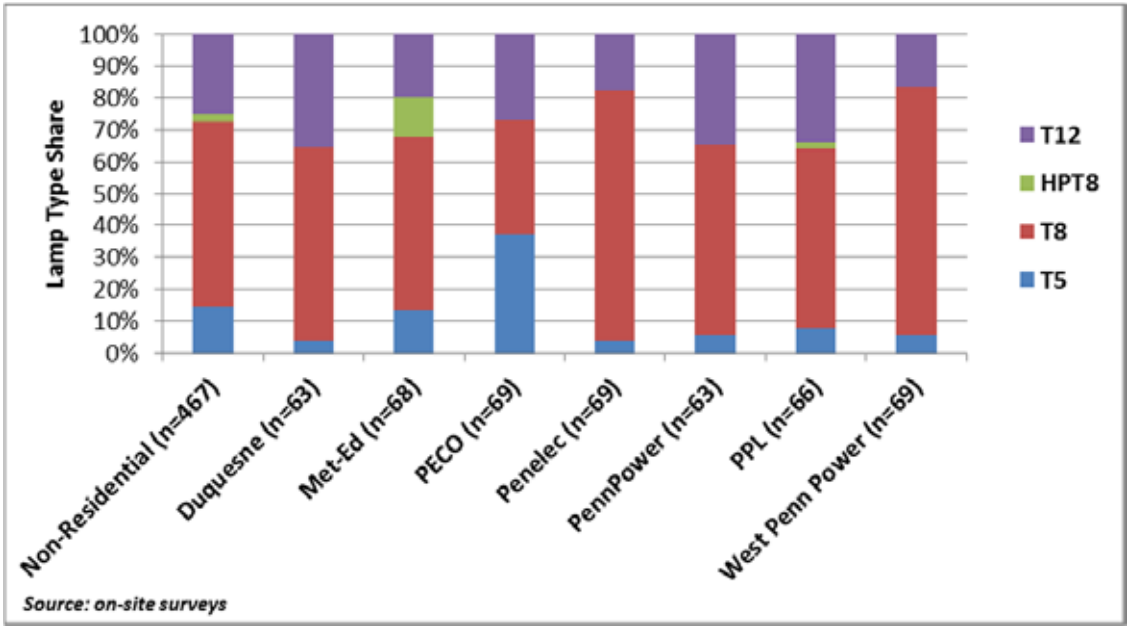
Table 1-9 details the lighting types used in each EDC as a percent of connected load. Connected load was calculated by multiplying fixture counts by applicable lamp wattages, ballast factors, and lamp counts. Linear fluorescents dominate the lighting types with an average of 77% of the connected load. Incandescent and metal halide lighting also show notable shares of the connected load and are dependent upon heavy saturations in the restaurant and warehouse segments, respectively (see Section 4.3.2 for more information).

Table 1-9: Lighting System Technology Shares by EDC (% of Connected Load)

Type	Non-Residential	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Linear Fluorescent	77.1%	80.8%	90.5%	83.1%	73.0%	77.1%	68.6%	80.9%
CFL	2.8%	4.7%	1.3%	2.6%	7.0%	2.7%	2.2%	1.1%
Incandescent	6.8%	4.5%	3.2%	9.9%	7.6%	5.8%	2.5%	6.9%
Metal Halide	10.3%	9.6%	4.6%	2.5%	4.4%	13.3%	24.2%	6.8%
High Pressure Sodium	1.5%	0.0%	0.3%	0.0%	7.5%	1.0%	0.2%	2.8%
Mercury Vapor	0.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.3%	0.1%
LED	0.3%	0.1%	0.0%	1.1%	0.2%	0.0%	0.0%	0.1%
Neon	0.1%	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%
Other	0.9%	0.1%	0.0%	0.6%	0.3%	0.0%	2.0%	1.4%
n-value	491	70	70	71	73	68	69	70

Diving further into linear fluorescent lighting, Figure 1-9 displays the share of different linear fluorescent types by total fixture count in each EDC. That is, T12 share ranged from 17% in Penelec and West Penn Power to 35% in Duquesne and Penn Power. With the exception of PECO, the average EDC T5 share was 7% (11% with PECO included).

Figure 1-9: Linear Fluorescent Lamp Type Saturation by EDC



Findings presented on a per fixture basis

(1) HPT8 saturation in Met-Ed highly influenced by very large surveyed facility with nearly all HPT8s installed

(2) T5 saturation in PECO highly influenced by very large surveyed facility with nearly 85% T5 fixtures installed

T12 Stockpiling

One other important component of this study involves the stockpiling of T12 lamps and ballasts. If Pennsylvania businesses maintain a large inventory of T12 replacement lamps and ballasts, this would suggest delaying the baseline shift for linear fluorescent fixtures (i.e., businesses would take longer to go through their existing stock of replacements prior to purchasing the new, efficient bulbs). While on-site, the SWE team engineers asked the site contact of each facility with at least one T12 fixture to estimate how many extra lamps and ballasts they currently had in storage to replace installed equipment when it burned out.

Table 1-10 shows the distribution of the 297 responses by EDC across the state. Most customers reported keeping enough lamps in storage to replace less than 10% of the active T12 bulbs in their facility and stockpiling behavior in attempt to delay fixture retrofits was uncommon. Met-Ed and West Penn Power were the two EDCs with the highest percent of spare lamps in Table 1-10. Each of these EDCs had one participant with a large number of T12 fixtures who reported purposely maintaining a large inventory of T12 lamps because they wished to avoid a lighting retrofit project and were unsure how long they would be able to purchase the lamps.

Table 1-10: Percentages of Replacement T12 Lamps Currently in Storage

EDC	Sites with T12 Fixtures	Total Count of T12 Lamps	Total Count of Replacement Lamps in Storage	Percent of Lamps
Duquesne	36	3,099	210	6.8%
Met-Ed	49	9,283	1,393	15.0%
PECO	51	4,934	356	7.2%
Penelec	40	5,628	199	3.5%
Penn Power	37	4,781	334	7.0%
PPL	40	7,187	389	5.4%
West Penn Power	44	4,520	458	10.1%
Statewide Total	**297**	**39,432**	**3,339**	**7.4%[(1)]**

Source: on-site surveys

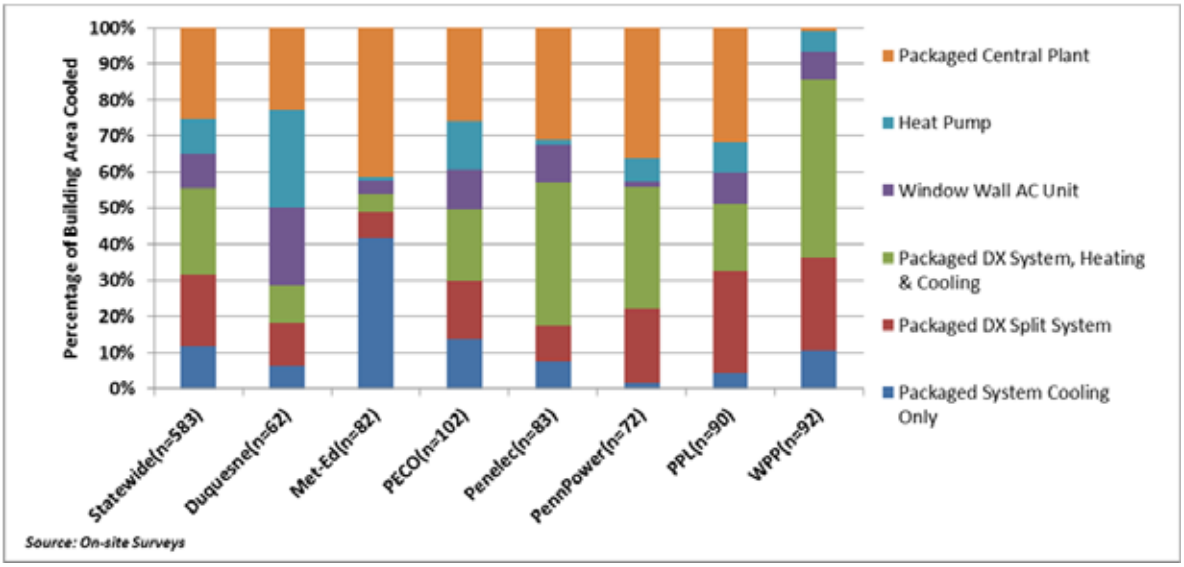
[(1)] Statewide total percentage is weighted by EDC and is not a straight average of the percentages for each EDC

1.3.6.3 Heating, Ventilation, and Cooling (HVAC)

Figure 1-10 depicts the percentage of square footage served by different types of cooling equipment. Each HVAC system surveyed during site visits was noted with an associated 'square footage served' based upon on site interviews and/or direct observation. Packaged central plants (i.e., systems with chillers) have the highest average saturation of 27.2% across all EDCs because

they typically serve large areas. The two most popular systems, DX split and packaged heating and cooling systems, account for an average of almost half (42.3%) of all building area with cooling.

Figure 1-10: Percentage of Building Area Cooled by Equipment Type, by EDC

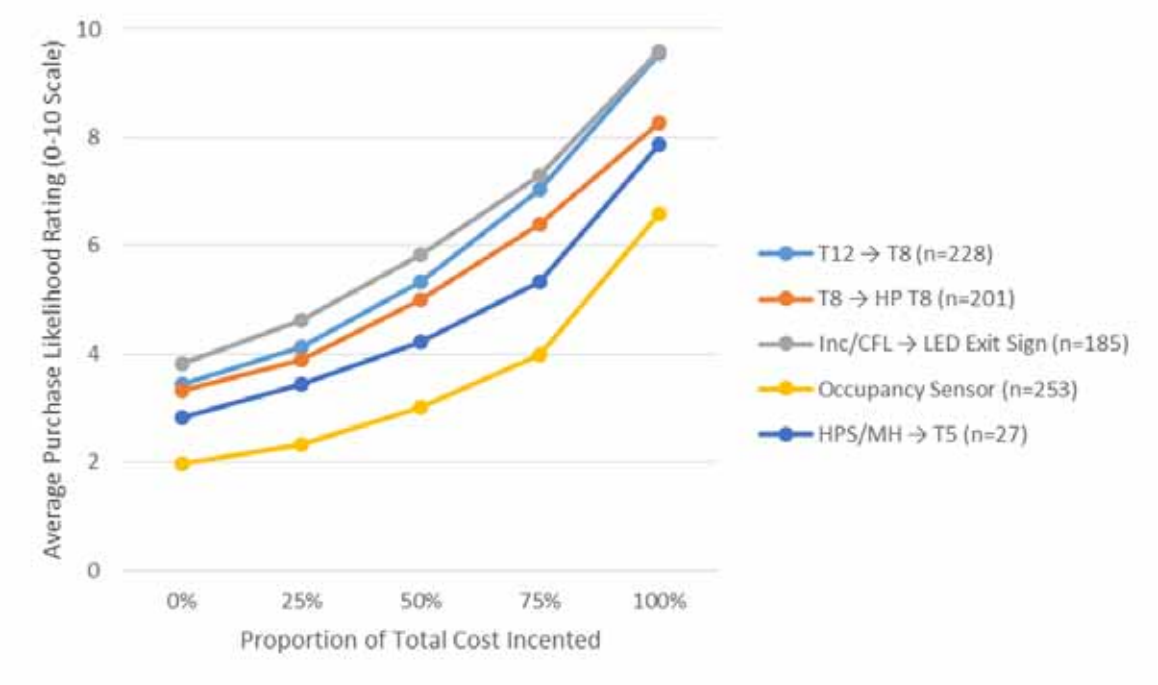


1.3.7 Willingness To Pay Findings

The objective of the non-residential baseline study's willingness-to-pay exercise was to gauge non-residential customers' relative purchase likelihood (or willingness-to-pay) for five non-residential energy efficiency measures under a series of pricing scenarios designed to mimic the incentives of a hypothetical consumer-focused energy efficiency program (see Chapter 6 for a complete discussion of methods and findings). Respondents used a 0-to-10 scale to rate their likelihood of upgrading their currently installed inefficient equipment to more efficient equipment at varying incentive levels (from 0% to 100% of the measure cost incented).

Respondents' average reported purchase likelihood for each of the measures in the willingness-to-pay exercises increased at each offered incentive level (0%, 25%, 50%, 75%, and 100% of the total measure cost) (Figure 1-11). In general, respondents were highly price sensitive for each lighting replacement measure and reported relatively low purchase likelihoods without being offered a discount (0% purchase discount). This suggests that non-residential customers will likely consider early replacement of lighting fixtures in their buildings/facilities if an appropriate incentive is offered.

Figure 1-11: Average Purchase Likelihood by Incentive Level



Source: on-site surveys

Even at a 100% purchase discount (full cost is covered by the EDC), average purchase likelihoods were less than 'extremely likely' (rating of "10") for three of the five measures. This suggests there are other non-financial barriers that may limit the success of a future incentive program.

1.3.8 Changes Between Phase I and Phase II Findings

This section presents a summary of the changes between the Phase I and Phase II baseline study findings noted in Chapter 7. Some changes, such as penetrations of linear fluorescent lamp types, are not directly comparable since the two studies used different bases for counting. The Phase I data for penetrations of linear fluorescent lamp types were collected on a "per square foot served" basis while this study's data are collected on a connected load basis. Chapter 7 discusses the nuances of changes between Phases in more detail. However, comparing the data allows some qualitative conclusions to be made about the buildings surveyed in the two study samples:

- End uses that can be fueled by either natural gas or electricity have increasingly become fueled by natural gas. This trend was consistent among space heating, cooking, and water heating.

- Space cooling equipment penetration has increased. The increase in share of sampled buildings with cooling equipment was due primarily to higher percentages of surveyed buildings with heat pumps and packaged DX (heating and cooling) systems.

- Furnaces have an increased share of all surveyed space heating equipment types while central heating plants and unit heaters have decreased in share in the buildings surveyed.

- Programmable thermostats have increased in share of all HVAC system controllers while manual thermostats have decreased in share in the buildings surveyed.

- The use of T12 linear fluorescent lights has decreased while the use of T8 and T5 lights have both increased in the buildings surveyed.

- The use of incandescent exit signs has decreased while the use of CFL and LED exit signs have both increased in the buildings surveyed.

Shown below are samples of changes noted between the studies which are counted using the same basis in both studies, allowing for straightforward review. Figure 1-12 shows the change in shares of exit signs. LED signs have seen a growth in share, largely lead by the restaurant and education segments, with 62% and 64% LED shares, respectively.

Figure 1-12: Comparison of Exit Sign Bulb Type Saturation by Total Fixture Count

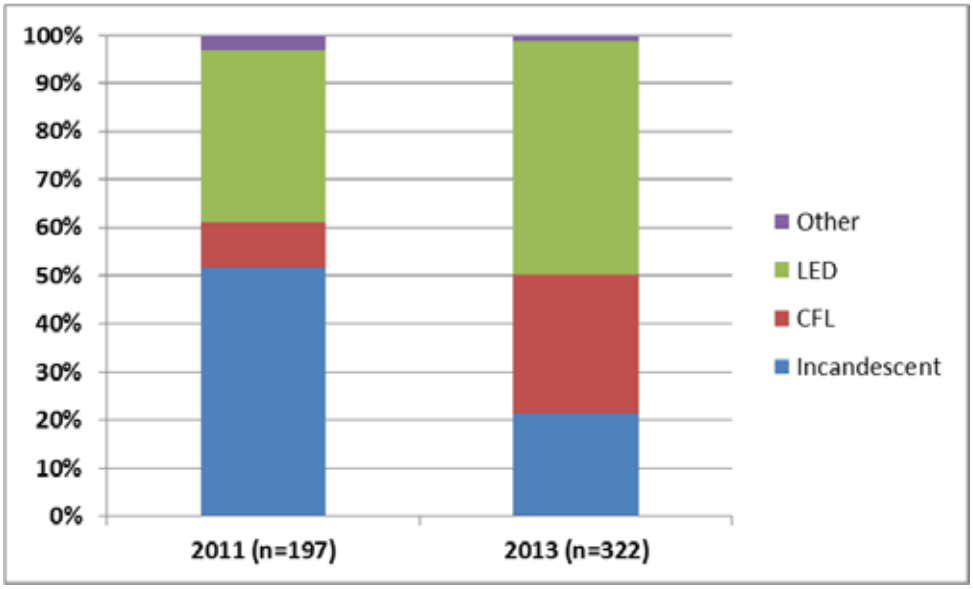
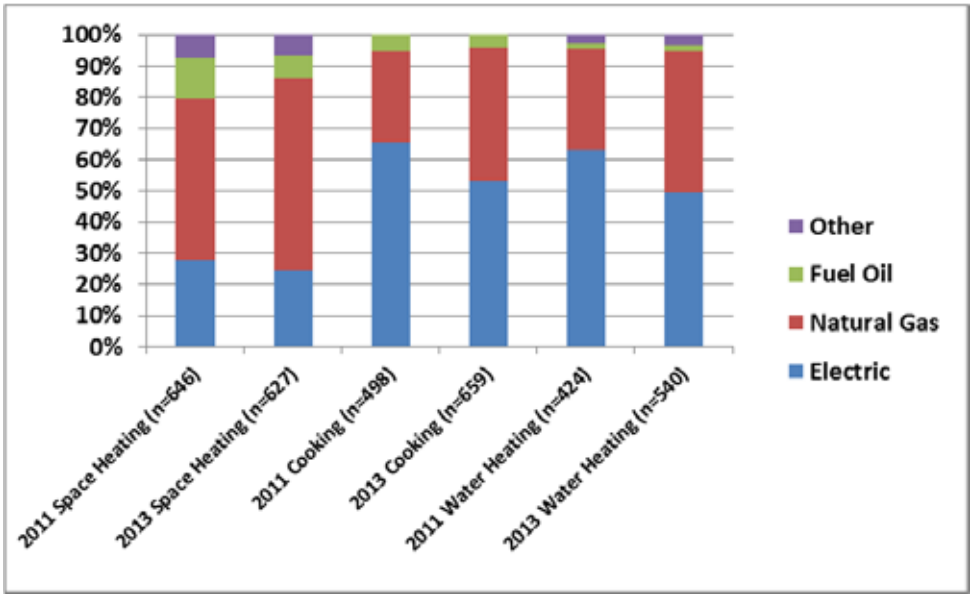


Figure 1-13 shows a comparison of fuel shares for end uses that are not exclusively electric. In the case of every end use, natural gas has increased and electricity has decreased. Specifically, the fuel share for natural gas has increased by an average of 12% and the fuel share for electricity has decreased by an average of 10% in the buildings surveyed.

Figure 1-13: Comparison of Fuel Shares for End Uses That Are Not Exclusively Electric by Total Counts



All end-uses are presented on a per unit basis to provide a direct comparison to Phase I findings

1.3.9 Appendices

Appendices at the end of this report include the on-site survey instrument utilized, recruitment letters and phone scripts, and mapping tables used to map business types to commercial building types.

2 INTRODUCTION

2.1 OVERVIEW

In response to RFP 2012-8, GDS and its subcontractors (Nexant, Research Into Action, and Apex Analytics) were selected by the PUC to conduct a EE C&I market potential study to help inform the implementation of Phase III of Act 129. As a first step in this process, the SWE (GDS and its subcontractors) conducted an end use and saturation study to characterize the energy usage in the State of Pennsylvania for the seven EDCs bound by Act 129. The SWE conducted a survey of Pennsylvania non-residential customers to gather accurate data that is specific to Pennsylvania and the seven EDC service territories included in this study. In order to maximize the reliability of the survey, the SWE aimed to gather information through customer site visits. Therefore, the results of this study rely mainly upon primary research conducted in the form of on-site customer surveys. A review of available secondary sources was also performed in an effort to streamline and compliment primary research efforts in addition to filling in gaps, either in the presence or quality of data. This baseline study not only provides useful insights into the manner in which energy is consumed in the state, but also provides important inputs into the calculation of energy efficiency potentials.

2.2 ACT 129 BACKGROUND

Pennsylvania Act 129 was passed in October of 2008 and signed into law.
The Act charged the seven largest EDCs in the state to deliver energy efficiency programs that reduce their electric load. Specifically, the Phase II Implementation Order required the seven EDCs meet the following targets as shown in Table 2-1 below. The PUC is currently considering targets for the possible implementation of Phase III of Act 129 starting June 1, 2016.

Table 2-1: Energy Reduction Targets

EDC	Phase II MWh/yr Reduction Target
Duquesne	276,722
Met-Ed	337,753
PECO	1,125,851
Penelec	318,813
Penn Power	95,502
PPL	821,072
West Penn Power	337,533

2.3 STUDY GOALS

While this study aims primarily to provide inputs to the energy efficiency potential study, it is also designed to serve as a stand-alone end use study, supplying information useful for EE program development, TRM improvement, system planning, and obtaining a general understanding of the

energy using equipment present in Pennsylvania. With consideration for these ultimate uses of this research, the following goals have been identified for this study:

- Profile non-residential electric customers at the sector and end use level.
- Determine the current saturation of energy using equipment in non-residential facilities.
- Determine the current saturation of energy efficiency measures in the non-residential sectors.
- Determine current end use fuel share at the segment and sector levels.
- Determine average levels of annual energy use by end use.

Using these objectives as a framework, the SWE designed this study to provide reasonable, defensible results to inform the potential study and facilitate improved system planning.

2.4 ORGANIZATION OF THE REPORT

The remainder of this report includes the following sections:

- Section 3 – Study Methodology
- Section 4 – Statewide Commercial, Industrial, and Institutional Findings
- Section 5 – EDC Specific Non-residential Findings
- Section 6 – Willingness To Pay Findings
- Section 7 – Changes in Phase I and Phase II Findings
- Appendices – *On-site Survey Instrument, Recruitment Letter, Telephone Script, End Use Descriptions, Mapping Tables*

3 METHODOLOGY

3.1 OVERVIEW

To accurately meet the objectives of this study, the SWE designed an approach which successfully melded the results of both primary and secondary data sources. The study began by analyzing customer billing data to provide a framework in which to gather additional primary and secondary data. The SWE then conducted on-site surveys to gather the equipment and facility characteristics of Pennsylvania non-residential customers. The SWE also reviewed secondary end use studies such as the Phase I Baseline Study Report, "2006 California Commercial End use Survey," and the U.S. Energy Information Administration's Commercial Buildings Energy Consumption Survey (CBECS).

Results in this study are presented at varying levels of resolution with varying levels of confidence for different data points. A total of 491 site surveys stratified by EDC, segment, and sector were planned across the state. Where appropriate, the number of observations or "n-values" is included with each table and figure. At the statewide level, sufficient numbers of on-site surveys were available to make reasonable conclusions about each of the commercial and institutional segments highlighted in this report. Therefore, data in the statewide section presents results by sector and by segment (though the number of surveys conducted by segment varies, and with that the confidence level varies by segment). The sample size was not large enough, nor was it intended, to provide segment specific results within each EDC (e.g., to compare offices or restaurants across the different EDCs) or within the industrial sector.

Finally, unlike the statewide end use study conducted in Pennsylvania during 2011 and 2012, this study included data collected from the PECO service territory in addition to the other six EDCs. This allowed PECO specific data to be presented in the same context as the other EDCs as well as integrate more seamlessly into all statewide findings.

3.2 CUSTOMER DATA CHARACTERIZATION

The SWE was provided with customer billing databases of each EDC's non-residential accounts. The first step in this study was to evaluate these datasets in order to appropriately structure the study's research and focus so a representative sample could be drawn. The databases included rate codes, 2012 annual sales (May 2012 through April 2013 was used for West Penn Power due to the company's acquisition by First Energy and subsequent customer account record transition), and SIC codes for non-residential customers.

3.2.1 Segments

In order to achieve maximum resolution in this study, the SWE worked with the PUC and the EDCs to define appropriate segment divisions for the commercial and institutional sectors. The sample and survey design was then based off of these segments. These segments are shown in Table 3-1 below.

Table 3-1: Sectors and Segments Defined in Study

Sector	Segment
Institutional	**Healthcare**
	Public Service/Institutional
	Government
	Religious
	Other Institutional
	Education
Commercial	**Office**
	Restaurant
	Retail
	Grocery
	Retail
	Warehouse
	Misc.
	Lodging
	Other Commercial
Industrial	**Industrial**

The sample is thus designed to capture a statewide, statistically representative sample by segment, allowing for comparisons across segments (e.g., offices vs. retail). Act 129 includes special carve-out targets for institutional buildings defined as government (federal, state, or local), education, and non-profit facilities. The SWE therefore created a separate sector for institutional to be included in the sample[1]. While this study provides a 90/10 relative precision for the GNI sector at the statewide level, each EDC's GNI sample size yielded a 90/20 relative precision. See Table 3-2 and Section 3.2.4 for more details on the sampling approach.

Additionally, from an equipment and energy usage perspective, it is expected that the difference between a large facility and a small facility can be significant. For example, the equipment saturations and energy use intensity found in a convenience store will likely vary significantly from that found in a supermarket. To account for variations of this sort, the SWE further stratified the segments into large and small buildings (based on median kWh consumption in each EDC) to capture the full spectrum of facilities when defining its sample.

[1] The definition of institutional used for this study doesn't exactly align with Act 129's definition of institutional, which defines institutional as "government, including municipalities, school districts, institutions of higher education and nonprofit entities." Since "nonprofit" cannot be isolated as a building type, this study utilized health and religious facilities as a proxy.

3.2.2 Premise Counts

To accurately describe building energy consumption, it was important to remove non-premise buildings from each EDC customer database. The SWE found that when samples were initially selected, a large number of non-building, closed and inactive accounts were selected. These accounts were linked to end uses such as fire pumps, street lights, railroad signals and other small miscellaneous items. To remove these from the sample, the SWE removed the following accounts:

- All accounts with 2012 annual consumption lower than would be reasonably expected for a building. This cutoff level was set at 2,000 kWh for non-residential accounts.
- All but the top tenth-percentile of Transportation, Communication & Utilities accounts based on kWh consumption.
- Unclassified accounts after SIC mapping and engineering analysis. This represented a small share of consumption for most EDCs. The non-residential customer database PECO provided to the SWE had only approximately 40% of accounts classified so this filter was not possible. Instead the SWE team assumed the 60% of unclassified accounts followed a similar segment distribution as the 40% of classified accounts.
- All "final," closed or inactive accounts in 2012.

Consumption values for these removed accounts represented a relatively small share of the total consumption across the state. Segment consumption also remained relatively unchanged with the reduced premise count.

3.2.3 SIC Mapping

The next step involved utilizing the SIC/NAICS codes provided by the EDCs to determine building and/or business type for each account. The SWE was able to use the SIC and NAICS data to assign accounts to the commercial, institutional, and industrial sectors. For the industrial sector, this was a straightforward process since industrial segments are defined as business types. However, segments for the commercial and institutional sectors in this study are defined by building type rather than the business types classified by SIC code. For example, while a SIC code may categorize an office headquarters for a restaurant chain as restaurant, our study would classify that building as an office to match the use of the facility. To bridge this gap, the SWE assigned each SIC code to a building type by adopting the SIC-building type mapping used by the *California Commercial End Use Survey*[1]. This mapping key was adjusted to ensure that building types are consistent with the definitions used in this study. Further work was done by the SWE to adjust the SIC mapping, primarily concerning the public service and institutional building types, to the segmentations used specifically in this study. Appendix E shows the SIC-building type mapping used. Extensive research was performed on the highest energy consuming accounts along with various random accounts to verify, and in some cases correct, the SIC mapping exercise.

[1] See *California Commercial End Use Survey* prepared by Itron, Inc. March, 2006.

3.2.4 Sampling Approach

To produce a defensible end use survey, the SWE aimed to gather data at a 95% confidence level with a precision interval of less than 5% (95/5) at the statewide non-residential level and at least a 90/10 confidence for the statewide commercial, institutional, and industrial sector findings. With a very large population, 95/5 confidence can generally be achieved with a minimum random sample size of 385 and 90/10 can be achieved with 68 samples (See Section 3.6 for more details).

The SWE planned to survey a total of 490 customers across the state with 70 surveys in each of the seven EDC territories (60 commercial/institutional and 10 industrial) providing a confidence/precision target of 90/10 for each EDC's non-residential sector findings.

In order to obtain a confidence level of at least 90/10 across the state, 10 industrial surveys were targeted for each EDC, yielding 70 sites across the state. The next step was to allocate the commercial and institutional segments/sub-segments among each EDC's remaining 60 surveys. The SWE assessed the segment distribution based on kWh consumption from an analysis of the EDC customer databases. Therefore, it was possible to ensure that each segment was represented in the sample by using a proportional allocation based on electricity consumption. A proportional allocation distributes the available sampling size to each segment according to its share of the total commercial electricity consumption.

With these segments clearly defined, the SWE was able to allocate the number of site visits. Table 3-2 shows the actual number of site visits conducted by field engineers for each segment in each EDC territory with the accompanying levels of confidence/ precision.

Table 3-2: Surveys Completed per EDC, per Segment & Confidence/Precision Levels

Segment	DLC	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP	State	Confidence / Precision
Education	9	8	6	8	3	7	11	**52**	90/15
Healthcare	7	7	6	8	7	6	2	**43**	90/15
Industrial	7	9	15	9	9	11	8	**68**	90/10
Misc.	9	6	6	12	7	10	9	**59**	90/15
Office	16	9	7	6	13	10	7	**68**	90/10
Public Service/Inst.	6	9	7	14	9	7	15	**67**	90/15
Restaurant	3	5	6	3	4	3	4	**28**	90/20
Retail	10	15	16	10	15	10	12	**88**	90/10
Warehouse	3	2	2	3	1	5	2	**18**	90/20
Total Completed	**70**	**70**	**71**	**73**	**68**	**69**	**70**	**491**	95/5
Confidence/ Precision	90/10	90/10	90/10	90/10	90/10	90/10	90/10	95/5	

The SWE further controlled for 50% 'large' and 50% 'small' businesses in each segment to ensure our sample wasn't biased towards small customer accounts (since a disproportionate number of customer accounts are small). The SWE elected to use a kWh consumption driven cut-off point defined as the median kWh consumption for each segment, specific to each EDC. Table 3-3 shows the cut-off level for each segment per EDC.

Table 3-3: Large/Small Sample Cut-Off (based on median kWh consumption)

Segment	DLC	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Education	137,820	50,324	103,800	60,100	114,720	70,545	74,973
Grocery	93,470	62,612	91,137	66,148	54,568	76,808	48,435
Health	34,655	54,880	201,550	50,863	20,696	90,847	36,628
Industrial	50,410	23,903	16,469	18,441	23,340	48,702	20,080
Public Service / Inst.	26,080	20,920	23,090	13,529	17,152	17,874	18,517
Lodging	388,560	48,914	90,879	32,763	98,860	73,200	14,192
Misc.	19,195	12,820	34,850	11,171	13,629	11,947	11,766
Office	12,770	14,004	16,694	13,651	16,441	14,611	13,892
Restaurant	80,145	58,040	70,680	52,620	66,394	61,063	58,054
Retail	29,680	19,452	31,956	19,713	23,886	24,440	22,265
Warehouse	42,150	17,899	24,722	13,116	28,107	14,372	10,855

3.3 PRIMARY DATA COLLECTION

On-site surveys conducted by trained field engineers were the primary method for collecting relevant data on the energy-using characteristics of non-residential facilities in Pennsylvania. This section provides an overview of the methodology for collecting the primary data summarized in this report.

3.3.1 Recruitment

The first step in the survey process was to design a letter to inform customers in the sample that an energy survey was to be performed in their respective territory and that a SWE representative would potentially contact them to ask for their participation in the study. The 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 customer, explain the on-site surveys, and ask for participation. If a customer volunteered to participate, SWE callers gathered basic premise data (number of structures, building size, age, occupants, etc.) and information on the presence of major end uses. This information was used to determine the expected length of the site visit and help prepare the on-site engineer. The SWE would attempt to contact customers a maximum of three

times before considering an account not part of the study. The introduction letters and phone script are included in Appendix B and Appendix C.

3.3.2 On-site Survey

On-site surveys provide highly accurate data because information is collected by engineers with experience identifying and describing building systems. In order to maximize the effectiveness of each site visit and provide results with a high level of detail, the SWE designed the on-site survey to be as comprehensive as possible. The on-site survey gathers data on the presence of each end use studied as well as its fuel type and efficiency level. In order to aid in the calculation of energy use intensities (EUIs) for some end uses, the survey also gathered information on equipment condition, age, and operating parameters as well as measurements on building square footage. Finally, the survey included questions pertaining to the applicability of specific measure technologies.

One of the major challenges in conducting on-site data collection was ensuring that building systems are accurately and consistently categorized. This was of particular concern when evaluating commercial HVAC systems due to their variability and complexity. Engineers were trained and instructed how best to categorize and record system types and parameters. A desk review was also performed of all 491 completed surveys by a single engineer to further ensure consistency. The complete on-site survey is included in Appendix A.

A commercial on-site survey typically lasted between one to four hours, depending primarily on the building size and complexity of building systems. Industrial facilities took between two and six hours, again depending on size and complexity of the facility. To encourage participation, a $100 gift card was offered to small business customers who permitted a site visit. Following the site visit all data were entered into a database for analysis.

3.3.3 End Uses

The study categorized 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 studied in national or regional surveys. Table 3-4 below displays the end uses included in this study.

Table 3-4: Non-Residential End Uses Evaluated

C&I End Uses
Heating
Cooling
Ventilation
Water Heating
Lighting
Plug Load
Cooking
Refrigeration
Process Loads
Other

3.3.4 Survey Results

The SWE contacted 2,732 customers across the state and performed a total of 491 site visits with a total recruitment rate (completed surveys divided by customers contacted) of 18.0%. Table 3-5 below shows the number of customers involved in this survey.

Table 3-5: Recruitment Rates by EDC

EDC	Recruiting Letters Sent	Customers Contacted	Surveys Completed	Recruitment Rate
Duquesne Light	3125	258	70	27.1%
Met-Ed	2982	275	70	25.5%
PECO	7322	681	71	10.4%
Penelec	3182	268	73	27.2%
Penn Power	2235	83	68	81.9%
PPL	5372	971	69	7.1%
WPP	3609	196	70	35.7%
Total	**27,827**	**2732**	**491**	**18.0%**

3.4 SECONDARY 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 data.

Where appropriate, secondary data was used to calibrate primary data findings and provide more robust results.

3.4.1 PA Phase I Baseline Study

The majority of the data types collected, the techniques used, and the reporting format of this Study largely build upon the precedent set by the Phase I End Use and Saturation Study. As such, much of the data presented in this report are directly comparable to the Phase I findings. This is beneficial for not only corroborating the findings of this study, but also providing a unique opportunity for examining the changes in Pennsylvania's building stock during the time period between the two studies. Key changes in findings between the studies are noted and discussed Chapter 7 of this report.

3.4.2 Other Data Sources

The SWE also examined a number of existing end use and energy consumption studies including:

- U.S. Energy Information Administration's 2003 Commercial Building Energy Consumption Survey (CBECS)
- U.S. Energy Information Administration's 2006 Manufacturing Energy Consumption Survey (MECS)
- California Energy Commission's California Commercial End Use Survey (CEUS)
- Consortium for Energy Efficiency
- ASHRAE 90.1 Standards
- Manufacturer Catalogs

Each secondary data source provided valuable information with which to compare the SWE's findings. For example, additional desk research was performed to utilize HVAC nameplate information collected on-site to report efficiency characteristics of that end use.

3.5 DATA ANALYSIS

Following the collection of primary and secondary data, the SWE calculated the output values involved in this end use study and evaluated them within a statewide context and the context of each EDC's service territory. These values included building characteristics, end use saturations, fuel shares, and efficiency shares.

3.5.1 Data Validation & Review

Due to the heterogeneous nature of non-residential buildings, significant effort was expended to ensure on-site data collected by field engineers was reported in a consistent and accurate manner. Unclear or questionable data points provided by field engineers were highlighted in the data entry process and later reviewed by a single engineer. Building types were also verified to ensure buildings were consistently categorized in the appropriate segment for later analysis. Finally, a

thorough review of electricity consumption by premise was performed to ensure all electricity consumption was accurately accounted for (for example, many premises have multiple meters so analysts reconciled kWh consumption recorded from the sample data with the EDC's full customer dataset).

To check for bias in the sample, the SWE compared the segment electricity consumption share in the sample with that of the full population across the state. In other words, the SWE sought to ensure that the share of electricity consumed by office buildings in the full population was similar to the share of electricity consumed by office buildings in the sample. Our analysis showed that the segment electricity shares between the population and sample were close enough to provide reasonable assurances that a representative sample was obtained for the study.

3.5.2 Weighting Factors

In an effort to provide a more inclusive study and provide statistically significant results for each of the EDC territories, it was decided to survey 70 non-residential customers per EDC irrespective of the size of the EDC. When scaling each of the EDCs findings up to statewide results for Pennsylvania, it was therefore deemed necessary to apply a weighted average based on the number of premises in each EDC. For example, the findings specific to each EDC were multiplied by the appropriate weighting factor (percentage) when averaging results at the statewide level. This approach, therefore, provides more weight to the data for larger EDCs (e.g., PPL and PECO) when compared to smaller EDCs (e.g., Penn Power and Met-Ed) in the statewide findings. These weights were applied at the non-residential and sector (commercial, institutional, and industrial) level. Weighting factors were not applied to commercial and institutional segment findings at the statewide level due to segment sample sizes. Different weighting factors were used for each EDC's commercial, institutional, industrial, and non-residential sectors. Table 3-6 details the weights that were applied throughout the analysis when rolling up EDC data to statewide findings. In accordance with discussions and the resulting decision that occurred during Phase I Technical Working Group meetings, the decision was made to base the weighting factor on premise counts. A weight based on premise count was considered the most applicable to this study since most end uses and saturations observed were at a premise level. However, weighting results for specific technologies by other means such as building square footage served, connected load, or equipment capacity was performed on a case by case basis as appropriate, and noted in the findings accordingly. Findings weighted by square footage, connected load, or capacity still have EDC weights applied when results are presented at the statewide or sector levels.

Table 3-6: EDC Weighting Factors by Sector

Commercial Premises: Weighting Factors								
	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	32,745	30,318	104,893	41,144	10,620	81,916	48,101	349,737
Weight	**9.4%**	**8.7%**	**30.0%**	**11.8%**	**3.0%**	**23.4%**	**13.8%**	
Industrial Premises: Weighting Factors								
	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	1,552	5,425	14,895	6,862	1,791	11,351	7,079	48,955
Weight	**3.2%**	**11.1%**	**30.4%**	**14.0%**	**3.7%**	**23.2%**	**14.5%**	
Institutional Premises: Weighting Factors								
	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	6,013	5,957	24,592	6,910	2,114	7,082	7,283	59,951
Weight	**10.0%**	**9.9%**	**41.0%**	**11.5%**	**3.5%**	**11.8%**	**12.1%**	
Non-Residential Premises: Weighting Factors								
	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	40,310	41,700	144,380	54,916	14,525	100,349	62,463	458,643
Weight	**8.8%**	**9.1%**	**31.5%**	**12.0%**	**3.2%**	**21.9%**	**13.6%**	

3.5.3 Reporting Methods

This report uses different methods to report findings appropriate for each end use. For example, lighting is presented on a fixture count or connected load basis. Using a more granular weighting scheme is considered portraying the data in a more accurate light. However, using different bases for presentation can be confusing to the reader, so each table and figure in this report has a note clarifying the basis for which the findings are presented.

For ease of reading and consistency, some key terms are used throughout this report: penetration, saturation, and mean units. Penetration refers to the proportion of buildings assigned a given equipment type or characteristic. For instance, desktop computers in the PPL service area have a penetration of 84%. This means 84% of all non-residential buildings have at least one desktop computer (though they could have more than one).

Saturation refers to the average number of units across all buildings. For instance, a desktop computer saturation of 543% in the PPL territory indicates that, on average, there are 5.43 computers at each non-residential site visited.

While saturations indicate the average number of units across all buildings (including buildings that do not have the equipment), a third metric, mean units, tells us the average number of units for buildings 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 543%, only 84% of the

buildings have at least one computer. This indicates that of the buildings that have at least one computer, there are, on average, 6.46 computers.

3.5.4 Energy Use Intensity Calculations

For each commercial and institutional segment, overall and end use consumption values were calculated as an Energy Use Intensity (EUI) by dividing annual electricity consumption by square footage. This allows energy consumption to be proportioned across varying premise square footages, which are prevalent in the commercial sector.

By using the survey data, customer billing data, and on-site square footage calculations, representative overall premise EUIs were calculated for each of the 491 buildings visited during the study. Average EUIs were then calculated for each commercial and institutional segment. This data was then screened for a bias. For example, if there was an overpopulation of a business type that produces a non-representative EUI or inaccurate premise kWh consumption or square footage estimates, these data points were removed from the analysis. Once biased values were believed to be removed, EUIs were compared to available regional data sources such as CBECS[1].

Commercial and institutional segment end use EUIs were further developed by analyzing on-site data collected for building-specific lighting power densities, which were then converted into lighting EUIs for each segment. Secondary data was then utilized to estimate the known building EUI shares for non-weather dependent end uses (e.g., plug load) from available regional sources such as CBECS. It was assumed EUIs across segments and end uses remained constant for all seven EDCs, with the exception of space cooling. The modeling program eQUEST was used to determine variations in the space cooling EUIs between different regions of the state. Differences in space cooling EUIs were calculated and incorporated into EDC-specific EUIs for each segment.

3.6 UNCERTAINTY

As with any survey or statistical analysis, the results in this report are subject to a certain degree of uncertainty. Practical constraints make it impossible for the SWE to survey the entire population of Pennsylvania non-residential electrical accounts, necessitating the selection of a small sample population from which to collect data. When using a sample to make predictions about a population, 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 report for the statewide non-residential sector at 95% and 5% respectively. This means that if this study were repeated multiple times, 95% of the studies would have results within ±5% of the results in

[1] Commercial Building Energy Consumption Survey published by the EIA.

this study. The sample size required to achieve these levels of confidence with a large population is given by Equation 3.1, below.

Equation 3.1

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

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, 0.05

Using this equation, it can be found that the minimum sample size required to achieve 95/5 confidence is 385. The SWE's targeted sample size of 490 customers from all non-residential sectors is sufficiently large to achieve this level of confidence. As can be shown by the equation above, a sample size greater than 385 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 general findings in this report have the highest confidence, while the confidence decreases as results become more specific. For example, if 340 customers out of 490 non-residential sample points across the state have central cooling, this saturation can be reported with a confidence level of greater than 95/5 due to the sample of 490 data points (more than 385). Likewise if 50 customers out of 70 sample points in an EDC territory have central cooling, this saturation can be reported with a confidence level of approximately 90/10. However, the percent of central cooling systems that are of a particular technology type will have greater uncertainty because the sample size of central cooling is only 50. Additionally, the amount of uncertainty increases even more when trying to say something about any one commercial segment due to the limited sample points. Therefore, while findings are presented for all commercial segments at the statewide level, the level of confidence differs by segment since some segments received fewer samples than others (e.g., warehouses received 18 surveys vs. 68 surveys in the office segment).

To assist the reader in identifying the level of certainty associated with each finding, we have included an "n-value" (or number of observations/sample points) for each table and figure, where possible. As described above, the greater the number of sample points (n-values), the greater degree of certainty.

Another factor that can influence the uncertainty of the results is the extent to which the sample is representative of the population as a whole. Though samples are selected randomly, it is possible that the sample contains some type of bias that can influence the overall results. One such example

is a sample with a high prevalence of retail customers who are busy during the holidays, and thus unavailable for a site visit, potentially resulting in a lower than average energy consumption.

Where possible, the SWE took steps to ensure that biases were minimized in the sample. Samples were selected randomly from the customer database in a manner which minimized the potential for human error or other biases. After gathering data, the SWE then analyzed the sample and compared the customers with known statistics about the population in an attempt to verify and calibrate the survey results. With these steps taken, the SWE believes that the results of the survey can be used to make reasonable assumptions about the characteristics of the overall customer base of the seven EDCs included in this study.

Readers should also be cognizant of the margin of error specific to Chapter 7. Some of the comparisons in that chapter show results that are presented on two different bases of measurement (i.e., square foot versus connected load) but are nonetheless still presented because the comparisons provide qualitative benefits. Most figures show comparisons where the results are presented on the same measurement basis, but one should be mindful that comparing findings between Phase I and Phase II baseline studies must include the compounded margin of error from both studies' results.

4 STATEWIDE NON-RESIDENTIAL FINDINGS

4.1 INTRODUCTION

This section presents results of the on-site survey and the findings of the subsequent data analysis for the commercial, institutional, and industrial sectors. Where possible, data is also presented by commercial and institutional segment at a state level. As noted in Section 3.5.2, statewide results were weighted by EDC to control for differences in the number of non-residential premises across the seven EDCs. This approach provides more weight to the data for larger EDCs when compared to smaller EDCs in the statewide findings. Data was collected primarily from the 491 on-site surveys conducted by Nexant and GDS engineers. Secondary data was used to fill in data gaps when deemed appropriate. All findings, except those that are specified otherwise, are presented by premise.

4.2 STATEWIDE NON-RESIDENTIAL OVERVIEW

Based on the findings of the SWE's primary and secondary research, the electricity usage of Pennsylvania's commercial, institutional, and industrial sector has been broken down by segment (type of building) and end use. The findings presented below are primarily derived from on-site survey data, with adjustments made for bias where appropriate.

4.2.1 Electricity Consumption by Segment

Data presented below are derived from the 2012 customer sales data from each of the EDCs. Figure 4-1 and Table 4-1 show the breakdown of electrical usage by commercial segment. Figure 4-2 and Table 4-2 show the same breakdown by institutional segment. Figure 4-3 and Table 4-3 also show the same breakdown by industrial segment. In the commercial sector, the office segment consumes the largest share of electricity (29.3%).

Figure 4-1: 2012 Statewide Commercial Electricity Consumption by Segment

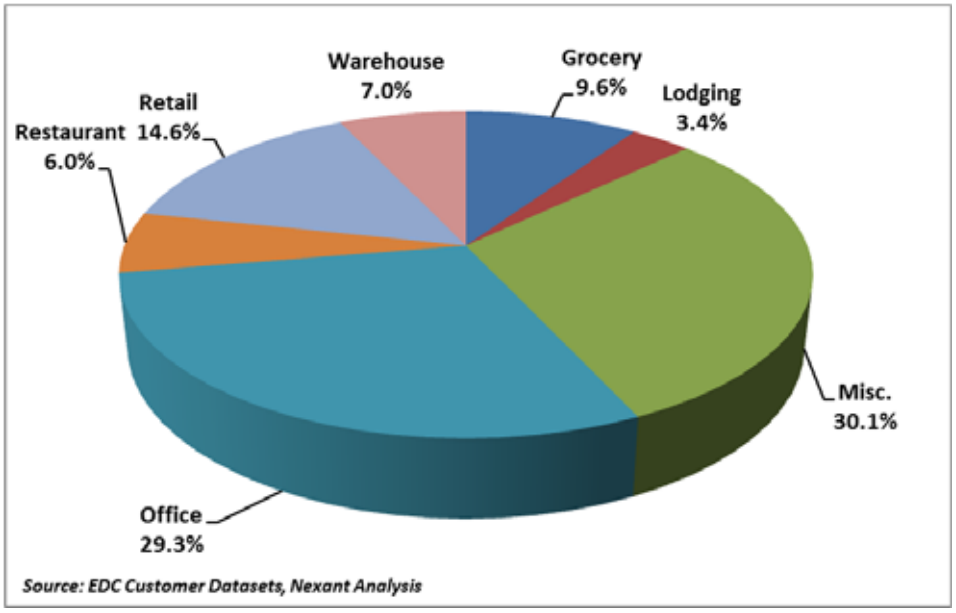


Table 4-1: 2012 Statewide Commercial Electricity Consumption by Segment

Commercial Segment	Consumption (MWh)	Electricity Share
Grocery	3,333,570	9.6%
Lodging	1,171,364	3.4%
Misc.	10,502,482	30.1%
Office	10,202,899	29.3%
Restaurant	2,100,244	6.0%
Retail	5,085,876	14.6%
Warehouse	2,452,146	7.0%
Total	**34,848,579**	**100%**

Source: EDC Customer Dataset, CBECS, Nexant Analysis

The education and health segments are the two largest energy consumers in the institutional sector, accounting for over 70% of the total sector consumption.

Figure 4-2: 2012 Statewide Institutional Electricity Consumption by Segment

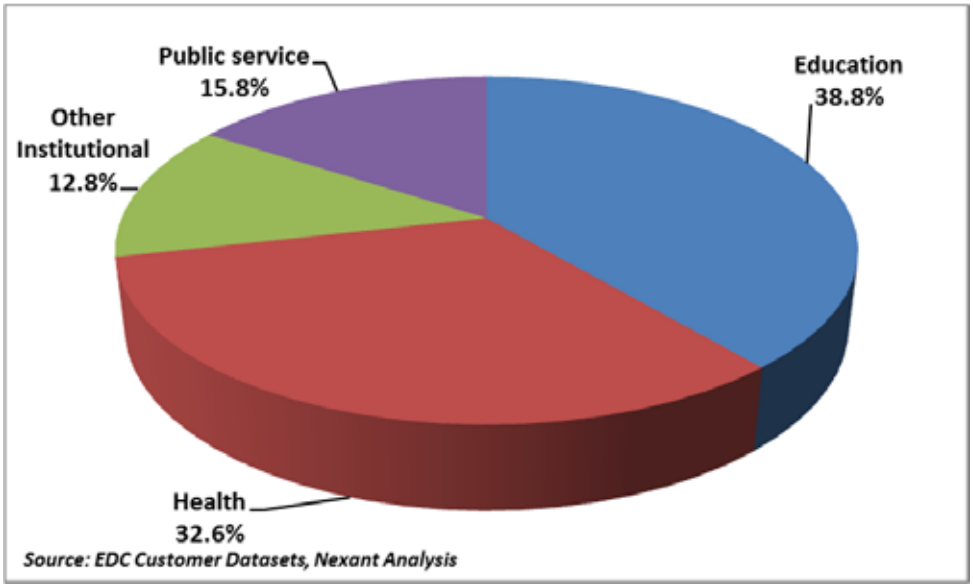


Table 4-2: 2012 Statewide Institutional Electricity Consumption by Segment

Institutional Segment	Consumption (MWh)	Electricity Share
Education	6,242,429	38.8%
Health	5,250,472	32.6%
Other Institutional	2,051,779	12.8%
Public Service	2,542,646	15.8%
Total	**16,087,326**	**100.0%**

Source: EDC Customer Dataset, CBECS, Nexant Analysis

"Other manufacturing" leads the consumption in the industrial sector (26.1%) followed by the manufacturing of metals consuming the second largest share of electricity in the industrial sector (20.8%).[1]

[1] Other manufacturing consists of a variety of manufacturing types such as apparel, furniture, leather, lumber, textile, tobacco, and misc.

Figure 4-3: 2012 Statewide Industrial Electricity Consumption by Segment

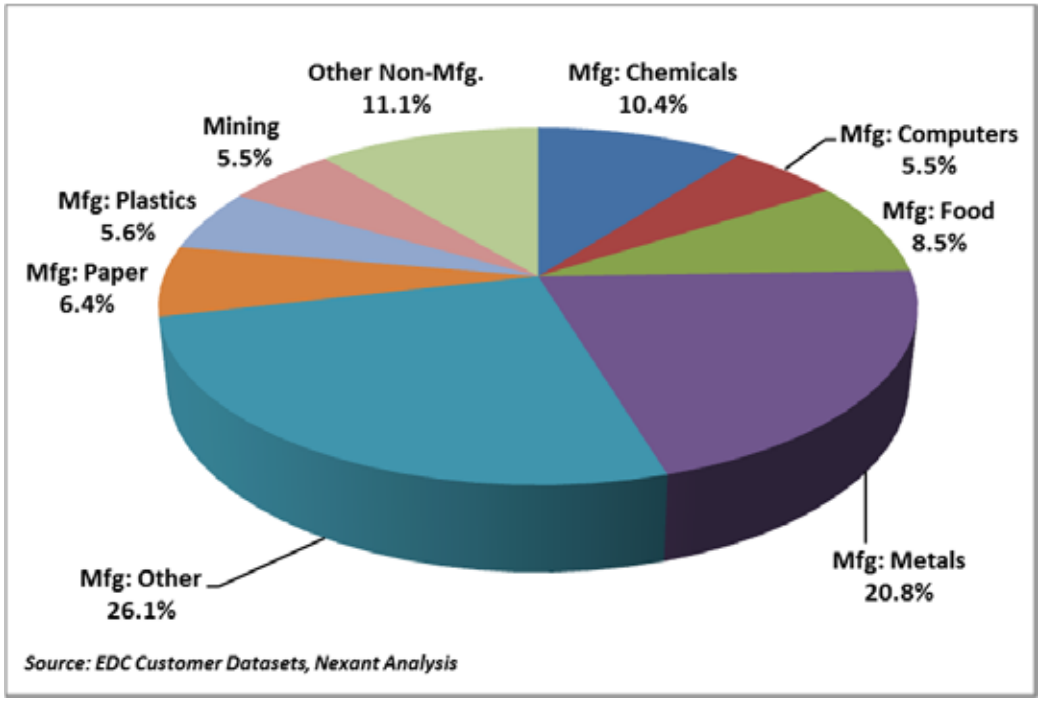


Table 4-3: 2012 Statewide Industrial Subsector Energy Consumption by Segment

Industrial Segment	Consumption (MWh)	Electricity Share
Mfg: Chemicals	4,220,720	10.4%
Mfg: Computers	2,244,176	5.5%
Mfg: Food	3,443,710	8.5%
Mfg: Metals	8,442,606	20.8%
Mfg: Other	10,556,491	26.1%
Mfg: Paper	2,582,251	6.4%
Mfg: Plastics	2,256,922	5.6%
Mining	2,236,866	5.5%
Other Non-Mfg.	4,508,426	11.1%
Total	**40,492,169**	**100.0%**

Source: EDC Customer Dataset, MECS, Nexant Analysis

4.2.2 End Use Penetrations & Fuel Shares

Table 4-4 shows the penetration of different end uses in Pennsylvania non-residential facilities. Penetration is defined as the percentage of buildings with a given end use present. In some cases penetration is also given for equipment types, in which case it refers to the percentage of buildings that have a specific equipment type present in buildings, regardless of the quantity of the equipment type present. Fuel shares by end use are calculated on a square footage basis to determine how many percent of the surveyed building area was served by the particular fuel. Space

heating, water heating, and cooking fuel shares are also represented, by segment, in Table 4-5 through Table 4-7 below. Space heating is present in 84.3% of the buildings surveyed, with cooking and refrigeration present in 27.9% and 35.0% of the buildings, respectively. End use fuel share varies significantly by segment. Electricity provides 6.8% of the fuel for space heating, and about one half of the fuel for cooking (53.3%). Electricity accounts for 39.1% of the fuel used for space heating in healthcare buildings and 0% in warehouses.

Table 4-4: Non-Residential End Use Penetrations and Fuel Shares

End Use	Penetration	Fuel Share				
		Electricity	Natural Gas	Fuel Oil	Other [2]	n-values [3]
Lighting	100.0%	100.0%	0.0%	0.0%	0.0%	-
Space Heating	100.0%	6.8%	84.4%	4.3%	4.5%	449
Space Cooling	84.3%	100.0%	0.0%	0.0%	0.0%	-
Plug Load	100.0%	100.0%	0.0%	0.0%	0.0%	-
Refrigeration	35.0%	100.0%	0.0%	0.0%	0.0%	-
Cooking	27.9%	53.3%	42.5%	0.0%	4.2%	659
Water Heating	92.7%	37.8%	56.3%	1.9%	3.8%	540
Other [1]	100.0%	100.0%	0.0%	0.0%	0.0%	-

[1] "Other" End Use includes pumps, motors, and misc. equipment
[2] "Other" fuel share includes LPG, purchase HW or steam, wood, and misc. fuels
[3] n-values for fuel share only
** Fuel shares for space heating and water heating are based on square footage served and tank capacity, respectively. All others are per premise*

Table 4-5: Space Heating Fuel Shares by Segment

Segment	Fuel Share					
	Electricity	Natural Gas	Fuel Oil	LPG	Other	n-values
Education	0.1%	92.4%	4.8%	2.7%	0.0%	48
Healthcare	39.1%	54.1%	5.4%	1.5%	0.0%	33
Office	6.6%	89.6%	0.8%	0.4%	2.6%	53
Public Service/Inst.	3.8%	88.0%	0.7%	3.3%	4.2%	58
Restaurant	6.9%	52.2%	8.5%	13.8%	18.6%	24
Retail	9.3%	76.4%	13.6%	0.7%	0.0%	81
Warehouse	0.0%	91.8%	5.5%	2.8%	0.0%	11
Misc.	21.5%	66.3%	10.9%	0.0%	1.4%	53

Source: On-site Surveys
[1] "Other" fuel share includes purchase HW or steam, wood, and misc. fuels
** Fuel shares for space heating are based on square footage served*

Table 4-6: Water Heating Fuel Shares by Segment

Segment	Fuel Share					
	Electricity	Natural Gas	Fuel Oil	LPG	Other	n-values
Education	23.3%	69.4%	2.8%	4.5%	0.0%	55
Healthcare	50.4%	49.6%	0.0%	0.0%	0.0%	44
Office	41.4%	55.4%	0.0%	3.3%	0.0%	64
Public Service/Inst.	42.6%	55.3%	0.0%	2.1%	0.0%	78
Restaurant	14.8%	65.3%	2.4%	17.5%	0.0%	29
Retail	39.9%	51.5%	5.5%	1.7%	1.4%	74
Warehouse	52.1%	47.9%	0.0%	0.0%	0.0%	13
Misc.	29.2%	65.0%	0.0%	5.8%	0.0%	61

Source: On-site Surveys
(1) "Other" fuel share includes LPG, purchase HW or steam, wood, and misc. fuels
**** Fuel shares for water heating are based on tank capacity***

Table 4-7: Cooking Fuel Shares by Segment(1)

Segment	Fuel Share			
	Electricity	Natural Gas	Propane	n-values
Education	49.2%	49.2%	1.7%	177
Healthcare	66.2%	33.8%	0.0%	68
Office	-	-	-	N/A
Public Service/Inst.	41.4%	58.6%	0.0%	99
Restaurant	45.0%	48.8%	6.2%	129
Retail	76.4%	23.6%	0.0%	106
Warehouse	-	-	-	N/A
Misc.	49.4%	29.9%	20.8%	77

Source: On-site Surveys
(1) Excluding residential microwaves
**** Fuel share is based on equipment count***

4.2.3 Energy Use Intensities

Energy Use Intensity (EUI) is a useful metric to measure how much electricity is consumed annually per square foot of building space and provides insight into how different building types and end uses consume electricity. A variety of data points were utilized to derive EUIs by segment and end use. Customer sales data for 2012 (kWh) was paired with the square footages of those buildings surveyed by Nexant and GDS engineers to come up with average EUIs by segment. End use EUIs were calibrated using a combination of national data and comparing those to this study's on site data. Figure 4-4, Table 4-8, and Table 4-9 below summarize the findings for EUIs for each segment and relevant end use. The grocery segment is the most energy-intensive, at 34.9 kWh/ft^2, due to the large amounts of electricity used to refrigerate food. On the other end of the spectrum, "other institutional," which includes primarily religious facilities, is the least energy-intensive segment using only 6.1 kWh/ft^2. HVAC is the most energy-intensive end use consuming an average of over 5 kWh/ft^2 across all the segments.

Figure 4-4: Energy Use Intensity (annual kWh/ft²) by End use, by Segment

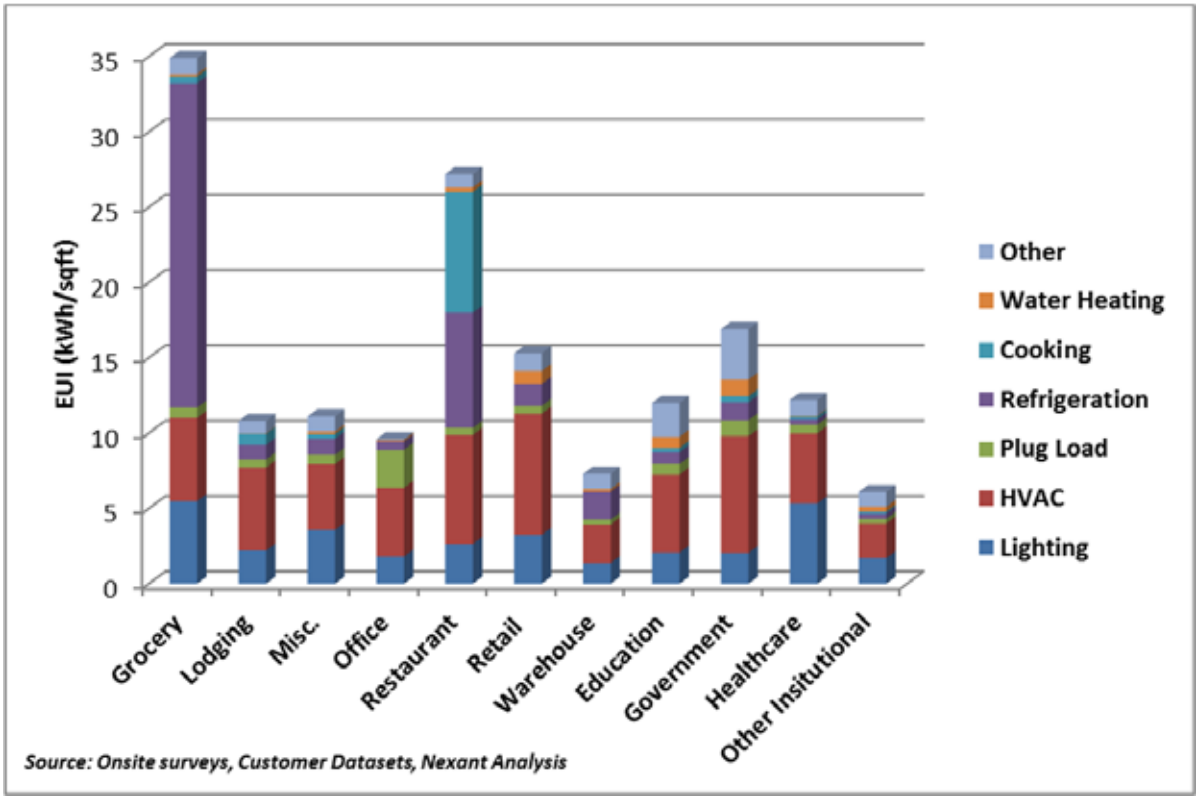


Table 4-8: Energy Use Intensity (annual kWh/ft²) by End use, by Commercial Segment

End Use	Grocery	Lodging	Misc.	Office	Restaurant	Retail	Warehouse	State Weighted Average
Lighting	5.5	2.2	3.6	1.8	2.6	3.3	1.4	2.9
HVAC	5.5	5.5	4.4	4.6	7.2	8.0	2.6	5.2
Plug Load	0.7	0.5	0.6	2.5	0.5	0.5	0.3	1.2
Refrigeration	21.5	1.0	1.1	0.5	7.6	1.4	1.9	3.4
Cooking	0.5	0.7	0.3	0.0	8.0	0.0	0.0	0.6
Water Heating	0.2	0.0	0.2	0.1	0.3	0.9	0.2	0.2
Other	1.1	0.8	1.0	0.0	0.9	1.2	1.0	0.7
Total	**34.9**	**10.8**	**11.1**	**9.6**	**27.2**	**15.3**	**7.3**	**14.3**

Source: On-site Surveys, CBECS, Nexant Analysis

Table 4-9: Energy Use Intensity (annual kWh/ft²) by End use, by Institutional Segment

End Use	Education	Government	Healthcare	Other Institutional	State Weighted Average
Lighting	2.1	2.1	5.3	1.7	3.1
HVAC	5.2	7.7	4.6	2.3	5.0
Plug Load	0.7	1.1	0.6	0.3	0.7
Refrigeration	0.8	1.2	0.3	0.4	0.6
Cooking	0.3	0.4	0.2	0.1	0.3
Water Heating	0.7	1.1	0.0	0.3	0.5
Other	2.2	3.4	1.0	1.0	1.8
Total	**12.0**	**16.9**	**12.2**	**6.1**	**12.0**

Source: On-site Surveys, CBECS, Nexant Analysis

4.2.4 Building Information

Figure 4-5 shows the distribution of building size for all non-residential buildings surveyed. More than 60% of the buildings visited were between 2,500 ft² and 20,000 ft². A substantial portion (5.9%) of the buildings visited by Nexant and GDS engineers were very large at more than 100,000 ft² - due in large part to the control for large buildings utilized in the sampling plan.

Figure 4-5: Building Size Distribution of Buildings Surveyed

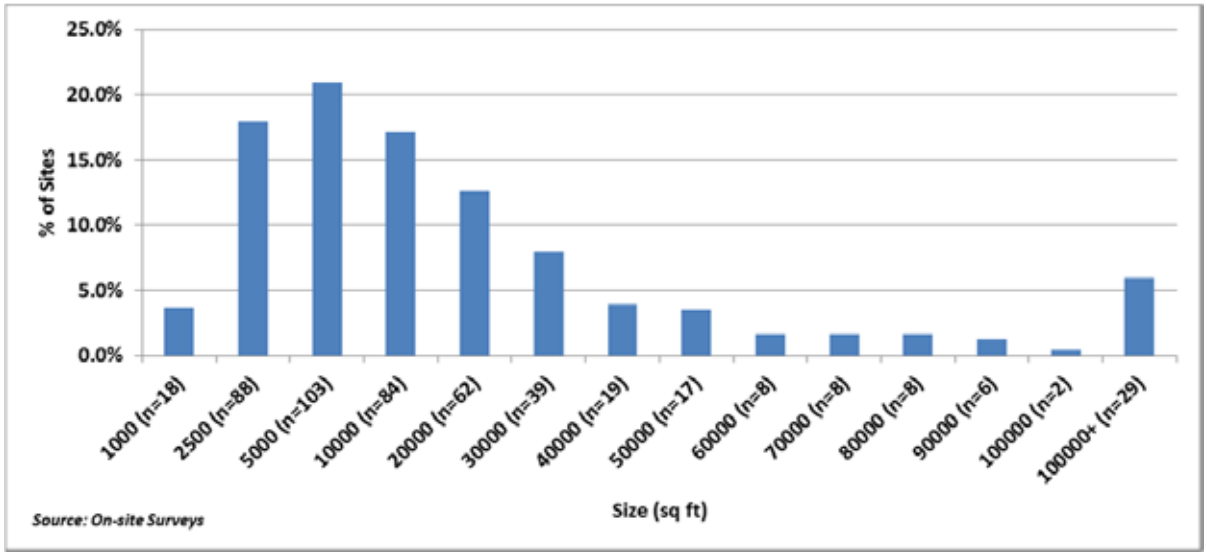


Table 4-10 through Table 4-13 provide an overview of additional characteristics of buildings in the non-residential sector. The average number of occupants recorded during core-business hours is 89.6 and ranges from 13.4 for retail up to 452.5 for education segments. The average number of occupants during non-business hours is 16.6 and ranges from 1.7 for warehouses up to 66.1 for healthcare. The average number of floors per premise is 1.7.

Only 5.4% of the buildings across the non-residential sectors have been commissioned, with 3.2% commissioned within the past five years and less than 1.4% being LEED certified. The average R-value of walls is 13.7 across all building types in Pennsylvania.

Table 4-10: Building Characteristics by Sector, by Segment

Sector, Segment	Avg. Age	Avg. # of Occupants: Core Business	Avg. # of Occupants: Non-Core Business	Avg. # of Floors
Unit	Years	-	-	-
Non-Residential	56.0	89.6	16.6	1.7
n-values[1]	462	452	430	453
Commercial	53.0	51.6	10.6	1.7
Industrial	50.0	39.1	9.2	1.4
Institutional	62.7	177.7	25.3	1.8
Education	56.8	452.5	32.0	1.7
Healthcare	50.7	119.9	66.1	1.9
Office	47.5	20.9	2.6	1.9
Public Service/Inst.	70.2	53.3	16.3	1.9
Restaurant	81.9	30.1	3.7	1.6
Retail	46.0	13.4	3.4	1.2
Warehouse	48.3	22.1	1.7	1.4
Misc.	56.8	203.5	24.9	2.1

Source: On-site Surveys
[1] ***n-values for non-residential findings only***

Table 4-11: Building Efficiency Levels by Sector

Parameter	Non-Residential	n-values[1]	Commercial	Industrial	Institutional
Percentage Building Commissioned	5.4%	491	3.9%	6.7%	14.6%
Percentage Commissioned in last 5 years	3.2%	491	0.0%	6.7%	8.6%
Percentage Buildings LEED Certified	1.4%	491	2.7%	0.0%	3.8%

Source: On-site Surveys
[1] ***n-values for non-residential findings only***

Table 4-12: Building Wall Insulation Characteristics by Sector, by Segment

Sector, Segment	Avg. Insulation (R-value)	n-values[1]
Non-residential	13.7	491
Commercial	14.0	261
Office	12.2	30
Restaurant	13.6	7
Retail	12.8	18
Warehouse	17.8	4
Misc.	13.3	20
Industrial	12.9	68
Institutional	12.7	162
Education	13.2	22
Healthcare	15.4	15
Public Service/Inst.	11.8	17

Source: On-site Survey
[1] ***n-values for non-residential findings only***

Table 4-13: Building Window Characteristics by Sector

Parameter	Non-Residential	n-values[(1)]	Commercial	Industrial	Institutional
Glazing Percentage of Walls	13.9%	435	13.5%	8.3%	16.1%
Pct. Double Paned	55.4%	389	54.3%	55.1%	54.1%
Pct. Metal Framed	61.5%	439	62.2%	56.8%	60.5%

Source: On-site Surveys

[(1)] ***n-values for non-residential findings only***

Figure 4-6 and Table 4-14 illustrate when buildings were constructed across the state. Pennsylvania has a relatively old building stock when compared to other parts of the U.S. with an average building age of 55 years. Restaurants were noticeably older than other building types with an average age of 82 years and 36% of these buildings being constructed before 1900.

Figure 4-6: Year of Building Construction for Non-Residential Buildings

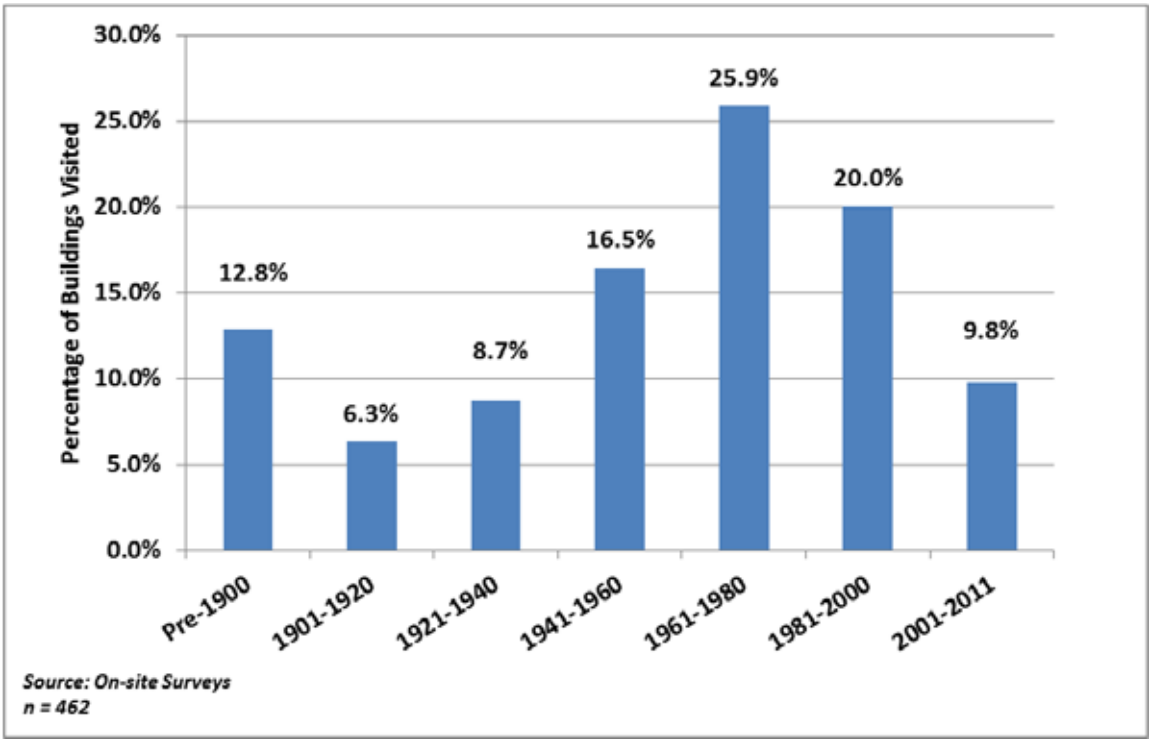


Table 4-14: Year of Building Construction by Sector, by Segment

Year Range	Pre-1900	1901-1920	1921-1940	1941-1960	1961-1980	1981-2000	2001-2014	n-values
Non-Residential	12.8%	6.3%	8.7%	16.5%	25.9%	20.0%	9.8%	462
Commercial	13.1%	5.4%	8.2%	7.4%	16.6%	24.4%	5.4%	243
Industrial	10.3%	12.7%	18.7%	15.5%	39.5%	23.4%	11.3%	64
Institutional	15.3%	9.0%	12.8%	18.6%	21.6%	19.1%	8.4%	155
Education	6.1%	2.0%	12.2%	28.6%	32.7%	12.2%	6.1%	49
Healthcare	9.8%	2.4%	14.6%	12.2%	19.5%	29.3%	12.2%	41
Public Service/Inst.	24.6%	9.2%	6.2%	13.8%	20.0%	21.5%	4.6%	65
Office	6.3%	7.9%	4.8%	14.3%	19.0%	36.5%	11.1%	63
Restaurant	36.0%	4.0%	8.0%	16.0%	24.0%	4.0%	8.0%	25
Retail	7.1%	4.8%	6.0%	15.5%	22.6%	33.3%	10.7%	84
Warehouse	0.0%	6.7%	13.3%	33.3%	26.7%	0.0%	20.0%	15
Misc.	12.5%	8.9%	8.9%	16.1%	25.0%	12.5%	16.1%	56

Source: On-site Surveys

Table 4-15 shows equipment ages by equipment type. The age data for each equipment type is broken out into 5-year age intervals, with the percentages showing how much of the total for each equipment type fall within each age range.

Table 4-15: Non-Residential Equipment Ages by Percent in 5 Year Intervals

Years Old	< 5	5 - 10	10 - 15	15 - 20	> 20	n-value
HVAC: Single Zone DX	21%	21%	24%	14%	20%	644
HVAC: Central AHU	25%	13%	11%	11%	40%	53
HVAC: Boiler	21%	16%	14%	10%	39%	148
HVAC: Chiller	21%	18%	29%	14%	18%	28
Hot Water Heater	30%	29%	24%	7%	9%	457
Refrigeration Equipment (non-walk-in)	14%	25%	30%	11%	19%	456
Refrigeration Equipment (walk-in)	8%	16%	19%	13%	43%	215
Motors	13%	18%	25%	8%	35%	424

Source: On-site Surveys

4.3 STATEWIDE NON-RESIDENTIAL END USE FINDINGS

This section provides detailed findings of each end use for the commercial, institutional, and industrial sectors in Pennsylvania. All findings, except those that are specified otherwise, are presented by premise.

Figure 4-7 through Figure 4-9 show how energy is consumed by end use in the commercial, institutional, and industrial sectors, respectively. For commercial and institutional buildings, HVAC systems consumed the largest share of electricity in buildings (36% and 42%). The "Other" end use represents primarily pumps and other miscellaneous loads in buildings. In the industrial sector, motors consume the largest share (40%) of all the electricity across the state. Process loads (heating, cooling and electro-chemical) make up another 24% of the electricity consumption.

Figure 4-7: 2012 Statewide Commercial Sector System Electricity Usage by End Use

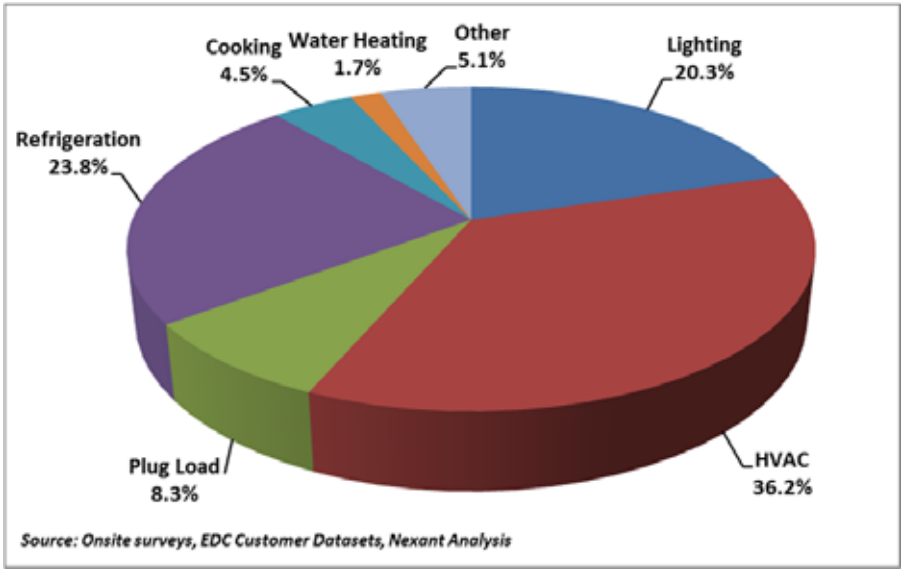


Figure 4-8: 2012 Statewide Institutional Sector System Electricity Usage by End Use

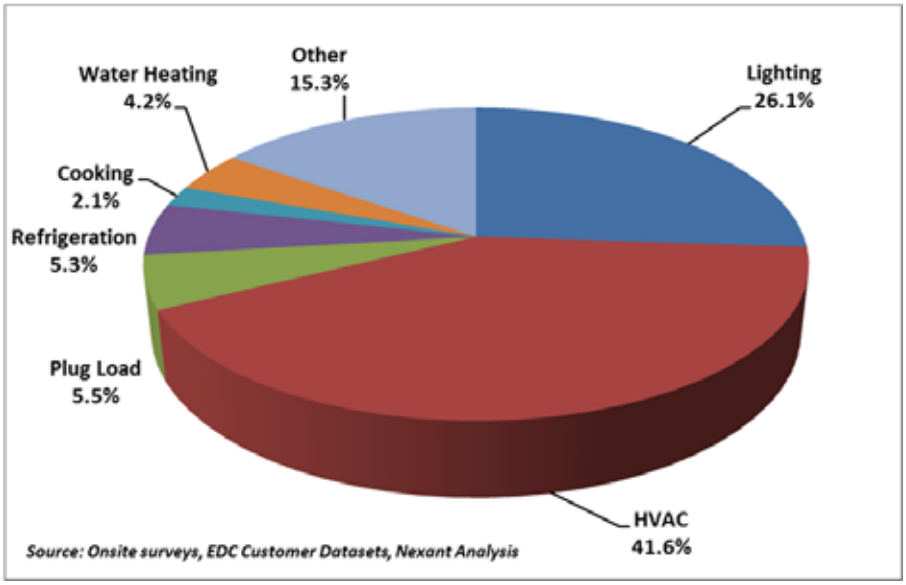
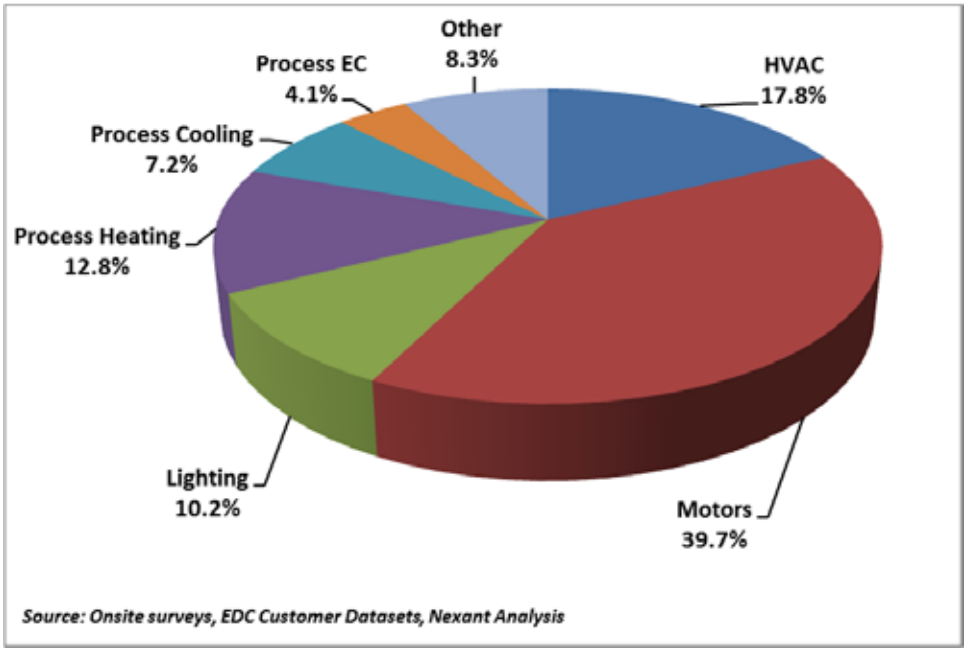


Figure 4-9: 2012 Statewide Industrial Sector System Electricity Usage by End Use



4.3.1 Heating, Ventilation & Cooling (HVAC)

While cooling load is fueled exclusively with electricity, heating systems can be fueled by electricity, natural gas or other fuels. Figure 4-10 shows the fuel share breakdown for space heating for all non-residential buildings in the state. Natural gas is the primary fuel used for heating (84.4%), with 6.8% of space heating equipment fueled by electricity.

Figure 4-10: Non-Residential Space Heating Fuel Share

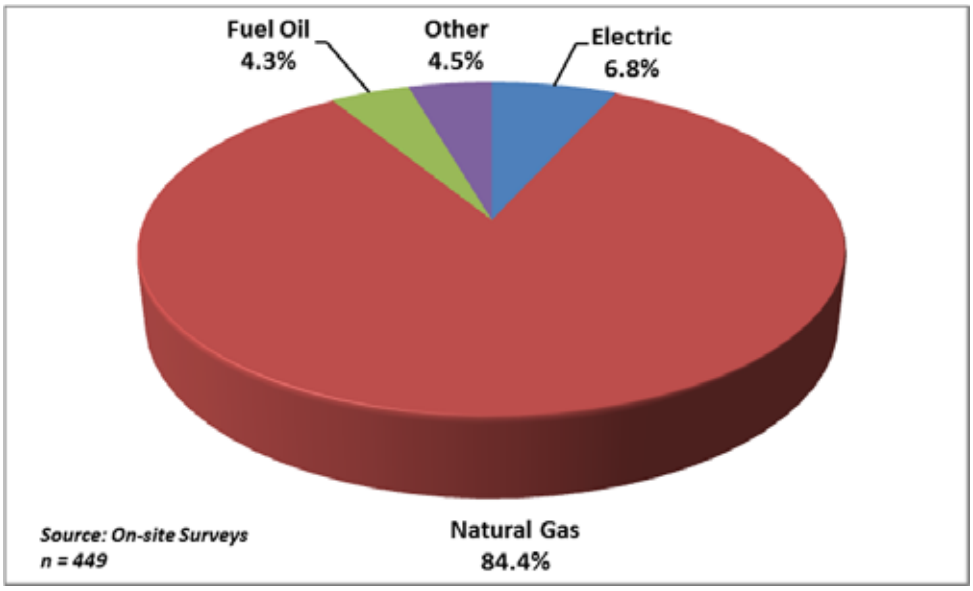
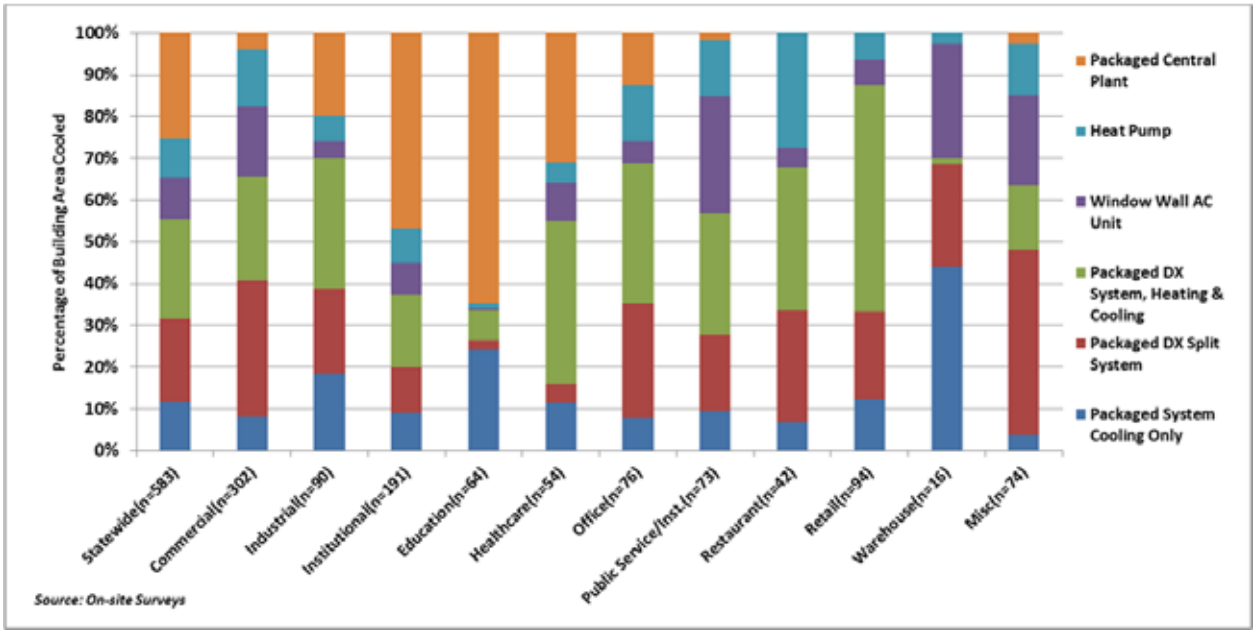


Figure 4-11 shows the prevalence of different types of cooling systems across the state, presented statewide and then by sector and segment. Cooling equipment percentages are weighted by square footage. For example, if a building had a chiller (packaged central plant) and two packaged DX split systems, the percentage of the building area served by each type of cooling equipment is multiplied by the total square footage of the building served to determine the area of cooled space. Out of all the surveyed buildings with cooling equipment, packaged central plants are responsible for cooling 25.5% of the total building area. The packaged DX split system and packaged DX system-heating & cooling are two popular cooling equipment types that served 43.8% of building cooling needs statewide. At the sector and segment level, a high percentage of total building area is cooled by packaged central plants in institutional facilities - particularly education and healthcare buildings.

Figure 4-11: Percentage of Building Area Cooled by Equipment Type by Sector, by Segment



n-values are the number of data points that have information on cooling equipment, total square footage of building, and percentage of building cooled

Table 4-16 summarizes some of the key parameters of cooling systems in non-residential sector. The average age of cooling systems in the state is 11.3 years, with an average cooling capacity of 5.5 tons. The average SEER value for DX cooling systems in Pennsylvania is 11.9. Cooling efficiency is weighted by square footage, where the efficiency of the system is multiplied by the building area cooled and then divided by the total cooled area. It should be noted that this weighting method gives more weight to larger units which have lower federal minimum efficiency standards and overall less efficient SEER/EER than smaller units. The penetration of automatic control systems like programmable thermostats ranges from 20% to 60% for the various subsectors suggesting that the majority of DX cooling systems in the state are manually controlled. On average energy management systems (EMS) were found in 10.3% of the buildings surveyed, with a significant penetration in education facilities.

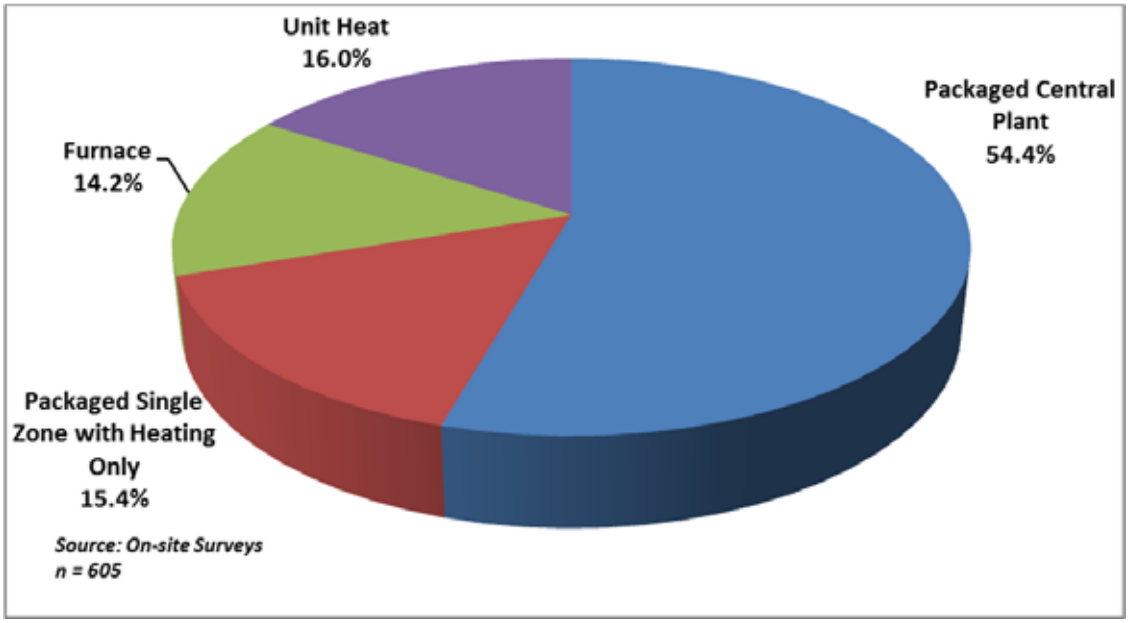
Table 4-16: DX Cooling Parameters

Sector, Segment	Avg. Age (yrs)	Avg. Cooling Capacity (tons)	Avg. Cooling Efficiency (SEER/EER)	Percentage Programmable	Percentage with EMS
Non-Residential	11.3	5.5	11.9/9.6	45.6%	10.3%
n-values[(1)]	504	333	78/31	529	529
Commercial	10.2	5.2	11.8/9.2	47.8%	7.8%
Office	12.0	5.6	10.5/10.6	61.4%	0.0%
Restaurant	8.0	4.0	11.9/9.3	59.0%	0.0%
Retail	16.2	6.2	12.6/8.3	50.9%	0.0%
Warehouse	18.7	3.5	14.4/7	17.9%	1.8%
Misc.	13.1	3.6	9.6/9.8	44.7%	3.8%
Industrial	14.5	5.3	12.4/9.8	33.1%	0.0%
Institutional	11.0	5.9	12.4/11	55.8%	36.3%
Education	25.1	2.5	11.6/8.7	57.6%	21.2%
Healthcare	11.5	7.1	14.5/11.3	24.0%	16.9%
Public Service/Inst.	15.5	4.9	10.5/10.6	66.6%	0.0%

Source: On-site Surveys
All parameters are weighted by square footage served except "Average Age" and "Average Cooling Capacity," which are weighted by equipment count
[(1)] n-values for statewide non-residential findings only

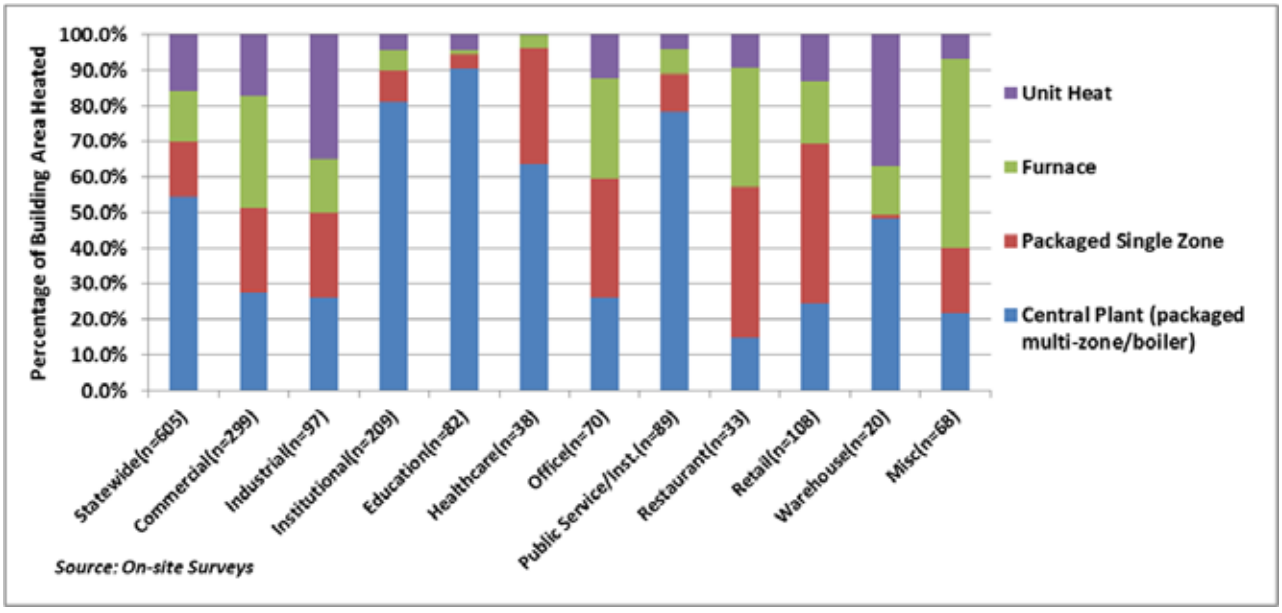
Figure 4-12 and Figure 4-13 show the prevalence of different types of heating systems across the state, presented statewide and then by sector and segment. Heating equipment percentages are weighted by square footage. For example, if a building had a boiler (packaged central plant) and 2 furnaces, the percentage of the building area served by each piece of heating equipment is multiplied by the total square footage of the building to determine the area of heated space.

Figure 4-12: Percentage of Building Area Heated by Equipment Type



n-values are the number of data points that have information on heating equipment, total square footage of building, and percentage of building heated by equipment

Figure 4-13: Percentage of Building Area Heated by Equipment Type by Sector, by Segment



n-values are the number of data points that have information on heating equipment, total square footage of building, and percentage of building heated by equipment

Table 4-17 summarizes some of the key parameters of heating systems (excluding boilers). Table 4-18 presents the same parameters for just boilers. The average age of heaters and boilers in non-residential buildings across the state is 13.0 and 17.9 years, respectively. The statewide average heating capacity of heaters is 134,492 (Btu/hr). Restaurant facilities have the lowest average heating capacity of 97,878 (Btu/hr).

Table 4-17: Heating Equipment

Sector, Segment	Avg. Age (yrs)	Avg. Heating Capacity (Btu/hr)	Heating Efficiency (%)	Percentage Programmable	Percentage EMS
Non-Residential	13.0	134,492	86.5%	40.6%	9.1%
n-values[(1)]	411	214	156	434	434
Commercial	11.2	129,862	87.4%	52.4%	9%
Office	7.6	147,336	83.5%	52.8%	0.0%
Restaurant	6.2	97,878	88.6%	46.0%	0.0%
Retail	9.3	105,034	82.5%	52.7%	0.0%
Warehouse	7.0	173,267	81.0%	41.4%	9.2%
Misc.	9.2	138,550	94.0%	53.1%	2.7%
Industrial	15.9	133,403	84.9%	30.9%	0.0%
Institutional	14.0	172,547	83.1%	36.8%	41.6%
Education	12.4	199,471	94.2%	7.4%	41.3%
Healthcare	8.7	181,903	86.1%	13.5%	22.8%
Public Service/Inst.	8.0	147,326	84.6%	55.4%	0.0%

Source: On-site Surveys
Does not include boilers.
All parameters are weighted by square footage served except "Average Age" and "Average Heating Capacity" which are weighted by equipment count
[(1)] n-values for non-residential findings only

Table 4-18: Boiler Heating Parameters

Sector, Segment	Avg. Age (yrs)	Avg. Heating Capacity (Btu/hr)	Heating Efficiency (%)	Percentage Programmable	Percentage EMS
Non-Residential	17.9	1,957,260	80.8%	21.2%	31.3%
n-values	147	141	77	273	273
Commercial	14.1	480,990	84.2%	30.3%	53.5%
Office	16.7	488,218	84.3%	46.5%	38.6%
Restaurant	50.0	190,000	86.6%	16.5%	0.0%
Retail	16.0	293,154	79.2%	38.6%	0.0%
Warehouse	37.0	366,000	80.0%	8.3%	0.0%
Misc.	11.5	613,714	81.7%	29.5%	38.0%
Industrial	21.8	705,069	79.5%	55.8%	0.0%
Institutional	17.2	2,489,775	80.8%	18.7%	36.7%
Education	15.4	4,715,253	80.7%	30.7%	25.1%
Healthcare	13.4	8,745,578	N/A	11.4%	30.5%
Public Service/Inst.	18.6	986,995	83.9%	17.0%	51.7%

Source: On-site Surveys
All parameters are weighted by square footage served except "Average Age" and "Average Cooling Capacity" which are weighted by equipment count
(1) n-values for non-residential findings only

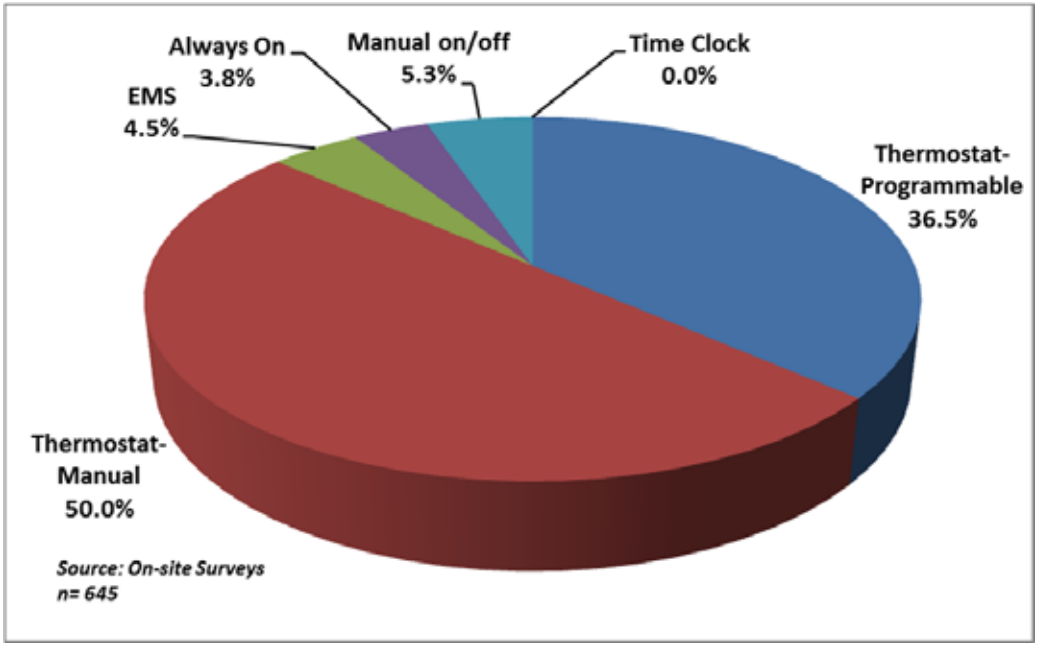
Table 4-19 and Figure 4-14 summarize some of the key parameters of temperature controls and illustrate the prevalence of different types of controls in the non-residential sector. The high prevalence of manual thermostats suggests that many systems are likely not being set back during times of non-occupancy.

Table 4-19: HVAC Control Parameters

Sector, Segment	Pct. Using Heater Reset Controls	Avg. Heating Set Back Points (Occupied/Unoccupied)	Avg. Cooling Set Back Points (Occupied/Unoccupied)
Non-Residential	22.5%	69.4/61.5	71.9/77.3
n-values[(1)]	343	215/209	172/169
Commercial	19.6%	69.7/62.4	72.0/77.1
Office	30.8%	70.6/64.3	71.8/78.3
Restaurant	10.0%	70.8/61.4	72.0/78.9
Retail	9.0%	68.3/60.8	72.8/77.8
Warehouse	12.5%	71.7/60.0	72.3/81.5
Misc.	25.0%	68.9/60.7	70.7/76.8
Industrial	14.6%	69.3/60.0	71.3/78.7
Institutional	30.9%	70.1/63.4	72.1/77.6
Education	60.5%	70.3/61.1	73.0/79.5
Healthcare	17.2%	69.8/63.8	71.3/75.8
Public Service/Inst.	30.2%	68.9/60.1	71.9/78.6

Source: On-site Surveys
[(1)] n-values for non-residential findings only

Figure 4-14: Temperature Control Types in Non-Residential Buildings by Square Footage Served



n-values are the number of data points that have information on temperature control type, total square footage of building, and percentage of building controlled

4.3.2 Lighting

Lighting is another significant end use in terms of energy consumption for the non-residential sector. Findings for lighting are typically presented as a percentage of connected load or fixture count and thus each sample was weighted differently from the rest of the study. Presenting lighting information on a basis of connected load is a change from the floor space square footage used in the Phase I Baseline Study Report. While findings presented on a connected load basis are generally similar to findings presented on a floor space basis, the connected load is thought to be more accurate, as it precludes any potential error from associating multiple lighting technologies to the same building zone.

Figure 4-15 and Table 4-20 show the saturation of different lighting system technologies. Figure 4-16 and Figure 4-17 show the breakdown of fluorescent lamp types. Linear fluorescent lighting accounts for 78% of the connected lighting load of non-residential buildings in Pennsylvania. High bay applications utilizing metal halide fixtures have a significantly higher saturation in the industrial sector at 29%. Incandescent lighting still represents a significant portion of restaurant lighting at 44% of the connected load.

Of all non-residential linear fluorescent fixtures, over half (58.1%) are T-8 fixtures, and roughly one quarter (24.9%) are T-12 fixtures. High performance T-8 lamps are only installed in a small fraction (2.5%) of the linear fluorescent fixtures in this study's sample. Most of the high performance T8 fixtures were found in one particular industrial site, suggesting that the percent of total fixtures for HPT8s may be lower. Findings indicate that T-8 fixtures are the most prevalent fluorescent lighting for all sectors and segments, with the only exceptions being warehouse and miscellaneous commercial segments. Finally, T-5 fixtures appear to have the highest percent of fixtures installed in the institutional sector, at 20%, while the total non-residential percent of T-5s stands at 14% of the total fixtures.

Figure 4-15: Non-Residential Lighting System Technology Saturation, by Percent of Connected Load

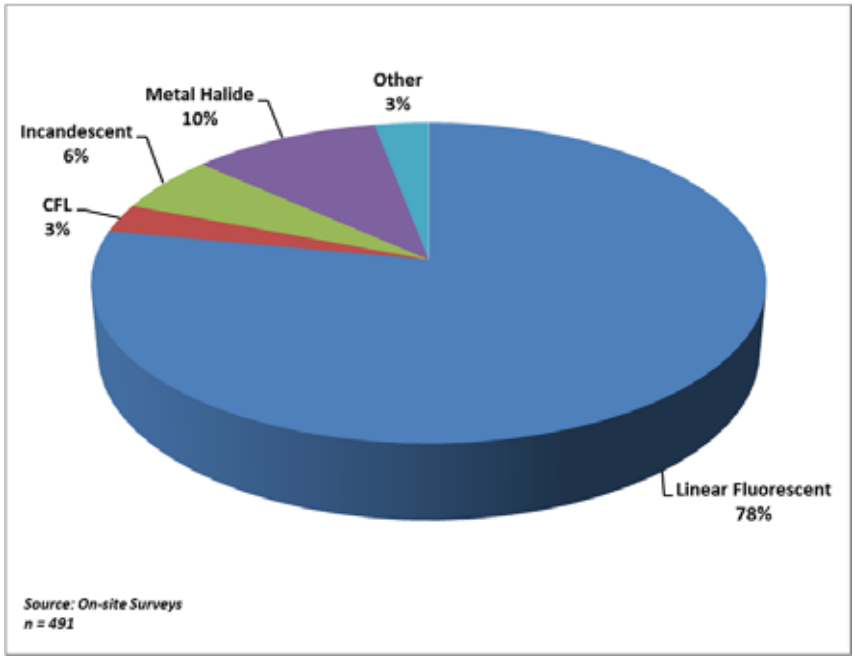


Table 4-20: Lighting System Technology Saturation by Sector by Segment (% of Connected Load)

Type	Non-Residential	Commercial	Industrial	Institutional	Education	Healthcare	Office	Public Service / Institutional	Restaurant	Retail	Warehouse	Misc.
Linear Fluorescent	78%	75%	61%	89%	94%	87%	88%	77%	48%	85%	83%	54%
CFL	3%	5%	0%	3%	1%	8%	2%	4%	3%	1%	0%	16%
Incandescent	6%	13%	1%	5%	1%	4%	6%	12%	44%	6%	2%	21%
Metal Halide	10%	7%	29%	2%	3%	0%	4%	5%	1%	8%	13%	9%
High Pressure Sodium*	2%	0%	7%	0%	0%	0%	0%	1%	0%	0%	1%	0%
Mercury Vapor*	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LED*	0%	0%	0%	1%	0%	0%	0%	1%	1%	0%	0%	0%
Neon*	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%
Other*	1%	0%	2%	0%	1%	0%	0%	0%	1%	0%	0%	0%
n-value	491	261	68	162	52	43	68	67	28	88	18	59

Source: On-site Surveys

***Included as part of the "other" category in Figure 4-15**

Figure 4-16: Non-Residential Linear Fluorescent Lamp Type Percent of Fixture Count

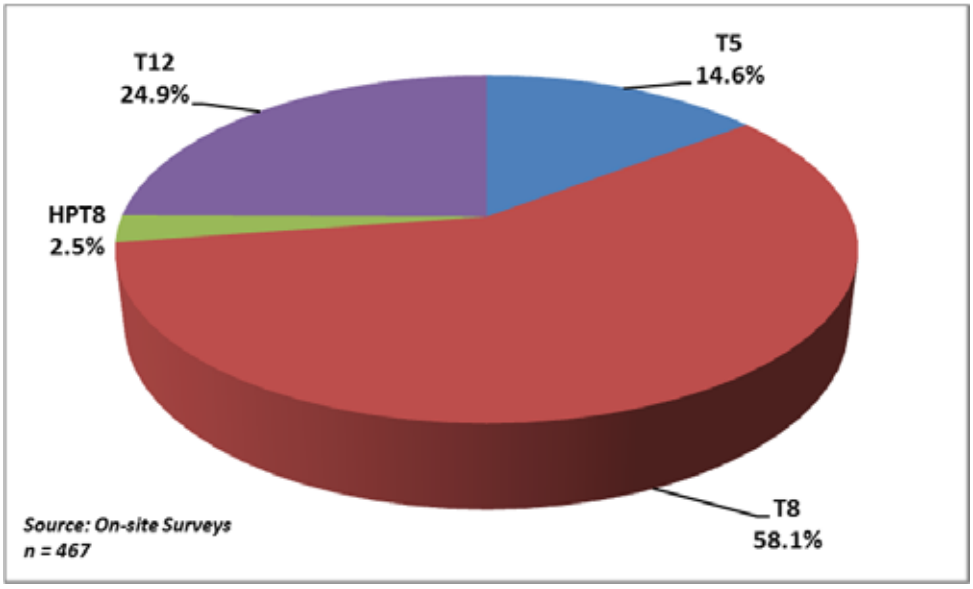
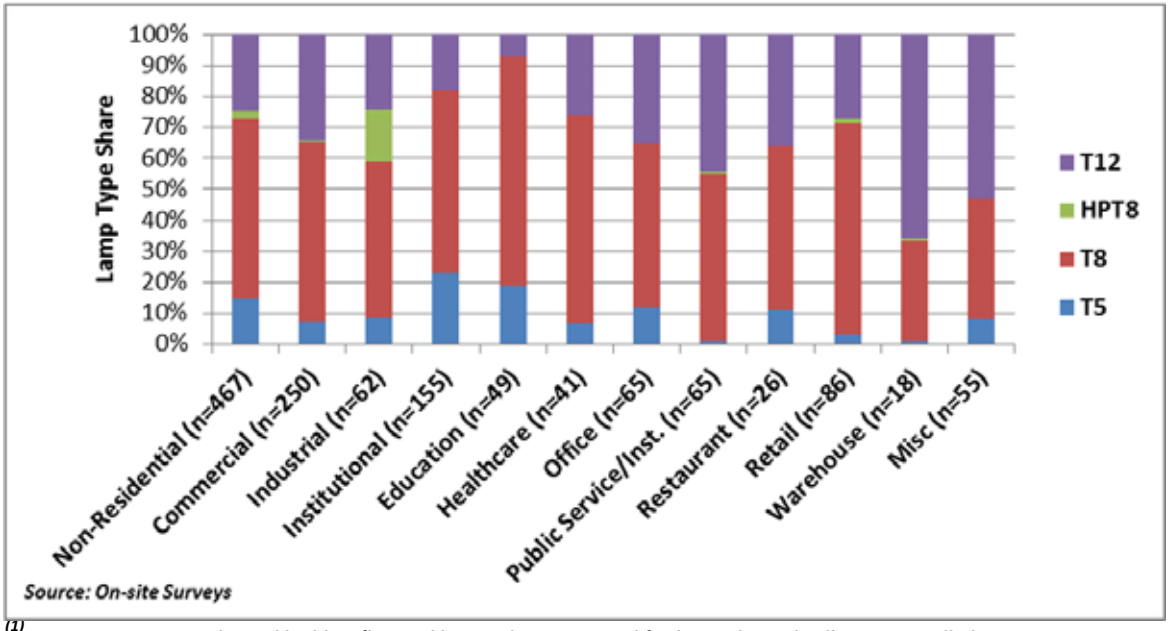


Figure 4-17: Linear Fluorescent Lamp Type Distribution by Sector and Segment, by Fixture Count



(1) HPT8 saturation in industrial highly influenced by very large surveyed facility with nearly all HPT8s installed

Below, Table 4-21 shows the penetration of different control types, showing that the majority (74%) of lighting is controlled by manual on/off switches. Nearly all the rest of the lighting is controlled by circuit breaker (9%), dimmer (7%), or occupancy sensor (7%). The industrial sector shows the largest amount of lighting controlled by circuit breaker (33%). The institutional sector controls 15% of its

lighting with dimmers and both the commercial and institutional sectors control a significant portion of their lighting using occupancy sensors (10% and 6%, respectively).

Table 4-21: Lighting Control Type Saturation by Sector (% of Connected Load)

Type	Non-Residential	Commercial	Industrial	Institutional
Manual - Switch	74%	87%	64%	71%
Circuit Breaker	9%	4%	33%	0%
Manual - Dual Level Switch	1%	0%	0%	3%
Dimmer	7%	1%	0%	15%
Timer	0%	0%	0%	1%
Occupancy Sensor	7%	6%	3%	10%
Daylight Controls	0%	0%	0%	1%
Energy Management System	0%	1%	0%	0%
None/Continuous	0%	0%	0%	0%
n-value	491	261	68	162

Source: On-site surveys

Figure 4-18 through Figure 4-21 show additional characteristics of lighting at and within the non-residential level in Pennsylvania. The presence of electronic ballasts generally follows the saturation of the more efficient T-8 lamps across sectors and segments. Approximately half of all exit signs have been upgraded to LED (49%). Also of note is that just over 40% of non-residential buildings across Pennsylvania report having upgraded their lighting in the previous five years. The data presented above concerning linear fluorescents indicates that these upgrades are largely conversions of T-12 to T-8 lamps. For example, just under half of institutional buildings have upgraded their lighting in the previous five years, and the institutional segment had the highest percentage of connected loads serving linear fluorescents and highest percent of fixture counts being either T-5 or T-8s.

Figure 4-18: Linear Fluorescent Lamp Ballast Type Share by Fixture Count

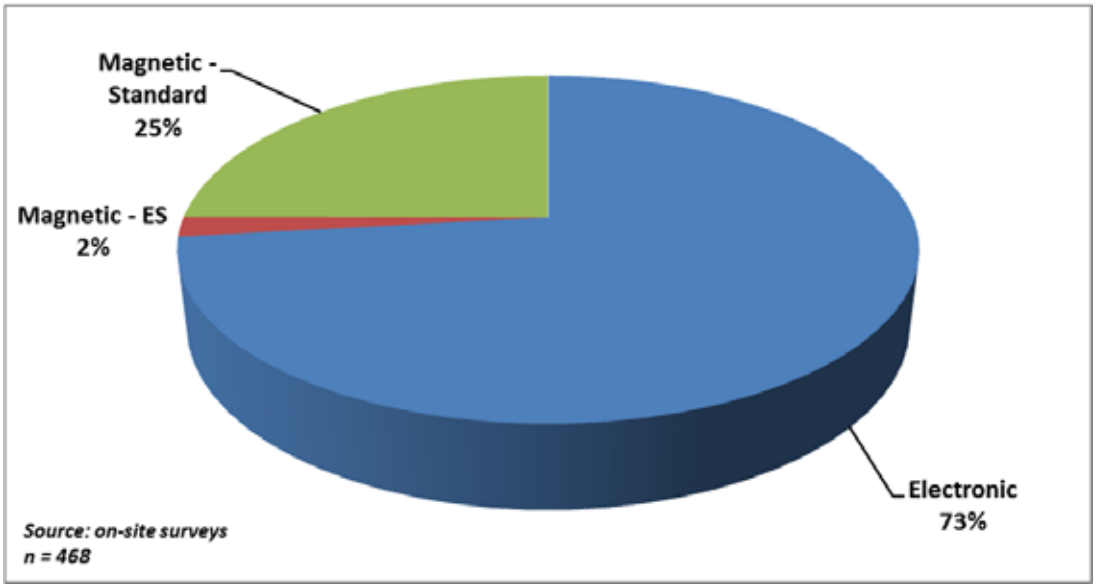


Figure 4-19: Linear Fluorescent Lamp Ballast Type Distribution by Sector and Segment (by Fixture Count)

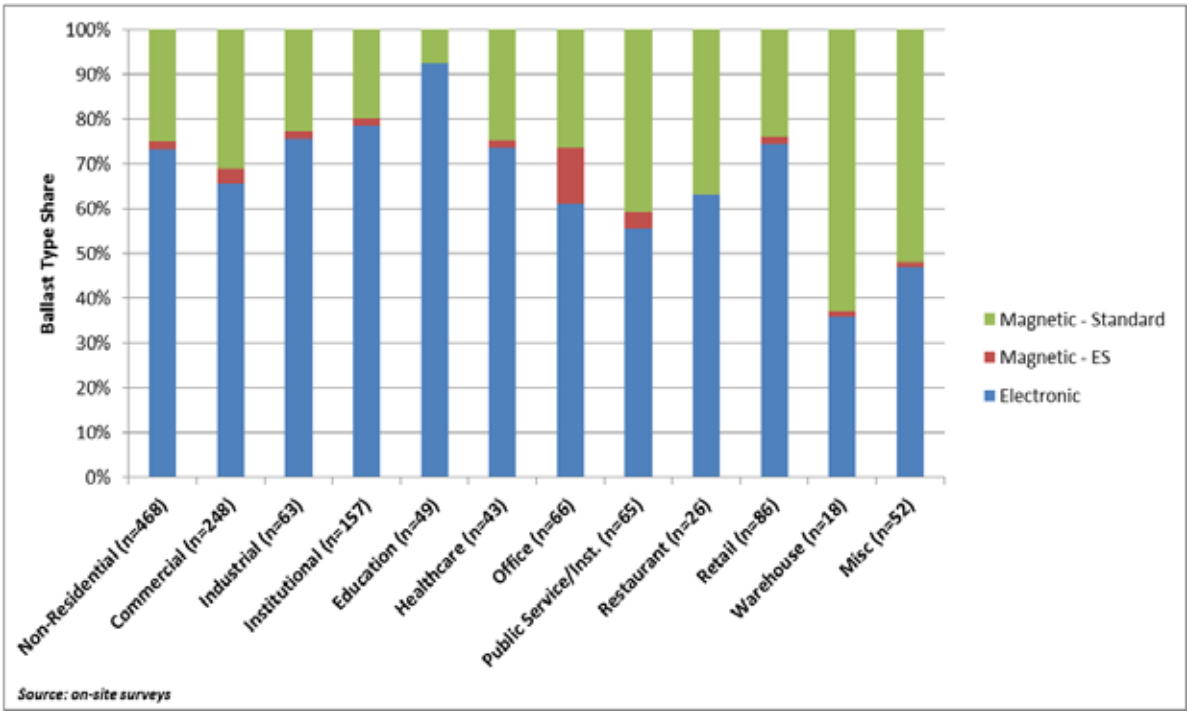


Figure 4-20: Non-Residential Exit Sign Bulb Type Share by Fixture Count

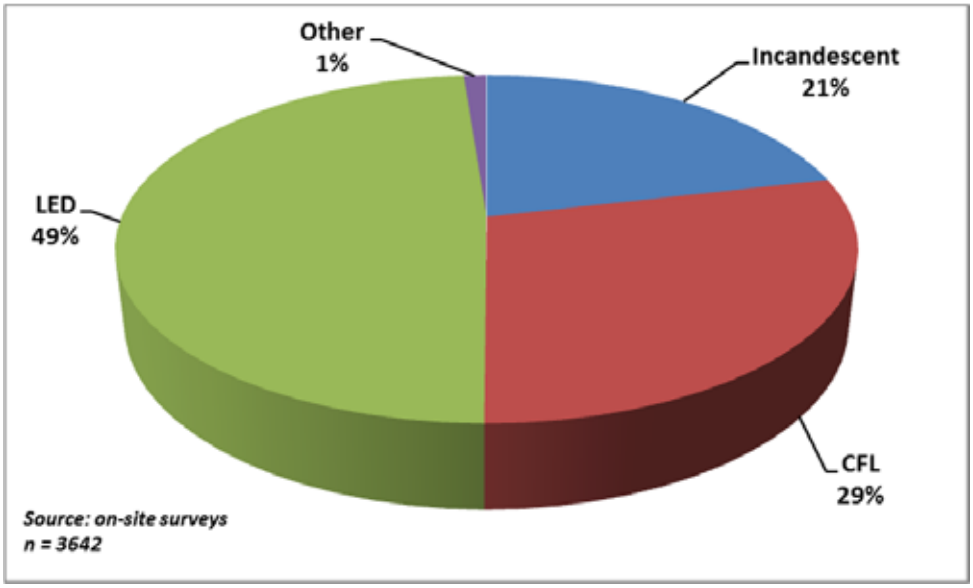
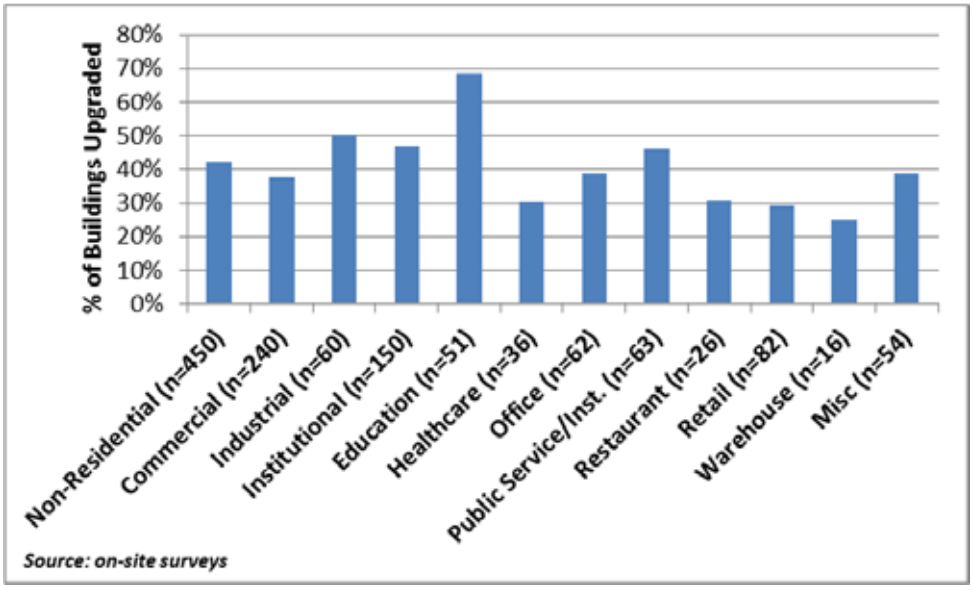


Figure 4-21: Percent of Buildings that Upgraded Lighting in Past 5 Years by Sector and Segment



4.3.3 Commercial Refrigeration

Figure 4-22 below shows that 34% of buildings in Pennsylvania have commercial refrigeration equipment installed. Restaurants had the highest penetration of commercial refrigeration

equipment (100%) of any segment. Figure 4-23 illustrates the type of equipment installed in buildings with commercial refrigeration equipment across all segments.

Figure 4-22: Penetration of Commercial Refrigeration Equipment by Sector and Segment

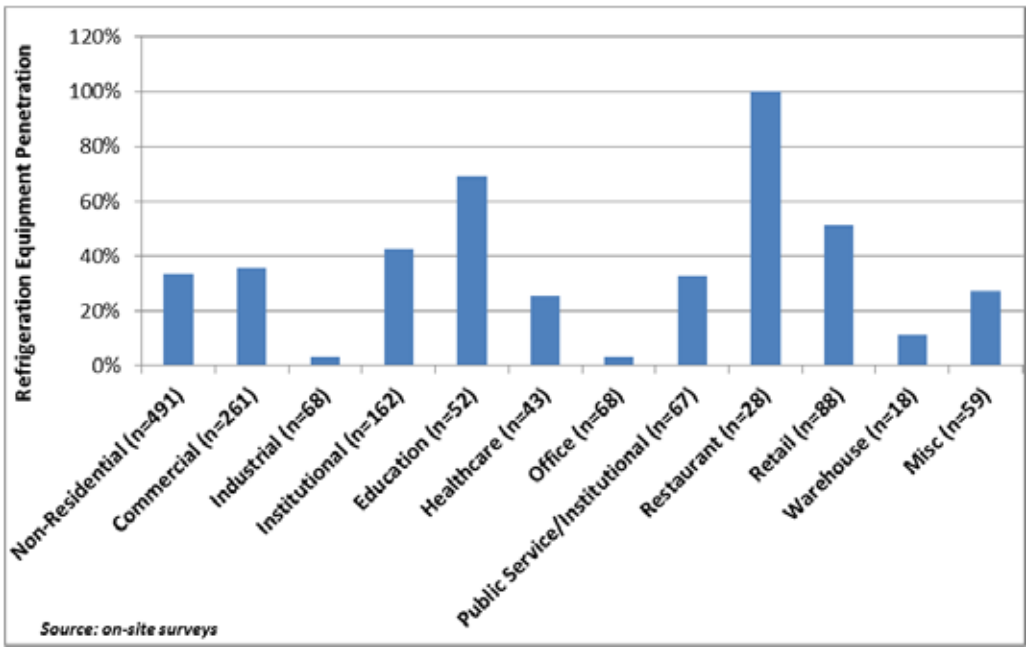


Figure 4-23: Non-Residential Refrigeration Equipment Type Share by Premise Count

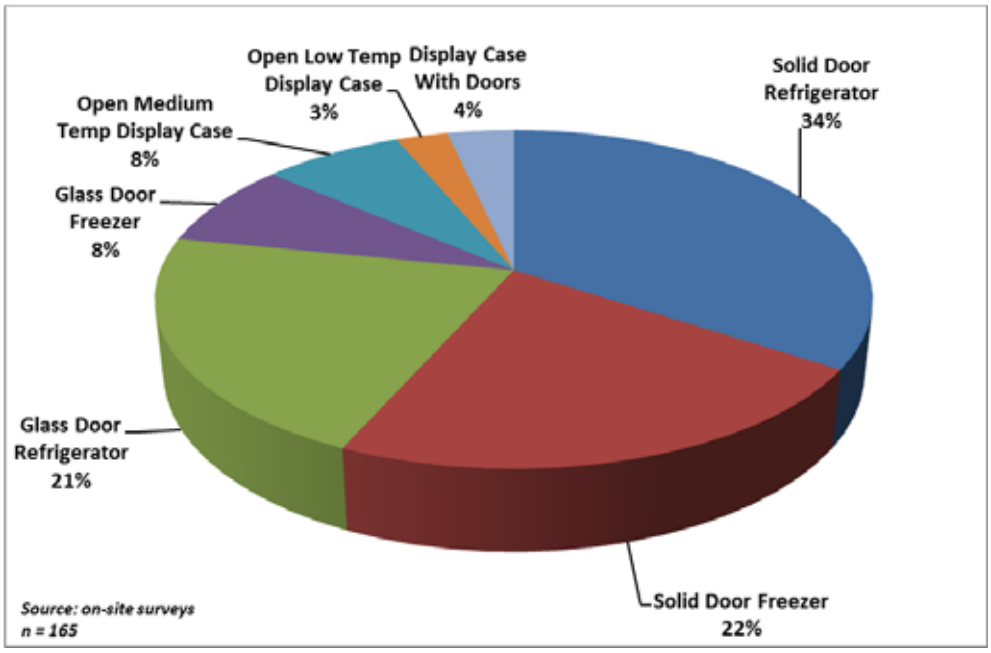


Figure 4-24 through Figure 4-26 depict the type of refrigeration equipment installed in institutional, restaurant, and grocery buildings, respectively. Solid door refridgerators/freezers represent the majority of refrigeration equipment in the educational and restaurant segments, followed closely by glass door refrigerators. Table 4-22 shows the presence of different types of measures in place for refrigeration equipment in the two segments with the highest refrigeration equipment saturations, restaurant and education, as well as in the grocery sub-segment (a sub-segment of retail).

Figure 4-24: Refrigeration Equipment Type Penetration for Educational Buildings by Premise

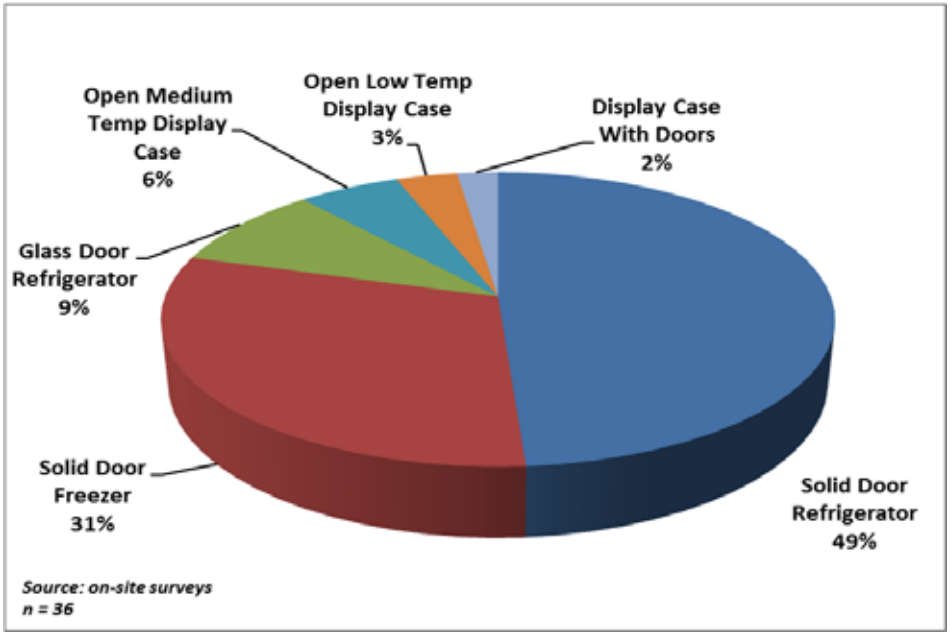


Figure 4-25: Refrigeration Equipment Type Penetration for Restaurant by Premise

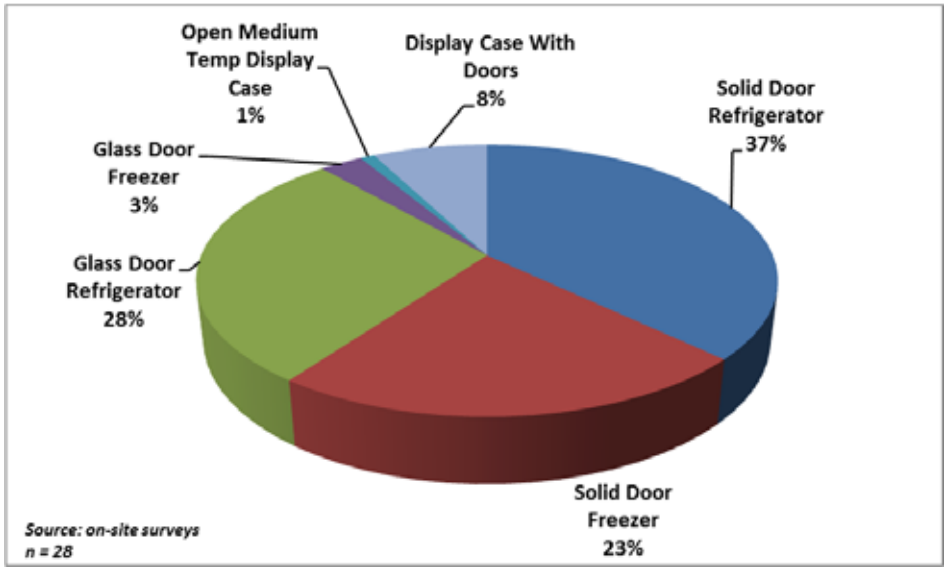


Figure 4-26: Refrigeration Equipment Type Penetration for Grocery by Premise

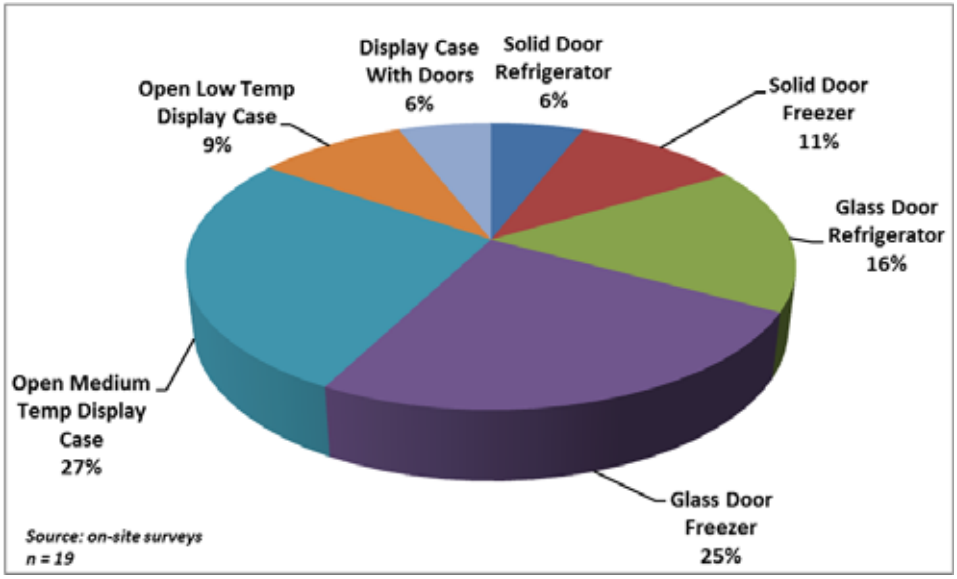


Table 4-22: Penetration of Measures for Buildings with Refrigeration Equipment

Measure	Education	Restaurant	Grocery
Anti-Sweat Heating Control	1.9%	7.1%	78.9%
LED Lights for Displays	0.0%	3.6%	0.0%
Motion Sensors	0.0%	0.0%	10.5%
VFDs on Compressors	3.8%	3.6%	0.0%
VFDs on Condensers	3.8%	0.0%	0.0%
ECM Motors	1.9%	3.6%	5.3%
Demand Defrost Controls	19.2%	14.3%	15.8%
Floating Head Pressure	17.3%	10.7%	15.8%
High Efficiency Evaporators	7.7%	0.0%	10.5%
Night Covers	0.0%	0.0%	10.5%
Evap. Fan Controls	3.8%	14.3%	10.5%
System Commissioned	11.5%	17.9%	5.3%
Applicable for Re-Commission	13.5%	21.4%	36.8%
Heat Recovery	0.0%	0.0%	15.8%
Special Doors	0.0%	0.0%	0.0%
Ice Makers	36.5%	64.3%	42.1%
n-value	52	28	19

Source: on-site surveys

4.3.4 Water Heating

As noted in Table 4-4, the majority of non-residential businesses (92.7%) have water heaters. Figure 4-27 shows the distribution of different types of water heating units installed in Pennsylvania businesses that have water heaters. The findings are weighted on the storage capacity of each water heating system, therefore giving more weight to larger systems. Using this methodology removes the impact of tankless water heaters; however, because there were much more storage capacity data than input power data available and observing that only 4% of the water heating systems surveyed were tankless, it was determined that weighting based on storage capacity of the unit was the most appropriate means of presenting the data.

90% of non-residential water heating capacity surveyed across the state is from self-contained units, with storage tanks associated with a central boiler representing nearly all of the rest of the systems. Table 4-23 shows the parameters of water heating units across different sectors and segments in the state. Less than 10% of the water heater systems have tank wraps installed and the average efficiency across all non-residential systems is 87.5%. Figure 4-28 through Figure 4-30 show the fuel share and distribution of system capacity for all non-residential water heaters. The majority (56%) of all systems are natural gas, by gallons stored. The segment with the highest percent of electrically-fueled water heaters, warehouses, is also the segment with the smallest average water

heater input power. Finally, approximately 70% of the water heating systems have a tank capacity of less than 50 gallons.

Figure 4-27: Saturation of Equipment Type in Non-Residential Buildings w/ Water Heating by Storage Capacity

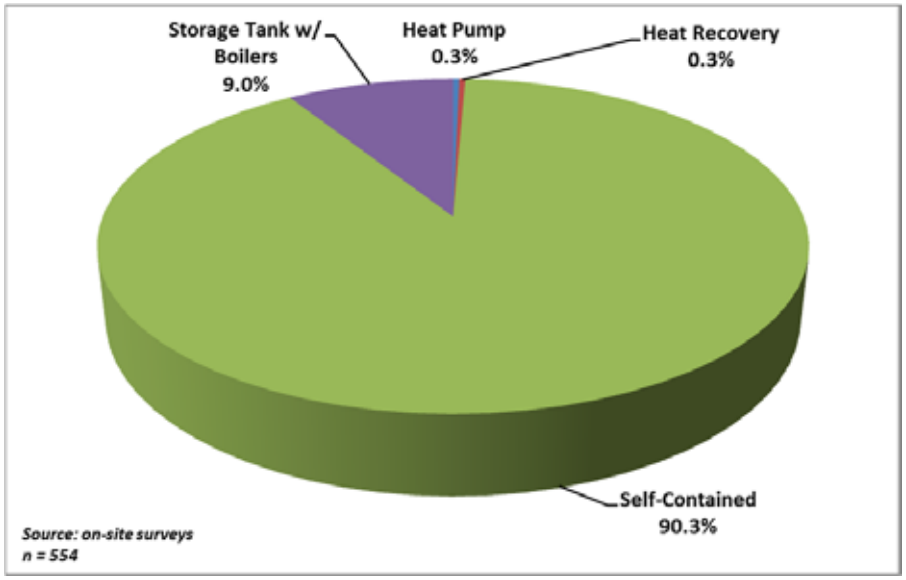


Table 4-23: Water Heating Parameters

Sector/Segment	Avg. age	% w/ tank wrap	% w/ pipe wrap	% w/ setback	Avg. tank capacity	Avg. Efficiency	Avg. Input Capacity
Non-Residential	8.3	9%	20%	3%	50.5	87.5	194,767
n-values	458	525	519	476	485	83	380
Institutional	9.1	13%	30%	5%	63.6	85.7	175,462
Healthcare	11.0	14%	27%	9%	65.8	96.4	333,731
Education	9.8	11%	42%	9%	90.2	81.3	216,558
Public Service/Institutional	8.0	11%	17%	6%	52.5	88.2	123,081
Commercial	7.4	7%	18%	2%	46.3	87.4	243,834
Office	8.4	11%	17%	3%	36.4	86.8	31,868
Restaurant	7.9	6%	19%	12%	57.2	82.7	61,434
Retail	8.4	4%	14%	0%	41.8	81.9	341,629
Warehouse	9.3	7%	0%	0%	24.1	100.0	18,078
Misc.	6.3	11%	18%	2%	56.3	92.0	74,539
Industrial	9.1	5%	8%	0%	33.3	94.7	31,648

Source: on-site surveys

Figure 4-28: Non-Residential Water Heating Fuel Share Presented by Storage Capacity

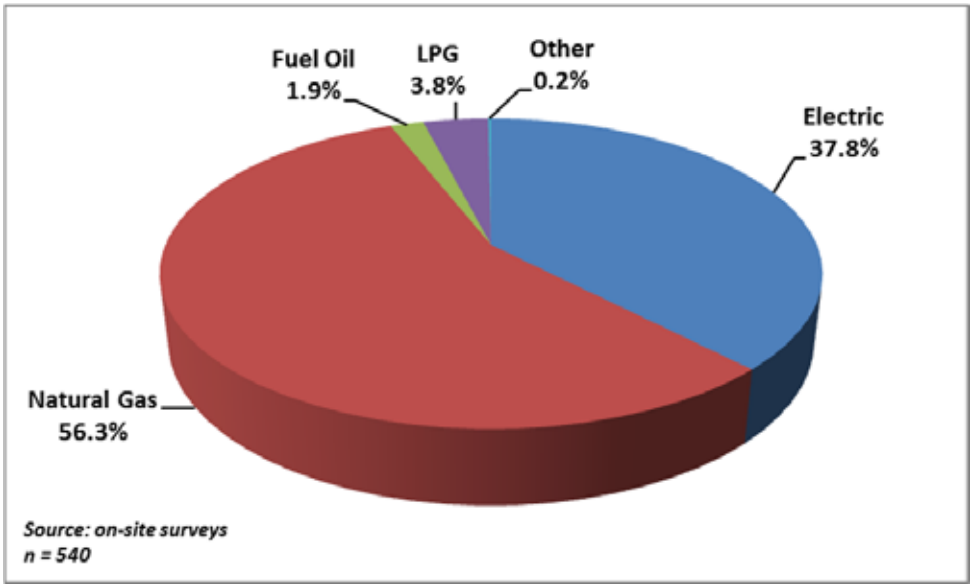


Figure 4-29: Water Heating Fuel Share by Segment, by Storage Capacity

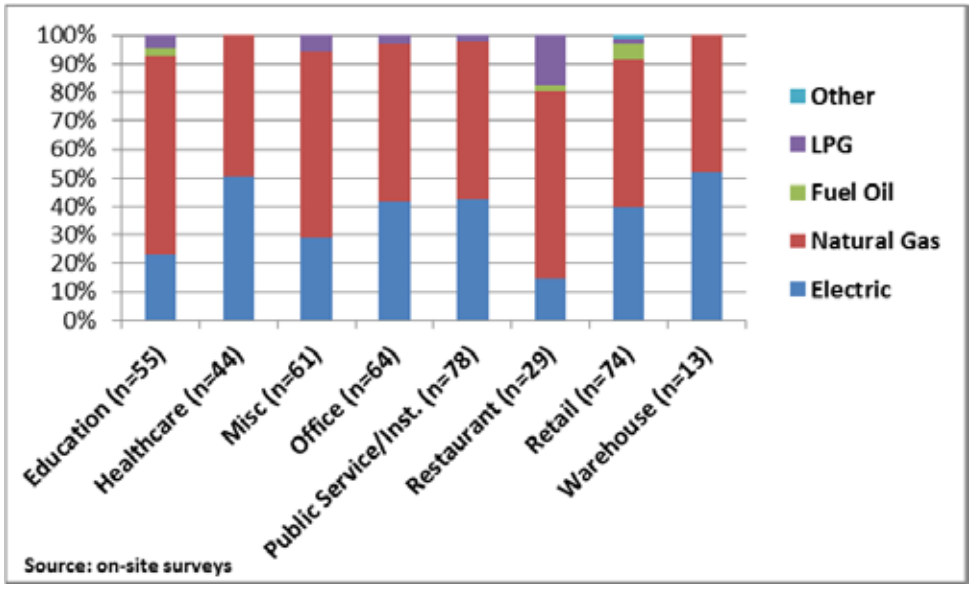
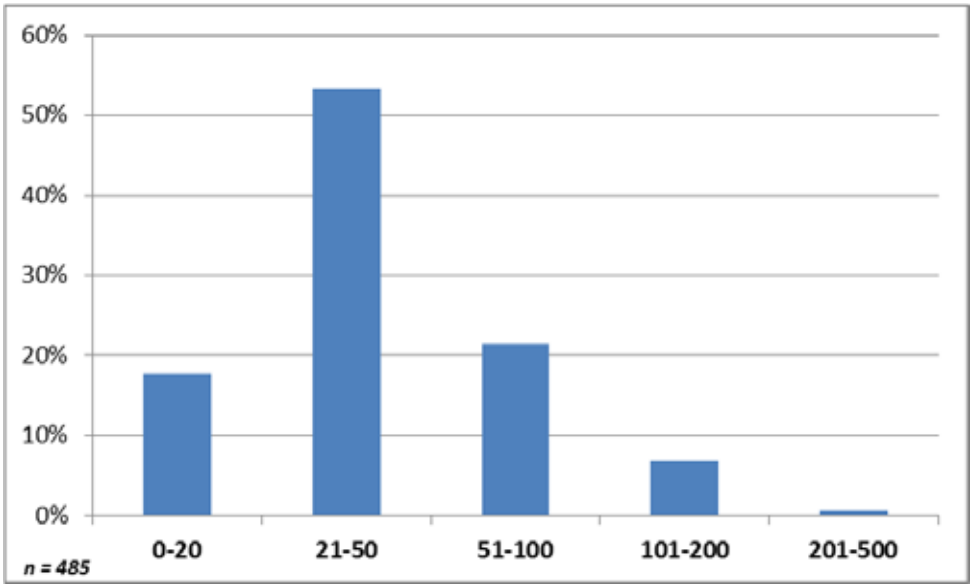


Figure 4-30: Non-Residential Water Heating Tank Capacity Distribution

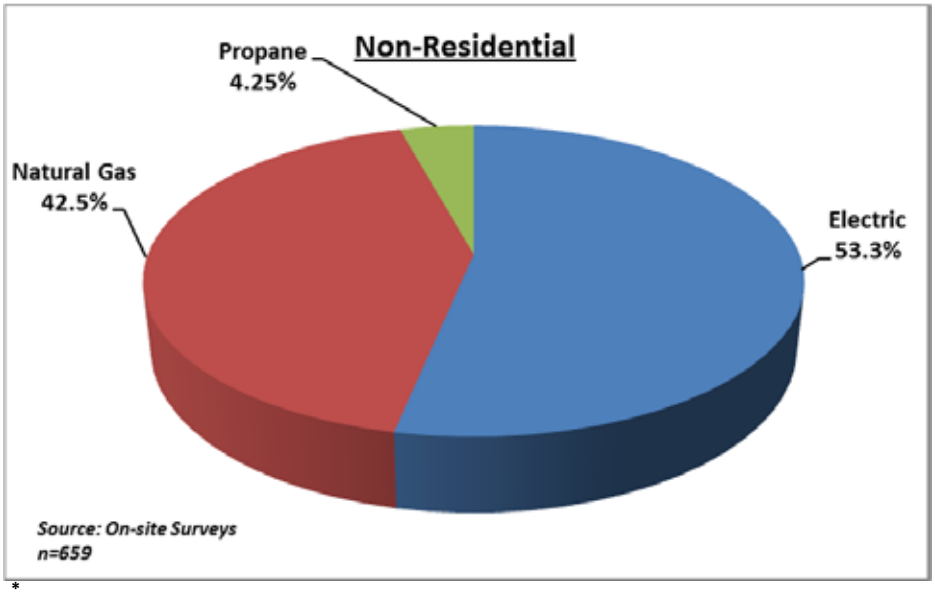


Source: on-site surveys

4.3.5 Commercial Cooking

Figure 4-31 and Figure 4-32 show the fuel share of cooking equipment across all non-residential buildings as well as just for restaurants. While electricity fuels the largest share (53.3%) of cooking equipment in all non-residential buildings that number drops to 45.0% for equipment in restaurants.

Figure 4-31: Cooking Fuel Share for Non-Residential Buildings by Equipment Count



* *Excluding residential-style microwaves*

Figure 4-32: Cooking Fuel Share for Restaurant Buildings

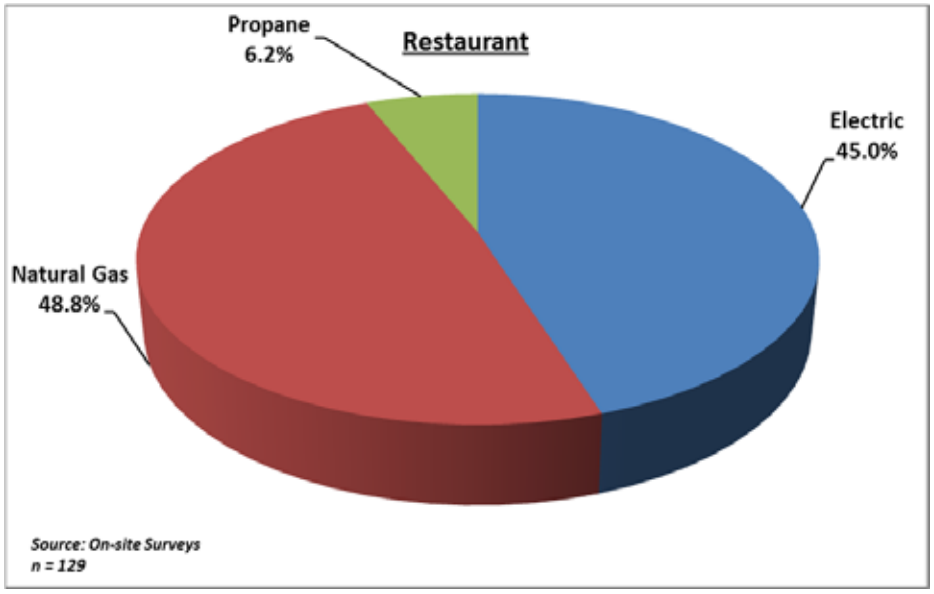


Figure 4-33 and Figure 4-34 illustrate this decrease in electric equipment use further in restaurants as restaurants have a higher saturation of ranges and ovens that typically are fueled by natural gas. Table 4-24 shows the saturation of electric cooking equipment in Pennsylvania businesses (not including gas cooking equipment). The data suggest that the vast majority of major cooking

equipment (e.g., ranges and ovens) in segments with a large cooking load (restaurants, cafeterias) are gas-fueled, as there is only minimal saturation of electric ovens, ranges and other cooking equipment present in surveyed buildings.

Figure 4-33: Fuel Share of Commercial Ranges

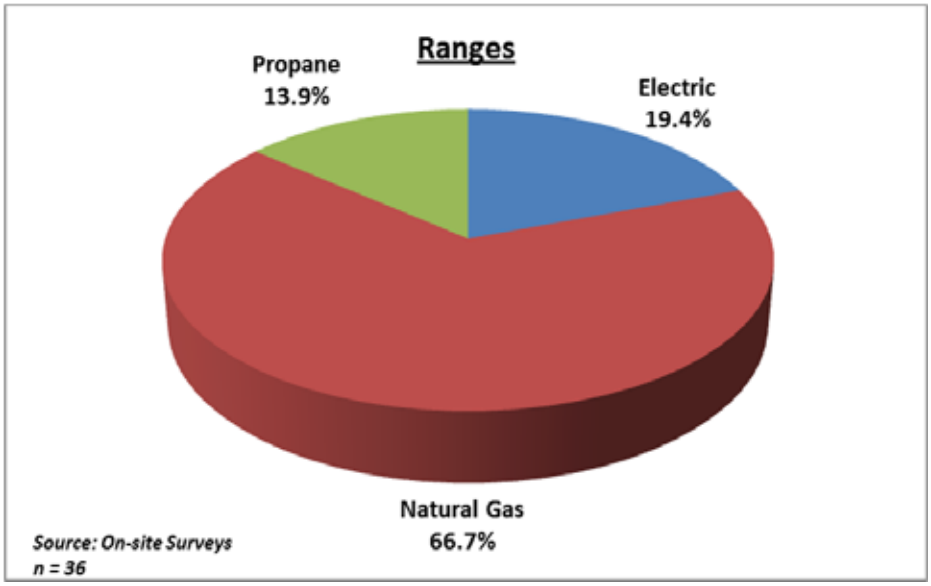


Figure 4-34: Fuel Share of Commercial Standard Ovens

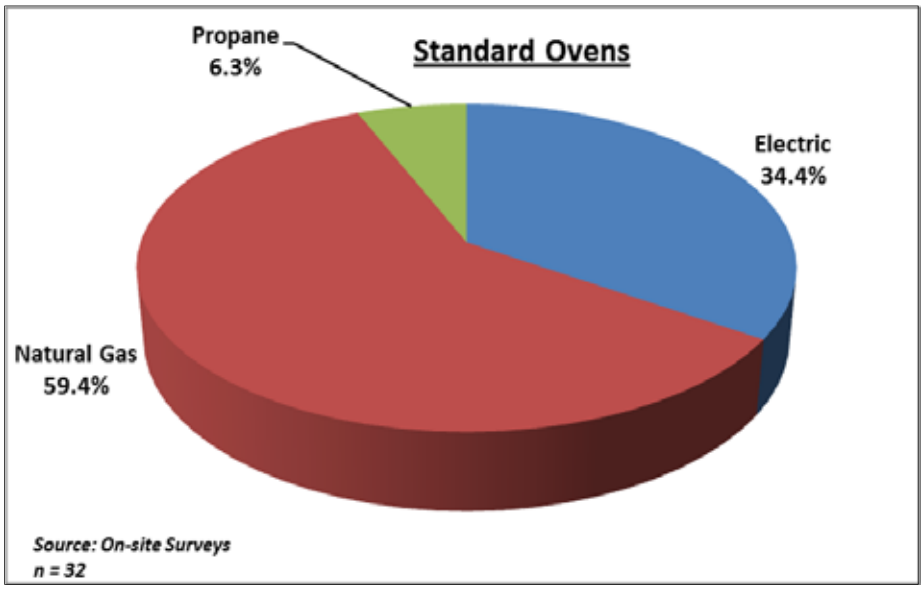


Table 4-24: Saturation of Electric Cooking Equipment in Building with Cooking Equipment

Type	Non-Residential	Commercial	Institutional	Restaurant
Electric Standard Oven	12.5%	10.0%	15.4%	7.0%
Electric Convection Oven	10.0%	10.1%	9.5%	9.3%
Electric Range	14.4%	13.1%	16.0%	10.9%
Electric Fryer	10.5%	13.4%	8.1%	17.1%
Electric Hot Food	8.0%	7.1%	8.7%	5.4%
Electric Steam Cooker	4.9%	3.1%	6.6%	1.6%
Electric Griddle	8.5%	11.1%	6.8%	12.4%
Electric Pizza Oven	3.8%	6.1%	2.6%	7.8%
Electric Warming Table	6.9%	5.7%	9.5%	4.7%
Electric Heat Lamp	4.2%	6.8%	3.1%	6.2%
Electric Soup Pot	4.1%	4.3%	4.5%	3.1%
Electric Continuous Toaster	3.1%	3.6%	4.3%	3.9%
Electric Microwave	9.6%	10.4%	10.0%	10.9%
n-values	659	312	345	129

Source: On-site Surveys

4.3.6 Plug Load

Table 4-25 shows the percentage of sites with at least one piece of each plug load equipment type by sector and Table 4-26 shows the average number of each plug load type per site by sector.

Table 4-25: Percentage of Sites with One or More Pieces (Penetration) of Plug Load Equipment by Sector

Type	Non-Residential	Commercial	Industrial	Institutional
Air Purifier/Dehumidifier	11%	8%	12%	14%
All-in one (printer/copier/scanner/fax)	59%	55%	70%	59%
Server	23%	19%	39%	24%
Secondary Monitor	16%	16%	24%	12%
Fax Machine	16%	17%	14%	15%
Laptop	29%	28%	40%	28%
Paper Shredder	33%	33%	39%	31%
Personal Computer	80%	78%	83%	81%
Photocopier	19%	17%	16%	22%
Printer	54%	49%	61%	55%
Scanner	6%	4%	7%	8%
Coffee Maker	61%	58%	68%	61%
Residential Style Refrigerator	67%	58%	80%	74%
Microwave	77%	72%	84%	83%
Refrigerated Vending Machine	20%	18%	31%	17%
Non-Refrigerated Vending Machine	13%	10%	31%	10%
Water Cooler	37%	28%	55%	42%
Space Heater	23%	20%	40%	18%
Television	47%	47%	30%	54%
Security Camera	26%	30%	25%	20%
n-values	484	256	68	160

Source: on-site surveys

Table 4-26: Average Number (Saturation) of Plug Load Equipment per Site by Sector

Type	Non-Residential	Commercial	Industrial	Institutional
Air Purifier/Dehumidifier	1.8	1.6	1.5	2.1
All-in one (printer/copier/scanner/fax)	2.6	2.2	2.0	3.5
Server	4.2	2.0	1.9	8.2
Secondary Monitor	7.2	4.5	4.2	13.6
Fax Machine	1.6	1.3	1.1	2.0
Laptop	20.4	5.6	3.6	49.4
Paper Shredder	1.9	1.7	1.4	2.5
Personal Computer	21.4	6.8	9.3	47.7
Photocopier	2.0	1.5	1.8	2.6
Printer	5.9	3.3	3.8	10.0
Scanner	4.1	1.7	1.3	8.1
Coffee Maker	3.8	3.6	1.8	4.7
Residential Style Refrigerator	3.1	3.5	1.9	3.0
Microwave	4.0	5.1	2.2	3.2
Refrigerated Vending Machine	2.1	1.5	2.8	2.6
Non-Refrigerated Vending Machine	2.1	1.8	2.2	2.2
Water Cooler	2.2	1.4	2.3	2.9
Space Heater	3.0	2.7	3.5	3.2
Television	12.3	10.5	1.6	17.2
Security Camera	11.4	8.1	7.4	19.8
n-value	467	249	62	156

Source: on-site surveys

5 EDC SPECIFIC NON-RESIDENTIAL FINDINGS

5.1 INTRODUCTION

This section presents results of the on-site surveys and the findings of the subsequent data analysis for the non-residential sector broken out by EDC. Non-residential is defined as the combined results of the commercial, industrial, and institutional sectors. Data was collected primarily from the 491 on-site surveys conducted by Nexant and GDS engineers. Secondary data was used to fill in data gaps when deemed appropriate. Findings are typically presented at the premise-level; however, weighting by other means such as building square footage served, connected load, or equipment capacity was performed on a case by case basis as appropriate, and noted in the findings accordingly.

5.2 NON-RESIDENTIAL OVERVIEW BY EDC

Based on the findings of the SWE's primary and secondary research, the electricity usage of each EDC's non-residential sector has been broken down by segment (type of building) and end use. The findings presented below are primarily derived from on-site survey data, with adjustments made as appropriate for biases.

5.2.1 Electricity Consumption by Segment

Data presented below is derived from the 2012 customer sales data from each of the EDCs. Table 5-1 through Table 5-3 shows the breakdown of electrical usage by EDC for the commercial, institutional, and industrial sectors, respectively. PECO and PPL represent almost 60% of the commercial electricity sales in Pennsylvania. The office segment comprises either the largest or second largest share of the commercial electricity sales for each of the EDCs except West Penn Power. As one might expect, the office segment's share of sales increases for EDCs with a larger metropolitan population – namely Duquesne, PPL, and PECO. PECO and PPL each have industrial sales around 10,000,000 MWh, amounting to approximately half of the state's industrial electricity sales.

Table 5-1: 2012 Statewide Commercial Energy Use, by EDC (MWh)

Commercial Subsector	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Grocery	240,034	245,896	1,187,718	290,297	66,902	953,448	349,274
Lodging	85,705	74,070	266,700	89,625	28,340	393,055	233,870
Misc.	806,457	854,665	3,338,505	676,161	258,110	2,537,828	707,296
Multifamily	148,008	46,233	580,236	99,124	22,914	314,509	112,438
Office	1,923,683	755,830	4,207,318	774,265	249,022	1,875,204	417,757
Restaurant	152,299	190,447	544,885	254,208	75,072	589,180	294,155
Retail	878,484	373,452	1,609,445	403,853	155,734	1,111,081	553,828
Warehouse	100,753	297,998	335,425	237,820	71,116	1,080,087	328,948
Total	**4,335,422**	**2,838,589**	**12,070,234**	**2,825,351**	**927,209**	**8,854,211**	**2,997,564**

Source: EDC Customer Datasets, CBECS, Nexant Analysis

Table 5-2: 2012 Statewide Institutional Energy Use, by EDC (MWh)

Institutional Subsector	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Education	922,037	442,203	2,377,776	534,544	98,839	1,281,032	585,998
Health	747,827	325,372	2,099,864	479,441	83,550	1,117,605	396,812
Institutional	152,788	140,919	528,942	306,750	55,508	439,045	427,828
Public Service	476,245	119,696	1,293,553	78,197	52,265	431,135	91,556
Total	**2,298,897**	**1,028,190**	**6,300,135**	**1,398,931**	**290,163**	**3,268,817**	**1,502,193**

Source: EDC Customer Datasets, CBECS, Nexant Analysis

Table 5-3: 2012 Statewide Industrial Energy Use, by EDC (MWh)

Industrial Segment	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Mfg: Chemicals	134,977	191,351	2,200,628	80,214	21,968	1,150,849	440,733
Mfg: Computers	74,271	657,926	663,863	146,784	11,527	293,885	395,920
Mfg: Food	23,364	479,224	821,404	274,827	79,830	1,657,604	107,456
Mfg: Metals	506,023	721,854	890,306	1,186,183	862,018	1,620,316	2,655,906
Mfg: Other	1,449,874	799,405	2,602,835	1,769,266	450,301	2,265,821	1,218,990
Mfg: Paper	1,649	173,327	783,145	624,680	9,467	678,983	311,000
Mfg: Plastics	25,348	344,699	388,678	379,262	1,875	1,020,287	96,772
Mining	5,291	359,998	115,417	284,798	10,553	129,717	1,331,092
Other Non-Mfg.	976,795	427,364	1,748,354	315,653	103,963	424,983	511,314
Total	**3,197,591**	**4,155,148**	**10,214,631**	**5,061,669**	**1,551,502**	**9,242,444**	**7,069,183**

Source: EDC Customer Datasets, Nexant Analysis

5.2.2 End Use Penetrations & Fuel Shares

Table 5-4 shows the penetration of different end uses in non-residential premises by EDC. Lighting, space heating, and plug loads were the only end uses found in all of the buildings visited across the state. Space cooling was less prevalent in PPL and Penelec territories at 76.8% and 79.5% respectively. Refrigeration and cooking equipment was found in fewer buildings than other end-uses, though this varied widely depending on building type. Water heating was also found in a large percentage of buildings across all of the EDCs, with an average of 86.4%.

Table 5-4: Non-Residential End Use Penetrations, by EDC

End Use	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Lighting	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Space Heating	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Space Cooling	82.9%	84.3%	88.7%	79.5%	86.8%	76.8%	91.4%
Plug Load	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Refrigeration	34.3%	30.0%	33.8%	38.4%	29.4%	29.0%	50.0%
Cooking	25.7%	24.3%	22.5%	37.0%	22.1%	23.2%	38.6%
Water Heating	87.1%	84.3%	81.7%	80.8%	88.2%	91.3%	91.4%
n-values	70	70	71	73	68	69	70

Source: On-site Surveys

****Penetration calculated on a per premise basis***

5.2.3 Building Information

Table 5-5 and Figure 5-1 presents the total building stock surveyed and average square footages of non-residential buildings in each EDC. Met-Ed and West Penn Power have the highest average square footage of buildings surveyed in their territories.

Table 5-5: Square Footage Overview of Non-Residential Buildings by EDC

EDC	Avg. Square Footage Surveyed	n-values[(1)]
Duquesne	17,361	70
Met-Ed	44,497	70
PECO	17,753	71
Penelec	26,856	73
Penn Power	20,832	68
PPL	30,473	69
WPP	35,635	70

Source: On-site Surveys

[(1)] n-values are for average square footage only

Figure 5-1: Average Square Footage of Non-Residential Buildings Surveyed by EDC

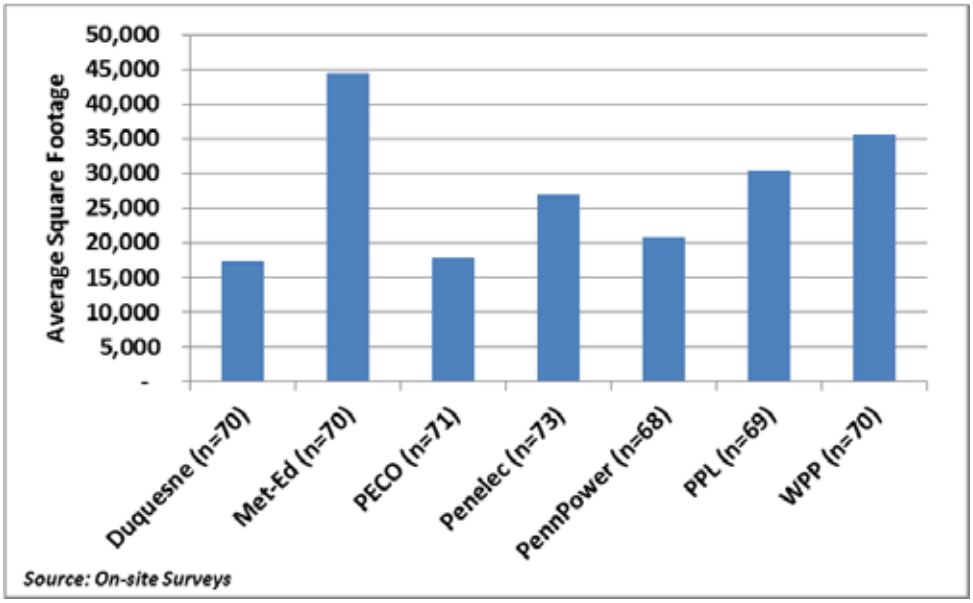


Table 5-6 through Table 5-9 provide an overview of the characteristics of non-residential buildings broken out by EDC. The average age for buildings across all EDCs was between 42.4 years for Duquesne and 65.2 years for West Penn Power. While Duquesne's average wall insulation R-value of 19.0 is significantly higher than other EDCs, it is important to note it is calculated from four data points.

Table 5-6: Building Characteristics by EDC

Parameter	Unit	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Avg. Age	Year	42.4	60.9	57.5	45.7	50.4	63.0	65.2
Avg. Occupants Core Business	-	217.9	127.8	110.6	80.2	73.0	73.5	54.1
Avg. Occupants Non-Core Business	-	11.7	24.3	22.7	11.1	32.6	9.9	5.6
Avg. # of Floors	-	1.5	1.8	1.7	1.6	1.9	1.8	1.6
n-values	-	70	70	73	68	69	70	71

Source: On-site Surveys

Table 5-7: Building Efficiency Levels by EDC

Parameter	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Percentage of Buildings Commissioned	0.0%	11.4%	1.4%	6.8%	1.5%	4.3%	7.1%
Percentage Commissioned in Last 5 Years	0.0%	4.3%	1.4%	1.4%	1.5%	1.4%	5.7%
Percentage of Buildings LEED Certified	0.0%	1.4%	0.0%	1.4%	1.5%	1.4%	1.4%
n-values	70	70	71	73	68	69	70

Source: On-site Surveys

Table 5-8: Building Wall Insulation R-Value by EDC

Parameter	Unit	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Avg. Insulation	R-Value	19.0	12.6	12.6	14.8	11.3	13.5	13.6
n-values	-	4	34	37	30	31	30	29

Source: On-site Surveys

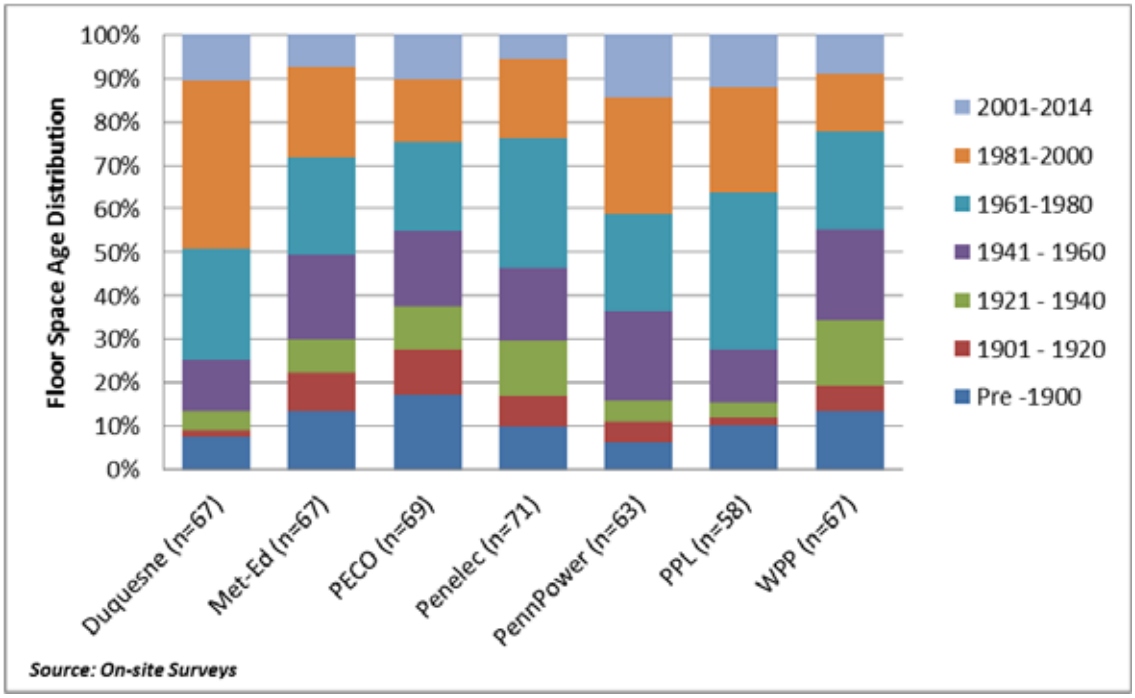
Table 5-9: Building Window Characteristics by EDC

Parameter	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Glazing Pct. Of Walls	19.1%	14.4%	10.7%	22.0%	17.7%	12.8%	11.7%
Pct. Double Paned	30.6%	67.8%	46.0%	44.7%	48.3%	86.4%	46.3%
Pct. Metal Framed	86.8%	50.8%	55.4%	67.7%	62.5%	62.7%	58.8%
n-values	70	70	71	73	68	69	70

Source: On-site Surveys

Figure 5-2 illustrates when non-residential buildings were constructed across the state broken out by EDC. All the EDCs followed the same general trend, with few buildings being built before 1920 or after 2000. Almost 50% of the Duquesne buildings surveyed were constructed after 1980. Also, 20.9% to 31.3% of all non-residential buildings surveyed were built in the 1960-1980 time-frame.

Figure 5-2: Year of Building Construction by EDC



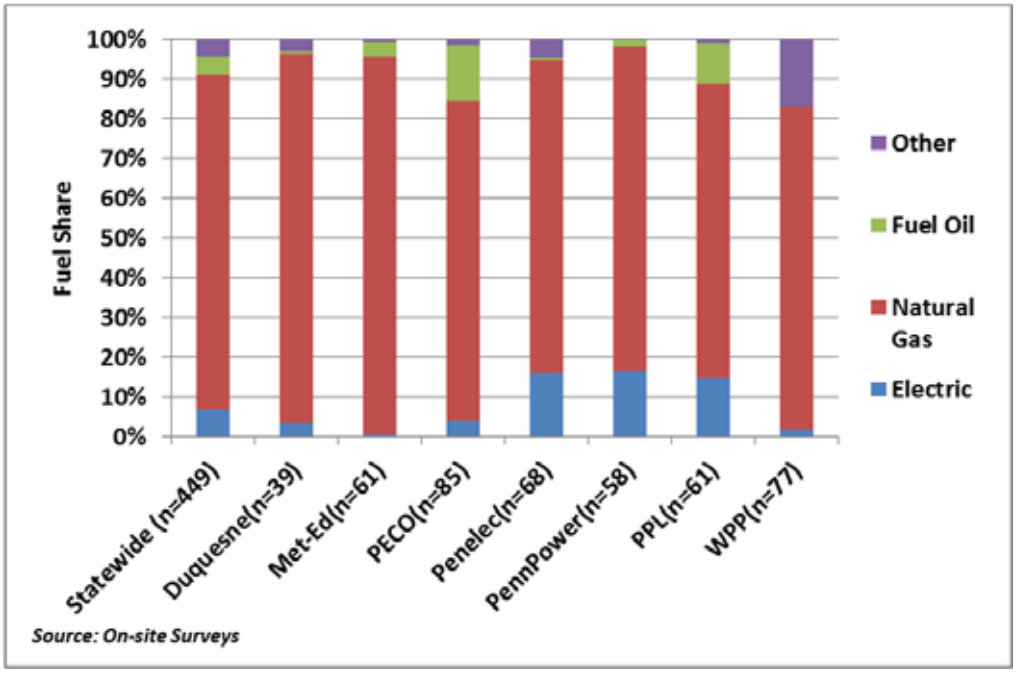
5.3 NON-RESIDENTIAL END USE FINDINGS BY EDC

This section provides detailed findings of each non-residential end use by EDC in Pennsylvania. All findings, except those that are specified otherwise, are presented by premise.

5.3.1 Heating, Ventilation & Cooling (HVAC)

Heating and cooling of buildings represents a significant portion of a building's energy usage. While cooling load is fueled exclusively with electricity, heating systems can be fueled by electricity, natural gas or other fuels. Figure 5-3 shows the percentage of building square footage heated by each fuel type by EDC. Natural gas fuels the majority of space heating systems for each of the EDCs, with the lowest share of 74.0% for PPL and the highest share of 95.1% for Met-Ed. Fuel oil plays a substantial role in the PECO and PPL territories, but has a small share of other territories' heating fuel sources. The "Other" space heating fuels are comprised of LPG, wood, and misc. fuels.

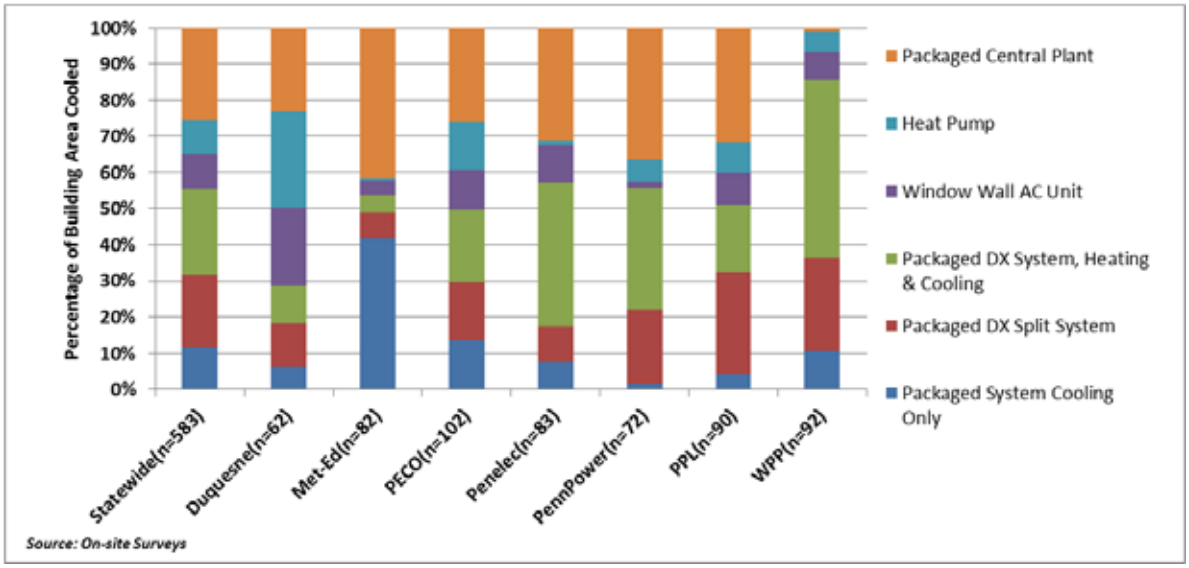
Figure 5-3: Space Heating Fuel Share by EDC by System Count



Fuel share is based on square footage

Figure 5-4 shows the prevalence of different types of cooling systems in the non-residential sector across the state, presented by EDC. Space cooling findings are presented by building square footage served. The distribution of cooling equipment is consistent across each of the EDCs except for Met-Ed. The majority of the cooling load in Met-Ed territories was served by packaged central plants and packaged systems with cooling only. Packaged central plants (chillers) also served a large percentage of building cooling load in all EDC territories except for WPP where 1.0% of building area was cooled by central plants.

Figure 5-4: Percentage of Building Area Cooled by Equipment Type by EDC



n-values are the number of data points that have information on cooling equipment, total square footage of building, and percentage of building cooled

Table 5-10 summarizes some of the key parameters of cooling systems in the non-residential sector presented by EDC. The average age of DX cooling systems ranges between 9.2 for PECO and 12.7 for PPL and West Penn Power. The wide variation in the penetration of automatically controlled cooling systems is noteworthy. For example, almost three-fourths of DX cooling systems in Penn Power, Met-Ed, and PECO's service territories are controlled by programmable thermostats, whereas fewer EMS systems are found throughout the state.

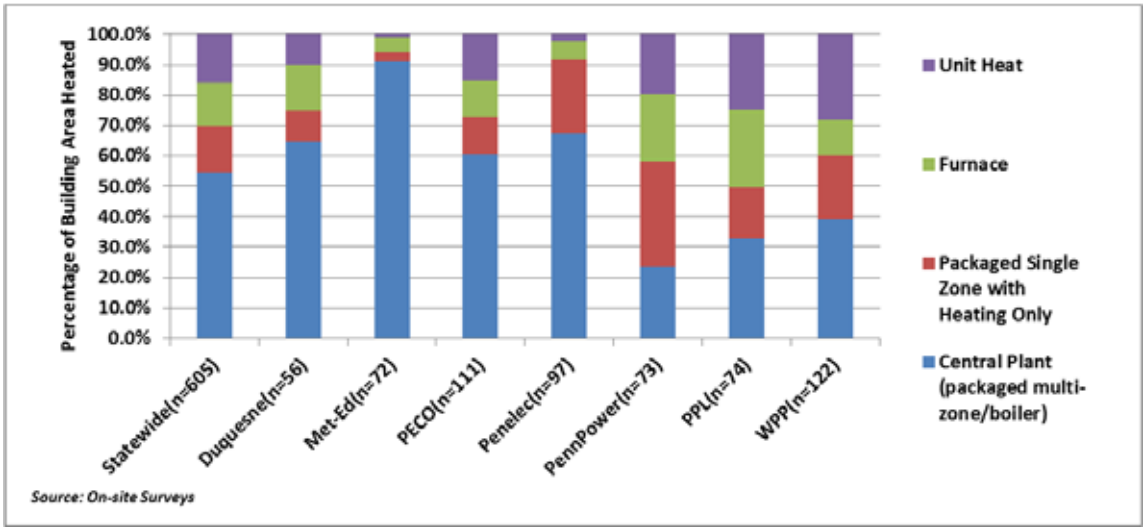
Table 5-10: DX Cooling Parameters by EDC

Parameter	Unit	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Avg. Age	Yrs	11.0	12.0	9.2	12.4	10.4	12.7	12.7
Avg. Cooling Capacity	Tons	10.6	6.0	5.3	5.6	6.1	4.2	4.3
Avg. Cooling Efficiency	SEER/EER	12.8/N/A	13.4/8	10.3/9.7	10/11	13.6/8.1	13.8/10.1	12/10.6
Pct. Programmable	%	40.9%	62.9%	61.8%	35.2%	69.6%	37.8%	15.4%
Pct. EMS	%	9.9%	0.0%	6.1%	0.0%	0.0%	9.6%	15.7%

Source: On-site Surveys
All parameters are weighted by square footage served except "Average Age" and "Average Cooling Capacity" which are weighted by equipment count

Figure 5-5 shows the prevalence of different types of heating systems in the non-residential sector across the state, presented by EDC. While there are significant variations between EDCs, each heating system type plays an appreciable role in each service territory with the exception of Met-Ed buildings, where packaged central plants served a majority of the building's heating load.

Figure 5-5: Percentage of Building Area Heated by Equipment Type by EDC



n-values are the number of data points that have information on heating equipment, total square footage of building, and percentage of building heated by equipment

Table 5-11 and Table 5-12 below summarize some of the key parameters of heating systems in the non-residential sector presented by EDC.

Table 5-11: Heating Equipment Parameters by EDC

Parameter	Unit	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Avg. Age	Yrs	15.3	13.5	10.9	12.0	11.3	14.1	15.7
Avg. Heating Capacity	Btu/hr	274,553	102,725	105,038	123,625	139,146	127,619	152,907
Avg. Heating Efficiency	%	85.5%	84.3%	82.2%	90.4%	85.9%	91.9%	86.9%
Pct. Programmable	%	31.9%	55.0%	60.2%	27.8%	50.3%	34.3%	10.3%
Pct. EMS	%	8.6%	0.0%	6.4%	0.0%	0.0%	11.1%	10.1%

Source: On-site Surveys
Does not include boilers
All parameters are weighted by square footage served except "Average Age" and "Average Heating Capacity" which are weighted by equipment count

Table 5-12: Boiler Heating Parameters, by EDC

Parameter	Unit	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Avg. Age	Yrs	16.9	21.6	15.6	12.3	18.0	21.6	20.4
Avg. Heating Capacity	Btu/hr	1,046,556	1,933,520	1,040,841	5,873,893	1,448,771	255,032	4,088,600
Avg. Heating Efficiency	%	78.3%	85.0%	80.4%	81.6%	73.0%	81.9%	80.2%
% Programmable	%	33.6%	17.5%	18.9%	70.0%	27.4%	2.7%	6.4%
% EMS	%	7.7%	48.5%	57.5%	2.6%	0.0%	70.5%	0.0%

Source: On-site Surveys
All parameters are weighted by square footage served except "Average Age" and "Average Heating Capacity" which are weighted by equipment count

Table 5-13 and Table 5-14 summarize some of the key parameters of temperature controls and illustrate the prevalence of different types of controls in the non-residential sector by EDC.

Table 5-13: HVAC Control Parameters by EDC

Parameter	Unit	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Pct. Using Heating Reset Controls	%	7.0%	16.3%	15.1%	30.2%	22.8%	22.2%	47.2%
Avg. Heating Set Back Points (Occupied/ Unoccupied)	Degrees F	70.0/64.4	70.2/61.0	68.7/60.1	69.3/60.8	69.2/61.3	70.3/64.5	68.2/60.1
Avg. Cooling Set Back Points (Occupied / Unoccupied)	Degrees F	71.0/74.2	72.5/79.6	72.4/76.9	70.9/78.0	70.4/75.4	72.1/78.0	71.3/79.6

Source: On-site Surveys

Table 5-14: Temperature Control Types by EDC

Parameter	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	WPP
Thermostat-Programmable	38.6%	58.0%	59.3%	32.3%	52.6%	30.3%	14.2%
Thermostat-Manual	52.4%	28.2%	28.1%	42.3%	47.4%	48.8%	79.7%
EMS	0.0%	3.1%	4.4%	2.3%	0.0%	14.3%	2.1%
Always On	4.6%	0.0%	0.0%	20.5%	0.0%	1.0%	0.0%
Manual on/off	4.4%	10.7%	8.2%	2.5%	0.0%	5.6%	4.1%
Time Clock	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
n-values	63	89	123	92	81	120	137

Source: On-site Surveys
Weighted by square footage served

5.3.2 Lighting

As mentioned in the statewide section of this report, lighting is another significant end use in terms of energy consumption for the non-residential sector and represents a large share of potential electricity savings for EDCs across the state. Table 5-15 and Figure 5-6 show the share of different lighting system technologies as a percentage of connected load and the breakdown of fluorescent lamp types by fixture count, respectively, presented by EDC. Linear fluorescents represent the vast majority of the connected lighting load in non-residential buildings, comprising between 68.6% in PPL and 90.5% of connected lighting load for Met-Ed. T8 lamps have become the predominant linear fluorescent type but 12 lamps still make up a significant amount of the fixtures. Survey results also show a relatively low saturation of T5s with the exception of the PECO territory, however, this is due

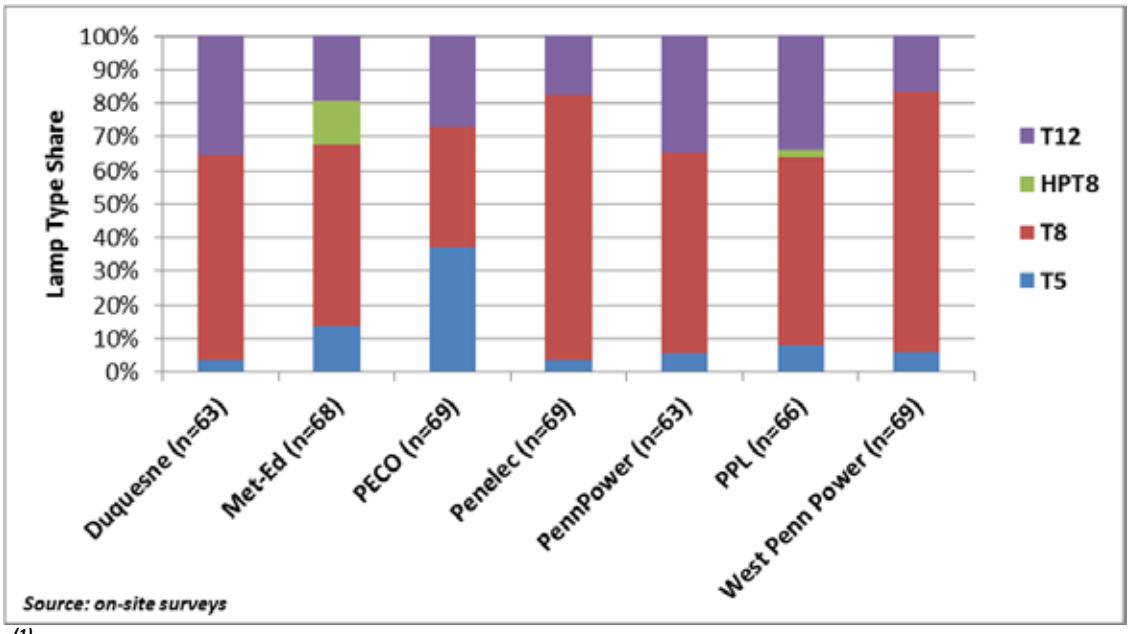
in part to the presence of a single very large school surveyed with 85% T5 fixtures installed. Very few fixtures had high performance T8 lamps except one large industrial site in Met-Ed territory.

Table 5-15: Lighting System Technology Share by EDC (% of Connected Load)

Type	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Linear Fluorescent	80.8%	90.5%	83.1%	73.0%	77.1%	68.6%	80.9%
CFL	4.7%	1.3%	2.6%	7.0%	2.7%	2.2%	1.1%
Incandescent	4.5%	3.2%	9.9%	7.6%	5.8%	2.5%	6.9%
Metal Halide	9.6%	4.6%	2.5%	4.4%	13.3%	24.2%	6.8%
High Pressure Sodium	0.0%	0.3%	0.0%	7.5%	1.0%	0.2%	2.8%
Mercury Vapor	0.4%	0.0%	0.0%	0.0%	0.0%	0.3%	0.1%
LED	0.1%	0.0%	1.1%	0.2%	0.0%	0.0%	0.1%
Neon	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%
Other	0.1%	0.0%	0.6%	0.3%	0.0%	2.0%	1.4%
n-values	69	70	71	73	68	69	70

Source: on-site surveys

Figure 5-6: Linear Fluorescent Lamp Type Share by EDC by Fixture Count



(1) HPT8 saturation in Met-Ed highly influenced by very large surveyed facility with nearly all HPT8s installed

(2) T5 saturation in PECO highly influenced by very large surveyed facility with nearly 85% T5 fixtures installed

Figure 5-7 through Figure 5-9 and Table 5-16 show additional characteristics of lighting within the non-residential building stock for each EDC. In line with the higher saturation of T8s in the West Penn Power and Penelec territories, there also exists a higher percentage of electronic ballasts in those territories. The control types for all EDCs are still vastly manually controlled, leaving significant opportunities for automated controls like occupancy sensors, timers, and EMS systems. On average, about 40% of the buildings visited in each of the EDCs report having their lighting systems upgraded in the past five years.

Figure 5-7: Linear Fluorescent Lamp Ballast Type Share by EDC by Fixture Count

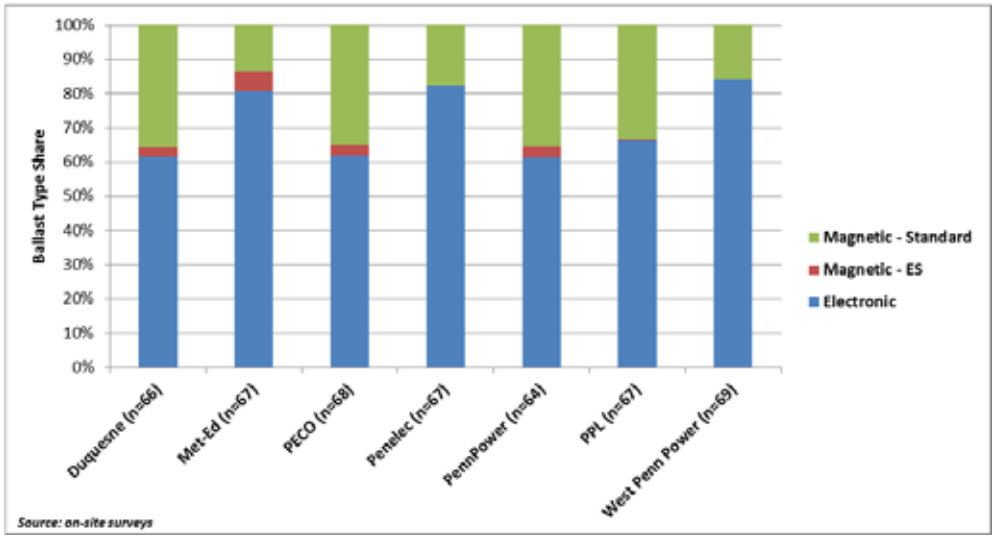


Figure 5-8: Exit Sign Bulb Type Share by EDC by Fixture Count

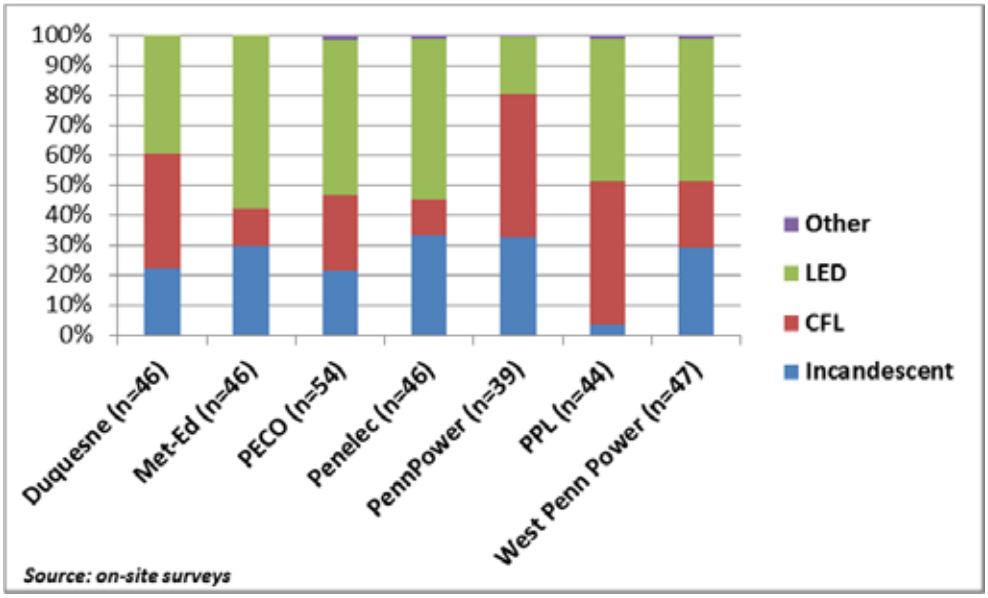


Figure 5-9: Percent of Buildings that Upgraded Lighting in Past Five Years by EDC

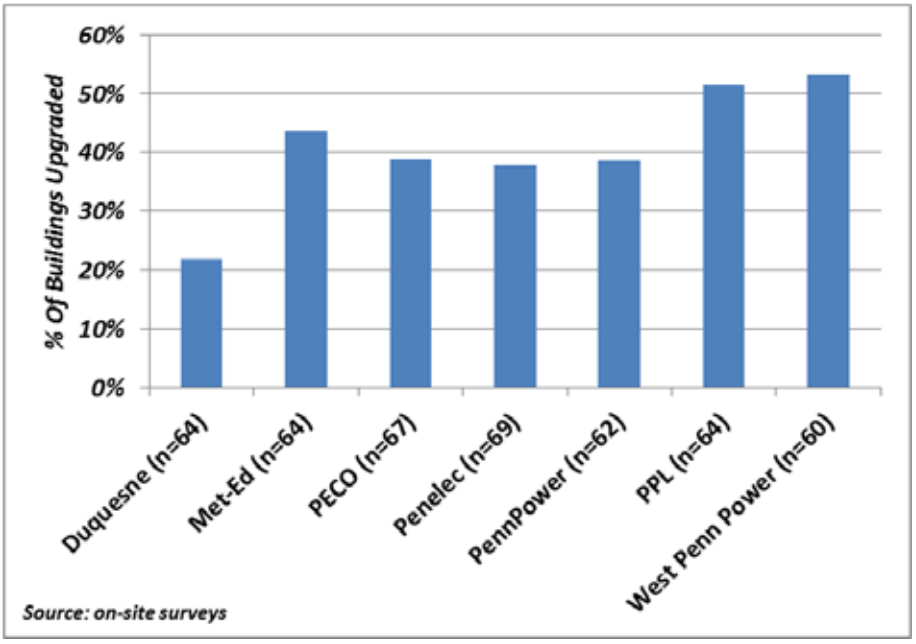


Table 5-16: Control Type Distribution by EDC (% of connected load)

Type	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Manual - Switch	99.7%	72.7%	54.5%	71.4%	92.3%	73.0%	90.5%
Circuit Breaker	0.0%	6.3%	3.7%	0.0%	0.5%	25.1%	5.9%
Manual - Dual Level Switch	0.0%	0.0%	4.2%	1.0%	0.2%	0.2%	1.3%
Dimmer	0.0%	0.1%	30.9%[1]	0.2%	1.1%	0.1%	1.6%
Timer	0.0%	0.0%	2.0%	0.0%	0.6%	0.0%	0.0%
Occupancy Sensor[2]	0.3%	21.0%	3.3%	25.6%	2.4%	1.6%	0.5%
Daylight Controls	0.0%	0.0%	1.4%	0.0%	0.6%	0.0%	0.0%
Energy Management System	0.0%	0.0%	0.0%	1.8%	2.4%	0.0%	0.3%
None/Continuous	0.3%	0.0%	0.2%	0.0%	0.8%	0.0%	0.1%
n-values	**69**	**70**	**71**	**73**	**68**	**69**	**70**

Source: on-site surveys

[1]This number is inflated due to one large site having almost exclusively dimmer controls. Without this site, dimmers were found to control approximately 4.4% of the connected load

[2] A review of the data shows that the large volatility in findings may be due to s a lack of consistency in recording primary and secondary lighting controls when present (i.e., a switch and an occupancy sensor on the same fixture)

Lastly, one important component of this study involves the stockpiling of T12 lamps and ballasts. If Pennsylvania businesses maintain a large inventory of T12 replacement lamps and ballasts, this would suggest delaying the baseline shift for linear fluorescent fixtures (i.e., businesses would take longer to go through their existing stock of replacements prior to purchasing the new, efficient bulbs). While on-site, the SWE team engineers asked the site contact of each facility with at least one T12 fixture to estimate how many extra lamps and ballasts they currently had in storage to replace installed equipment when it burned out.

Table 5-7 shows the distribution of the 297 responses by EDC across the state. Most customers reported keeping enough lamps in storage to replace less than 10% of the active T12 bulbs in their facility and stockpiling behavior in attempt to delay fixture retrofits was uncommon. Met-Ed and West Penn Power were the two EDCs with the highest percent of spare lamps in Table 5-17. Each of these EDCs had one participant with a large number of T12 fixtures who reported purposely maintaining a large inventory of T12 lamps because they wished to avoid a lighting retrofit project and were unsure how long they would be able to purchase the lamps.

Table 5-17: Percentages of Replacement T12 Lamps Currently in Storage

EDC	Sites with T12 Fixtures	Total Count of T12 Lamps	Total Count of Replacement Lamps in Storage	Percent of Lamps
Duquesne	36	3,099	210	6.8%
Met-Ed	49	9,283	1,393	15.0%
PECO	51	4,934	356	7.2%
Penelec	40	5,628	199	3.5%
Penn Power	37	4,781	334	7.0%
PPL	40	7,187	389	5.4%
West Penn Power	44	4,520	458	10.1%
Statewide Total	**297**	**39,432**	**3,339**	**7.4%[(1)]**

Source: on-site surveys

[(1)] Statewide total percentage is weighted by EDC and is not a straight average of the percentages for each EDC

The observed frequency of storing replacement T12 ballasts was significantly lower that the storage rate of replacement lamps. As shown in Table 5-18, the statewide average percentage of fixtures with replacement ballasts in storage was only 2.1%. 83% of the sites surveyed reported having zero replacement ballasts in storage.

Table 5-18 Percentage of T12 Lamp Ballasts Currently in Storage

EDC	Count of Sites with T12 Fixtures	Sum of Total T12 Fixtures in Facility	Sum of T12 Replacement Ballasts in Storage	Percent of Fixtures
Duquesne	36	1,222	11	0.9%
Met-Ed	49	3,254	31	1.0%
PECO	51	1,997	63	3.2%
Penelec	40	2,250	19	0.8%
Penn Power	37	1,758	17	1.0%
PPL	40	3,085	79	2.6%
West Penn Power	44	1,754	23	1.3%
Statewide Total	**297**	**15,320**	**243**	**2.1%[(1)]**

Source: on-site surveys

[(1)] Statewide total percentage is weighted by EDC and is not a straight average of the percentages for each EDC

5.3.3 Commercial Refrigeration

Figure 5-10 and Figure 5-11 show the penetration of refrigeration equipment in non-residential buildings and the breakdown of refrigeration equipment type by EDC. The average percentage of sites with refrigeration across EDCs was 33%. The three most common types of refrigeration equipment for every EDC were solid door refrigerators, solid door freezers, and glass door refrigerators. Together, these three equipment types ranged in share of overall refrigeration equipment installed from 64% in PPL to 93% in Duquesne.

Figure 5-10: Penetration of Commercial Refrigeration Equipment in Buildings by EDC

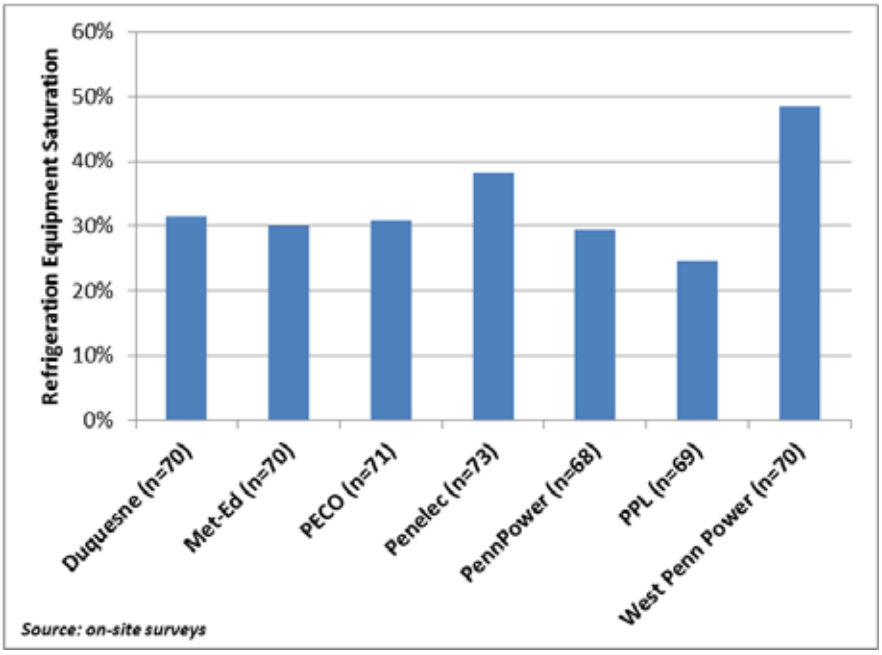
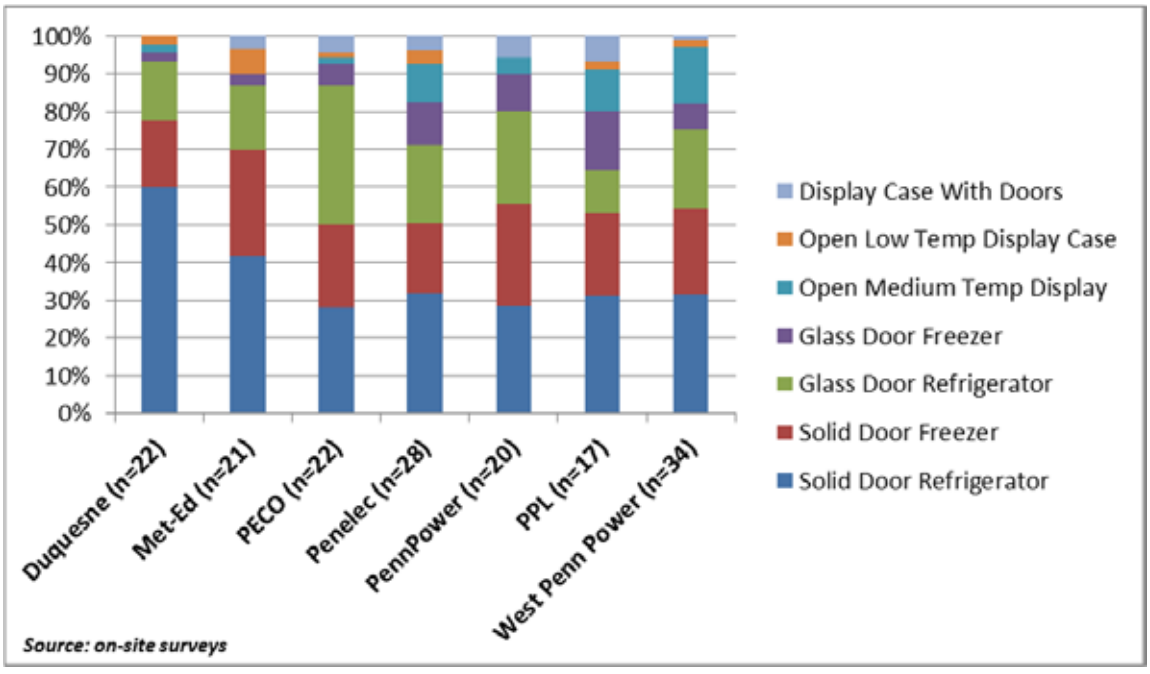


Figure 5-11: Share of Refrigeration Equipment Type for Buildings With Refrigeration Equipment by EDC



5.3.4 Water Heating

Figure 5-12 and Figure 5-13 show the share of different types of water heating units installed in Pennsylvania businesses broken out by EDC. The two figures differ on the basis for which the equipment was counted. Figure 5-12 presents the findings based on counting each heater as one data point, regardless of the size while Figure 5-13 presents the findings on a basis of heater storage capacity. In both figures, the vast majority of water heating systems across all EDCs were self-contained. Table 5-19 shows some of the characteristics of water heaters for each of the EDCs.

Figure 5-12: Share of Equipment Type for Buildings with Water Heating by EDC by Equipment Count

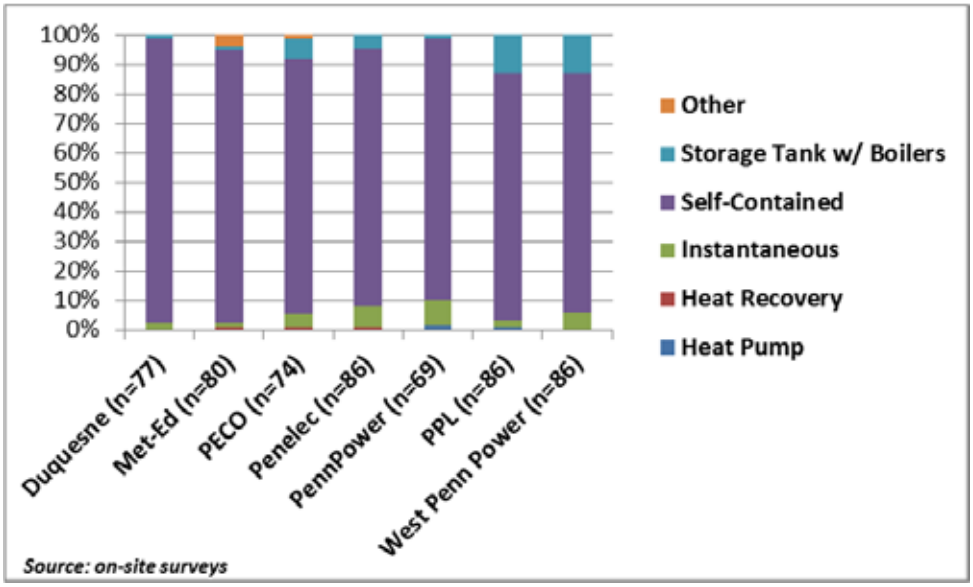


Figure 5-13: Share of Equipment Type for Buildings with Water Heating by EDC by Storage Capacity

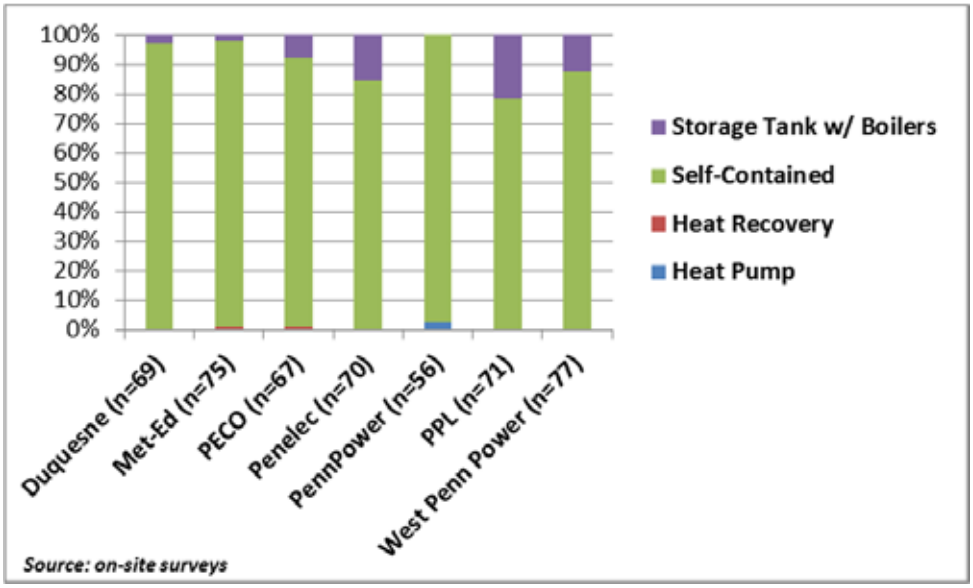


Table 5-19: Water Heating Parameters by EDC

Parameter	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Avg. age	9.2	10.3	8.1	9.2	8.0	7.0	8.3
% w/ tank wrap	13%	6%	5%	11%	5%	12%	9%
% w/ pipe wrap	22%	27%	23%	11%	21%	14%	6%
% w/setback	9%	0%	0%	2%	8%	3%	0%
Avg. tank capacity (gal)	53.7	56.5	48.2	53.9	49.8	46.2	54.3
Avg Efficiency	86.7	92.0	87.2	68.7[(1)]	92.4	88.6	84.2
Avg Input Capacity (btu/h)[(2)]	99,149	84,012	51,816	70,210	51,444	103,699	102,430

Source: on-site surveys

[(1)] Only three data points were collected for this finding while the average n-value per EDC for water heater efficiencies was 12

[(2)] Fewer "average input capacity" data points were collected than "average tank capacity", leading to higher volatility in input capacity findings, relative to tank capacity findings

Figure 5-14 and Figure 5-15 show the fuel share of water heaters by tank capacity and equipment count, respectively. Because natural gas shows a higher percent share by tank capacity than equipment counts, one can infer that on average, natural gas water heaters are larger than their electric counterparts. PPL has the highest saturation of electric water heaters of all the EDCs at 68% of the fixture count and 61% of the storage capacity. The "Other" fuel types are comprised of purchasing hot water/steam, wood, and misc. Table 5-20 shows the storage capacities for water

heaters by EDC. An average of 72% of the water heaters had capacities of 50 gallons or less and an average of 93% of water heaters had capacities of 100 gallons or less.

Figure 5-14: Water Heating Fuel Share by EDC by Tank Capacity

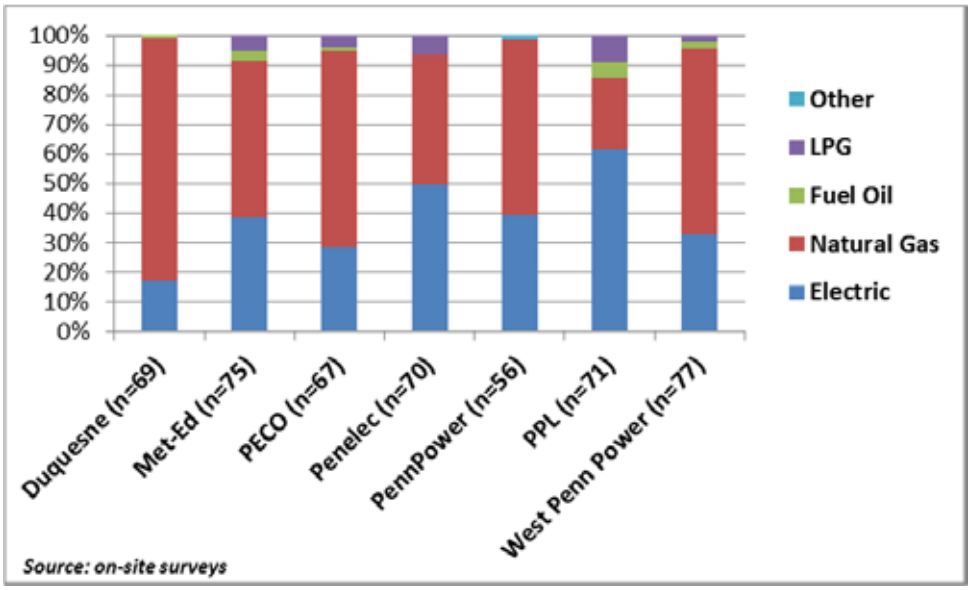


Figure 5-15: Water Heating Fuel Share by EDC by Equipment Count

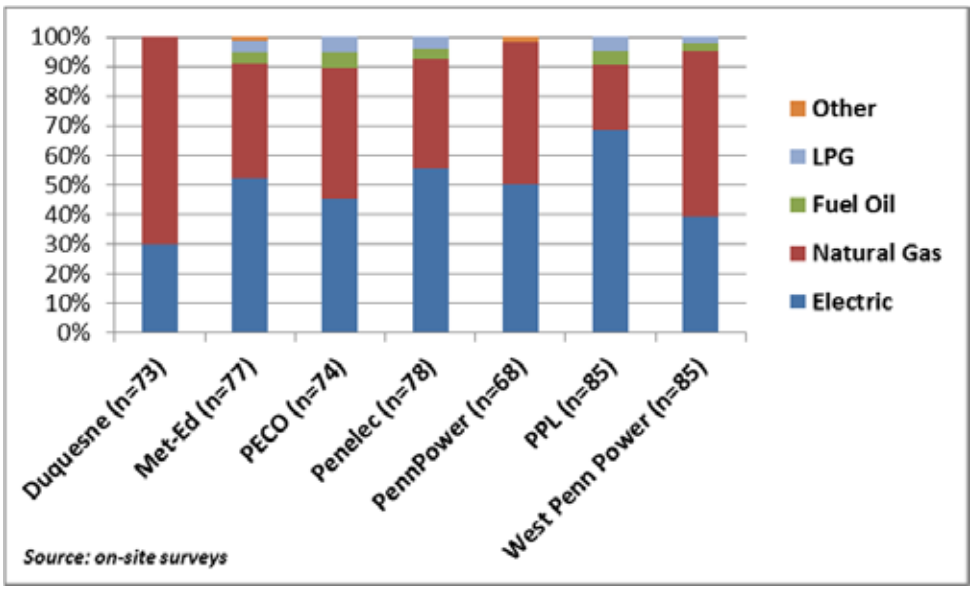


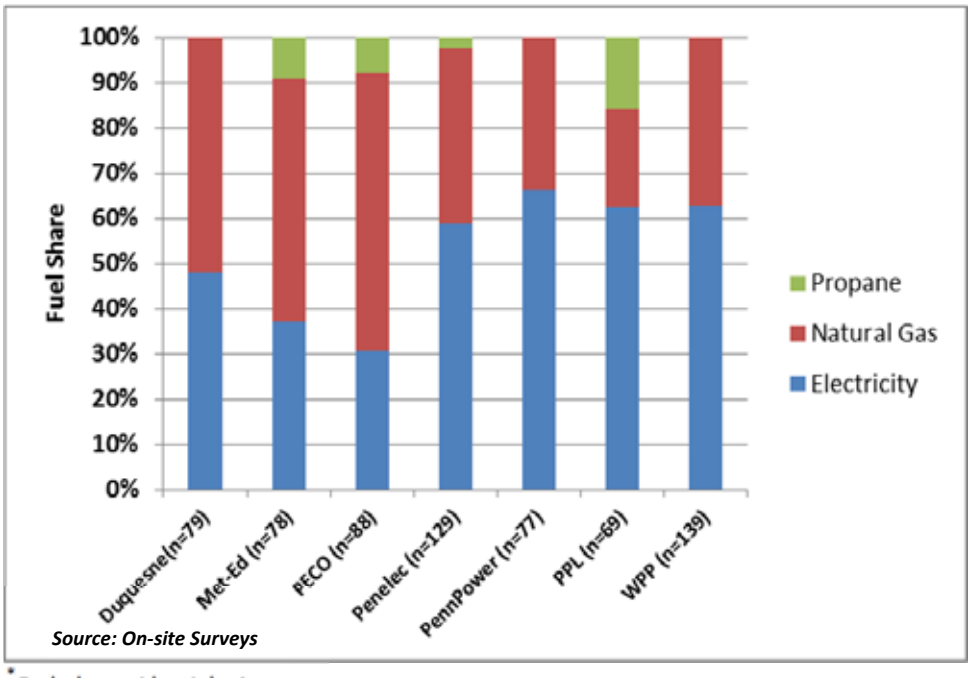
Table 5-20: Water Heating Capacity Distribution by EDC

Capacity (Gal)	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
0-20	17%	13%	25%	16%	25%	28%	22%
21-50	57%	51%	45%	56%	52%	49%	51%
51-100	14%	29%	27%	16%	20%	14%	23%
101-200	12%	7%	3%	13%	2%	8%	1%
201-500	0%	0%	0%	0%	2%	0%	3%
n-values	**69**	**75**	**67**	**70**	**56**	**71**	**77**

5.3.5 Commercial Cooking

Electricity typically fuels between 30% and 70% of the all cooking equipment across all of the EDCs, with natural gas and propane making up the remainder. Figure 5-16 shows the fuel share breakdown for cooking equipment by EDC.

Figure 5-16: Cooking Fuel Share by EDC by Equipment Count



*Excludes residential microwaves

5.3.6 Plug Load

Table 5-21 and Table 5-22 show the percentage of sites with at least one piece (penetration) of each plug load equipment type by EDC and the average number (saturation) of each plug load type per site by EDC, respectively.

Table 5-21: Percentage of Sites with One or More Pieces (Penetration) of Plug Load Equipment by EDC

Plug Load	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Air Purifier/Dehumidifier	3%	14%	6%	12%	9%	17%	14%
All-in one (printer/copier/scanner/fax)	65%	62%	47%	63%	55%	75%	70%
Server	18%	46%	19%	25%	31%	22%	26%
Secondary Monitor	5%	6%	12%	22%	15%	22%	28%
Fax Machine	23%	33%	9%	15%	20%	19%	22%
Laptop	54%	43%	21%	22%	40%	30%	35%
Paper Shredder	26%	44%	29%	28%	43%	38%	46%
Personal Computer	68%	81%	91%	82%	65%	86%	77%
Photocopier	14%	37%	10%	16%	25%	25%	29%
Printer	34%	49%	65%	47%	43%	64%	52%
Scanner	6%	8%	4%	9%	5%	6%	10%
Coffee Maker	54%	75%	57%	62%	69%	73%	64%
Residential Style Refrigerator	46%	79%	63%	78%	58%	78%	75%
Microwave	58%	86%	79%	78%	77%	89%	81%
Refrigerated Vending Machine	9%	29%	18%	22%	20%	27%	20%
Non-Refrigerated Vending Machine	6%	13%	9%	21%	14%	19%	16%
Water Cooler	29%	41%	35%	29%	32%	48%	43%
Space Heater	9%	44%	19%	19%	28%	31%	23%
Television	35%	54%	50%	44%	52%	55%	45%
Security Camera	23%	40%	15%	26%	20%	36%	36%
n-values	65	63	68	68	65	64	69

Source: on-site surveys

Table 5-22: Average Number (Saturation) of Plug Load Equipment per Site by EDC

Plug Load	Duquesne	Met-Ed	PECO	Penelec	Penn Power	PPL	West Penn Power
Air Purifier/Dehumidifier	1.0	2.3	1.3	1.5	2.7	1.7	1.7
All-in one (printer/copier/scanner/fax)	2.4	3.1	2.0	1.6	4.3	2.6	2.6
Server	6.1	2.7	1.9	2.5	10.3	1.5	4.2
Secondary Monitor	5.0	13.5	4.1	2.5	8.5	3.2	13.4
Fax Machine	1.7	1.1	1.7	1.1	2.2	1.2	2.1
Laptop	16.1	26.6	2.8	5.1	19.5	25.2	37.0
Paper Shredder	1.2	2.2	1.3	2.4	3.2	1.2	1.8
Personal Computer	18.1	14.2	10.7	31.1	26.8	8.9	42.5
Photocopier	1.7	2.4	2.0	3.6	2.0	1.2	1.7
Printer	6.9	3.6	5.0	9.5	5.5	2.8	9.0
Scanner	1.8	1.4	1.3	7.2	4.0	1.2	7.5
Coffee Maker	2.4	3.0	1.9	3.5	4.4	3.1	7.6
Residential Style Refrigerator [1]	3.4	2.6	1.6	3.4	3.8	1.9	4.6
Microwave	14.4	2.1	1.6	4.1	2.6	2.0	4.4
Refrigerated Vending Machine	1.5	1.9	1.3	2.5	2.5	2.8	1.9
Non-Refrigerated Vending Machine	1.5	2.1	1.2	2.2	1.9	2.1	2.7
Water Cooler	1.5	2.1	2.0	2.1	2.4	2.3	2.4
Space Heater	1.7	3.5	2.3	2.8	4.1	3.2	2.2
Television	31.7	12.9	4.6	13.3	10.9	8.0	10.9
Security Camera	15.9	10.5	8.4	7.9	15.1	11.3	11.3
n-values	65	63	68	68	65	64	69

Source: on-site surveys

[1] Counts for plug loads such as residential style televisions, refrigerators, and microwaves are highly impacted by large quantities found in lodging and healthcare buildings

6 WILLINGNESS TO PAY FINDINGS

6.1 INTRODUCTION

As part of its baseline study of the non-residential sector, the SWE team conducted a willingness-to-pay exercise during the in-person surveys with non-residential energy decision makers. This section of the report describes the details of this exercise and its associated findings; details regarding the overall baseline study (e.g., sampling, recruiting, other survey details) are described elsewhere. Although findings from this exercise are reported here, these findings will be used as inputs in the follow-up market potential study of non-residential customers.

Willingness-to-pay survey exercises are examples of a social science methodology commonly referred to as contingent valuation and are intended to measure a survey respondent's stated intention to purchase a product (or service) when presented with series of alternative scenarios usually involving the manipulation of the price (or cost) of the product (or service). The results of these studies, when aggregated, are frequently used to gauge the relative demand (e.g., purchase likelihood) for a product (or service) and ultimately help determine the selling price for a product (or service). It is important to note that these exercises ask respondents direct questions that require them to estimate their purchase likelihood when presented with a hypothetical future purchase scenario. Although there are other approaches to conducting pricing research, such as analyzing product sales at different prices in different markets, these approaches were not feasible given the time and budget constraints of the non-residential baseline study.

The objective of the non-residential baseline study's willingness-to-pay exercise was to gauge the relative purchase likelihood or willingness-to-pay among non-residential customers for five non-residential energy efficiency measures under a series of pricing scenarios designed to mimic the incentives of a hypothetical consumer-focused energy efficiency program.

6.2 METHODOLOGY

As noted, the willingness-to-pay exercise was included as part of the overall onsite baseline survey of non-residential customers. The exercise focused on five energy efficiency measures and lighting replacement scenarios for non-residential lighting applications. The specific replacement scenarios included in the exercise were:

- Upgrading T12 fluorescent lighting fixtures to T8
- Upgrading T8 fluorescent lighting fixtures to high performance T8
- Upgrading high pressure sodium (HPS)/metal halide (MH) to T5 fluorescent lighting fixtures
- Upgrading incandescent/CFL exit signs to LED exit signs
- Installing room occupancy sensors

The selection scenarios presented to respondents was determined by the onsite interviewers based on the prevalence of lighting fixtures installed in the building. That is, if a building had a mix of T12 or T8 lights, then interviewers asked non-residential respondents about only those lighting

replacement scenarios associated with converting T12 or T8 lights. Occasionally, interviewers inquired about replacing the most dominant lighting fixture in a building or a facility (if there was a mix of lighting fixtures) to not burden the respondent. Thus, most respondents were asked questions for only two or three replacement measures.

For each measure, a series of questions were asked to elicit the stated purchase likelihood (willingness-to-pay) of the measure under five alternative incentive levels. The first level was purchasing the product without any financial discount. Levels two through five involved offering the respondent a 25%, 50%, 75%, or 100% discount, respectively, off the initial purchase price. The willingness-to-pay questions used an 11-point scale, where 0 meant 'not at all likely' and 10 meant 'extremely likely', and respondents were asked to indicate their likelihood of purchasing the product given each of the five scenarios. The efficiency estimates and costs of the replacement measures were determined from a review of the Pennsylvania TRM and Incremental Cost Database.

The framing of the questions was an important part of the exercise. Respondents were presented with the measures assuming an early replacement context. The interviewers informed respondents about the energy efficiency potential of the replacement measure and then presented the cost of replacing a single fixture and asked the respondent to indicate their relative purchase likelihood on the 11-point scale described above during the next two years. For example, a T8 light fixture was described as being 20% more efficient than a T12 light fixture.

6.3 DATA ANALYSIS

Following data collection, the survey responses were compiled by respondent and analyzed statewide and sector (commercial, institutional, or industrial) and then by the seven EDCs. Three metrics were computed: 1) average purchase likelihood; 2) average purchase likelihood sensitivity; and 3) average incremental increase in purchase likelihood. Average likelihood was computed using the responses to the 0-10 purchase likelihood questions. Likelihood sensitivity is variation on the economic concept of elasticity and measures the percentage change in purchase likelihood relative to the percentage change in the price discount (incentive amount). It was calculated as the ratio of the change in purchase likelihood relative to the percentage change in price—0% purchase discount vs. 100% purchase discount. Higher sensitivity values imply larger changes in purchase likelihood given a change in the purchase discount. Lastly, the incremental purchase likelihood measures the incremental increase in purchase likelihood at each incentive level (i.e., 0%, 25%, 50%, 75%, and 100% discounts).

The overall baseline survey placed equal sampling emphasis on all seven EDCs, regardless of the incidence of the utilities' overall statewide proportions of the premises, and approximately 70 surveys were completed for each EDC. In the presentation of statewide and sector results that follow, the appropriate post-stratification weights were applied to each survey response to adjust for differences in statewide and sector proportions of the number of premises in each EDC. The development of these weights is discussed elsewhere in this report in Section 3.5.2. Note that

sample sizes vary considerably throughout this section and care should be taken in drawing inferences from these estimates. Furthermore, although higher relative precision (smaller margin of error) is achieved with larger sample sizes, for given sample size, smaller proportion estimates (and also larger proportions) have higher relative precision. See Section 3.6 for more discussion regarding the measurement of uncertainty in this study.

6.4 KEY OVERALL FINDINGS

There are two key findings from the willingness-to-pay analysis:

1. In general, respondents were highly price sensitive for each lighting replacement measure and reported relatively low purchase likelihoods without being offered a discount (0% purchase discount). This suggests that non-residential customers will likely consider early replacement of lighting fixtures in their buildings/facilities if an appropriate incentive is offered.

2. Even at a 100% purchase discount (full cost is covered by the EDC), average purchase likelihoods were less than 'extremely likely' (rating of "10") for three of the five measures. This suggests there are other non-financial barriers that may limit the success of a future incentive program.

6.5 STATEWIDE FINDINGS

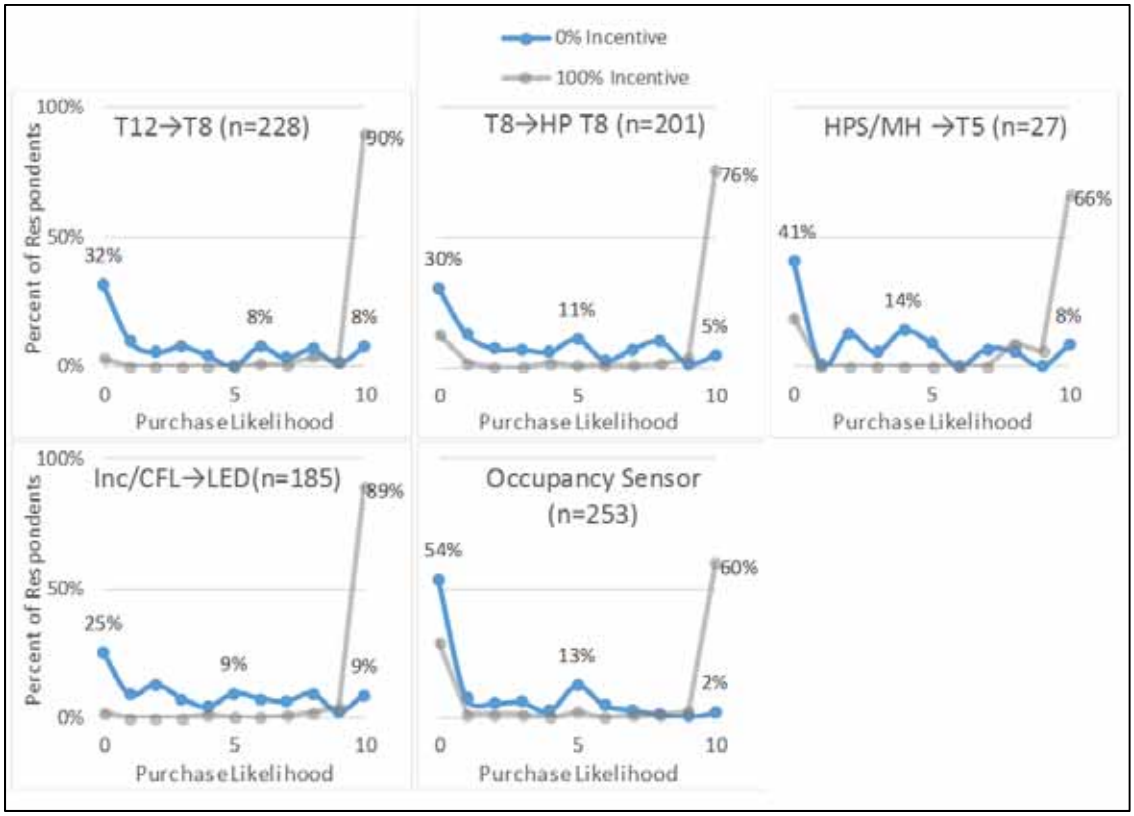
This section describes respondents' weighted purchase likelihood responses for each lighting replacement scenario. It is divided into four sub-sections:

- Distribution of likelihood responses
- Average purchase likelihood for each lighting replacement scenario
- Purchase likelihood sensitivity
- Incremental increase in average purchase likelihood

6.5.1 Distribution of Likelihood Responses

To illustrate the distribution of survey responses during the willingness-to-pay exercise, Figure 6-1 shows the weighted distribution of respondents' purchase likelihood ratings for each measure at 0% incentive (blue line) and 100% of the cost incented by a EDC (gray line). Without any incentive, 25% to 54% of respondents reported for LED exit signs and occupancy sensors respectively that they were 'not at all likely' (a rating of '0') to purchase the measure. When offered a 100% purchase incentive, most respondents reported a high purchase likelihood rating. However, between 2% and 29% of respondents reported a purchase likelihood rating of '0', even when they were offered a 100% purchase incentive.

Figure 6-1: Distribution of Purchase Likelihood Ratings by Measure and Incentive Level

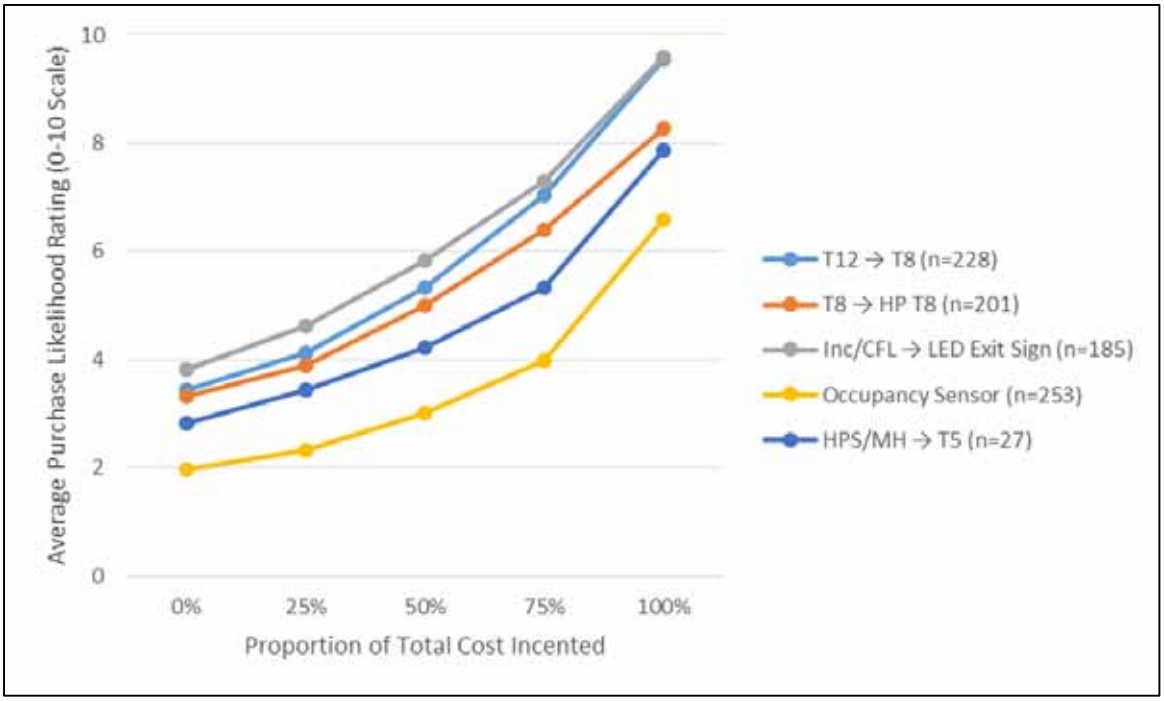


Source: on-site surveys

6.5.2 Purchase Likelihood

Respondents' average reported purchase likelihood for each of the measures in the willingness-to-pay exercises increased at each offered incentive level (0%, 25%, 50%, 75%, and 100% of the measure cost) (Figure 6-2). Respondents reported slightly higher purchase likelihoods for replacement LED exit signs compared to the other measures, and occupancy sensors received the lowest purchase likelihood scores among the five measures, but the overall patterns of increasing purchase likelihood among the lighting measures were similar.

Figure 6-2: Average Purchase Likelihood by Incentive Level



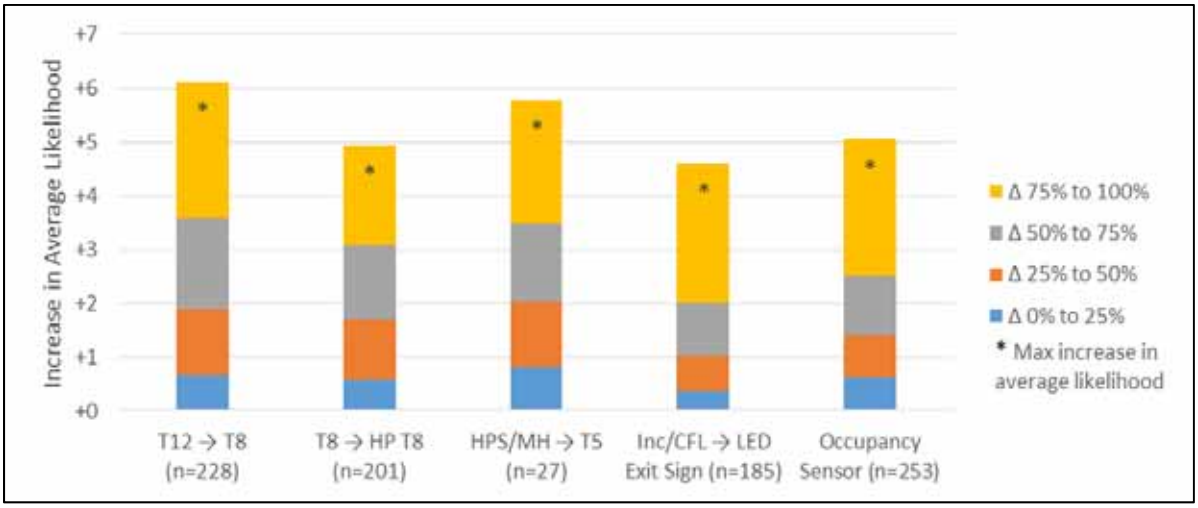
Source: on-site surveys

Without any offered incentive, purchase likelihoods were on the low end of the likelihood scale, and even when the full purchase cost was offered as an incentive, average purchase likelihoods were less than 'extremely likely' for three of the five measures. This suggests there are other non-financial barriers that may limit the success of a future incentive program.

6.5.3 Incremental Likelihood

The SWE team also analyzed the changes in incremental purchase likelihood across each of the products. Incremental likelihood refers to the increase in average purchase likelihood from one incentive level to the next (for example, the increase in purchase likelihood without any incentive to an incentive covering 25% of the measure cost). This incremental likelihood can be examined by comparing the slope of the line between each of the points in Figure 6-2, or the height of each colored bar in Figure 6-3. The overall height of the bars in Figure 6-3 shows the total change in respondents' reported purchase likelihood between no incentive and 100% cost incented. Each color shows the incremental change in purchase likelihood at from one incentive level to the next. The asterisk highlights the maximum change in average likelihood for each measure. Across all lighting replacement scenarios, the largest incremental change in the average purchase likelihood was at 100% purchase discount level.

Figure 6-3: Incremental Increase in Purchase Likelihood by Incentive Level



Source: on-site surveys, SWE analysis

6.5.4 Likelihood Sensitivity

Another metric to assess the effects of incentives change on purchase likelihood is sensitivity. As described in the Methodology section, sensitivity is the total change in purchase likelihood divided by the change in the percentage price discount—0% purchase discount versus 100% purchase discount. Higher sensitivity values imply larger changes in purchase likelihood given a change in the purchase discount. To enable comparison across measures, the units in Table 6-1 are: (increase in purchase likelihood rating)/(percent incentive increase).

The price sensitivities across all the measures illustrate small but important differences. For example, respondents are 1.2 times more sensitive to the price for changing T12s to T8s compared to changing T8s to HP T8s and compared to changing HPS/MH to T5 fixtures. In addition, respondents are 1.3 times more sensitive to the price for upgrading Exit Signs compared to upgrading occupancy sensors even though the incremental price for the latter is 200% higher.

Table 6-1: Likelihood Sensitivity for Each Replacement Measure

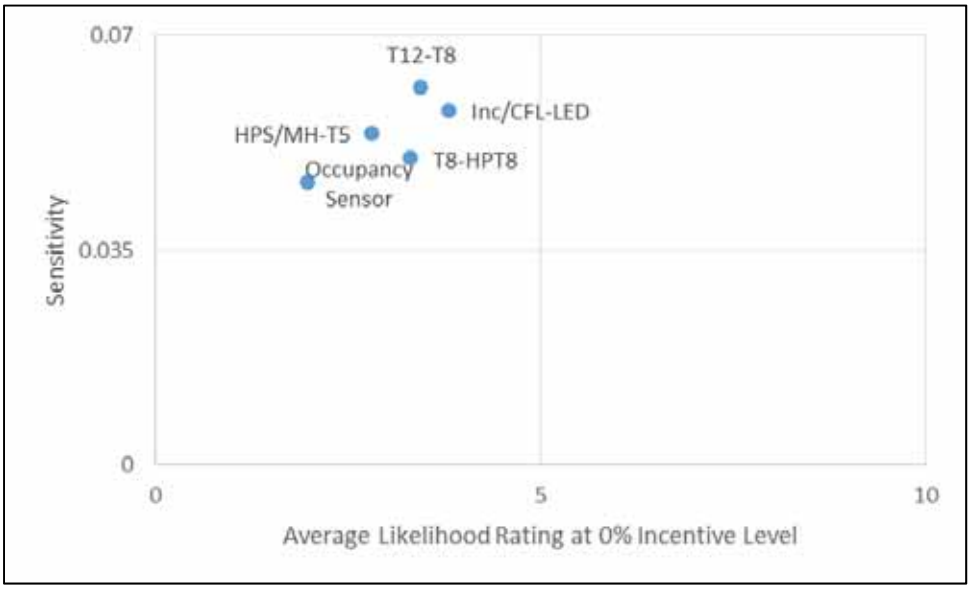
Measure Replacement Scenario	Average Sensitivity
T12 to T8 (n=220)	0.062
Inc/CFL exit sign to LED exit sign (n=183)	0.058
HPS/MH to T5 (n=25)	0.054
T8 to HP T8 (n=194)	0.050
Occupancy Sensor (n=250)	0.046

Source: on-site surveys, SWE analysis

6.5.5 Likelihood Versus Sensitivity

The SWE team plotted the respondents' average purchase likelihood at 0% purchase discount against the sensitivity values (between 0% and 100% purchase discount options) for each lighting replacement scenario. This showed that all lighting replacement scenarios clustered in the upper left quadrant of the plot, indicating that respondents were highly price sensitive and exhibited low likelihood of purchase at 0% purchase discount. The plot also showed that replacing T12 fixtures with T8 fixtures and incandescent/CFL exit sign with LED exit signs had the highest price sensitivity and the highest average likelihood purchase ratings at 0% purchase discount, compared to all other lighting replacement scenarios (Figure 6-4).

Figure 6-4: Sensitivity as a Function of Unincented Purchase Likelihood (0% Purchase Discount)



Source: on-site surveys, SWE analysis

6.6 FINDINGS BY SECTOR

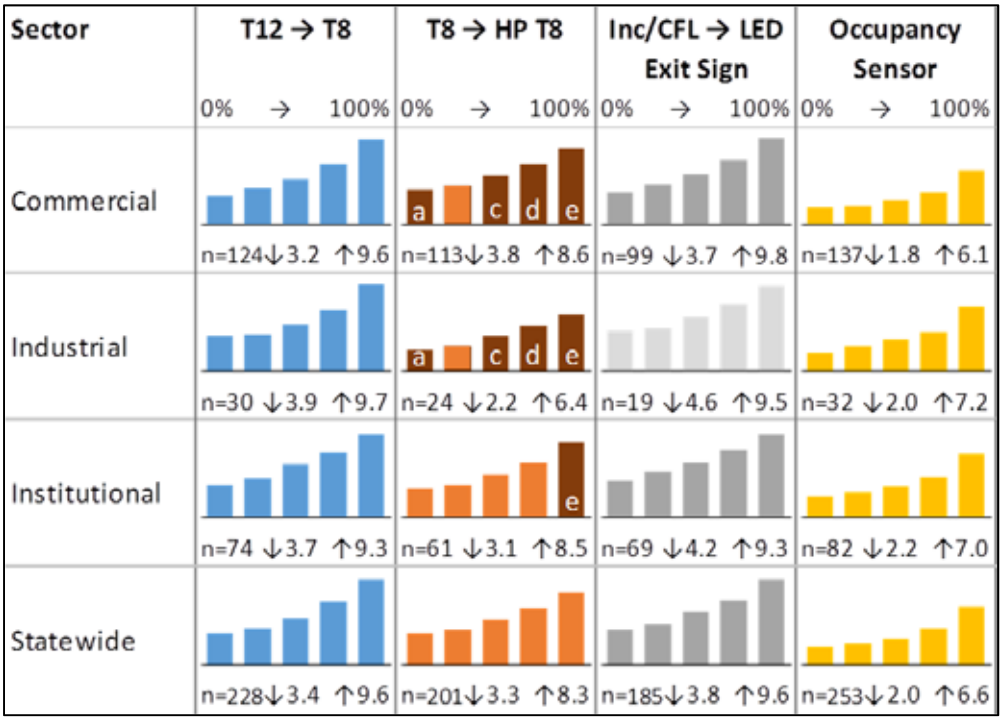
This section describes respondents' weighted purchase likelihood responses for four of five lighting replacement scenario across EDCs. The evaluation team could not explore differences in purchase likelihood for replacing HPS/MH with T5 fixtures due to small sample size. This section is divided into two sub-sections:

- Average purchase likelihood
- Purchase likelihood sensitivity

6.6.1 Purchase Likelihood

There was only one lighting replacement scenario where the SWE team found significant differences in average purchase likelihood among the non-residential sectors. [1] Industrial firms, compared to commercial firms, reported lower average purchase likelihoods for replacing a T8 with a high performance T8 if 0%, 50%, 75%, and 100% of the cost was incented (Figure 6-5).

Figure 6-5: Average Purchase Likelihood by Sector



Source: on-site surveys, SWE analysis

Note: Letters denote significant purchase likelihood differences between sectors. Below each graphic is the count of cases, mean purchase likelihood under 0% incentive scenario, and mean purchase likelihood under 100% incentive scenario.

The key features of Figure 6-5 are:

- **Bars.** Within each cell, the bars show the average purchase likelihood ratings for a given measure and sector at 0% (left), 25%, 50%, 75%, and 100% (right) of the total cost incented.
- **Light shading**. This cell has a sample size below 20, and trends should be interpreted with caution.

[1] One-way ANOVA at $p<0.05$; Tukey post hoc tests at $p<0.1$

- **Dark shading, labeled.** Within columns, darkly shaded bars with the same label indicate that purchase likelihood ratings differed significantly (p<.10) from one another for these sectors at this incentive level.
- "**n=**". Sample size for this cell.
- "↓". Average purchase likelihood at minimum incentive (0%).
- "↑". Average purchase likelihood at maximum incentive (100% of total cost).

6.6.2 Likelihood Sensitivity

Again, higher sensitivity values imply being more price sensitive or larger changes in purchase likelihood given a change in the purchase discount at 0% and 100% purchase discount. There were no significant differences in purchase likelihood sensitivity by sector (Table 6-2).

Table 6-2: Likelihood Sensitivity by Sector

Sector	T12 to T8		T8 to HP T8		Inc/CFL to LED Exit Sign		Occupancy Sensor	
	Sensitivity	n	Sensitivity	n	Sensitivity	n	Sensitivity	n
Commercial	.063	124	.048	113	.061	99	.043	137
Industrial	.065	30	.042	24	.048	19	.050	32
Institutional	.056	74	.054	61	.051	69	.047	82
Statewide	.061	228	.050	201	.058	185	.046	253

Source: on-site surveys, SWE analysis

6.7 FINDINGS BY EDC

This section describes respondents' un-weighted purchase likelihood responses for four of the five lighting replacement scenarios across the seven EDCs. The SWE team was unable to investigate differences in purchase likelihood for converting HPS/MH to T5 fixtures due to small sample size. This section is divided into two sub-sections:

- Average purchase likelihood
- Purchase likelihood sensitivity

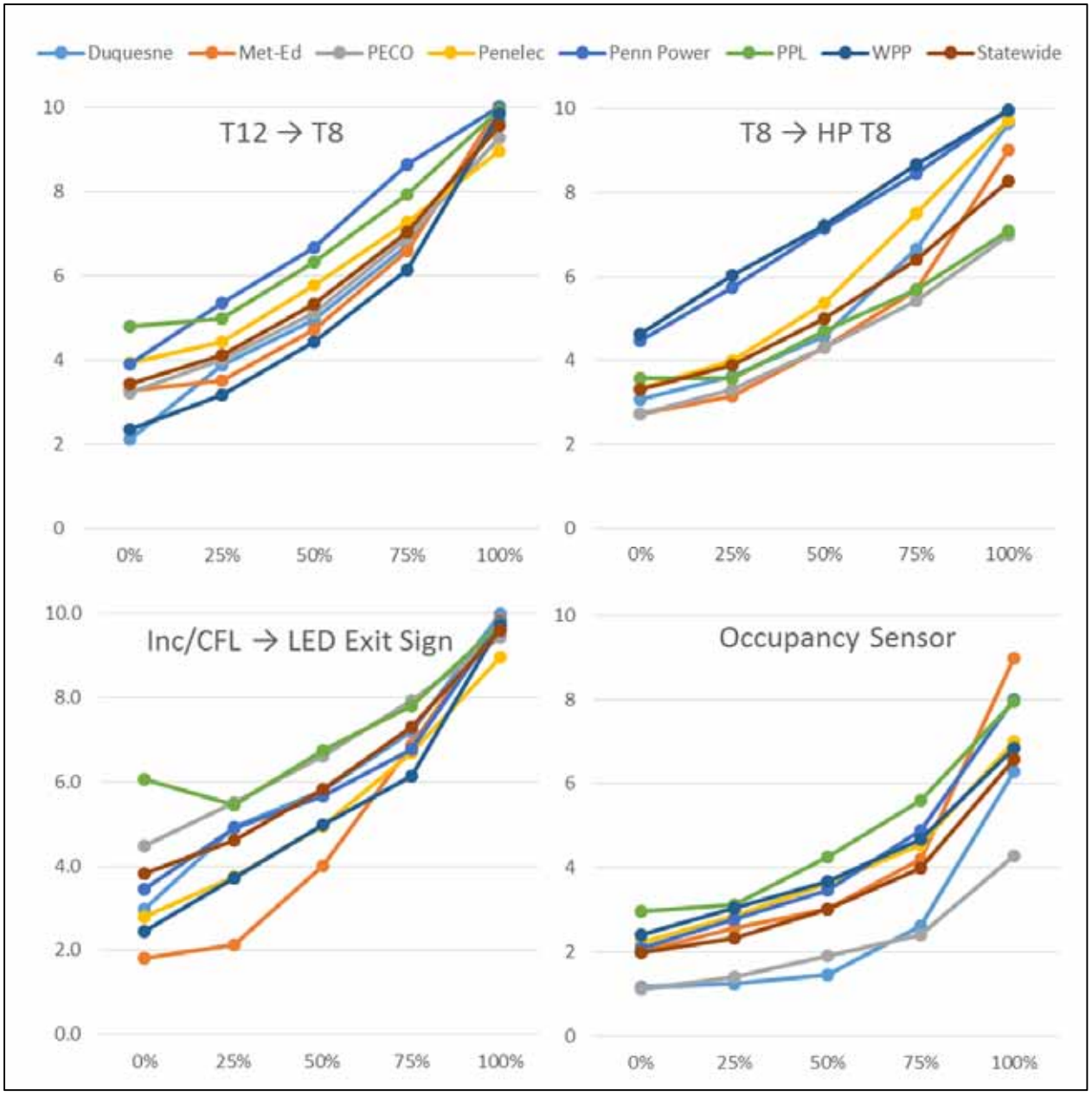
6.7.1 Purchase Likelihood

The SWE team compared the differences across EDCs in average reported purchase likelihoods for each measure and incentive level. Figure 6-6 shows overall trends in average purchase likelihood (vertical axis) at each incentive level (horizontal axis); Figure 6-7 shows the same data, highlighting significant differences and sample sizes. Four notable differences between EDCs are observed:

- Average purchase likelihood for converting T12 to T8 were relatively similar across EDCs. The most variability in this metric was observed at 0% purchase discount/incentive level, where Duquesne had the lowest and PPL had the highest average purchase likelihood.

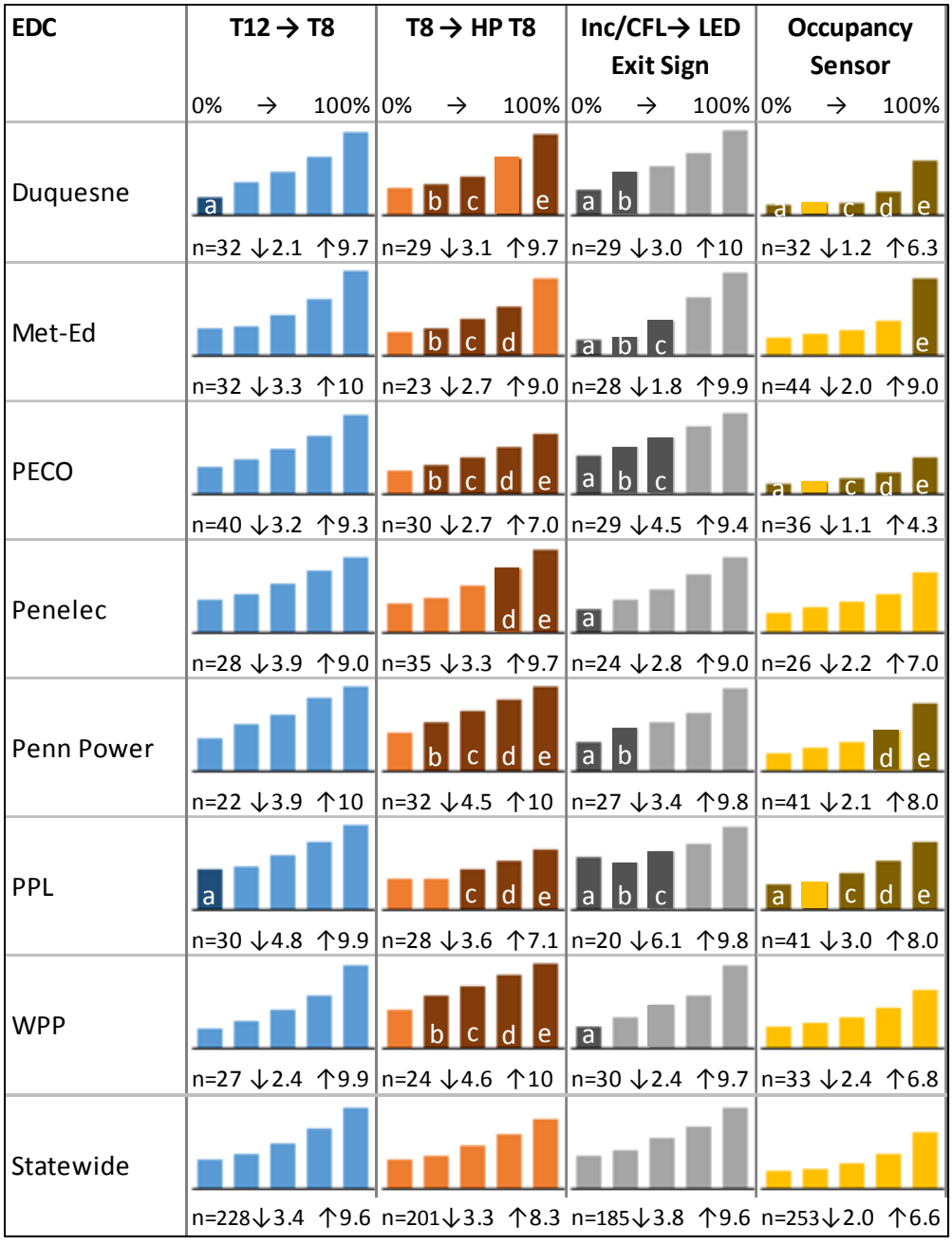
- Although there were few significant differences across EDCs in reported likelihood at low incentive levels, there were significant differences in responses at higher incentive levels. Customers of Penn Power and West Penn Power have higher average purchase likelihoods for converting T8s to high performance T8s than customers of all other EDCs across all incentive levels.
- Average purchase likelihood for converting incandescent/CFL exit signs to LED exit signs clustered at 75% and 100% EDC incentive levels; all other responses were more variable.
- Customers of Duquesne and PECO have the lowest average purchase likelihood for installing a room occupancy sensor when compared to customers of other EDCs across all incentive levels.

Figure 6-6: Overall Trends in Average Purchase Likelihood by EDC



Source: on-site surveys

Figure 6-7: Significant Differences in Average Purchase Likelihood by EDC



Source: on-site surveys, SWE analysis

Note: Letters denote significant purchase likelihood differences between EDCs (One-way ANOVA at $p<0.05$; Tukey post hoc tests at $p<0.1$). Below each graphic is the count of cases, mean purchase likelihood under 0% incentive scenario, and mean purchase likelihood under 100% incentive scenario.

The key features of Figure 6-7 are:

- **Bars.** Within each cell, the bars show the average purchase likelihood ratings for a given measure and sector at 0% (left), 25%, 50%, 75%, and 100% (right) of the total cost incented.
- **Light shading**. This cell has a sample size below 20, and trends should be interpreted with caution.
- **Dark shading, labeled.** Within columns, darkly shaded bars with the same label indicate that purchase likelihood ratings differed significantly (p<.10) from one another for these sectors at this incentive level.
- "**n=**". Sample size for this cell.
- "↓". Average purchase likelihood at minimum incentive (0%).
- "↑". Average purchase likelihood at maximum incentive (100% of total cost).

To understand what might explain these purchase likelihood differences among EDCs, the SWE team examined whether there were any differences in firmographic characteristics between EDCs. Note that the SWE team collected information on the building/facility size and firm type only. The SWE team found no significant differences with respect to building/facility size or firm type (office, retail, industrial, healthcare, etc.) by EDCs.

6.7.2 Likelihood Sensitivity

Again, higher sensitivity values imply being more price sensitive or larger changes in the purchase likelihood given a change between 0% and 100% purchase discount. Table 6-3 lists the likelihood sensitivities by EDC, and significant differences are noted in the following listing[1]:

- Customers of Duquesne and West Penn Power were more price sensitive regarding converting T12 to T8 fixture than Penelec customers.
- Customers of Duquesne and Penelec were more price sensitive regarding converting T8 to high performance T8 fixture than PPL customers.
- Customers of Duquesne, Met-Ed, Penn Power and West Penn Power were more price sensitive regarding converting incandescent/CFL exit sign to LED exit sign than PPL customers. Also, customers of Met-Ed and West Penn Power were more price sensitive regarding converting incandescent/CFL exit sign to LED exit sign than PECO customers.
- Customers of Met-Ed and Penn Power were more price sensitive regarding installing a room occupancy sensor than PECO customers.

[1] One-way ANOVA at p<0.05; Tukey post hoc tests at p<0.1

Table 6-3: Likelihood Sensitivity By EDC

EDC	T12 to T8		T8 to HP T8		Inc/CFL to LED Exit Sign		Occupancy Sensor	
	Sensitivity	n	Sensitivity	n	Sensitivity	n	Sensitivity	n
a. Duquesne	.076 [d]	32	.066 [f]	29	.070 [f]	29	.051	32
b. Met-Ed	.067	32	.060	23	.082 [f, c]	28	.068 [c]	44
c. PECO	.060	40	.042	30	.050 [b, g]	29	.032 [b, e]	36
d. Penelec	.050 [a, g]	28	.064 [f]	35	.062	24	.048	26
e. Penn Power	.061	22	.055	32	.064 [f]	27	.059 [c]	41
f. PPL	.053	30	.038 [a, d]	28	.037 [a,b,e,g]	20	.051	41
g. WPP	.075 [d]	27	.053	24	.073 [f, c]	30	.045	33
Statewide	.061	228	.050	201	.058	185	.046	253

Source: on-site surveys, SWE analysis

Note: The evaluation team gave EDCs letters from "a" through "g." These letters are used in the subscripts to denote significant differences in sensitivity values between EDCs.

7 CHANGES BETWEEN PHASE I AND PHASE II FINDINGS

7.1 INTRODUCTION

This section presents changes in key findings between the baseline studies conducted during Phase I and Phase II of Act 129.[1] In an effort to provide the highest level of confidence in the changes observed, each analysis performed for this chapter was at the statewide (non-residential) level unless otherwise noted.

Many of the findings for all Phase II non-lighting end uses were weighted by premise, and are therefore directly comparable to Phase I data. The findings for Phase II lighting end use were weighted by connected load while the findings for Phase I lighting end use were weighted by square footage served. Therefore, while Phase I results are not *directly* comparable to Phase II results, comparing the two datasets still provides a valuable qualitative assessment and is consequently included in this chapter.

7.2 NON-RESIDENTIAL OVERVIEW

This section provides a side-by-side comparison of key findings about Pennsylvania's non-residential building stock contained in the Phase I and Phase II Baseline Study reports.

7.2.1 Electricity Consumption

Many EDCs saw their total non-residential electricity sales stay level or drop between 2010 and 2012 as shown in Figure 7-1. While the exact reasons are not clear, looking at the heating and cooling degree days in Figure 7-2 and Figure 7-3 show that 2012 was generally a more mild year than 2010.

However, PECO shows a large gain in sales between the two years. The gain is primarily due to the manner in which "premises", and their associated energy use, are counted. Since the PECO findings in the Phase I baseline study relied on data from the PECO-specific baseline study (PECO was not included in statewide primary data collection in Phase I) the sales figure used was also adopted from the data in the PECO-specific study. The definition used in the PECO-specific study appears to be more selective than the definition used in this study, and therefore, shows lower associated MWh sales. See Section 3.2.2 for more information on the definition of a "premise" used in this study.

[1] All data collection for the 2014 baseline report was performed in late 2013. Similarly, data for the 2012 baseline study was collected in late 2011. An exception to this is the electricity consumption data, which was collected from the EDCs in 2011 and 2013, but was derived from 2012 and 2010 billing data, respectively.

Figure 7-1: Comparison of Non-residential Sales by EDC

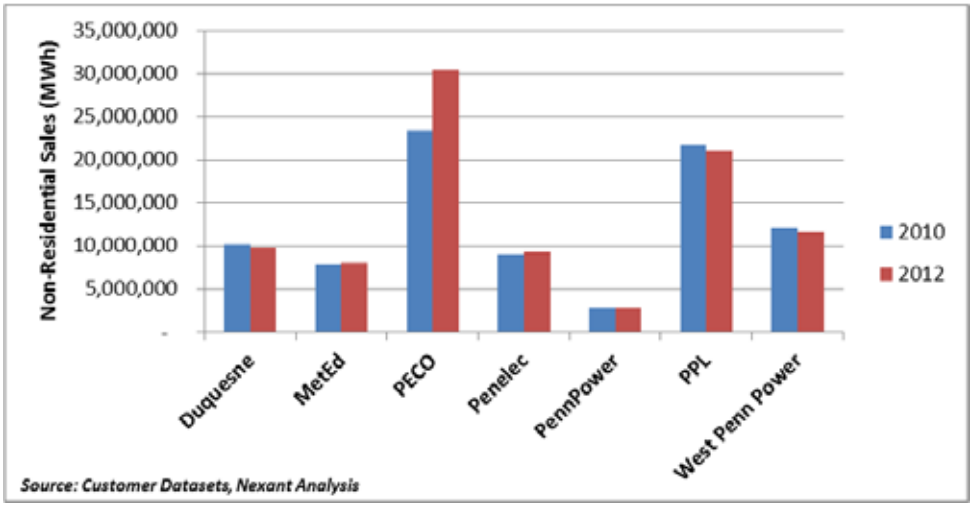


Figure 7-2: Comparison of Cooling Degree Days in Pennsylvania Cities

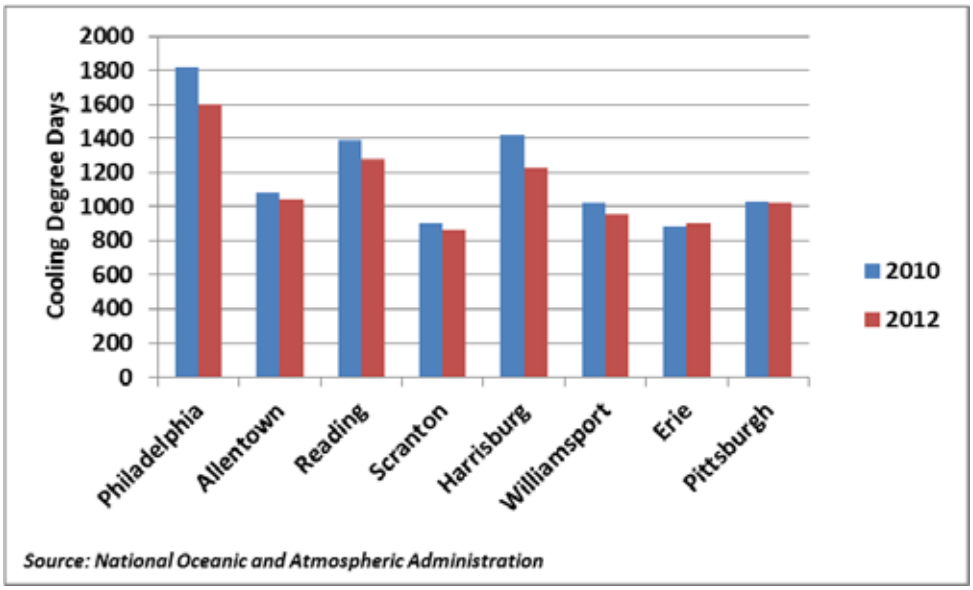
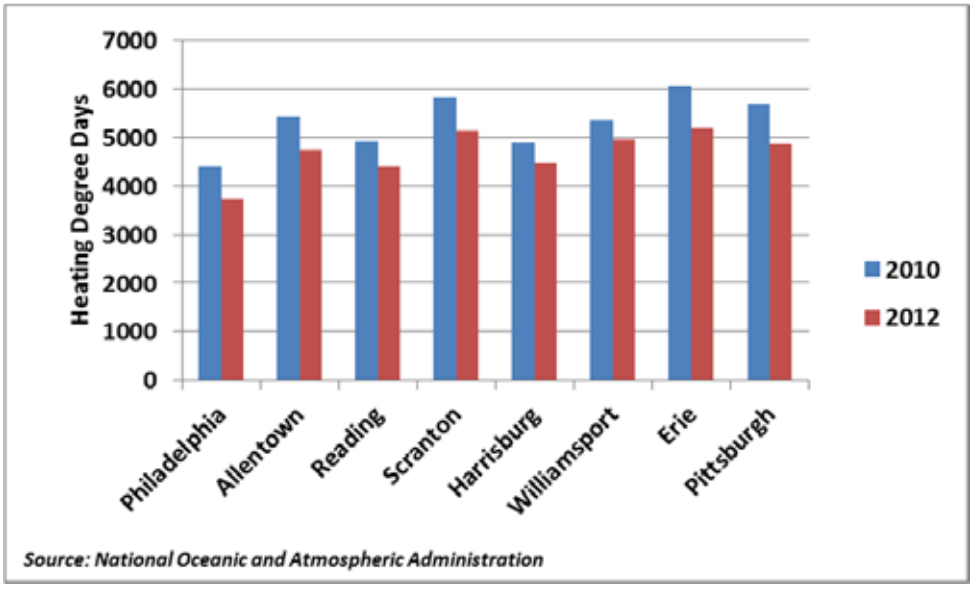


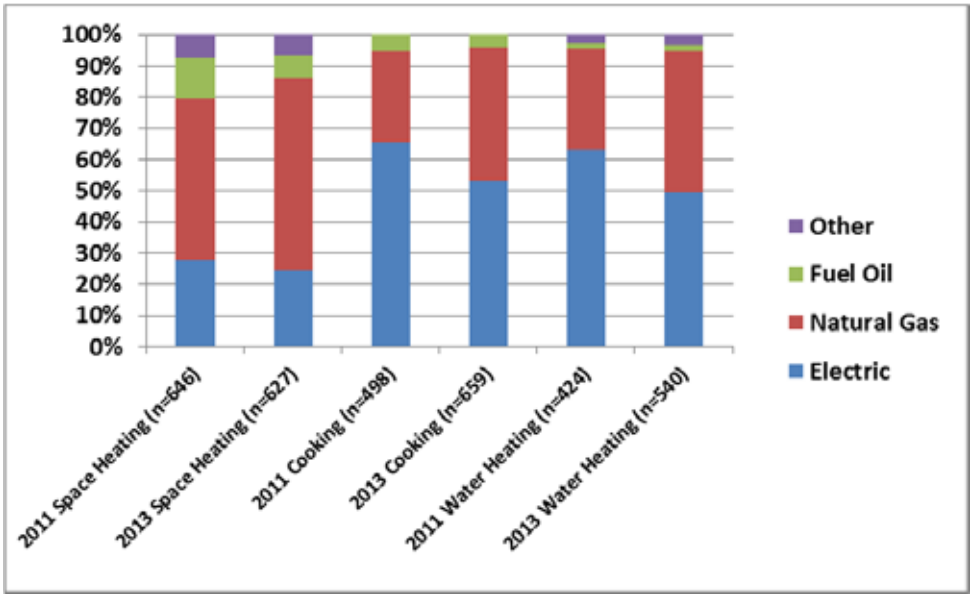
Figure 7-3: Comparison of Heating Degree Days in Pennsylvania Cities



7.2.2 End Use Penetration and Fuel Share

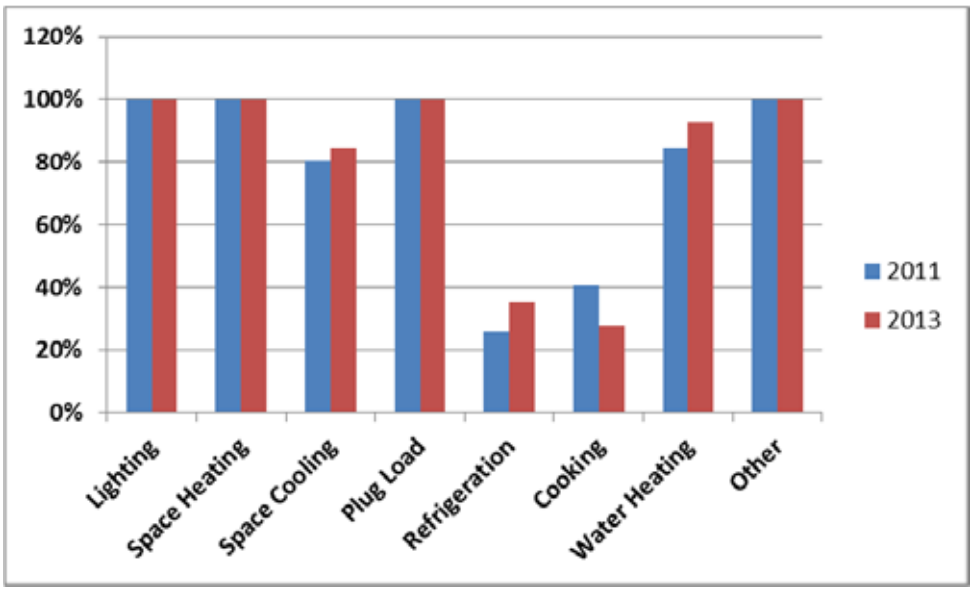
Figure 7-4 shows the 2011 and 2013 fuel shares for end uses that are not exclusively electric. For every end use, natural gas has gained fuel share over electric between the two studies. This indicates a general overall trend of customers switching from electric to natural gas when natural gas is available. Figure 7-5 shows that water heating and space cooling are each close to full non-residential market penetration, going from 85% to 93% and 80% to 84%, respectively.

Figure 7-4: Comparison of Fuel Shares for End Uses That are Not Exclusively Electric by Equipment Count



"Other" fuel share includes LPG, wood, and misc. fuels

Figure 7-5: Comparison of Penetrations of End Uses in All Non-Residential Buildings



"Other" End Use includes motors, pumps and misc. equipment

7.2.3 Building Information

Figure 7-6 shows similar results to the sales differences noted in Figure 7-1. Generally, the EDCs show level to slightly lower counts of premises in 2012. For similar reasons as discussed in Section 7.2.1, PECO's premise count appears much higher than it was in 2010. More than any real change in building stock, the change is largely attributable to a change in "premise" definition.

Figure 7-7 compares the sizes of the buildings surveyed in each study. The general distribution appears to be relatively the same between years with the 2013 buildings surveyed showing a slightly lower percent of buildings with less than 1000 square feet and a slightly higher percentage surveyed in the 30,000-40,000 square feet range than the 2011 buildings surveyed. The relative similarity in building sizes surveyed is partially due to the initial customer sample for each EDC being divided equally into small and large halves based on median sales per EDC. See Section 3.2.4 for more information regarding the sample selection.

Figure 7-6: Comparison of Premise Counts by EDC

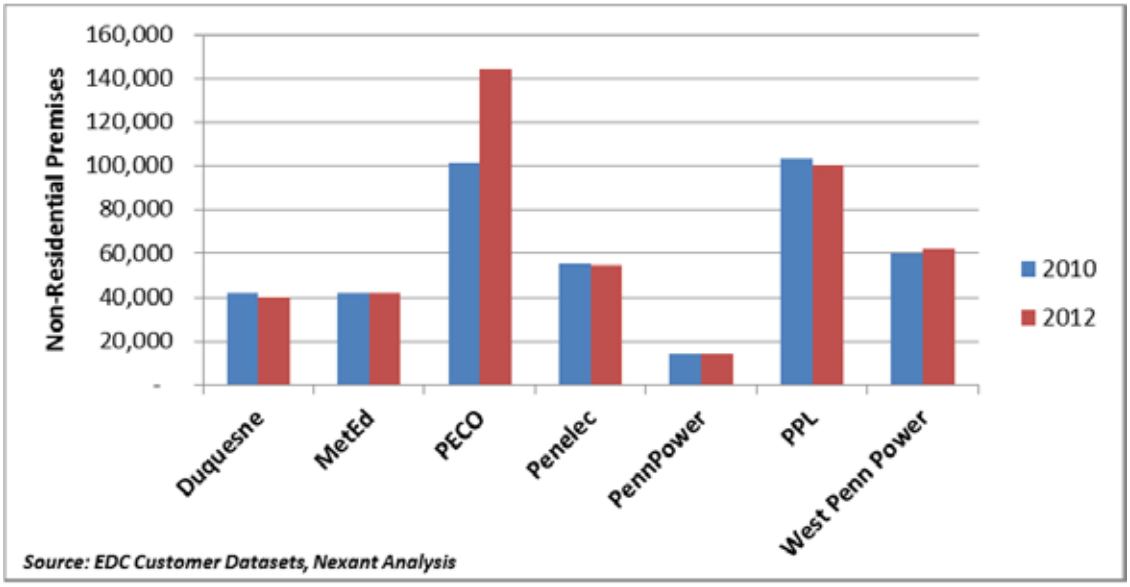
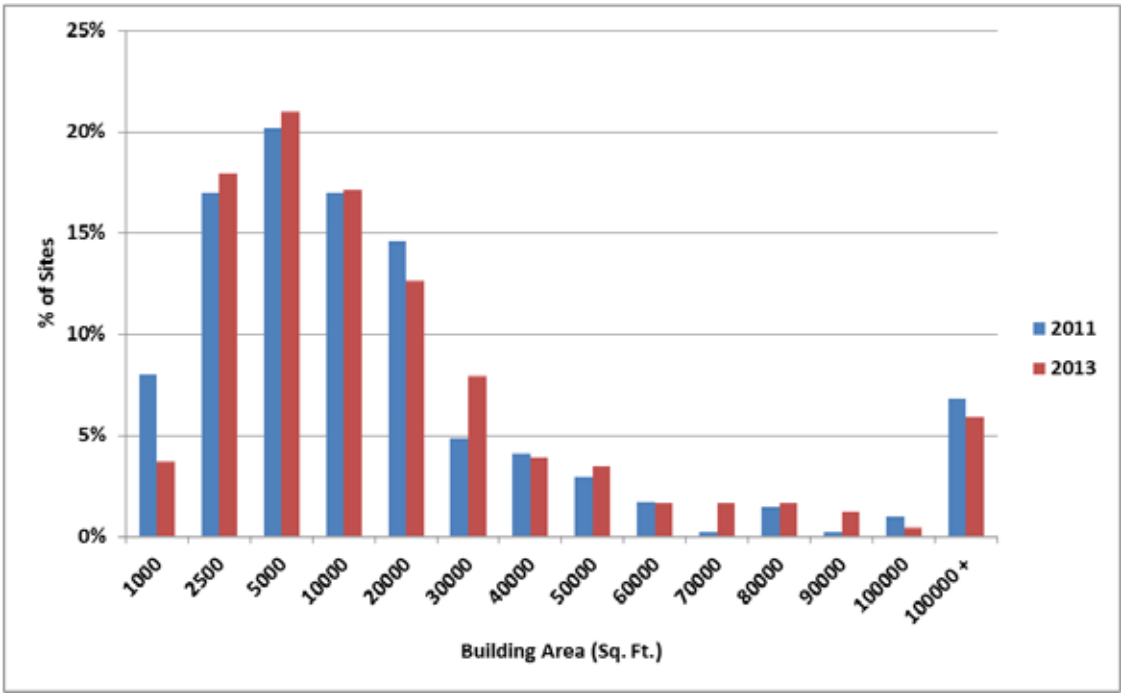


Figure 7-7: Comparison of Building Sizes Surveyed



7.3 STATEWIDE END USES

This section provides a side-by-side comparison of key statewide end use and saturation findings contained in the Phase I and Phase II Baseline Study reports. As previously noted, the findings for Phase II lighting end use were weighted by connected load while the findings for Phase I lighting end

use were weighted by square footage. Therefore, while Phase I results are not *directly* comparable to Phase II results, comparing the two datasets still provides a valuable qualitative assessment.

7.3.1 Heating, Ventilation, and Cooling (HVAC)

Figure 7-8 shows the types of cooling equipment in service across all non-residential buildings. In order to compare results between the two baseline studies, space cooling findings are presented as penetrations, or the percentage of buildings with a given system type present (as was the method used for the Phase I findings). For example, if a building had one chiller (packaged central plant), but also 35 window AC units, it was counted as simply two system types present in one building – one central cooling plant and one window AC. While central plants (e.g., chillers) are present in only a small percentage of surveyed buildings, they tend to service larger buildings and thus would have a larger share of electricity load than other cooling systems. Similarly, Figure 7-9 shows the types of heating equipment in service across all non-residential buildings. The use of furnaces has grown between the studies, which may be due to the proliferation of gas usage noted in Figure 7-4.

Figure 7-10 shows the share of HVAC control types for all non-residential buildings. While the share of thermostats (manual and programmable) has stayed relatively the same, the share of programmable thermostats has become increasingly prevalent.

Figure 7-8: Comparison of Cooling Equipment Shares

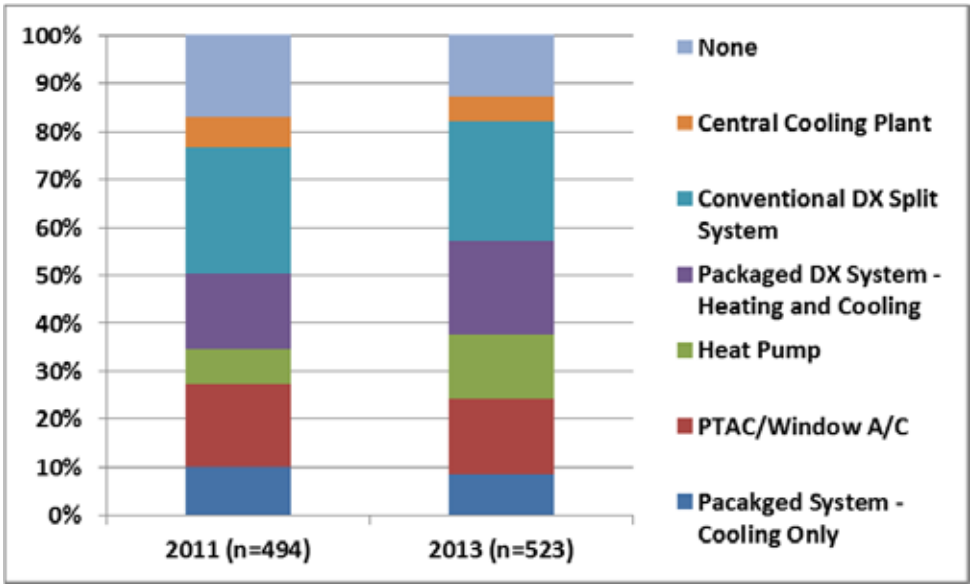


Figure 7-9: Comparison of Heating Equipment Shares

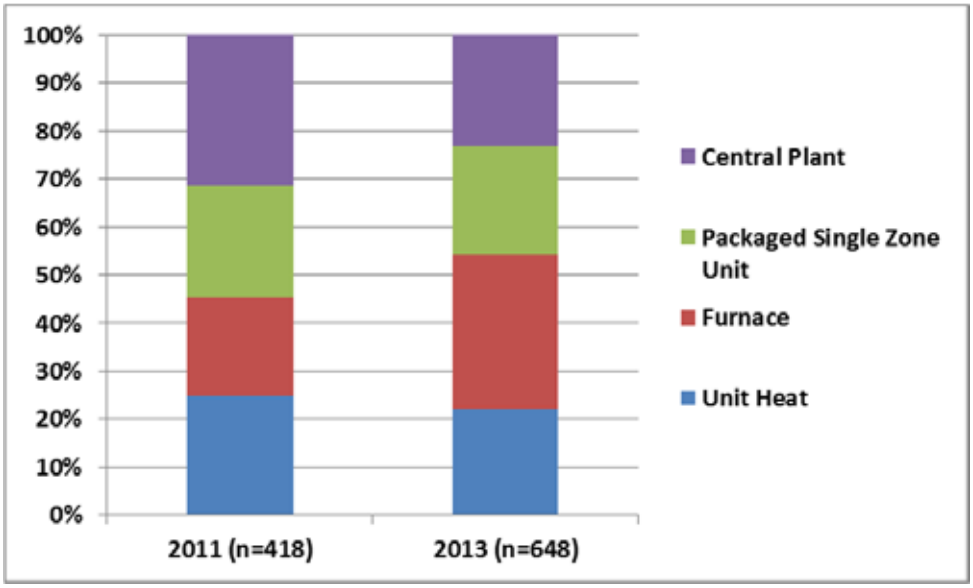
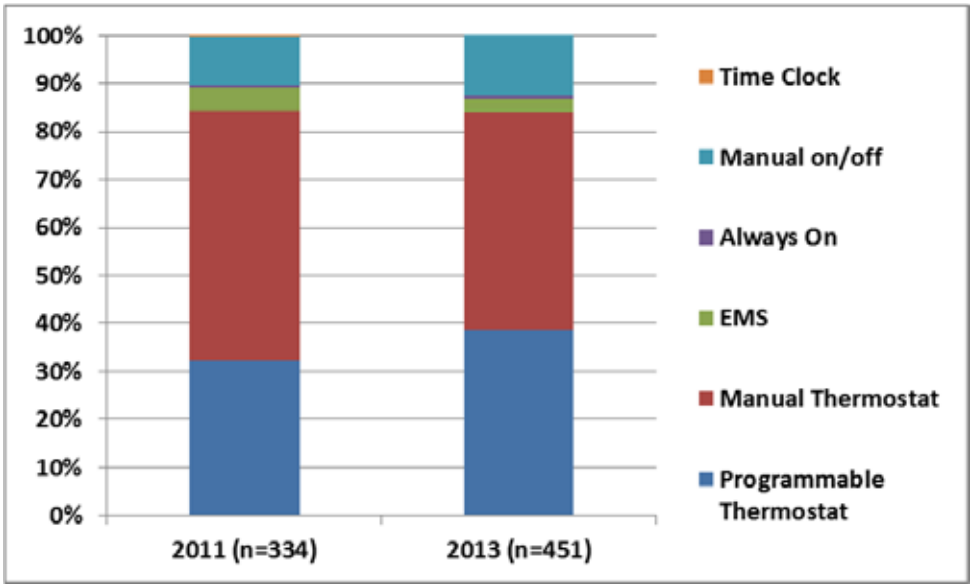


Figure 7-10: Comparison of HVAC Control Shares by Controller Count



7.3.2 Lighting

Figure 7-11 and Figure 7-12 show comparisons of lighting technologies in use and more specifically, linear fluorescent lamp types in use, respectively. It is important to remember that the 2011 data

was based on square footage and the 2013 data was based on the lighting's connected load. Even though the two reporting methods differ, Figure 7-12 provides some insight into changes in linear fluorescent use between 2011 and 2013. If the lighting types were to remain unchanged between 2011 and 2013, we would see the more efficient lamp types (T8 and T5) shrink in their 2013 share as their connected loads are relatively smaller than less efficient lamps (T12). However, the relative proportions of lamp types between the two study years has remained relatively consistent, indicating that more efficient lights such as T8s and T5s have gained in usage overall. Figure 7-13 shows a clear shift in exit sign lighting technology in use. While the share of LED signs has gone up 13%, CFL sign share has increased by 20% between the two studies.

Figure 7-11: Comparison of Lighting Technologies

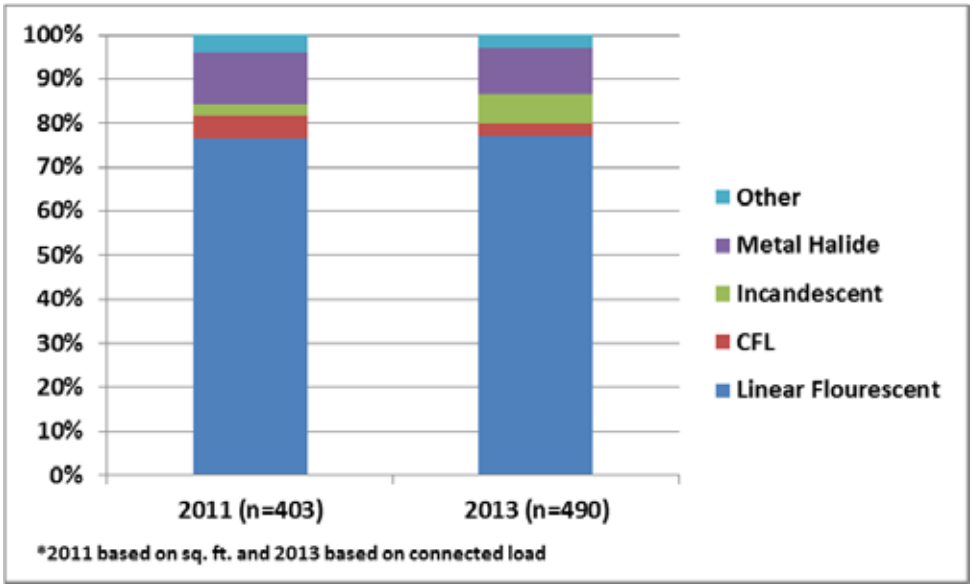


Figure 7-12: Comparison of Linear Fluorescent Lamp Type Distribution

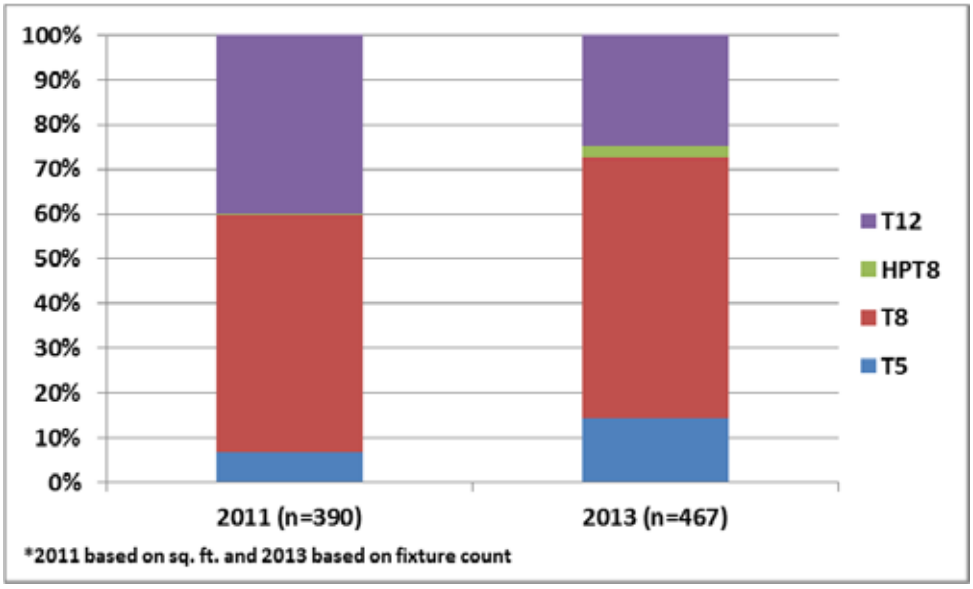
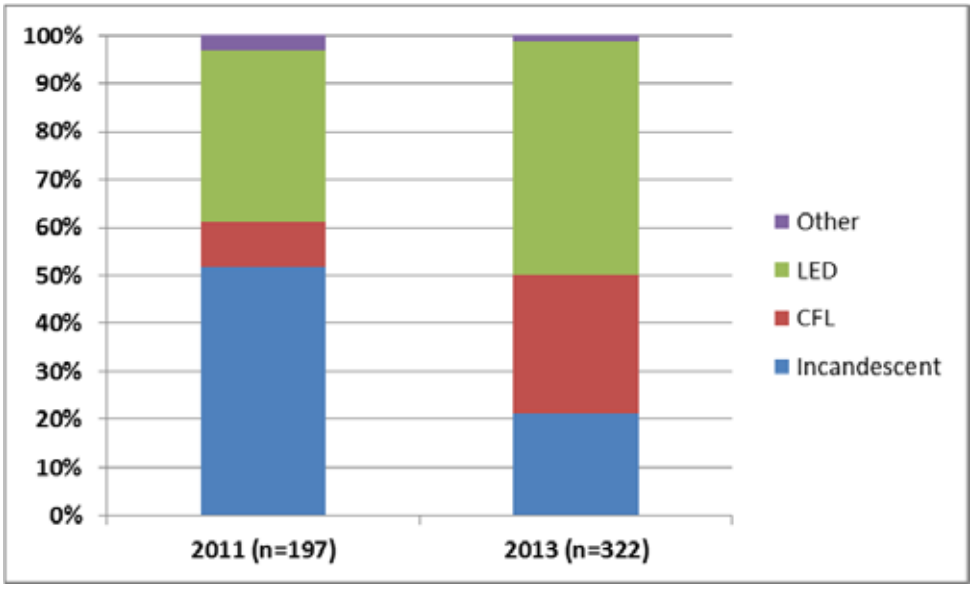


Figure 7-13: Comparison of Exit Sign Lighting Distribution by Fixture Count



7.3.3 Commercial Refrigeration

Figure 7-14 shows that between 2011 and 2013 refrigeration equipment penetration has generally increased. Specifically, the commercial and institutional sectors show increases in penetration, primarily driven by 7% and 6% increases in the retail (which includes grocery) and education segments, respectively. Figure 7-15 indicates that the only change in equipment types was a shift in

more glass door refrigerator/freezers and less display cases with doors. The 29% represented in the 2013 “glass door refrigerator/freezer” category is broken down into 8% glass door freezer and 21% glass door refrigerator. Since the use of a glass door refrigerator is similar to that of display case with doors, Figure 7-15 therefore signifies that little change has occurred in the share of the refrigeration equipment types used throughout the state.

Figure 7-14: Comparison of Refrigeration Equipment Penetrations by Premise Count

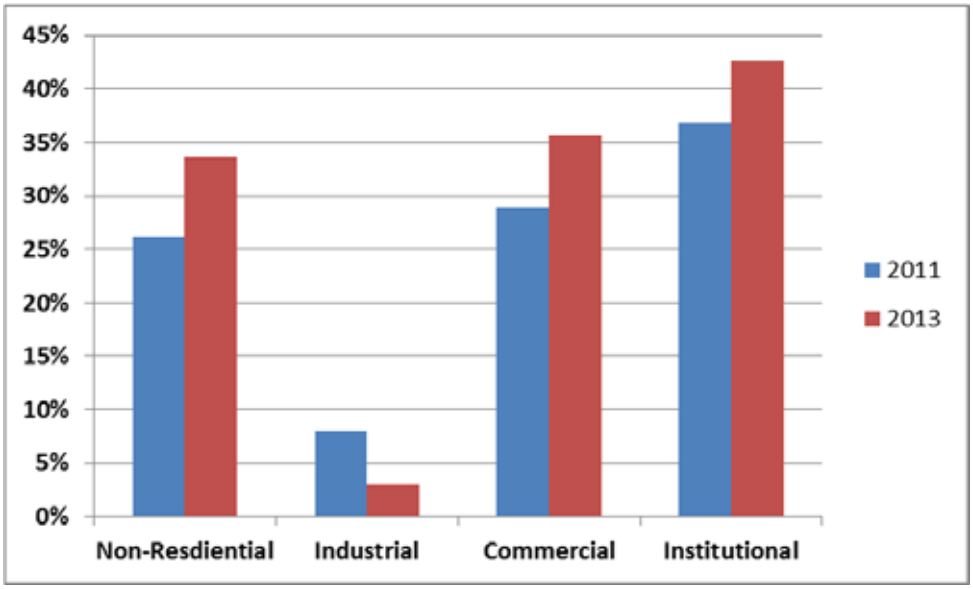
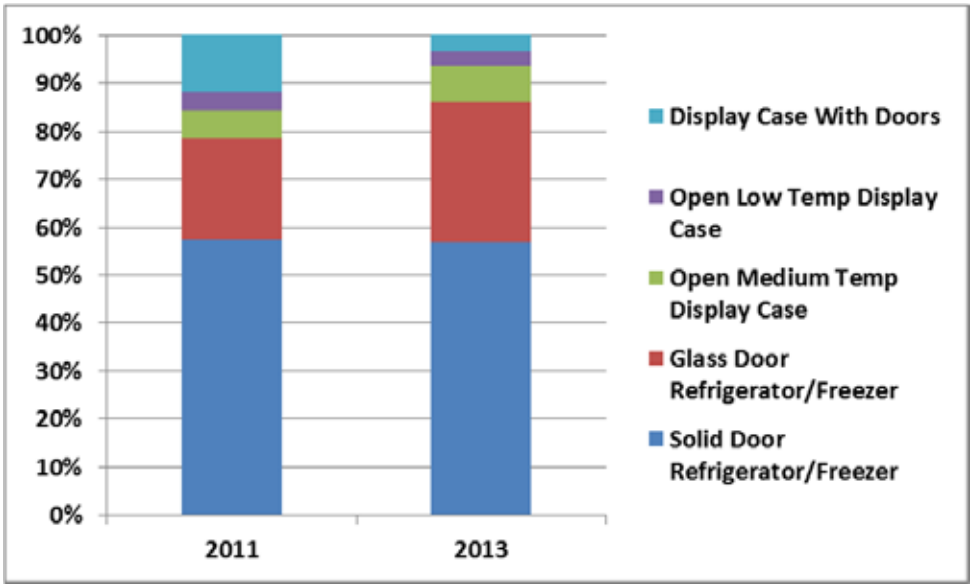


Figure 7-15: Comparison of Refrigeration Equipment Shares by Equipment Count



7.3.4 Water Heating

Similar to trends noted in other end uses fueled by either electricity or natural gas, Figure 7-16 shows that a greater share of the water heating surveyed in 2013 was fueled by natural gas, moving from a 32% to a 42% fuel share while electrically-fueled heaters dropped in fuel share from 63% to 51%. Figure 7-17 indicates that the water heaters surveyed between both studies generally follow the same trend in capacity, where approximately 93% of all water heaters were found to be less than 100 gallon capacity in both studies.

Figure 7-16: Comparison of Fuel Share of Water Heaters by Equipment Count

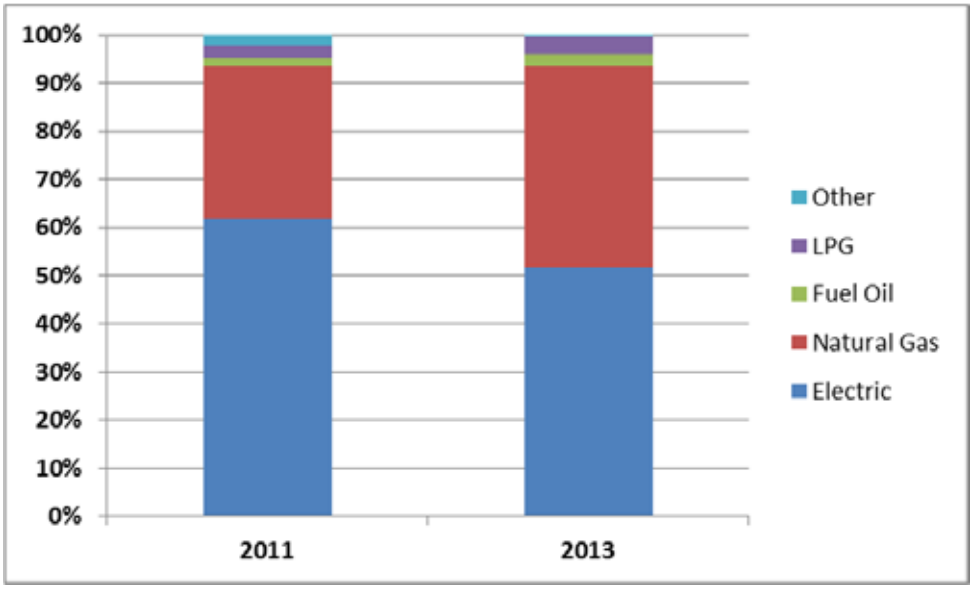
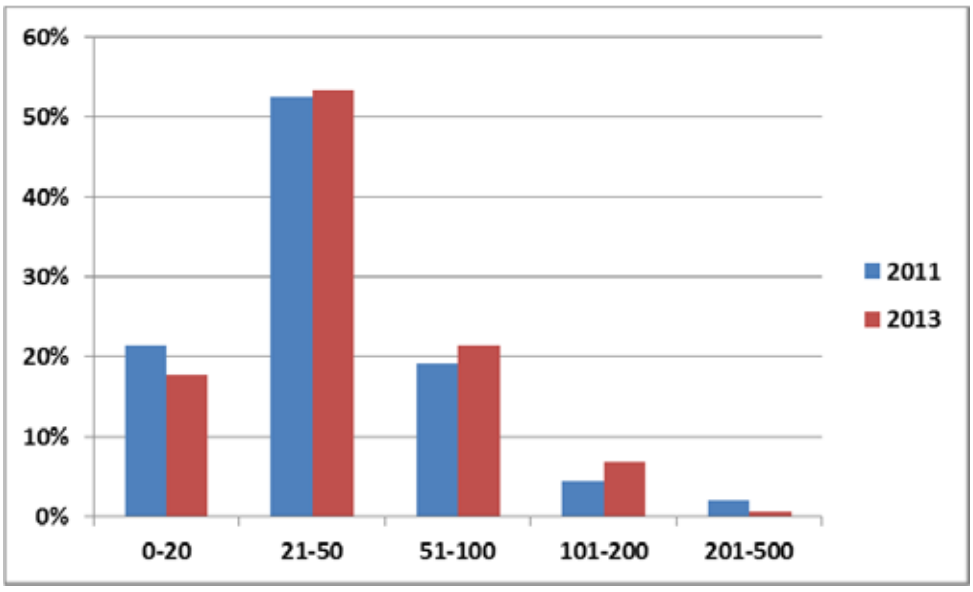


Figure 7-17: Comparison of Water Heating Tank Capacity Distribution



8 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.[1]"

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 penetrations and 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, fuel shares, equipment efficiencies, and energy use intensities (EUIs), among other findings, are all intended to be utilized in the market potential study.

It was through the use of on-site data collection that the SWE team was able to gather accurate information regarding not only the type of equipment installed in non-residential facilities throughout the state, but also the efficiency level of various major equipment types or end uses. The study also collected valuable information on the building characteristics such as square footage, glazing types, and more. Finally, the contemporary nature of the data collection effort (SWE data collection occurred during Fall 2013) enables juxtaposition to other recent and similar regional and national studies, including the previous Pennsylvania End Use and Saturation Study, that capture fuel shares and equipment types and efficiency levels. 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.

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

Appendix A ON-SITE SURVEY INSTRUMENT

Commercial On-site Survey

Pennsylvania Statewide Baseline Study

Revised August 2, 2013

General Info (Complete before visit):

Company Name:		Unique ID	
Contact Name:		★ **# of Buildings onsite:**	
Contact Phone Number:		★ **# of Bldgs surveyed:**	
Address:		No. Electric Meters:	
City, State, Zip:		No. Gas Meters:	
Engineer:			
Site Visit Date:			
Site Visit Time:			
Electric Distribution Company:			
Notes:			

Survey Key

N/A = Not Applicable

NX = Not Available

★ = Highest Priority Data Points

General Info

★ 1. Please provide details about the number of electric meters listed above:

Electric Meters	Facility Zone Served (Office, Warehouse, etc)	Annual kWh	Meter Number (if accessible or provided by facility manager)
#1			
#2			
#3			
#4			

2. Do you have any other energy service providers? Y / N

3. Is this facility owned or leased? Own / Lease

4. If leased, who makes decisions about the lighting and HVAC systems? Landlord / Tenant

★ 5. How many people on average occupy this building during **core business** hours? _____

During **non- core business** hours? _____

★ 6. When is this building occupied? [Check appropriate season and corresponding months]

All Year			Summer Only			Winter Only			Other Seasonal		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

★ 7. What is the weekly occupancy schedule of this building?

Schedule 1

Day	Business Hours	Closed All Day?	Open 24 Hours?
Sunday	From: ____ To: ____	☐	☐
Monday	From: ____ To: ____	☐	☐
Tuesday	From: ____ To: ____	☐	☐
Wednesday	From: ____ To: ____	☐	☐
Thursday	From: ____ To: ____	☐	☐
Friday	From: ____ To: ____	☐	☐
Saturday	From: ____ To: ____	☐	☐

★ 8. Does your facility have more than one occupancy schedule (second shift, retail holiday schedule)? Y / N
(If yes, fill out tables below otherwise leave blank)

9. When does the alternative schedule apply? [Check appropriate season and corresponding months]

All Year			Summer Only			Winter Only			Other Seasonal		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Schedule 2

Day	Business Hours	Closed All Day?	Open 24 Hours?
Sunday	From: ____ To: ____	☐	☐
Monday	From: ____ To: ____	☐	☐
Tuesday	From: ____ To: ____	☐	☐
Wednesday	From: ____ To: ____	☐	☐
Thursday	From: ____ To: ____	☐	☐

Friday	From: ____ To: ____	☐	☐
Saturday	From: ____ To: ____	☐	☐

10. When does third alternative schedule apply? [Check appropriate season and corresponding months]

All Year			**Summer Only**			**Winter Only**			**Other Seasonal**		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Schedule 3

Day	Business Hours	Closed All Day?	Open 24 Hours?
Sunday	From: ____ To: ____	☐	☐
Monday	From: ____ To: ____	☐	☐
Tuesday	From: ____ To: ____	☐	☐
Wednesday	From: ____ To: ____	☐	☐
Thursday	From: ____ To: ____	☐	☐
Friday	From: ____ To: ____	☐	☐
Saturday	From: ____ To: ____	☐	☐

★ 11. Of the following options, what is the **PRIMARY** use of your building? [Only check ***ONE*** appropriate space]

Education	Grocery	Health	Lodging	Office	Restaurant	Retail	Warehouse	Industrial	Multifamily	Public Assembly	Other

12. If Other: Please describe: _____

13. Of the following options, what is the **SECONDARY** use of your building? [Leave *blank* if no secondary use exists]

Education	Grocery	Health	Lodging	Office	Restaurant	Retail	Warehouse	Industrial	Multifamily	Other

14. If Other: Please describe: _____

15. If Hospital: How many beds does this facility have? _____

16. If Restaurant: What is the average number of customer meals served per day? _____

17. If Lodging: How many rooms are offered? _____

18. If Education with classrooms: How many students? _____

Building Information

★ 19. What is the year of ***original*** building construction? _____

★ 20. How large is this building in square feet, not including any parking garages? _____ ft^2

21. If this building has an interior parking garage, how large is it? _____ ft^2

22. Does the building have a data center? Y / N

23. If the building has a data center what percentage of the building square footage is it? _____ ft^2

★ 24. How many floors is this building (excluding the basement)? _____

★ 25. Have there been any renovations/additions since date of original construction? Y / N

a. What year did renovations/additions occur? _____

b. What is the approximate ft^2 of additions? _____ ft^2

26. Was this building commissioned upon original construction? Y / N

27. When was the last time this building was commissioned? _____

28. What level of LEED certification does this building have?
(1=certified, 2=silver, 3=gold, 4=platinum, 5=Not LEED Certified) _____

★ Lighting

29. Please select **ONE** number from each of the tables below for each space.

Lighting									
Lighting Configuration									
Lamp Type (see below)	Length in ft (if Applicable)	Lamp Wattage	# of Fixtures	Lamps/ Fixture	Ballast Type (See Below)	Control Type (See Below)	Average weekly hours of use	Zone #	Zone Description

Lamp Type	
1=Incandescent	8=T5
2=Metal Halide	9=T8
3=High Pressure Sodium	10=HPT8
4=Mercury Vapor	11=T10
5=CFL	12=T12
6=Neon (Cold Cathode)	O=Other
7=LED	

Control Type
1=Switch (Manual on/off)
2=Circuit Breaker
3=Dual Level Switch
4=Dimmer Switch
5=Timer
6=Motion/Occupancy Sensor
7=Daylighting Controls
8=Energy Management System
9=None/Continuous

Ballast Type
1=Magnetic Standard
2=Magnetic-ES
3=Electronic
4=Electronic Dimming
5=Emergency

Zone #	Sq Footage (per zone)	W/ft^2 (per zone)

30.

Exterior Lighting							
Lighting Configuration							
Lamp Type (see below)	**Length in ft** (if Applicable)	**Lamp Wattage**	**# of Fixtures**	**Lamps/ Fixture**	**Ballast Type (See Below)**	**Control Type (See Below)**	**Average weekly hours of use**

Lamp Type	
1=Incandescent	8=T5
2=Metal Halide	9=T8
3=High Pressure Sodium	10=HPT8
4=Mercury Vapor	11=T10
5=CFL	12=T12
6=Neon (Cold Cathode)	0=Other
7=LED	

Control Type
1=Switch (Manual on/off)
2=Circuit Breaker
3=Dual Level Switch
4=Dimmer Switch
5=Timer
6=Motion/Occupancy Sensor
7=Daylighting Controls
8=Energy Management System
9=None/Continuous

Ballast Type
1=Magnetic Standard
2=Magnetic-ES
3=Electronic
4=Electronic Dimming
5=Emergency

31. What is the **primary** lighting application? _____
(1=standard interior lighting, 2=high-bay)

★32. What is the estimated interior lighting power density for the building[s]? _____ W/ft^2
(Use data from previous page to calculate a weighted average based on square feet)

★33. Has the lighting system been updated in the last 5 years? Y / N

34. Are bi-level lighting controls used in stairways? Y / N

★35. Lighting (T12 → T8)

[If majority of lights are T12s → ask 35a to 35c]

35a. I noticed your building has T12 light fixtures installed. How many of each of the following do you keep in storage?

a. T12 bulbs _____
b. T12 ballasts _____

I would like to ask you a few questions about your interest in purchasing more efficient lighting products to replace your T12s. [If needed: "T8 lights are 20% more efficient than the T12 lights you currently have.] For each question, please indicate your likelihood to purchase the more efficient lights on a scale of 0-10, in which 0 means "not at all likely" and 10 means "extremely likely".

35b. If converting one of your T12 lights to a more energy efficient T8 light costs $150 per fixture, how likely are you to purchase one in the next two years?

Not at all Likely										Extremely Likely
0	1	2	3	4	5	6	7	8	9	10

35c. What if the cost was discounted _Fill-in 1 (Fill-in 2), so that you would pay _Fill-in 3 to convert a T12 light to a T8 light? How likely are you to purchase one in the next two years?

			Not at all likely										Extremely likely
Fill-in 1	**Fill-in 2**	**Fill-in 3**	0	1	2	3	4	5	6	7	8	9	10
25 %	One-quarter	$112.50											
50%	One-half	$75.00											
75%	Three-Quarters	$37.50											
100%	Full cost	Nothing											

★36. Lighting (T8 → HPT8)

[If majority of lights are T8s → ask 36a to 36c]

36a. I noticed your building has T8 light fixtures installed. How many of each of the following do you keep in storage?

a. T8 bulbs _____
b. T8 ballasts _____

I would like to ask you a few questions about your interest in purchasing more efficient lighting products to replace your T8s. [If needed: "High Performance T8 lights are 12% more efficient than the regular T8 lights you currently have.] For each question, please indicate your likelihood to purchase the more efficient lights on a scale of 0-10, in which 0 means "not at all likely" and 10 means "extremely likely".

36b. If converting one of your T8 lights to a more energy efficient high-performance T8 light costs $2.50 per lamp, how likely are you to purchase one in the next two years?

Not at all Likely										Extremely Likely
0	1	2	3	4	5	6	7	8	9	10

36c. What if the cost was discounted _Fill-in 1 (Fill-in 2), so that you would pay _Fill-in 3 to convert a T8 light to a high performance T8 light? How likely are you to purchase one in the next two years?

			Not at all likely										Extremely likely
Fill-in 1	**Fill-in 2**	**Fill-in 3**	0	1	2	3	4	5	6	7	8	9	10
25 %	One-quarter	$1.88											
50%	One-half	$1.25											
75%	Three-Quarters	$0.63											
100%	Full cost	Nothing											

★37. **Lighting (HPS or MH → T5)**
[If majority of lights are HPS or MH → ask 37a & 37b]

I noticed that your building has [High Pressure Sodium AND/OR Metal Halide] lights installed. I would like to ask you a few questions about your interest in purchasing more efficient lighting products to replace your [HPS/MH] lights. [If needed: "T5 lights are about 20% more efficient than the [HPS/MH] lights you currently have."] For each question, please indicate your likelihood to purchase the more efficient lights on a scale of 0-10, in which 0 means 'not at all likely' and 10 means 'extremely likely'.

37a. If converting one of your [High Pressure Sodium OR Metal Halide] lights to a more energy efficient T5 costs $225 per fixture, how likely are you to purchase one in the next two years?

Not at all Likely										Extremely Likely
0	1	2	3	4	5	6	7	8	9	10

37b. What if the cost was discounted _Fill-in 1 (Fill-in 2), so that you would pay Fill-in 3 to convert a [High Pressure Sodium OR Metal Halide] light to a T5 light? How likely are you to purchase one in the next two years?

			Not at all likely										Extremely likely
Fill-in 1	**Fill-in 2**	**Fill-in 3**	0	1	2	3	4	5	6	7	8	9	10
25%	One-quarter	$170											
50%	One-half	$112											
75%	Three-Quarters	$56											
100%	Full cost	Nothing											

38. Does this facility have lit exit signs? Y / N

39. Are the exit signs lit 24/7 Y / N

★40.

Exit Signs		
Lamp type	**# of signs**	**Wattage**
Incandescent		
Compact Fluorescent		
LED		
Other		
Don't Know		

★41. Exit Signs

[If majority of exit signs are Incandescent or CFL → ask 41a & 41b]

I noticed that your Exit Signs have [Incandescent AND/OR CFL] bulbs. I would like to ask you a few questions about your interest in purchasing more efficient LED exit signs. [If needed: "[If Incandescent Exit Sign installed] LED Exit Signs are 75% more efficient than the incandescent signs you currently have, [If CFL Exit Sign Installed] and 50% more efficient than the CFL signs you currently have."] For each question, please indicate your likelihood to purchase the more efficient lights on a scale of 0-10, in which 0 means 'not at all likely' and 10 means 'extremely likely'.

41a. If converting one of your [Incandescent OR CFL] Exit Signs to a more energy-efficient LED Exit Sign costs $50 per sign, how likely are you to purchase one in the next two years?

Not at all Likely										Extremely Likely
0	1	2	3	4	5	6	7	8	9	10

41b. What if the cost was discounted Fill-in 1 (Fill-in 2), so that you would pay Fill-in 3 to convert a(n) [Incandescent OR CFL] Exit Sign to an LED Exit Sign? How likely are you to purchase one in the next two years?

			Not at all likely									Extremely likely
Fill-in 1	**Fill-in 2**	**Fill-in 3**	0	1	2	3	4	5	6	7	8	9	10
25 %	One-quarter	$38											
50%	One-half	$25											
75%	Three-Quarters	$13											
100%	Full cost	Nothing											

★42. Occupancy Sensors

[If majority of rooms do not have occupancy sensors installed → ask 42a & 42b]

I noticed that rooms in your building have manual control light switches. I would like to ask you a few questions about your interest in purchasing occupancy sensors to replace your manual light switches. [If needed: "Occupancy sensors are typically 24% more efficient than the manual switches you currently have."] For each question, please indicate your likelihood to purchase the more efficient occupancy sensor on a scale of 0-10, in which 0 means 'not at all likely' and 10 means 'extremely likely'.

42a. If installing a more energy-efficient occupancy light sensor in one room costs $150, how likely are you to purchase one in the next two years?

Not at all Likely										Extremely Likely
0	1	2	3	4	5	6	7	8	9	10

42b. What if the cost was discounted Fill-in 1 (Fill-in 2), so that you would pay Fill-in 3 to install an occupancy sensor? How likely are you to purchase one in the next two years?

			Not at all likely									Extremely likely
Fill-in 1	**Fill-in 2**	**Fill-in 3**	0	1	2	3	4	5	6	7	8	9	10
25 %	One-quarter	$113											
50%	One-half	$75											
75%	Three-Quarters	$38											
100%	Full cost	Nothing											

HVAC System

43. Does this building have a Single Zone HVAC System? Y / N

SINGLE-ZONE HVAC SYSTEM				
		System 1	System 2	System 3
★ System Type	(See Table Below)			
Zone Description				
Regular Maintenance?	(Circle One)	Y / N	Y / N	Y / N
Percent of Building	(%)			
Age	(Years)			
Temperature Control Type	(See Table Below)			
★ Number of Identical Units				
Do the Units run 24/7?		Y / N	Y / N	Y / N
If not, what is the operating schedule?	(e.g. M-F 6am to 6pm)			
Manufacturer/Model Name				
Model Number				
Serial Number				
Use rows below to enter additional Manufacturer/Model information for multi-component split systems				
Manufacturer/Model Name #2				
Model Number #2				
Serial Number #2				
Cooling Data:				
★ Rated Cooling Capacity	(Tons)			
Performance Rating	(Circle One)	EER SEER	EER SEER	EER SEER
★ Performance Rating Value				
Heating Data:				
★ Rated Heating Output	(circle One)	Btu/h kW	Btu/h kW	Btu/h kW
Fuel Type	(See Table Below)			
★ Efficiency	(%,AFUE,COP,HSPF)			
Compressors:				
Quantity				
HP or Volts/Phase/FL Amps				
Supply Fans:				
Motor HP				
Motor Efficiency	(%)			
VFD	(Circle One)	Y / N	Y / N	Y / N
Insulated Duct	(Circle One)	Y / N	Y / N	Y / N
Air-to-Air Heat Recovery	(Circle One)	Y / N	Y / N	Y / N
Economizer	(Circle One)	Y / N	Y / N	Y / N
Demand Control Ventilation	(Circle One)	Y / N	Y / N	Y / N

Single-Zone HVAC System Types		
Packaged Systems	**Split Systems**	**Unitary**
1=Packaged DX Unit - Heating and Cooling	8=Conventional - CU & Blower/Furnace	13=Evaporative Cooler
2=Packaged DX Unit - Cooling Only	9="Aquatherm" - CU & H_2O Source Heat Pump	14=Unit Heater
3=PTAC / Window A/C	10=Ductless A/C	15=Electric Fan Coil / Air Handler
4=PTAC w/Heating	11=Split System Heat Pump	16=Electric Baseboard Radiator
5=MAU w/Heating	12=Ground Source Heat Pump	17=Infrared Radiant Heater
6=MAU w/Evap. Cooling		
7=MAU w/Heating & Cooling		

Temperature Control Types
1=Thermostat-Programmable
2=Thermostat-Manual
3=EMS
4=Always on
5=Manual on/off
6=Time Clock

Fuel Types
1=Electric
2=Natural Gas
3=Fuel Oil
4=LPG
5=Purchase HW or Steam
6=Wood
7=Other (Make Note)

44. Does this building have a Multi-Zone HVAC System? Y / N

★ If Yes: (Circle One) **Central Air Distribution (pg 8)** or **Steam/Water Distribution (pg 10)**

MULTI-ZONE HVAC SYSTEM				
Central Air Distribution				
★		System 1	System 2	System 3
Air Distribution System Type:	*(See Table 1 Below)*			
Main Air Supply/Return System	*1=Built-up Packaged DX Unit 2=Central AHU*			
Regular Maintenance?	*(Circle One)*	Y / N	Y / N	Y / N
Percent of Building	*(%)*			
Age	*(Years)*			
Temperature Control Type	*(See Table 2 Below)*			
Number of Identical Units				
Do the Units run 24/7?		Y / N	Y / N	Y / N
If not, what is the operating sched	*(e.g. M-F 6am to 8pm)*			
Demand Control Ventilation		Y / N	Y / N	Y / N
Supply Fans:				
Volume Control	*1=Discharge Damper 2=Inlet Vane 3=VFD*			
Motor HP				
Volts/Phase/FL Amps				
Motor Efficiency	*(%)*			
Return Fans:				
Volume Control	*1=Discharge Damper 2=Inlet Vane 3=VFD*			
Motor HP				
Volts/Phase/FL Amps				
Motor Efficiency	*(%)*			
Terminal Reheat Type	*1=Elec 2=Water 3=Steam 4=None*			
Evaporative Cooling	*(Circle One)*	Y / N	Y / N	Y / N
Insulated Duct	*(Circle One)*	Y / N	Y / N	Y / N
Air-to-Air Heat Recovery	*(Circle One)*	Y / N	Y / N	Y / N
Economizer	*(Circle One)*	Y / N	Y / N	Y / N

Table Continued On Next Page

Table 1 - Multi-Zone Central Air Distribution Systems
1=Constant Volume - Single Duct System
2=Constant Volume - Single Duct System w/ Reheat
3=VAV - Single Duct System
4=VAV - Single Duct System w/ Reheat
5=VAV - Single Duct System w/ Fan-Powered Boxes & Reheat
6=VAV - Dual Duct System
7=VAV - Dual Duct System w/ Reheat
8=VAV - Dual Duct System w/ Fan-Powered Boxes & Reheat
9=Under Floor Air Distribution
10=Under Floor Air Distribution w/ Reheat
11=Under Floor Air Distribution w/ Fan-Powered Boxes & Reheat
12=Variable Refrigerant Volume

Table 2 - Temperature Control Types
1=Thermostat-Programmable
2=Thermostat-Manual
3=EMS
4=Always on
5=Manual on/off
6=Time Clock

MULTI-ZONE HVAC SYSTEM CONTINUED				
For Central Air Handling Units Only				
Cooling Coil?	(Circle One)	Y / N	Y / N	Y / N
Heating Coil?	(Circle One)	Y / N	Y / N	Y / N
Heating Coil Type	1=Elec 2=Water 3=Steam 4=None			
For Built-up Packaged DX Units Only				
Equipment Data:				
Manufacturer/Model Name				
Model Number				
Serial Number				
Cooling Data:				
Rated Cooling Capacity	(Tons)			
Performance Rating	(Circle One)	EER SEER	EER SEER	EER SEER
Performance Rating Value				
Heating Data:				
Rated Heating Output	(circle One)	Btu/h kW	Btu/h kW	Btu/h kW
Fuel Type	(See Table 3 Below)			
Efficiency	(%, COP, HSPF)			
Compressors:				
Quantity				
HP or Volts/Phase/FL Amps				

Table 3 - Fuel Types
1=Electric
2=Natural Gas
3=Fuel Oil
4=LPG
5=Purchase HW or Steam
6=Wood
7=Other (Make Note)

MULTI-ZONE HVAC SYSTEM				
Central Water/Steam Distribution				
		System 1	System 2	System 3
System Type:	1=Two-pipe 2=Four-pipe			
Steam or Hot Water Heating?	1=Water 2=Steam			
Antifreeze in loop?	(Circle One)	Y / N	Y / N	Y / N
Regular Maintenance?	(Circle One)	Y / N	Y / N	Y / N
Percent of Building	(%)			
Age	(Years)			
Temperature Control Type	(See Table Below)			
Terminal Systems:				
Unit Type:	(See Table Below)			
Number of Identical Units				
Do the Units run 24/7?		Y / N	Y / N	Y / N
If not, what is the operating schedule?	(e.g., M-F 6am to 6pm)			
For Heat Pumps Only				
Manufacturer/Model Name:				
Model Number				
Serial Number				
Cooling Data:				
Rated Cooling Capacity (if applicable)	(Tons)			
Performance Rating	(Circle One)	EER SEER	EER SEER	EER SEER
Performance Rating Value				
Heating Data:				
Rated Heating Output	(circle One)	Btu/h kW	Btu/h kW	Btu/h kW
Fuel Type	(See Table Below)			
Efficiency	(COP, HSPF)			
Compressors:				
Quantity				
HP or Volts/Phase/FL Amps				
Supply Fan:				
Motor HP				
Motor Efficiency	(%)			

Table 3 - Multi-Zone Water/Steam Distribution System - Terminal Systems
1=Two-Pipe Water-Source Heat Pump
2=Two-Pipe Water-Source Heat Pump w/ Supplemental Self-Contained DX Cooling
3=Four-Pipe Water-Source Heat Pump
4=Four-Pipe Water-Source Heat Pump w/ Supplemental Self-Contained DX Cooling
5=Baseboard Radiator
6=Water-Source Unit Heater
7=Radiant Slab Heating
8=Induction Units

Temperature Control Types
1=Thermostat-Programmable
2=Thermostat-Manual
3=EMS
4=Always on
5=Manual on/off
6=Time Clock

Fuel Types
1=Electric
2=Natural Gas
3=Fuel Oil
4=LPG
5=Purchase HW or Steam
6=Wood
7=Other (Make Note)

Central HVAC System –Boiler

45. Does this system have Boiler(s)? Y / N

Central HVAC System-Boiler				
		System 1	System 2	System 3
Fuel Type	*(See Table Below)*			
Output type	*Steam or Hot Water*			
Heating Zone Description				
Regular Maintenance	*(Circle One)*	Y / N	Y / N	Y / N
Percent of Building	*(%)*			
Age	*(Years)*			
Temperature Control Type	*(See Table Below)*			
Number of Identical Units				
Do the Units run 24/7?		Y / N	Y / N	Y / N
If not, what is the operating schedule?	*(e.g. M-F 6am to 8pm)*			
Manufacturer				
Model Name				
Model Number				
Serial Number				
Input Capacity	*(Btu/h)*			
Efficiency	*(%, AFUE)*			
Number of Identical Boilers				
Number of Units on Standby				
Hot Water Pumps				
Quantity				
Motor HP				
Motor Efficiency				
Temperature Control Type	*(See Table Below)*			
Capacity Control Type	*1=Constant Speed 2=Variable Speed*			
Heating Pipes Insulated	*(Circle One)*	Y / N	Y / N	Y / N
Number of Units on Standby				

Fuel Types
1=Electric
2=Natural Gas
3=Fuel Oil
4=LPG
5=Purchase HW or Steam
6=Wood
7=Other (Make Note)

Temperature Control Types
1=Thermostat-Programmable
2=Thermostat-Manual
3=EMS
4=Always on
5=Manual on/off
6=Time Clock

Central HVAC System – Chiller

46. Does this system have a Chiller? Y / N

Central HVAC System-Chiller				
		System 1	System 2	System 3
Chiller Type	*(See Table Below)*			
Zone Description				
Regular Maintenance	*(Circle One)*	Y / N	Y / N	Y / N
Percent of Building	*(%)*			
Age	*(Years)*			
Temperature Control Type	*(See Table Below)*			
Manufacturer				
Model Name				
Model Number				
Serial Number				
Rated Cooling Capacity	*(Tons)*			
Performance Rating	*(Circle One)*	EER - IPLV - kW/ton	EER - IPLV - kW/ton	EER - IPLV - kW/ton
Performance Rating Value				
Compressor:				
Design Full Load KW *(or)*				
Volts/Phase/FL Amps				
Number of Identical Chillers				
Number of Units on Standby				
Heat Rejection System				
Condenser Type	*(See Table Below)*			
Capacity Control	*1=Fixed Temp 2=Floating Temp 3=Head Pressure*			
Fan Control	*1=Constant 2=Cycle 3=Pony Motor 4=Two-Speed 5=Variable Speed*			
Water Side Economizer	*(Circle One)*	Y / N	Y / N	Y / N
Temperature Control Type	*(See Table Below)*			
Condenser Fans:				
Quantity				
HP				
Motor Efficiency	*(N or S,H,P)*			

Chiller Types	
1=Centrifugal	5 = Absorption, Hot Water
2=Reciprocating	6 = Absorption, Natural Gas
3=Rotary	7 = Absorption, Steam
4=Scroll	8 = Other

Condenser Types
1=Air Cooled Condenser
2=Cooling Tower
3=Evaporative Cooler

Temperature Control Types
1=Thermostat-Programmable
2=Thermostat-Manual
3=EMS
4=Always on
5=Manual on/off
6=Time Clock

Central HVAC System -Chiller (Continued)

Chilled Water Pumps				
Pump Use	1=Primary 2=Secondary			
Quantity				
Motor HP				
Motor Efficiency				
Pipes insulated	(Circle One)	Y / N	Y / N	Y / N
Capacity Control	1=Constant Speed 2=Variable Speed			
Temperature Control Type	(See Table Below)			
Number of Units on Standby				
Condenser Water Pumps				
Quantity				
Motor HP				
Motor Efficiency				
Capacity Control	1=Constant Speed 2=Variable Speed			
Temperature Control Type	(See Table Below)			
Number of Units on Standby				

Temperature Control Types
1=Thermostat-Programmable
2=Thermostat-Manual
3=EMS
4=Always on
5=Manual on/off
6=Time Clock

★HVAC Controls

47. Is **Heating** system set to a single temperature? (No control schedule used) Y / N
    a. If so, what is the set temperature? _____ °F

48. If *"No"* to #36, please fill out schedule below.

Heating set-points and schedules:

	System 1		System 2		System 3		System 4	
	Time (# hrs/day)	Temp (°F)	Time (# hrs/day)	Temp (°F)	Time (# hrs/day)	Temp (°F)	Time (# hrs/day)	Temp (°F)
Occupied								
Unoccupied								

49. **Heating** Months (for system lock-out or reset)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

50. Does the **heating system** employ temperature reset controls? Y / N

51. Is **Cooling** system set to a single temperature? (No control schedule used) Y / N
    a. If so, what is the set temperature? _____ °F

52. If *"No"* to #40, please fill out schedule below.

Cooling set-points and schedules:

	System 1		System 2		System 3		System 4	
	Time (# hrs/day)	Temp (°F)	Time (# hrs/day)	Temp (°F)	Time (# hrs/day)	Temp (°F)	Time (# hrs/day)	Temp (°F)
Occupied								
Unoccupied								

53. **Cooling** Months (for system lock-out or reset)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

★54. Are the temperature set points self-reported or verified from a thermostat?
☐ Self-reported ☐ Verified from thermostat

55. How often are the temperature sensors or thermostats calibrated? _____

Domestic Hot Water

56. Does this building have domestic water heating? Y / N

Domestic Water Heating				
		System 1	System 2	System 3
Water Heater Type	(See Table Below)			
Fuel Type	(See Table Below)			
Age	(Years)			
Location	(Conditioned or Unconditioned)			
Tank Wrap	(Circle One)	Y / N	Y / N	Y / N
Pipe Wrap	(Circle One)	Y / N	Y / N	Y / N
Circulation Pump	(Circle One)	Y / N	Y / N	Y / N
Continuously Circulating	(Circle One)	Y / N	Y / N	Y / N
Set-Point	(°F)			
Is a Setback Used	(Circle One)	Y / N	Y / N	Y / N
Manufacturer				
Model Name				
Model Number				
Serial Number				
Tank Capacity	(Gal)			
Input Capacity	(circle One)	KW / Btu/hr	KW / Btu/hr	KW / Btu/hr
Recovery	(Gal/hr)			
Efficiency	(EF or COP)			
Heating Pipes Insulated	(Circle One)	Y / N	Y / N	Y / N
Is Drain Water Heat Recovery Used	(Circle One)	Y / N	Y / N	Y / N

Water Heater Types
1=Heat Pump
2=Heat Recovery
3=Instantaneous (Tankless)
4=Self Contained (Conventional)
5=Storage Tank (Central Boiler)
6=Other (Make Note)

Fuel Types	
1=Electric	5=Purchase HW or Steam
2=Natural Gas	6=Wood
3=Fuel Oil	7=Other (Make Note)
4=LPG	

Number of faucets with given flow rate:

	<0.5 GPM	0.5 to 1.5 GPM	1.5 to 3.0 GPM	>3.0 GPM
Number				
Motion Controllers? (# that have M.C.)				

Plug Loads

Appliances: *If there is **more than one** type used in the building note the average age, average frequency of use, and the % of the total Quantity that are Energy Star.*

	★Quantity	(Average) Age (years)	Hours of Use (Hrs/wk)	★% that are Energy Star
57. Air purifiers/Dehumidifiers				%
58. All-in-one (printer/copier/scanner/fax)				%
59. Servers				%
60. Secondary Monitors				%
61. Fax Machine				%
62. Laptops				%
63. Paper Shredder				%
64. Personal Computers				%
65. Photocopiers				%
66. Printers				%
67. Scanners				%
68. Coffee Maker				%
69. Residential Style Refrigerators				%
70. Microwave				%
71. Refrigerated Vending Machine				%
72. Non-Refrigerated Vending Machine				%
73. Water coolers				%
74. Space Heaters				%
75. Television				%
76. Security Cameras				%
77. Other:_____				%

78. Is a network computer energy management system used? Y / N

79. Are any vending machine controllers used? Y / N

80. How many vending machines use controllers? _____

★ 81. Does this building have a washer and/or dryer? Y / N

		Commercial		Residential	
		Washer	Dryer	Washer	Dryer
★	Type (Majority) (1=front load, 2=top load)				
	Quantity				
	Age (years) [Avg]				
	Manufacturer				
	Model Name				
★	Loads per week (Avg)				
	% that are Energy Star	%	%	%	%
	Dryer fuel type (1=electric, 2=natural gas, 3=propane)	--		--	
★	Efficiency (MEF)				

82. Does this building have residential style dishwashers? Y / N

Age (years)	
Quantity	
Manufacturer	
Model Name	
Model Number	
Loads per week (average)	
% that are Energy Star	%
Efficiency (EF)	

Commercial Kitchen

83. Does this building have any **COMMERCIAL** kitchen equipment? Y / N

Which equipment is present? *If there is **more than one** type used in the building, note the most common fuel, average age, average frequency of use, and the % of the total Quantity that are Energy Star.*

	★Fuel	Quantity ★	Average Age (years)	Frequency of Use (hrs/wk)	Control Type: (1=Manual, 2=Timer, 3='Smart' Controller/EMS, 4=Other)	★% that are Energy Star
84. Standard Oven	E / G / P					%
85. Convection Oven	E / G / P					%
86. Range	E / G / P					%
87. Fryer	E / G / P					%
88. Hot food holding cabinet	E / G / P					%
89. Electric Steam Cooker	E / G / P					%
90. Griddle	E / G / P					%
91. Pizza Oven	E / G / P					%
92. Warming Table	E / G / P					%
93. Heat Lamps	E / G / P					%
94. Soup Pots	E / G / P					%
95. Continuous Toaster	E / G / P					%
96. Microwave	E / G / P					%

97. Are ventilation hoods used? Y / N

98. Are any demand based controls used for the ventilation hoods? Y / N

99. Are the ventilation hoods variable volume? Y / N

100. Is make-up air provided directly at the ventilation hood? Y / N

101. Is any other cooking equipment present? Y / N

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Type					
Quantity					

Average Age (years)					
Fuel	E / G / P	E / G / P	E / G / P	E / G / P	E / G / P
Usage (Hrs/wk)					

102. Number of pre-rinse spray valves with given flow rate:

	Exact Flow rate (GPM) if known	<0.5 GPM	0.5 to 1.5 GPM	1.5 to 3.0 GPM	>3.0 GPM
Number					
Motion Controllers? (# that have M.C.)					

103. Are commercial dishwashers used? Y / N

104. Is the dishwasher a low-temp system? Y / N

105. Does the dishwasher have a booster heater? Y / N

106. Are the dishwashers Energy Star? Y / N

107. Booster heater details:

	System 1	System 2	System 3
Age (years)			
Fuel	E / G / P	E / G / P	E / G / P
Manufacturer			
Model Name			
Model Number			

Refrigeration

108. Does this building have any commercial refrigeration equipment? Y / N
(Non-residential-style refrigerators)

★ Refrigeration equipment details:
(Types: 1=Solid Door Refrigerator, 2=Solid Door Freezer, 3=Glass Door Refrigerator, 4=Glass Door Freezer, 5=Open Medium Temp Display Case, 6=Open Low Temp Display Case, 7=Display case with doors)

	Type	Size (Cu. Ft)	Qty	Stand alone?	Avg. Age (years)	% Energy Star
System 1						%
System 2						%
System 3						%
System 4						%
System 5						%
System 6						%
System 7						%
System 8						%
System 9						%
System 10						%

Walk-ins on next page

★ Refrigerated space details:
(Types: 1=Walk-in Refrigerator, 2=Walk-in Freezer, 3=Refrigerated Warehouse, 4=Freezer Warehouse)

	Type	Model #	Size (Sq. Ft)	Qty	Avg. Age (years)	Strip Curtains	Lighting (Fluorescent, LED, Incand, None)	Compressor (hp)
System 1						Y / N		
System 2						Y / N		
System 3						Y / N		
System 4						Y / N		
System 5						Y / N		
System 6						Y / N		
System 7						Y / N		
System 8						Y / N		
System 9						Y / N		
System 10						Y / N		

If a multiplex compressor system is used describe it below:

	Age (years)	Qty Compressor	Compressor (hp)
System 1			
System 2			
System 3			
System 4			

109. Are anti-sweat heater controls used on display case doors? Y / N

110. What type of lights do display cases have? _____
(1=fluorescent, 2=LED)

111. Are display case lights controlled by motion sensors? Y / N

112. Are VFDs used on compressors? Y / N

113. Are VFDs used on condenser fans? Y / N

114. Are ECM Motors in use? Y / N

115. Are demand defrost controls used? Y / N

116. Are floating head pressure controllers used? Y / N

117. Are high-efficiency evaporator fans used (Circle one: PSC / ECM / Other)? Y / N

118. Are night covers used on open display cases? Y / N

119. Are evaporator fan controls used? Y / N

120. Has this refrigeration system been commissioned? Y / N

121. Would re-commissioning be appropriate for this system? Y / N

122. Is a heat recovery system used? Y / N

123. Do any display cases have special doors that don't require anti-sweat heat? Y / N

124. Does this building have any ice makers? Y / N

Ice maker details:

	Capacity (lbs/hr)	Qty	Stand alone?	Age (years)	Energy-Star?
Ice Maker 1			Y / N		Y / N
Ice Maker 2			Y / N		Y / N
Ice Maker 3			Y / N		Y / N

Water

125. Does this building have any irrigation systems connected to the electric meter? Y / N

Irrigation Pump Details:

	Unit 1	Unit 2	Unit 3
Size of land being irrigated (ft^2)			
Age (years)			
Manufacturer			
Model Number			
Serial Number			
Size (hp)			
RPM			
Enclosure Type (1=ODP, 2=TEFC)			
Efficiency (%)			
VFD Installed	Y / N	Y / N	Y / N
Control Type: (1=Manual, 2=Timer, 3='Smart' Controller, 4=Other)			

126. Does this building have a hot tub? Y / N
127. Does the hot tub use a cover when not in use? Y / N

128. What type of fuel is used to heat the hot tub? [Check one]

Electricity	
Natural Gas	
Propane	
None	
Other	

129. Does this building have a pool? Y / N

130. What type of fuel is used to heat the pool? [Check one]

Electricity	
Natural Gas	

Propane	
None	
Other	

131. Pool pump details:

	Pump
Age (years)	
Manufacturer	
Model Number	
Serial Number	
Size (hp)	
RPM	
Enclosure Type (1=ODP, 2=TEFC)	
Efficiency (%)	

132. How is the pool pump controlled?

Runs continuously	
Timer	
VSD	
Other	

133. When is the pool used?

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Motors/Engines (Process Related)

★ 134. Does facility have Motors or Engines that are process related? Y / N

	Description	★ Qty.	★ Service Type (Below)	★ Control Type (Below)	hp	★ NEMA Type (Below)	★ Nom. Eff. %	Drive Type (Below)	Duty Type (Below)	Avg Age (yrs)	Avg. Run hrs/wk
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Service Type
1=Pump
2=Fan/Blower
3=Material Handling/Conveyor
4=Machine Tool
5=Grinding/Milling
6=Escalator
7=Passenger Elevator
8=Freight Elevator
9=Separation
10=Motor-Generator Set
0=Other_____

Drive Type
1=AC
2= DC w/ SCR
3=DC w/ MGS
4=Nat. Gas Driven
5=Fossil Fuel Driven
6=Steam Driven

Control Type
1=Throttled
2=Mechanical VSD
3=Electronic VSD
4=Constant Speed
5=Two Speed
6=Synchronous

NEMA Type
ODP = Open Drip Proof
TEFC = Totally Enclosed Fan
OT=_____

Duty Type
1=Constant
2=Variable
3=Intermittent

Air Compressors

135. Does this Facility have Air Compressors? Y / N

136. Does the facility have a leak Reduction Maintenance Program? Y / N

	Description	Compressor Type (below)	Application Type (below)	Control Type (below)	Hp	Quantity	Nom. Efficiency %	Drive Type (below)	Avg. run hrs per wk	Air Dryer
1										Y / N
2										Y / N
3										Y / N
4										Y / N
5										Y / N
6										Y / N
7										Y / N
8										Y / N
9										Y / N
10										Y / N

Compressor Type
1= Reciprocating (2-stage, Double-acting)
2=Reciprocating (single-stage, Double-acting)
3=Reciprocating (2-stage, Single-acting)
4=Reciprocating (Single-stage, Single-acting
5=Rotary Screw (2-Stage)
6=Centrifugal
O:Other _____

Application Type
1=Cleaning
2=Drive Tools
3=HVAC Pneumatic
O=Other

Control Type
1=Start/Stop
2=Load/Unload
3=VSD Throttling
O=Other

Drive Type
1 =AC
2= DC w/ SCR
3=DC w/MGS
4=Nat gas driven
5=Fossil driven
6=Steam driven

Other Process Loads

137. Does this building have any other process loads? Y / N

138. Briefly describe each process load: (*Include Product Produced if applicable*)

	Description
Process 1	
Process 2	
Process 3	
Process 4	
Process 5	
Process 6	
Process 7	
Process 8	

Process Load Details

	Qty	Avg. Age (years)	Mfg	Model Number	Primary Fuel Type (see table below)	Secondary Fuel Type (see table below)	Avg run hrs per wk	Avg. Unit Capacity KW	Avg Unit Capacity Btuh
Process 1									
Process 2									
Process 3									
Process 4									
Process 5									
Process 6									
Process 7									
Process 8									

Fuel Types	
1=Electricity	5=Wood
2=Natural Gas	6=Purchased Steam
3=Propane	7=Purchased HW
4=Fuel Oil	8=Other (Make Note)

Ventilation

139. Is an indoor parking garage with ventilation present?	Y / N	
140. If yes, how large is the parking garage?	_____	ft^2
141. If yes, is the garage ventilation system controlled with CO sensors?	Y / N	
142. Are ERVs, enthalpy wheels, or other heat exchangers used?	Y / N	

Renewable Energy

143. Does this building have any renewable energy systems?	Y / N	
144. If so what type?	_____	
145. What is the nameplate capacity of the system (kW)?	_____	

Envelope

146. Please include info. about the ***majority*** of the building: **ONLY Select *ONE*** option for each section

Building Envelope		
Walls		
Surface Type (Majority)	1=Brick 2=Concrete 3=Concrete Block 4=Wood 5=Metal	
Framing Type (Majority)	1=Metal 2=Wood	
★ Insulation Type (Majority)	1=fiberglass batt 2=Cellulose - Loose Fill 3=Cellulose - Dense Pack 4=Cellulose - Spray-in 5=Urethane (foam) - Spray-in 6=Rigid board 7=None 8=Unknown	
Insulation Thickness (Majority)		
★ Estimated R-Value (Average)		
Windows		
% of Wall Area (on average)	(%)	
Layers of Glazing (Majority)	(1,2,3)	
Glazing Type (Majority)	1=Clear 2=Reflective 3=Tinted 4=Low E 5=Gas Filled	
Frame Type (Majority)	1=Metal 2=Wood 3=Vinyl	
Window Type (Majority)	1=fixed 2=Operable	
Roofs		
Total Roof Area	(Ft^2)	
Roof Type (Majority)	1=flat 2=Pitched	
Surface Material (Majority)	1=Built-up 2=Cool Roof 3=Membrane 4=Metal 5=Shingles/Tile	
Deck Material (Majoirty)	1=Concrete 2=Metal 3=Wood	
Insulation Type (Majority)	1=fiberglass batt 2=Cellulose - Loose Fill 3=Cellulose - Dense Pack 4=Cellulose - Spray-in 5=Urethane (foam) - Spray-in 6=Rigid board 7=None 8=Unknown	
Insulation Thickness (Majority)		
Estimated R-Value (Average)		
Skylights	(Circle One)	Y / N
Green Roof	(Circle One)	Y / N

Typical Insulation R-values

Insulation Type	R-value per inch	Typical Applications
Cellulose, loose fill	3.7	Attic Floor
Cellulose, high density	3.2	Walls, Enclosed Cavities, Framing Transitions
Fiberglass, batts	3.0"	Basement Ceiling, Open Stud Walls, Attic Floor*
Fiberglass, loose fill	2.8	Attic Floor, Walls (existing)
Fiberglass, loose fill, fluffed below manufacturer's standards	uncertain	Do not install, or correct by blowing over with higher density
Rockwool	3.0	Attic Floor, Walls, Basement Ceiling (may be loose or batts)
Vermiculite	2.7	Attic Floor
Poly-isocyanurate, rigid board	7.0	Foundation Walls, Attic Access Doors
Polystyrene, expanded rigid board	4.0	Foundation Walls, Sill Plate
Polystyrene, extruded rigid board	5.0	Foundation Walls, Sub-Slab, Sill Plate
Low Density Urethane, sprayed foam	3.7	Attics, Walls (new construction), Sill Plate, Band Joist, Framing Transitions
Urethane, sprayed foam	6.0	Attics, Walls (new construction), Sill Plate, Band Joist, Framing Transitions
Urea Formaldehyde Foam	4.0	Attics, Walls (existing)

Floors		
Floor Type (Majority)	1=Basement 2=Crawl 3=Slab 4=Unconditioned	
Material Type (Majority)	1=Concrete 2=Metal 3=Wood 4=Other	
Insulation Type (Majority)	1=Fiberglass Batt 2=Cellulose - Loose Fill 3=Cellulose - Dense Pack 4=Cellulose - Spray-in 5=Urethane (foam) - Spray-in 6=Rigid board 7=None 8=Unknown	
Insulation Thickness (Majority)		
Estimated R-Value (Average)		

Appendix A

Lighting								
Lighting Configuration (Interior)								
Lamp Type (see below)	Length in ft (if Applicable)	Lamp Wattage	# of Fixtures	Lamps/ Fixture	Ballast Type (See Below)	Control Type (See Below)	Zone #	Description

Zone #	Sq Footage (per zone)	W/ft^2 (per zone)

Ballast Type
1=Magnetic Standard
2=Magnetic-ES
3=Electronic
4=Electronic Dimming
5=Emergency

Control Type
1=Switch (Manual on/off)
2=Circuit Breaker
3=Dual Level Switch
4=Dimmer Switch
5=Timer
6=Motion/Occupancy Sensor
7=Daylighting Controls
8=Energy Management System
9=None/Continuous

Lamp Type	
1=Incandescent	7=LED
2=Metal Hallide	8=T8
3=High Pressure Sodium	9=T9
4=Mercury Vapor	10=T10
5=T5	12=T12
6=Neon (Cold Cathode)	O=Other

Notes:

Appendix B RECRUITMENT LETTER

<DATE>

<First Name> <Last Name>
<Company Name>
<Street Address>
<City>, <State> <Zip Code>

Dear <Facilities Manager>

In order to support the energy-efficiency planning associated with PA Act 129 of 2008, your company has been randomly chosen as a potential participant for two statewide studies that will gather information on the energy using equipment installed in commercial facilities. The Pennsylvania Public Utilities Commission (PA PUC) is conducting this research to find ways to help Pennsylvania businesses like yours save money and energy. <EDC> is aware of and supports the PA PUC efforts to help our customers save energy.

This notice is in regards to the following site address:

<Customer Name>
<Service Address>
<Service City, Service State, Service Zip Code>

The first study is aimed at detailing the types and efficiency level of energy using equipment in commercial facilities, including lights, heating and cooling system, ventilation, etc. The second study is aimed at understanding of how many hours per day businesses use their lights in various areas of their buildings. The goal of both studies is to provide the PA PUC with a better understanding of how energy is consumed in commercial facilities and improve energy efficiency programs offerings to Commonwealth businesses like you.

This letter is to inform you that you may be receiving a call from a Nexant representative (the contractor chosen to conduct this research on behalf of the PA PUC) in the coming days. This Nexant representative will ask for your company's permission to conduct an on-site visit for one or both of the studies mentioned. Depending on which of the studies you are participating in, a trained Nexant engineer will visit your facility to gather information about the energy systems installed in your building(s) and/or deploy metering equipment on the lights in various areas of the facility.

If you would like further information about the study, or if you are interested in participating, please call <Nexant 800 number> to speak with a Nexant representative. Participants will be offered up to $175 in pre-paid Visa cards as incentive for cooperating in these studies.

All data collected for this study will be kept anonymous and will simply be used to help the Commonwealth of Pennsylvania and <EDC Name> develop better energy-efficiency programs in the future. Your participation in this survey is optional, but would be greatly appreciated.

If you have any questions or concerns regarding these studies, please feel free to contact the PA PUC at 717-425-7584 or by email at ra-act129@pa.gov. You may also contact <EDC> customer call center at X-XXX-XXX-XXXX. Please be sure to reference the "Energy Usage" survey. Thank you.

Best Regards,

<EDC Representative>

If you are not the appropriate person to decide on participation, <EDC> and the PA PUC request that this letter be forwarded to the facilities manager (or similar) for your company.

Appendix C PHONE RECRUITING SCRIPTS

Phone Message:

Hello, my name is <Your name> from Nexant, Inc, and I'm calling on behalf of the Pennsylvania Public Utilities Commission and <EDC>. We are conducting an energy efficiency study throughout the Commonwealth on for the Pennsylvania Public Utilities Commission and <EDC>. As part of the study, trained engineers will be visiting commercial & industrial facilities to collect information on energy-using equipment such as lighting and HVAC systems. As an incentive, we are offering participants who allow an on-site survey a $100 pre-paid Visa card for their time and cooperation.

If you are interested in participating or would like further information, please call XXX-XXX-XXXX

Thank you, and have a good day.

Introduction:

Hi, my name is <Your name> from Nexant and I am calling on behalf of the Pennsylvania Public Utility Commission and <EDC>, is <CONTACT NAME> (or the facilities manager) available?

When correct contact is located

Hello <CONTACT NAME>, my name is <Your name> from Nexant and I am calling on behalf of the Pennsylvania Public Utility Commission and <EDC>, how are you doing today? I'm calling because we recently sent a letter to your company regarding a statewide study on energy usage in commercial facilities aimed at improving energy efficiency programs for businesses like you. Did you receive this letter and did you find a chance to read it?

IF NOT…briefly explain the purpose of the study*: The Pennsylvania Public Utilities Commission is conducting a study that is aimed at detailing the types and efficiency level of energy using equipment in commercial facilities, including lights, heating and cooling system, ventilation, etc. This study will provide the Commission and <EDC> with a better understanding of how to improve the energy efficiency programs in the future, as well as help businesses like yours save on energy and utility bills.*

If yes…

With your permission, we would like to send a trained engineer to conduct an on-site survey and walk-through of your facility. Depending on the size of your facility, the walk-through typically take between 1 to 3hours, but should only require 15-20 minutes of your time to answer a few questions up-front. During the survey, the engineer will collect basic information on your electric equipment (e.g. # and types of lights, efficiency of heating/cooling equipment, among other basic

building characteristics such as square footage). The engineer will not be altering or generally touching any equipment. They will simply be collecting information on equipment characteristics, efficiency, operating parameters, etc.

For Small and Medium Size Businesses: *You will also receive a $100 pre-paid Visa card as a thank you for your time and cooperation*

Would you be willing to let one of our engineers come to your building for this purpose?

If No: Okay, thank you for your time today

If Yes: Great, thank you for your cooperation! For the on-site visit, we will need a knowledgeable facilities representative to be available for 15-20 minutes to answer a few questions for the field engineer. After that, it is up to your discretion if you would like to have someone accompany the engineer throughout the facility. We request that you simply provide access to all appropriate areas inside and outside of the facility.

Before we schedule the appointment, I would like to ask a few basic questions about your facility:

- I would like to confirm your address before we arrive for the survey <RECITE THE LISTED ADDRESS>. Is this correct?

  >> If not, PLEASE update with the correct address
- What is the primary use of your building (i.e., Restaurant, Office, warehouse)
- What is the square footage of your facility?
- Do you have a commercial grade kitchen in your facility? <If yes> this may add some time to the site visit
- Is there anywhere in the building we will not have access to for the on-site survey? If so, which areas?

Commercial Facilities	
Size (sq. ft.)	Time Est.
< 25000	~ 1 hour
25,000 - 50,000	~ 2 hours
50,000 - 100,000	~ 3 hours
100,000 +	~ 4 hours
* Grocery Stores last 2 hours plus * Commercial Kitchen add 1 hour	
Industrial Facilities	
Size (sq. ft.)	Time Est.
< 250,000	~ 2-4 hours
> 250,000	~3-6 hours

Great, based on the information you provided, we estimate that the on-site visit will last for approximately <insert time from table above> hours.

Schedule Site Visit

- We have engineers going out into the field during the weeks of _____. What availability would you have during those days?
- Will we be meeting with you when we arrive? If not, who will be the point of contact at your facility for the field engineer?
- What is the best phone number to reach you or the point of contact?
- Do you or the point of contact have an email address where we can send you more information and confirmation of your appointment?
- If you have access to blueprints of your facility, please have those available for the engineer when he arrives? It will expedite the time on site.
- Is there any specific safety equipment the engineer needs when arriving on-site, such as steel-toed shoes, hard hat, safety glasses, etc.?

We will be sending you an email 2 days prior to the site visit. Should you need to re-schedule the appointment, please contact us and we will be happy to find another time that will be convenient for you. You can reach us at <PHONE NUMBER>

Appendix D COMMERCIAL END USE DESCRIPTIONS

Cooling DX
Definition: A form of cooling where the supply air is cooled directly by an expanding refrigerant, and there is no intermediary
Saturations: Percentage of buildings with DX cooling systems taken from survey data.

Cooling Chiller
Definition: A unit that removes heat from a buildings chilled water loop via a self-contained refrigeration cycle.
Saturations: Percentage of buildings with chilled water cooling systems taken from survey data.

Heat Pump
Definition: A direct expansion cooling unit that utilizes a reversible refrigerant loop for heating. Both air source and water source heat pumps are included.
Saturations: Percentage of buildings with heat pumps taken from survey data.

Space Heating
Definition: Energy used to provide heat to the building shell.
Saturations: 100%

HVAC Auxiliary
Definition: Non-heating and cooling energy use from HVAC system. HVAC air distribution fan motor energy for DX air conditioning/heat pump systems, heating systems. Also included are electrical pumping loads in chilled and hot water systems.
Saturations: 100%

Interior Lighting
Definition: All lighting that is contained within the building shell.
Saturations: 100%

Exterior Lighting
Definition: All lighting which is outside the shell of the building
Saturations: 100%

Plug Loads
Definition: Any electrical equipment that is plugged into a wall outlet or electrical plug, and isn't contained within another category. Office equipment such as fax machines, computers, printers, and copiers are included within this energy end use.
Saturations: 100%

Refrigeration
Definition: Energy that is consumed by refrigerators (both self-contained and those with remote mounted compressors).
Saturations: Percentage of buildings with refrigeration loads taken from survey data.

Other
Definition: Electric consumption segment not specifically identified in this study. A heterogeneous category composed largely of process loads.
Saturations: Percentage of buildings with other loads taken from survey data.

Cooking
Definition: All energy consumed by cooking equipment.
Saturations: Percentage of buildings with cooking loads taken from survey data.

Water Heating
Definition: All energy that is used for domestic water heating (potable water)
Saturations: Percentage of buildings with cooking loads taken from survey data.

Appendix E SIC TO BUILDING TYPE MAPPING TABLES

The mapping table below shows the assignment of building type to segment used in our sample design and analysis.

Building Type	Segment
Religious	Public Service/Institutional
Education	Education
Grocery	Retail
Health	Healthcare
Lodging	Misc.
Government	Public Service/Institutional
Office	Office
Restaurant	Restaurant
Retail	Retail
Warehouse	Warehouse
Industrial	Industrial
Multifamily	Misc.
Service	Misc.
Other	Misc.

To come up with the building types listed above, Nexant began by assigning each SIC code to a building type by adopting the SIC-building type mapping used by the *California Commercial End Use Survey*. Further work was done by Nexant to adjust the SIC mapping, primarily concerning the public service and institutional building types, to the segmentations used specifically in this study. The table on the following pages shows the mapping utilized for this study.

SIC Code	SIC Description	Building Type	SIC Code	SIC Description	Building Type
0		Unclassified	3951	PENS AND MECHANICAL PENCILS	Mfg: Misc Mfg
11		Unclassified	3952	LEAD PENCILS AND ART GOODS	Mfg: Misc Mfg
12		Unclassified	3953	MARKING DEVICES	Mfg: Misc Mfg
13		Unclassified	3955	CARBON PAPER AND INKED RIBBONS	Mfg: Misc Mfg
14		Unclassified	3960		Mfg: Misc Mfg
16		Unclassified	3961	COSTUME JEWELRY	Mfg: Misc Mfg
17		Unclassified	3962		Mfg: Misc Mfg
19		Unclassified	3963		Mfg: Misc Mfg
20		Unclassified	3964		Mfg: Misc Mfg
21		Unclassified	3965	FASTENERS, BUTTONS, NEEDLES, &	Mfg: Misc Mfg
22		Unclassified	3990		Mfg: Misc Mfg
23		Unclassified	3991	BROOMS AND BRUSHES	Mfg: Misc Mfg
24		Unclassified	3993	SIGNS AND ADVERTISING SPECIALI	Mfg: Misc Mfg
27		Unclassified	3995	BURIAL CASKETS	Mfg: Misc Mfg
29		Unclassified	3996	HARD SURFACE FLOOR COVERINGS,	Mfg: Misc Mfg
30		Unclassified	3999	MANUFACTURING INDUSTRIES, NEC	Mfg: Misc Mfg
31		Unclassified	4000		TCU
32		Unclassified	4010		TCU
33		Unclassified	4011	RAILROADS, LINE-HAUL OPERATING	TCU
34		Unclassified	4013	SWITCHING AND TERMINAL SERVICE	TCU
37		Unclassified	4018		TCU
39		Unclassified	4040		TCU
100		Ag & Pumping	4041		TCU
110		Ag & Pumping	4100		TCU
111	WHEAT	Ag & Pumping	4110		TCU
112	RICE	Ag & Pumping	4111	LOCAL AND SUBURBAN TRANSIT	TCU

115	CORN	Ag & Pumping	4119	LOCAL PASSENGER TRANSPORTATION	TCU
116	SOYBEANS	Ag & Pumping	4120		TCU
119	CASH GRAINS, NEC	Ag & Pumping	4121	TAXICABS	TCU
130		Ag & Pumping	4130		TCU
131	COTTON	Ag & Pumping	4131	INTERCITY & RURAL BUS TRANSPOR	TCU
132	TOBACCO	Ag & Pumping	4140		TCU
133	SUGARCANE AND SUGAR BEETS	Ag & Pumping	4141	LOCAL BUS CHARTER SERVICE	TCU
134	IRISH POTATOES	Ag & Pumping	4142	BUS CHARTER SERVICE, EXCEPT LO	TCU
139	FIELD CROPS, EXCEPT CASH GRAIN	Ag & Pumping	4150		TCU
160		Ag & Pumping	4151	SCHOOL BUSES	TCU
161	VEGETABLES AND MELONS	Ag & Pumping	4170		TCU
170		Ag & Pumping	4171		TCU
171	BERRY CROPS	Ag & Pumping	4172		TCU
172	GRAPES	Ag & Pumping	4173	BUS TERMINAL AND SERVICE FACIL	TCU
173	TREE NUTS	Ag & Pumping	4200		TCU
174	CITRUS FRUITS	Ag & Pumping	4210		TCU
175	DECIDUOUS TREE FRUITS	Ag & Pumping	4212	LOCAL TRUCKING, WITHOUT STORAG	TCU
179	FRUITS AND TREE NUTS, NEC	Ag & Pumping	4213	TRUCKING, EXCEPT LOCAL	TCU
180		Ag & Pumping	4214	LOCAL TRUCKING WITH STORAGE	Warehouse
181	ORNAMENTAL NURSERY PRODUCTS	Ag & Pumping	4215	COURIER SERVICES, EXCEPT BY AI	TCU
182	FOOD CROPS GROWN UNDER COVER	Ag & Pumping	4220		Warehouse
189		Ag & Pumping	4221	FARM PRODUCT WAREHOUSING AND S	Warehouse
190		Ag & Pumping	4222	REFRIGERATED WAREHOUSING AND S	Warehouse
191	GENERAL FARMS, PRIMARILY CROP	Ag & Pumping	4224		Warehouse
200		Ag & Pumping	4225	GENERAL WAREHOUSING AND STORAG	Warehouse
210		Ag & Pumping	4226	SPECIAL WAREHOUSING AND STORAG	Warehouse
211	BEEF CATTLE FEEDLOTS	Ag & Pumping	4230		TCU
212	BEEF CATTLE, EXCEPT FEEDLOTS	Ag & Pumping	4231	TRUCKING TERMINAL FACILITIES	TCU
213	HOGS	Ag & Pumping	4300		TCU

214	SHEEP AND GOATS	Ag & Pumping	4310		TCU
219	GENERAL LIVESTOCK, NEC	Ag & Pumping	4311	U.S. POSTAL SERVICE	TCU
240		Ag & Pumping	4400		TCU
241	DAIRY FARMS	Ag & Pumping	4410		TCU
250		Ag & Pumping	4411		TCU
251	BROILER, FRYER, AND ROASTER CH	Ag & Pumping	4412	DEEP SEA FOREIGN TRANSPORTATIO	TCU
252	CHICKEN EGGS	Ag & Pumping	4420		TCU
253	TURKEYS AND TURKEY EGGS	Ag & Pumping	4421		TCU
254	POULTRY HATCHERIES	Ag & Pumping	4422		TCU
259	POULTRY AND EGGS, NEC	Ag & Pumping	4423		TCU
270		Ag & Pumping	4424	DEEP SEA DOMESTIC TRANSPORTATI	TCU
271	FUR-BEARING ANIMALS AND RABBIT	Ag & Pumping	4430		TCU
272	HORSES AND OTHER EQUINES	Ag & Pumping	4431		TCU
273	ANIMAL AQUACULTURE	Ag & Pumping	4432	FREIGHT TRANSPORTATION ON THE	TCU
279	ANIMAL SPECIALTIES, NEC	Ag & Pumping	4440		TCU
290		Ag & Pumping	4441		TCU
291	GENERAL FARMS, PRIMARILY ANIMA	Ag & Pumping	4449	WATER TRANSPORTATION OF FREIGH	TCU
700		Ag & Pumping	4450		TCU
710		Ag & Pumping	4452		TCU
711	SOIL PREPARATION SERVICES	Ag & Pumping	4453		TCU
720		Ag & Pumping	4454		TCU
721	CROP PLANTING AND PROTECTING	Ag & Pumping	4459		TCU
722	CROP HARVESTING	Ag & Pumping	4460		TCU
723	CROP HARVESTING SERVICES FOR M	Ag & Pumping	4463		TCU
724	COTTON GINNING	Ag & Pumping	4464		TCU
729		Ag & Pumping	4469		TCU
740		Office	4480		TCU
741	VETERINARY SERVICES FOR LIVEST	Office	4481	DEEP SEA PASSENGER TRANSPORTAT	TCU
742	VETERINARY SERVICES, SPECIALTI	Office	4482	FERRIES	TCU
750		Ag & Pumping	4489	WATER PASSENGER TRANSPORTATION	TCU
751	LIVESTOCK SERVICES, EXCEPT VET	Ag & Pumping	4490		TCU
752	ANIMAL SPECIALTY SERVICES	Ag & Pumping	4491	MARINE CARGO HANDLING	TCU

760		Office	4492	TOWING AND TUGBOAT SERVICE	TCU
761	FARM LABOR CONTRACTORS	Office	4493	MARINAS	TCU
762	FARM MANAGEMENT SERVICES	Office	4499	WATER TRANSPORTATION SERVICES,	TCU
780		Office	4500		TCU
781	LANDSCAPE COUNSELING AND PLANN	Office	4510		TCU
782	LAWN AND GARDEN SERVICES	Office	4511		TCU
783	ORNAMENTAL SHRUB AND TREE SERV	Office	4512	AIR TRANSPORTATION, SCHEDULED	TCU
800		Forestry	4513	AIR COURIER SERVICES	TCU
810		Forestry	4520		TCU
811	TIMBER TRACTS	Forestry	4521		TCU
820		Forestry	4522	AIR TRANSPORTATION, NONSCHEDUL	TCU
821		Forestry	4580		TCU
830		Forestry	4581	AIRPORTS, FLYING FIELDS, & SER	TCU
831	FOREST PRODUCTS	Forestry	4582		TCU
840		Forestry	4583		TCU
843		Forestry	4600		TCU
849		Forestry	4610		TCU
850		Forestry	4612	CRUDE PETROLEUM PIPELINES	TCU
851	FORESTRY SERVICES	Forestry	4613	REFINED PETROLEUM PIPELINES	TCU
900		Fishing	4619	PIPELINES, NEC	TCU
910		Fishing	4700		TCU
912	FINFISH	Fishing	4710		TCU
913	SHELLFISH	Fishing	4712		TCU
919	MISCELLANEOUS MARINE PRODUCTS	Fishing	4720		TCU
920		Fishing	4722		TCU
921	FISH HATCHERIES AND PRESERVES	Fishing	4723		TCU
970		Fishing	4724	TRAVEL AGENCIES	TCU
971	HUNTING, TRAPPING, GAME PROPAG	Fishing	4725	TOUR OPERATORS	TCU
1000		Mining & Extraction	4729	PASSENGER TRANSPORT ARRANGEMEN	TCU
1010		Mining & Extraction	4730		TCU
1011	IRON ORES	Mining & Extraction	4731	FREIGHT TRANSPORTATION ARRANGE	TCU

1020		Mining & Extraction	4740		TCU
1021	COPPER ORES	Mining & Extraction	4741	RENTAL OF RAILROAD CARS	TCU
1030		Mining & Extraction	4742		TCU
1031	LEAD AND ZINC ORES	Mining & Extraction	4743		TCU
1040		Mining & Extraction	4780		TCU
1041	GOLD ORES	Mining & Extraction	4782		TCU
1044	SILVER ORES	Mining & Extraction	4783	PACKING AND CRATING	TCU
1050		Mining & Extraction	4784		TCU
1051		Mining & Extraction	4785	INSPECTION & FIXED FACILITIES	TCU
1060		Mining & Extraction	4789	TRANSPORTATION SERVICES, NEC	TCU
1061	FERROALLOY ORES, EXCEPT VANADI	Mining & Extraction	4800		TCU
1080		Mining & Extraction	4810		TCU
1081	METAL MINING SERVICES	Mining & Extraction	4811		TCU
1090		Mining & Extraction	4812	RADIOTELEPHONE COMMUNICATIONS	TCU
1092		Mining & Extraction	4813	TELEPHONE COMMUNICATIONS, EXCE	TCU
1094	URANIUM-RADIUM-VANADIUM ORES	Mining & Extraction	4820		TCU
1099	METAL ORES, NEC	Mining & Extraction	4821		TCU
1100		Mining & Extraction	4822	TELEGRAPH & OTHER COMMUNICATIO	TCU
1110		Mining & Extraction	4830		TCU
1111		Mining & Extraction	4832	RADIO BROADCASTING STATIONS	TCU
1112		Mining & Extraction	4833	TELEVISION BROADCASTING STATIO	TCU
1200		Mining & Extraction	4840		TCU
1210		Mining & Extraction	4841	CABLE AND OTHER PAY TV SERVICE	TCU
1211		Mining & Extraction	4890		TCU
1213		Mining & Extraction	4899	COMMUNICATIONS SERVICES, NEC	TCU
1220		Mining & Extraction	4900		TCU
1221	BITUMINOUS COAL AND LIGNITE-SU	Mining & Extraction	4910		TCU
1222	BITUMINOUS COAL-UNDERGROUND	Mining & Extraction	4911	ELECTRIC SERVICES	TCU
1230		Mining & Extraction	4912		TCU
1231	ANTHRACITE MINING	Mining & Extraction	4913		TCU
1240		Mining & Extraction	4914		TCU

1241	COAL MINING SERVICES	Mining & Extraction	4915		TCU
1300		Mining & Extraction	4916		TCU
1310		Mining & Extraction	4917		TCU
1311	CRUDE PETROLEUM AND NATURAL GA	Mining & Extraction	4918		TCU
1320		Mining & Extraction	4919		TCU
1321	NATURAL GAS LIQUIDS	Mining & Extraction	4920		TCU
1380		Mining & Extraction	4922	NATURAL GAS TRANSMISSION	TCU
1381	DRILLING OIL AND GAS WELLS	Mining & Extraction	4923	GAS TRANSMISSION AND DISTRIBUT	TCU
1382	OIL AND GAS EXPLORATION SERVIC	Mining & Extraction	4924	NATURAL GAS DISTRIBUTION	TCU
1389	OIL AND GAS FIELD SERVICES, NE	Mining & Extraction	4925	GAS PRODUCTION AND/OR DISTRIBU	TCU
1400		Mining & Extraction	4926		TCU
1410		Mining & Extraction	4927		TCU
1411	DIMENSION STONE	Mining & Extraction	4928		TCU
1420		Mining & Extraction	4930		TCU
1422	CRUSHED AND BROKEN LIMESTONE	Mining & Extraction	4931	ELECTRIC AND OTHER SERVICES CO	TCU
1423	CRUSHED AND BROKEN GRANITE	Mining & Extraction	4932	GAS AND OTHER SERVICES COMBINE	TCU
1429	CRUSHED AND BROKEN STONE, NEC	Mining & Extraction	4933		TCU
1440		Mining & Extraction	4934		TCU
1442	CONSTRUCTION SAND AND GRAVEL	Mining & Extraction	4935		TCU
1446	INDUSTRIAL SAND	Mining & Extraction	4937		TCU
1450		Mining & Extraction	4939	COMBINATION UTILITIES, NEC	TCU
1452		Mining & Extraction	4940		TCU
1453		Mining & Extraction	4941	PUBLIC WATER SYSTEM	TCU
1454		Mining & Extraction	4949	DOMESTIC PUMPING (MPC CODE)	TCU
1455	KAOLIN AND BALL CLAY	Mining & Extraction	4950		TCU
1459	CLAY AND RELATED MINERALS, NEC	Mining & Extraction	4952	SEWER SYSTEMS	TCU
1470		Mining & Extraction	4953	REFUSE SYSTEMS	TCU
1472		Mining & Extraction	4959	SANITARY SERVICES, NEC	TCU
1473		Mining & Extraction	4960		TCU
1474	POTASH, SODA, AND BORATE MINER	Mining & Extraction	4961	STEAM AND AIR-CONDITIONING SUP	TCU
1475	PHOSPHATE ROCK	Mining & Extraction	4970		TCU
1476		Mining & Extraction	4971	IRRIGATION SYSTEMS	TCU

1477		Mining & Extraction	4980		TCU
1479	CHEMICAL AND FERTILIZER MINING	Mining & Extraction	4981		TCU
1480		Mining & Extraction	4982		TCU
1481	NONMETALLIC MINERALS SERVICES	Mining & Extraction	4983		TCU
1490		Mining & Extraction	4988		TCU
1492		Mining & Extraction	5000		Warehouse
1496		Mining & Extraction	5010		Warehouse
1499	MISCELLANEOUS NONMETALLIC MINE	Mining & Extraction	5012	AUTOMOBILES AND OTHER MOTOR VE	Warehouse
1500		Construction	5013	MOTOR VEHICLE SUPPLIES AND NEW	Warehouse
1520		Construction	5014	TIRES AND TUBES	Warehouse
1521	SINGLE-FAMILY HOUSING CONSTRUC	Construction	5015	MOTOR VEHICLE PARTS, USED	Warehouse
1522	RESIDENTIAL CONSTRUCTION, NEC	Construction	5020		Warehouse
1530		Construction	5021	FURNITURE	Warehouse
1531	OPERATIVE BUILDERS	Construction	5023	HOMEFURNISHINGS	Warehouse
1540		Construction	5030		Warehouse
1541	INDUSTRIAL BUILDINGS AND WAREH	Construction	5031	LUMBER, PLYWOOD, AND MILLWORK	Warehouse
1542	NONRESIDENTIAL CONSTRUCTION, N	Construction	5032	BRICK, STONE, & RELATED MATERI	Warehouse
1543		Construction	5033	ROOFING, SIDING, & INSULATION	Warehouse
1600		Construction	5039	CONSTRUCTION MATERIALS, NEC	Warehouse
1610		Construction	5040		Warehouse
1611	HIGHWAY AND STREET CONSTRUCTIO	Construction	5041		Warehouse
1620		Construction	5042		Warehouse
1622	BRIDGE, TUNNEL, & ELEVATED HIG	Construction	5043	PHOTOGRAPHIC EQUIPMENT AND SUP	Warehouse
1623	WATER, SEWER, AND UTILITY LINE	Construction	5044	OFFICE EQUIPMENT	Warehouse
1629	HEAVY CONSTRUCTION, NEC	Construction	5045	COMPUTERS, PERIPHERALS & SOFTW	Warehouse
1700		Construction	5046	COMMERCIAL EQUIPMENT, NEC	Warehouse
1710		Construction	5047	MEDICAL AND HOSPITAL EQUIPMENT	Warehouse
1711	PLUMBING, HEATING, AIR-CONDITI	Construction	5048	OPHTHALMIC GOODS	Warehouse

1720		Construction	5049	PROFESSIONAL EQUIPMENT, NEC	Warehouse
1721	PAINTING AND PAPER HANGING	Construction	5050		Warehouse
1730		Construction	5051	METALS SERVICE CENTERS AND OFF	Warehouse
1731	ELECTRICAL WORK	Construction	5052	COAL AND OTHER MINERALS AND OR	Warehouse
1740		Construction	5060		Warehouse
1741	MASONRY AND OTHER STONEWORK	Construction	5063	ELECTRICAL APPARATUS AND EQUIP	Warehouse
1742	PLASTERING, DRYWALL, AND INSUL	Construction	5064	ELECTRICAL APPLIANCES, TV & RA	Warehouse
1743	TERRAZZO, TILE, MARBLE, MOSAIC	Construction	5065	ELECTRONIC PARTS AND EQUIPMENT	Warehouse
1750		Construction	5070		Warehouse
1751	CARPENTRY WORK	Construction	5072	HARDWARE	Warehouse
1752	FLOOR LAYING AND FLOOR WORK, N	Construction	5074	PLUMBING & HYDRONIC HEATING SU	Warehouse
1760		Construction	5075	WARM AIR HEATING & AIR-CONDITI	Warehouse
1761	ROOFING, SIDING, AND SHEET MET	Construction	5078	REFRIGERATION EQUIPMENT AND SU	Warehouse
1770		Construction	5080		Warehouse
1771	CONCRETE WORK	Construction	5081		Warehouse
1780		Construction	5082	CONSTRUCTION AND MINING MACHIN	Warehouse
1781	WATER WELL DRILLING	Construction	5083	FARM AND GARDEN MACHINERY	Warehouse
1790		Construction	5084	INDUSTRIAL MACHINERY AND EQUIP	Warehouse
1791	STRUCTURAL STEEL ERECTION	Construction	5085	INDUSTRIAL SUPPLIES	Warehouse
1793	GLASS AND GLAZING WORK	Construction	5086		Warehouse
1794	EXCAVATION WORK	Construction	5087	SERVICE ESTABLISHMENT EQUIPMEN	Warehouse
1795	WRECKING AND DEMOLITION WORK	Construction	5088	TRANSPORTATION EQUIPMENT & SUP	Warehouse
1796	INSTALLING BUILDING EQUIPMENT,	Construction	5090		Warehouse
1799	SPECIAL TRADE CONTRACTORS, NEC	Construction	5091	SPORTING & RECREATIONAL GOODS	Warehouse
2000		Mfg: Industrial	5092	TOYS AND HOBBY GOODS AND SUPPL	Warehouse
2010		Mfg: Industrial	5093	SCRAP AND WASTE MATERIALS	Warehouse
2011	MEAT PACKING PLANTS	Mfg: Food	5094	JEWELRY & PRECIOUS STONES	Warehouse
2013	SAUSAGES AND OTHER	Mfg: Food	5099	DURABLE GOODS, NEC	Warehouse

	PREPARED ME				
2015	POULTRY SLAUGHTERING AND PROCE	Mfg: Food	5100		Warehouse
2016		Mfg: Industrial	5110		Warehouse
2017		Mfg: Industrial	5111	PRINTING AND WRITING PAPER	Warehouse
2020		Mfg: Industrial	5112	STATIONERY AND OFFICE SUPPLIES	Warehouse
2021	CREAMERY BUTTER	Mfg: Food	5113	INDUSTRIAL & PERSONAL SERVICE	Warehouse
2022	CHEESE, NATURAL AND PROCESSED	Mfg: Food	5120		Warehouse
2023	DRY, CONDENSED, EVAPORATED PRO	Mfg: Food	5122	DRUGS, PROPRIETARIES, AND SUND	Warehouse
2024	ICE CREAM AND FROZEN DESSERTS	Mfg: Food	5130		Warehouse
2026	FLUID MILK	Mfg: Food	5131	PIECE GOODS & NOTIONS	Warehouse
2030		Mfg: Industrial	5133		Warehouse
2032	CANNED SPECIALTIES	Mfg: Food	5134		Warehouse
2033	CANNED FRUITS AND VEGETABLES	Mfg: Food	5136	MEN'S AND BOYS'CLOTHING	Warehouse
2034	DEHYDRATED FRUITS, VEGETABLES,	Mfg: Food	5137	WOMEN'S AND CHILDREN'S CLOTHIN	Warehouse
2035	PICKLES, SAUCES, AND SALAD DRE	Mfg: Food	5139	FOOTWEAR	Warehouse
2037	FROZEN FRUITS AND VEGETABLES	Mfg: Food	5140		Warehouse
2038	FROZEN SPECIALTIES, NEC	Mfg: Food	5141	GROCERIES, GENERAL LINE	Warehouse
2040		Mfg: Industrial	5142	PACKAGED FROZEN FOODS	Warehouse
2041	FLOUR AND OTHER GRAIN MILL PRO	Mfg: Food	5143	DAIRY PRODUCTS, EXCEPT DRIED O	Warehouse
2043	CEREAL BREAKFAST FOODS	Mfg: Food	5144	POULTRY AND POULTRY PRODUCTS	Warehouse
2044	RICE MILLING	Mfg: Food	5145	CONFECTIONERY	Warehouse
2045	PREPARED FLOUR MIXES AND DOUGH	Mfg: Food	5146	FISH AND SEAFOODS	Warehouse
2046	WET CORN MILLING	Mfg: Food	5147	MEATS AND MEAT PRODUCTS	Warehouse
2047	DOG AND CAT FOOD	Mfg: Food	5148	FRESH FRUITS AND VEGETABLES	Warehouse
2048	PREPARED FEEDS, NEC	Mfg: Food	5149	GROCERIES AND RELATED PRODUCTS	Warehouse
2050		Mfg: Industrial	5150		Warehouse
2051	BREAD, CAKE, AND RELATED PRODU	Mfg: Food	5152		Warehouse
2052	COOKIES AND CRACKERS	Mfg: Food	5153	GRAIN AND FIELD BEANS	Warehouse
2053	FROZEN BAKERY PRODUCTS,	Mfg: Food	5154	LIVESTOCK	Warehouse

	EXCEPT				
2060		Mfg: Industrial	5159	FARM-PRODUCT RAW MATERIALS, NE	Warehouse
2061	RAW CANE SUGAR	Mfg: Food	5160		Warehouse
2062	CANE SUGAR REFINING	Mfg: Food	5161		Warehouse
2063	BEET SUGAR	Mfg: Food	5162	PLASTICS MATERIALS & BASIC SHA	Warehouse
2064	CANDY & OTHER CONFECTIONERY PR	Mfg: Food	5169	CHEMICALS & ALLIED PRODUCTS, N	Warehouse
2065		Mfg: Industrial	5170		Warehouse
2066	CHOCOLATE AND COCOA PRODUCTS	Mfg: Food	5171	PETROLEUM BULK STATIONS & TERM	Warehouse
2067	CHEWING GUN	Mfg: Food	5172	PETROLEUM PRODUCTS, NEC	Warehouse
2068	SALTED AND ROASTED NUTS AND SE	Mfg: Food	5180		Warehouse
2070		Mfg: Industrial	5181	BEER AND ALE	Warehouse
2074	COTTONSEED OIL MILLS	Mfg: Food	5182	WINE AND DISTILLED BEVERAGES	Warehouse
2075	SOYBEAN OIL MILLS	Mfg: Food	5190		Warehouse
2076	VEGETABLE OIL MILLS, NEC	Mfg: Food	5191	FARM SUPPLIES	Warehouse
2077	ANIMAL AND MARINE FATS AND OIL	Mfg: Food	5192	BOOKS, PERIODICALS, & NEWSPAPE	Warehouse
2079	EDIBLE FATS AND OILS, NEC	Mfg: Food	5193	FLOWERS & FLORISTS' SUPPLIES	Warehouse
2080		Mfg: Industrial	5194	TOBACCO AND TOBACCO PRODUCTS	Warehouse
2082	MALT BEVERAGES	Mfg: Food	5198	PAINTS, VARNISHES, AND SUPPLIE	Warehouse
2083	MALT	Mfg: Food	5199	NONDURABLE GOODS, NEC	Warehouse
2084	WINES, BRANDY, AND BRANDY SPIR	Mfg: Food	5200		Retail
2085	DISTILLED AND BLENDED LIQUORS	Mfg: Food	5210		Retail
2086	BOTTLED AND CANNED SOFT DRINKS	Mfg: Food	5211	LUMBER AND OTHER BUILDING MATE	Retail
2087	FLAVORING EXTRACTS AND SYRUPS,	Mfg: Food	5230		Retail
2090		Mfg: Industrial	5231	PAINT, GLASS, AND WALLPAPER ST	Retail
2091	CANNED AND CURED FISH AND SEAF	Mfg: Food	5250		Retail
2092	FRESH OR FROZEN PREPARED FISH	Mfg: Food	5251	HARDWARE STORES	Retail
2095	ROASTED COFFEE	Mfg: Food	5260		Retail
2096	POTATO CHIPS AND SIMILAR SNACK	Mfg: Food	5261	RETAIL NURSERIES AND GARDEN ST	Retail

2097	MANUFACTURED ICE	Mfg: Food	5270		Retail
2098	MACARONI AND SPAGHETTI	Mfg: Food	5271	MOBILE HOME DEALERS	Retail
2099	FOOD PREPARATIONS, NEC	Mfg: Food	5300		Retail
2100		Mfg: Industrial	5310		Retail
2110		Mfg: Industrial	5311	DEPARTMENT STORES	Retail
2111	CIGARETTES	Mfg: Tobacco	5318		Retail
2120		Mfg: Industrial	5330		Retail
2121	CIGARS	Mfg: Tobacco	5331	VARIETY STORES	Retail
2130		Mfg: Industrial	5390		Retail
2131	CHEWING AND SMOKING TOBACCO	Mfg: Tobacco	5399	MISCELLANEOUS GENERAL MERCHAND	Retail
2140		Mfg: Industrial	5400		Grocery
2141	TOBACCO STEMMING AND REDRYING	Mfg: Tobacco	5410		Grocery
2200		Mfg: Industrial	5411	GROCERY STORES	Grocery
2210		Mfg: Industrial	5420		Grocery
2211	BROADWOVEN FABRIC MILLS, COTTO	Mfg: Textile	5421	MEAT AND FISH MARKETS	Grocery
2220		Mfg: Industrial	5422		Grocery
2221	BROADWOVEN FABRIC MILLS, MANMA	Mfg: Textile	5423		Grocery
2230		Mfg: Industrial	5430		Grocery
2231	BROADWOVEN FABRIC MILLS, WOOL	Mfg: Textile	5431	FRUIT AND VEGETABLE MARKETS	Grocery
2240		Mfg: Industrial	5440		Grocery
2241	NARROW FABRIC MILLS	Mfg: Textile	5441	CANDY, NUT, AND CONFECTIONERY	Grocery
2250		Mfg: Industrial	5450		Grocery
2251	WOMEN'S HOSIERY, EXCEPT SOCKS	Mfg: Textile	5451	DAIRY PRODUCTS STORES	Grocery
2252	HOSIERY, NEC	Mfg: Textile	5460		Grocery
2253	KNIT OUTERWEAR MILLS	Mfg: Textile	5461	RETAIL BAKERIES	Grocery
2254	KNIT UNDERWEAR MILLS	Mfg: Textile	5462		Grocery
2257	WEFT KNIT FABRIC MILLS	Mfg: Textile	5463		Grocery
2258	LACE & WARP KNIT FABRIC MILLS	Mfg: Textile	5490		Grocery
2259	KNITTING MILLS, NEC	Mfg: Textile	5499	MISCELLANEOUS FOOD STORES	Grocery
2260		Mfg: Industrial	5500		Retail
2261	FINISHING PLANTS, COTTON	Mfg: Textile	5510		Retail
2262	FINISHING PLANTS, MANMADE	Mfg: Textile	5511	NEW AND USED CAR DEALERS	Retail
2269	FINISHING PLANTS, NEC	Mfg: Textile	5520		Retail

2270		Mfg: Industrial	5521	USED CAR DEALERS	Retail
2271		Mfg: Industrial	5530		Retail
2272		Mfg: Industrial	5531	AUTO AND HOME SUPPLY STORES	Retail
2273	CARPETS AND RUGS	Mfg: Textile	5540		Misc
2279		Mfg: Industrial	5541	GASOLINE SERVICE STATIONS	Misc
2280		Mfg: Industrial	5550		Retail
2281	YARN SPINNING MILLS	Mfg: Textile	5551	BOAT DEALERS	Retail
2282	THROWING AND WINDING MILLS	Mfg: Textile	5560		Retail
2283		Mfg: Industrial	5561	RECREATIONAL VEHICLE DEALERS	Retail
2284	THREAD MILLS	Mfg: Textile	5570		Retail
2290		Mfg: Industrial	5571	MOTORCYCLE DEALERS	Retail
2291		Mfg: Industrial	5590		Retail
2292		Mfg: Industrial	5599	AUTOMOTIVE DEALERS, NEC	Retail
2293		Mfg: Industrial	5600		Retail
2294		Mfg: Industrial	5610		Retail
2295	COATED FABRICS, NOT RUBBERIZED	Mfg: Textile	5611	MEN'S & BOYS' CLOTHING STORES	Retail
2296	TIRE CORD AND FABRICS	Mfg: Textile	5620		Retail
2297	NONWOVEN FABRICS	Mfg: Textile	5621	WOMEN'S CLOTHING STORES	Retail
2298	CORDAGE AND TWINE	Mfg: Textile	5630		Retail
2299	TEXTILE GOODS, NEC	Mfg: Textile	5631		Retail
2300		Mfg: Industrial	5632	WOMEN'S ACCESSORY & SPECIALTY	Retail
2310		Mfg: Industrial	5640		Retail
2311	MEN'S AND BOYS' SUITS AND COAT	Mfg: Apparel	5641	CHILDREN'S AND INFANTS' WEAR S	Retail
2320		Mfg: Industrial	5650		Retail
2321	MEN'S AND BOYS' SHIRTS	Mfg: Apparel	5651	FAMILY CLOTHING STORES	Retail
2322	MEN'S AND BOYS' UNDERWEAR & NI	Mfg: Apparel	5660		Retail
2323	MEN'S AND BOYS' NECKWEAR	Mfg: Apparel	5661	SHOE STORES	Retail
2325	MEN'S AND BOYS' TROUSERS AND S	Mfg: Apparel	5680		Retail
2326	MEN'S AND BOYS' WORK CLOTHING	Mfg: Apparel	5681		Retail
2327		Mfg: Industrial	5690		Retail
2328		Mfg: Industrial	5699	MISCELLANEOUS APPAREL & ACCESS	Retail
2329	MEN'S AND BOYS' CLOTHING, NEC	Mfg: Apparel	5700		Retail

2330		Mfg: Industrial	5710		Retail
2331	WOMEN'S & MISSES' BLOUSES & SH	Mfg: Apparel	5712	FURNITURE STORES	Retail
2335	WOMEN'S, JUNIORS', & MISSES' D	Mfg: Apparel	5713	FLOOR COVERING STORES	Retail
2337	WOMEN'S AND MISSES' SUITS AND	Mfg: Apparel	5714	DRAPERY AND UPHOLSTERY STORES	Retail
2339	WOMEN'S AND MISSES' OUTERWEAR,	Mfg: Apparel	5719	MISCELLANEOUS HOMEFURNISHINGS	Retail
2340		Mfg: Industrial	5720		Retail
2341	WOMEN'S AND CHILDREN'S UNDERWE	Mfg: Apparel	5722	HOUSEHOLD APPLIANCE STORES	Retail
2342	BRAS, GIRDLES, AND ALLIED GARM	Mfg: Apparel	5730		Retail
2343		Mfg: Industrial	5731	RADIO, TV, & ELECTRONIC STORES	Retail
2350		Mfg: Industrial	5732		Retail
2351		Mfg: Industrial	5733		Retail
2352		Mfg: Industrial	5734	COMPUTER AND SOFTWARE STORES	Retail
2353	HATS, CAPS, AND MILLINERY	Mfg: Apparel	5735	RECORD & PRERECORDED TAPE STOR	Retail
2360		Mfg: Apparel	5736	MUSICAL INSTRUMENT STORES	Retail
2361	GIRLS' & CHILDREN'S DRESSES, B	Mfg: Apparel	5800		Restaurant
2363		Mfg: Industrial	5810		Restaurant
2369	GIRLS' AND CHILDREN'S OUTERWEA	Mfg: Apparel	5812	EATING PLACES	Restaurant
2370		Mfg: Industrial	5813	DRINKING PLACES	Restaurant
2371	FUR GOODS	Mfg: Apparel	5900		Retail
2380		Mfg: Industrial	5910		Retail
2381	FABRIC DRESS AND WORK GLOVES	Mfg: Apparel	5912	DRUG STORES AND PROPRIETARY ST	Retail
2384	ROBES AND DRESSING GOWNS	Mfg: Apparel	5920		Grocery
2385	WATERPROOF OUTERWEAR	Mfg: Apparel	5921	LIQUOR STORES	Grocery
2386	LEATHER AND SHEEP-LINED CLOTHI	Mfg: Apparel	5930		Retail
2387	APPAREL BELTS	Mfg: Apparel	5931		Retail
2389	APPAREL AND ACCESSORIES, NEC	Mfg: Apparel	5932	USED MERCHANDISE STORES	Retail
2390		Mfg: Industrial	5940		Retail
2391	CURTAINS AND DRAPERIES	Mfg: Apparel	5941	SPORTING GOODS AND BICYCLE SHO	Retail
2392	HOUSEFURNISHINGS, NEC	Mfg: Apparel	5942	BOOK STORES	Retail
2393	TEXTILE BAGS	Mfg: Apparel	5943	STATIONERY STORES	Retail

2394	CANVAS AND RELATED PRODUCTS	Mfg: Apparel	5944	JEWELRY STORES	Retail
2395	PLEATING AND STITCHING	Mfg: Apparel	5945	HOBBY, TOY, AND GAME SHOPS	Retail
2396	AUTOMOTIVE AND APPAREL TRIMMIN	Mfg: Apparel	5946	CAMERA & PHOTOGRAPHIC SUPPLY S	Retail
2397	SCHIFFLI MACHINE EMBROIDERIES	Mfg: Apparel	5947	GIFT, NOVELTY, AND SOUVENIR SH	Retail
2399	FABRICATED TEXTILE PRODUCTS, N	Mfg: Apparel	5948	LUGGAGE AND LEATHER GOODS STOR	Retail
2400		Mfg: Industrial	5949	SEWING, NEEDLEWORK, AND PIECE	Retail
2410		Mfg: Industrial	5960		Retail
2411	LOGGING	Mfg: Lumber and Wood Products	5961	CATALOG AND MAIL-ORDER HOUSES	Retail
2420		Mfg: Industrial	5962	MERCHANDISING MACHINE OPERATOR	Retail
2421	SAWMILLS AND PLANING MILLS, GE	Mfg: Lumber and Wood Products	5963	DIRECT SELLING ESTABLISHMENTS	Retail
2426	HARDWOOD DIMENSION & FLOORING	Mfg: Lumber and Wood Products	5980		Retail
2429	SPECIAL PRODUCT SAWMILLS, NEC	Mfg: Lumber and Wood Products	5982		Retail
2430		Mfg: Industrial	5983	FUEL OIL DEALERS	Retail
2431	MILLWORK	Mfg: Lumber and Wood Products	5984	LIQUEFIED PETROLEUM GAS DEALER	Retail
2434	WOOD KITCHEN CABINETS	Mfg: Lumber and Wood Products	5989	FUEL DEALERS, NEC	Retail
2435	HARDWOOD VENEER AND PLYWOOD	Mfg: Lumber and Wood Products	5990		Retail
2436	SOFTWOOD VENEER AND PLYWOOD	Mfg: Lumber and Wood Products	5992	FLORISTS	Retail
2439	STRUCTURAL WOOD MEMBERS, NEC	Mfg: Lumber and Wood Products	5993	TOBACCO STORES AND STANDS	Retail
2440		Mfg: Industrial	5994	NEWS DEALERS AND NEWSSTANDS	Retail
2441	NAILED WOOD BOXES AND SHOOK	Mfg: Lumber and Wood Products	5995	OPTICAL GOOD STORES	Retail
2448	WOOD PALLETS AND SKIDS	Mfg: Lumber and Wood Products	5999	MISCELLANEOUS RETAIL STORES, N	Retail
2449	WOOD CONTAINERS, NEC	Mfg: Lumber and Wood Products	6000		Office
2450		Mfg: Industrial	6010		Office
2451	MOBILE HOMES	Mfg: Lumber and Wood Products	6011	FEDERAL RESERVE BANKS	Public Service
2452	PREFABRICATED WOOD BUILDINGS	Mfg: Lumber and Wood Products	6019	CENTRAL RESERVE DEPOSITORY, NE	Public Service
2490		Mfg: Industrial	6020		Office
2491	WOOD PRESERVING	Mfg: Lumber and Wood Products	6021	NATIONAL COMMERCIAL	Office

				BANKS	
2492		Mfg: Industrial	6022	STATE COMMERCIAL BANKS	Office
2493	RECONSTITUTED WOOD PRODUCTS	Mfg: Lumber and Wood Products	6023		Office
2499	WOOD PRODUCTS, NEC	Mfg: Lumber and Wood Products	6024		Office
2500		Mfg: Industrial	6025		Office
2510		Mfg: Industrial	6026		Office
2511	WOOD HOUSEHOLD FURNITURE	Mfg: Furniture and Fixtures	6027		Office
2512	UPHOLSTERED HOUSEHOLD FURNITUR	Mfg: Furniture and Fixtures	6028		Office
2514	METAL HOUSEHOLD FURNITURE	Mfg: Furniture and Fixtures	6029	COMMERCIAL BANKS, NEC	Office
2515	MATTRESSES AND BEDSPRINGS	Mfg: Furniture and Fixtures	6030		Office
2517	WOOD TV AND RADIO CABINETS	Mfg: Furniture and Fixtures	6032		Office
2519	HOUSEHOLD FURNITURE, NEC	Mfg: Furniture and Fixtures	6033		Office
2520		Mfg: Industrial	6034		Office
2521	WOOD OFFICE FURNITURE	Mfg: Furniture and Fixtures	6035	FEDERAL SAVINGS INSTITUTIONS	Office
2522	OFFICE FURNITURE, EXCEPT WOOD	Mfg: Furniture and Fixtures	6036	SAVINGS INSTITUTIONS, EXCEPT F	Office
2530		Mfg: Industrial	6040		Office
2531	PUBLIC BUILDING & RELATED FURN	Mfg: Furniture and Fixtures	6042		Office
2540		Mfg: Industrial	6044		Office
2541	WOOD PARTITIONS AND FIXTURES	Mfg: Furniture and Fixtures	6050		Office
2542	PARTITIONS AND FIXTURES, EXCEP	Mfg: Furniture and Fixtures	6052		Office
2590		Mfg: Industrial	6054		Office
2591	DRAPERY HARDWARE & BLINDS & SH	Mfg: Furniture and Fixtures	6055		Office
2599	FURNITURE AND FIXTURES, NEC	Mfg: Furniture and Fixtures	6056		Office
2600		Mfg: Industrial	6059		Office
2610		Mfg: Industrial	6060		Office
2611	PULP MILLS	Mfg: Paper and Allied Products	6061	FEDERAL CREDIT UNIONS	Office
2620		Mfg: Industrial	6062	STATE CREDIT UNIONS	Office
2621	PAPER MILLS	Mfg: Paper and Allied Products	6080		Office
2630		Mfg: Industrial	6081	FOREIGN BANK & BRANCHES & AGEN	Office
2631	PAPERBOARD MILLS	Mfg: Paper and Allied Products	6082	FOREIGN TRADE & INTERNATIONAL	Office

2640		Mfg: Industrial	6090		Office
2641		Mfg: Industrial	6091	NONDEPOSIT TRUST FACILITIES	Office
2642		Mfg: Industrial	6099	FUNCTIONS RELATED TO DEPOSIT B	Office
2643		Mfg: Industrial	6100		Office
2645		Mfg: Industrial	6110		Office
2646		Mfg: Industrial	6111	FEDERAL & FEDERAL SPONSORED CR	Office
2647		Mfg: Industrial	6112		Office
2648		Mfg: Industrial	6113		Office
2649		Mfg: Industrial	6120		Office
2650		Mfg: Industrial	6122		Office
2651		Mfg: Industrial	6123		Office
2652	SETUP PAPERBOARD BOXES	Mfg: Paper and Allied Products	6124		Office
2653	CORRUGATED AND SOLID FIBER BOX	Mfg: Paper and Allied Products	6125		Office
2654		Mfg: Industrial	6130		Office
2655	FIBER CANS, DRUMS & SIMILAR PR	Mfg: Paper and Allied Products	6131		Office
2656	SANITARY FOOD CONTAINERS	Mfg: Paper and Allied Products	6140		Office
2657	FOLDING PAPERBOARD BOXES	Mfg: Paper and Allied Products	6141	PERSONAL CREDIT INSTITUTIONS	Office
2660		Mfg: Industrial	6142		Office
2661		Mfg: Industrial	6143		Office
2670		Mfg: Industrial	6144		Office
2671	PAPER COATED & LAMINATED, PACK	Mfg: Paper and Allied Products	6145		Office
2672	PAPER COATED AND LAMINATED, NE	Mfg: Paper and Allied Products	6146		Office
2673	BAGS: PLASTICS, LAMINATED, & C	Mfg: Paper and Allied Products	6149		Office
2674	BAGS: UNCOATED PAPER & MULTIWA	Mfg: Paper and Allied Products	6150		Office
2675	DIE-CUT PAPER AND BOARD	Mfg: Paper and Allied Products	6153	SHORT-TERM BUSINESS CREDIT	Office
2676	SANITARY PAPER PRODUCTS	Mfg: Paper and Allied Products	6159	MISCELLANEOUS BUSINESS CREDIT	Office
2677	ENVELOPES	Mfg: Paper and Allied Products	6160		Office
2678	STATIONERY PRODUCTS	Mfg: Paper and Allied Products	6162	MORTGAGE BANKERS AND CORRESPON	Office
2679	CONVERTED PAPER PRODUCTS, NEC	Mfg: Paper and Allied Products	6163	LOAN BROKERS	Office
2700		Mfg: Industrial	6200		Office
2710		Mfg: Industrial	6210		Office

2711	NEWSPAPERS	Mfg: Printing	6211	SECURITY BROKERS AND DEALERS	Office
2720		Mfg: Industrial	6220		Office
2721	PERIODICALS	Mfg: Printing	6221	COMMODITY CONTRACTS BROKERS, D	Office
2730		Mfg: Industrial	6230		Office
2731	BOOK PUBLISHING	Mfg: Printing	6231	SECURITY AND COMMODITY EXCHANG	Office
2732	BOOK PRINTING	Mfg: Printing	6280		Office
2740		Mfg: Industrial	6281		Office
2741	MISCELLANEOUS PUBLISHING	Mfg: Printing	6282	INVESTMENT ADVICE	Office
2750		Mfg: Industrial	6289	SECURITY & COMMODITY SERVICES,	Office
2751		Mfg: Industrial	6300		Office
2752	COMMERCIAL PRINTING, LITHOGRAP	Mfg: Printing	6310		Office
2753		Mfg: Industrial	6311	LIFE INSURANCE	Office
2754	COMMERCIAL PRINTING, GRAVURE	Mfg: Printing	6320		Office
2759	COMMERCIAL PRINTING, NEC	Mfg: Printing	6321	ACCIDENT AND HEALTH INSURANCE	Office
2760		Mfg: Industrial	6324	HOSPITAL AND MEDICAL SERVICE P	Office
2761	MANIFOLD BUSINESS FORMS	Mfg: Printing	6330		Office
2770		Mfg: Industrial	6331	FIRE, MARINE, AND CASUALTY INS	Office
2771	GREETING CARDS	Mfg: Printing	6350		Office
2780		Mfg: Industrial	6351	SURETY INSURANCE	Office
2782	BLANKBOOKS AND LOOSELEAF BINDE	Mfg: Printing	6360		Office
2789	BOOKBINDING AND RELATED WORK	Mfg: Printing	6361	TITLE INSURANCE	Office
2790		Mfg: Industrial	6370		Office
2791	TYPESETTING	Mfg: Printing	6371	PENSION, HEALTH, AND WELFARE F	Office
2793		Mfg: Industrial	6390		Office
2794		Mfg: Industrial	6399	INSURANCE CARRIERS, NEC	Office
2795		Mfg: Industrial	6400		Office
2796	PLATEMAKING SERVICES	Mfg: Printing	6410		Office
2800		Mfg: Industrial	6411	INSURANCE AGENTS, BROKERS, & S	Office
2810		Mfg: Industrial	6500		Office
2812	ALKALIES AND CHLORINE	Mfg: Chemicals and Allied Products	6510		Office
2813	INDUSTRIAL GASES	Mfg: Chemicals and Allied Products	6511	PROFESSIONAL CENTER/	Office

				OFFICES (	
2816	INORGANIC PIGMENTS	Mfg: Chemicals and Allied Products	6512	NONRESIDENTIAL BLDG OPERATORS;	Office
2819	INDUSTRIAL INORGANIC CHEMICALS	Mfg: Chemicals and Allied Products	6513	APARTMENTS - CONDOS > 4 UNITS	Residential
2820		Mfg: Industrial	6514	APARTMENTS - CONDOS < 5 UNITS	Residential
2821	PLASTICS MATERIALS AND RESINS	Mfg: Chemicals and Allied Products	6515	MOBILE HOME SITE OPERATORS, RV	Office
2822	SYNTHETIC RUBBER	Mfg: Chemicals and Allied Products	6517	RAILROAD PROPERTY LESSORS	Office
2823	CELLULOSIC MANMADE FIBERS	Mfg: Chemicals and Allied Products	6519	REAL PROPERTY LESSORS, NEC	Office
2824	ORGANIC FIBERS, NONCELLULOSIC	Mfg: Chemicals and Allied Products	6520		Office
2830		Mfg: Industrial	6521		Office
2831		Mfg: Industrial	6522		Office
2833	MEDICINALS AND BOTANICALS	Mfg: Chemicals and Allied Products	6530		Office
2834	PHARMACEUTICAL PREPARATIONS	Mfg: Chemicals and Allied Products	6531	REAL ESTATE AGENTS AND MANAGER	Office
2835	DIAGNOSTIC SUBSTANCES	Mfg: Chemicals and Allied Products	6540		Office
2836	BIOLOGICAL PRODUCTS EXCEPT DIA	Mfg: Chemicals and Allied Products	6541	TITLE ABSTRACT OFFICES	Office
2840		Mfg: Industrial	6550		Office
2841	SOAP AND OTHER DETERGENTS	Mfg: Chemicals and Allied Products	6552	SUBDIVIDERS AND DEVELOPERS, NE	Office
2842	POLISHES AND SANITATION GOODS	Mfg: Chemicals and Allied Products	6553	CEMETERY SUBDIVIDERS AND DEVEL	Office
2843	SURFACE ACTIVE AGENTS	Mfg: Chemicals and Allied Products	6560		Office
2844	TOILET PREPARATIONS	Mfg: Chemicals and Allied Products	6561		Office
2850		Mfg: Industrial	6600		Office
2851	PAINTS AND ALLIED PRODUCTS	Mfg: Chemicals and Allied Products	6610		Office
2860		Mfg: Industrial	6611		Office
2861	GUM AND WOOD CHEMICALS	Mfg: Chemicals and Allied Products	6620		Office
2865	CYCLIC CRUDES AND INTERMEDIATE	Mfg: Chemicals and Allied Products	6621		Office
2869	INDUSTRIAL ORGANIC CHEMICALS,	Mfg: Chemicals and Allied Products	6700		Office
2870		Mfg: Industrial	6710		Office
2873	NITROGENOUS FERTILIZERS	Mfg: Chemicals and Allied Products	6711		Office
2874	PHOSPHATIC FERTILIZERS	Mfg: Chemicals and Allied Products	6712	BANK HOLDING COMPANIES	Office
2875	FERTILIZERS, MIXING ONLY	Mfg: Chemicals and Allied Products	6719	HOLDING COMPANIES, NEC	Office
2879	AGRICULTURAL CHEMICALS, NEC	Mfg: Chemicals and Allied Products	6720		Office

2890		Mfg: Chemicals and Allied Products	6722	MANAGEMENT INVESTMENT, OPEN-EN	Office
2891	ADHESIVES AND SEALANTS	Mfg: Chemicals and Allied Products	6723		Office
2892	EXPLOSIVES	Mfg: Chemicals and Allied Products	6724		Office
2893	PRINTING INK	Mfg: Chemicals and Allied Products	6725		Office
2895	CARBON BLACK	Mfg: Chemicals and Allied Products	6726	INVESTMENT OFFICES, NEC	Office
2899	CHEMICAL PREPARATIONS, NEC	Mfg: Chemicals and Allied Products	6730		Office
2900		Mfg: Industrial	6732	EDUCATIONAL, RELIGIOUS, ETC. T	Office
2910		Mfg: Industrial	6733	TRUSTS, NEC	Office
2911	PETROLEUM REFINING	Mfg: Petroleum Refining and Related Industries	6790		Office
2950		Mfg: Industrial	6792	OIL ROYALTY TRADERS	Office
2951	ASPHALT PAVING MIXTURES AND BL	Mfg: Petroleum Refining and Related Industries	6793		Office
2952	ASPHALT FELTS AND COATINGS	Mfg: Petroleum Refining and Related Industries	6794	PATENT OWNERS AND LESSORS	Office
2990		Mfg: Industrial	6798	REAL ESTATE INVESTMENT TRUSTS	Office
2992	LUBRICATING OILS AND GREASES	Mfg: Petroleum Refining and Related Industries	6799	INVESTORS, NEC	Office
2999	PETROLEUM AND COAL PRODUCTS, N	Mfg: Petroleum Refining and Related Industries	7000		Lodging
3000		Mfg: Industrial	7010		Lodging
3010		Mfg: Industrial	7011	HOTELS AND MOTELS	Lodging
3011	TIRES AND INNER TUBES	Mfg: Rubber and Mixed Plastics	7020		Lodging
3020		Mfg: Industrial	7021	ROOMING AND BOARDING HOUSES	Lodging
3021	RUBBER AND PLASTICS FOOTWEAR	Mfg: Rubber and Mixed Plastics	7030		Misc
3030		Mfg: Industrial	7032	SPORTING AND RECREATIONAL CAMP	Misc
3031		Mfg: Industrial	7033	TRAILER PARKS AND CAMPSITES	Misc
3040		Mfg: Industrial	7040		Lodging
3041		Mfg: Industrial	7041	MEMBERSHIP-BASIS ORGANIZATION	Lodging
3050		Mfg: Industrial	7200		Misc
3052	RUBBER & PLASTICS HOSE & BELTI	Mfg: Rubber and Mixed Plastics	7210		Misc
3053	GASKETS, PACKING AND SEALING D	Mfg: Rubber and Mixed Plastics	7211	POWER LAUNDRIES, FAMILY & COMM	Misc
3060		Mfg: Industrial	7212	GARMENT PRESSING & CLEANERS' A	Misc

3061	MECHANICAL RUBBER GOODS	Mfg: Rubber and Mixed Plastics	7213	LINEN SUPPLY	Misc
3069	FABRICATED RUBBER PRODUCTS, NE	Mfg: Rubber and Mixed Plastics	7214		Misc
3070		Mfg: Industrial	7215	COIN-OPERATED LAUNDRIES AND CL	Misc
3079		Mfg: Industrial	7216	DRYCLEANING PLANTS, EXCEPT RUG	Misc
3080		Mfg: Industrial	7217	CARPET AND UPHOLSTERY CLEANING	Misc
3081	UNSUPPORTED PLASTICS FILM & SH	Mfg: Rubber and Mixed Plastics	7218	INDUSTRIAL LAUNDERERS	Misc
3082	UNSUPPORTED PLASTICS PROFILE S	Mfg: Rubber and Mixed Plastics	7219	LAUNDRY AND GARMENT SERVICES,	Misc
3083	LAMINATED PLASTICS PLATE & SHE	Mfg: Rubber and Mixed Plastics	7220		Misc
3084	PLASTICS PIPE	Mfg: Rubber and Mixed Plastics	7221	PHOTOGRAPHIC STUDIOS, PORTRAIT	Misc
3085	PLASTICS BOTTLES	Mfg: Rubber and Mixed Plastics	7230		Misc
3086	PLASTICS FOAM PRODUCTS	Mfg: Rubber and Mixed Plastics	7231	BEAUTY SHOPS	Misc
3087	CUSTOM COMPOUND PURCHASED RESI	Mfg: Rubber and Mixed Plastics	7240		Misc
3088	PLASTICS PLUMBING FIXTURES	Mfg: Rubber and Mixed Plastics	7241	BARBER SHOPS	Misc
3089	PLASTICS PRODUCTS, NEC	Mfg: Rubber and Mixed Plastics	7250		Misc
3100		Mfg: Industrial	7251	SHOE REPAIR AND SHOESHINE PARL	Misc
3110		Mfg: Industrial	7260		Misc
3111	LEATHER TANNING AND FINISHING	Mfg: Leather	7261	FUNERAL SERVICE AND CREMATORIE	Misc
3130		Mfg: Industrial	7290		Misc
3131	FOOTWEAR CUT STOCK	Mfg: Leather	7291	TAX RETURN PREPARATION SERVICE	Office
3140		Mfg: Industrial	7299	MISCELLANEOUS PERSONAL SERVICE	Misc
3142	HOUSE SLIPPERS	Mfg: Leather	7300		Office
3143	MEN'S FOOTWEAR, EXCEPT ATHLETI	Mfg: Leather	7310		Office
3144	WOMEN'S FOOTWEAR, EXCEPT ATHLE	Mfg: Leather	7311	ADVERTISING AGENCIES	Office
3149	FOOTWEAR, EXCEPT RUBBER, NEC	Mfg: Leather	7312	OUTDOOR ADVERTISING AND BILLBO	Office
3150		Mfg: Leather	7313	RADIO, TV, PUBLISHER REPRESENT	Office
3151	LEATHER GLOVES AND MITTENS	Mfg: Leather	7318		Office
3160		Mfg: Industrial	7319	ADVERTISING, NEC	Office
3161	LUGGAGE	Mfg: Leather	7320		Office

3170		Mfg: Industrial	7321		Office
3171	WOMEN'S HANDBAGS AND PURSES	Mfg: Leather	7322	ADJUSTMENT & COLLECTION SERVIC	Office
3172	PERSONAL LEATHER GOODS, NEC	Mfg: Leather	7323	CREDIT REPORTING SERVICES	Office
3190		Mfg: Industrial	7330		Office
3199	LEATHER GOODS, NEC	Mfg: Leather	7331	DIRECT MAIL ADVERTISING SERVIC	Office
3200		Mfg: Industrial	7332		Office
3210		Mfg: Industrial	7333		Office
3211	FLAT GLASS	Mfg: Stone Clay Glass and Concrete	7334	PHOTOCOPYING & DUPLICATING SER	Office
3220		Mfg: Industrial	7335	COMMERCIAL PHOTOGRAPHY	Office
3221	GLASS CONTAINERS	Mfg: Stone Clay Glass and Concrete	7336	COMMERCIAL ART AND GRAPHIC DES	Office
3229	PRESSED AND BLOWN GLASS, NEC	Mfg: Stone Clay Glass and Concrete	7338	SECRETARIAL & COURT REPORTING	Office
3230		Mfg: Industrial	7339		Office
3231	PRODUCTS OF PURCHASED GLASS	Mfg: Stone Clay Glass and Concrete	7340		Office
3240		Mfg: Industrial	7341		Office
3241	CEMENT, HYDRAULIC	Mfg: Stone Clay Glass and Concrete	7342	DISINFECTING & PEST CONTROL SE	Office
3250		Mfg: Industrial	7343		Office
3251	BRICK AND STRUCTURAL CLAY TILE	Mfg: Stone Clay Glass and Concrete	7349	BUILDING MAINTENANCE SERVICES,	Office
3253	CERAMIC WALL AND FLOOR TILE	Mfg: Stone Clay Glass and Concrete	7350		Office
3255	CLAY REFRACTORIES	Mfg: Stone Clay Glass and Concrete	7351		Office
3259	STRUCTURAL CLAY PRODUCTS, NEC	Mfg: Stone Clay Glass and Concrete	7352	MEDICAL EQUIPMENT RENTAL	Office
3260		Mfg: Industrial	7353	HEAVY CONSTRUCTION EQUIPMENT R	Office
3261	VITREOUS PLUMBING FIXTURES	Mfg: Stone Clay Glass and Concrete	7359	EQUIPMENT RENTAL & LEASING, NE	Office
3262	VITREOUS CHINA TABLE & KITCHEN	Mfg: Stone Clay Glass and Concrete	7360		Office
3263	SEMIVITREOUS TABLE & KITCHENWA	Mfg: Stone Clay Glass and Concrete	7361	EMPLOYMENT AGENCIES	Office
3264	PORCELAIN ELECTRICAL SUPPLIES	Mfg: Stone Clay Glass and Concrete	7362		Office
3269	POTTERY PRODUCTS, NEC	Mfg: Stone Clay Glass and Concrete	7363	HELP SUPPLY SERVICES	Office
3270		Mfg: Industrial	7369		Office
3271	CONCRETE BLOCK AND BRICK	Mfg: Stone Clay Glass and Concrete	7370		Office
3272	CONCRETE PRODUCTS, NEC	Mfg: Stone Clay Glass and Concrete	7371	COMPUTER PROGRAMMING	Office

				SERVICES	
3273	READY-MIXED CONCRETE	Mfg: Stone Clay Glass and Concrete	7372	PREPACKAGED SOFTWARE	Office
3274	LIME	Mfg: Stone Clay Glass and Concrete	7373	COMPUTER INTEGRATED SYSTEMS DE	Office
3275	GYPSUM PRODUCTS	Mfg: Stone Clay Glass and Concrete	7374	DATA PROCESSING AND PREPARATIO	Office
3280		Mfg: Industrial	7375	INFORMATION RETRIEVAL SERVICES	Office
3281	CUT STONE AND STONE PRODUCTS	Mfg: Stone Clay Glass and Concrete	7376	COMPUTER FACILITIES MANAGEMENT	Office
3290		Mfg: Industrial	7377	COMPUTER RENTAL & LEASING	Office
3291	ABRASIVE PRODUCTS	Mfg: Stone Clay Glass and Concrete	7378	COMPUTER MAINTENANCE & REPAIR	Office
3292	ASBESTOS PRODUCTS	Mfg: Stone Clay Glass and Concrete	7379	COMPUTER RELATED SERVICES, NEC	Office
3293		Mfg: Industrial	7380		Office
3295	MINERALS, GROUND OR TREATED	Mfg: Stone Clay Glass and Concrete	7381	DETECTIVE & ARMORED CAR SERVIC	Office
3296	MINERAL WOOL	Mfg: Stone Clay Glass and Concrete	7382	SECURITY SYSTEMS SERVICES	Office
3297	NONCLAY REFRACTORIES	Mfg: Stone Clay Glass and Concrete	7383	NEWS SYNDICATES	Office
3299	NONMETALLIC MINERAL PRODUCTS,	Mfg: Stone Clay Glass and Concrete	7384	PHOTOFINISHING LABORATORIES	Office
3300		Mfg: Industrial	7389	BUSINESS SERVICES, NEC	Office
3310		Mfg: Industrial	7500		Misc
3312	BLAST FURNACES AND STEEL MILLS	Mfg: Primary Metals	7510		Misc
3313	ELECTROMETALLURGICAL PRODUCTS	Mfg: Primary Metals	7512		Misc
3315	STEEL WIRE AND RELATED PRODUCT	Mfg: Primary Metals	7513	TRUCK RENTAL AND LEASING, NO D	Misc
3316	COLD FINISHING OF STEEL SHAPES	Mfg: Primary Metals	7514	PASSENGER CAR RENTAL	Misc
3317	STEEL PIPE AND TUBES	Mfg: Primary Metals	7515	PASSENGER CAR LEASING	Misc
3320		Mfg: Industrial	7519	UTILITY TRAILER RENTAL	Misc
3321	GRAY AND DUCTILE IRON FOUNDRIE	Mfg: Primary Metals	7520		Misc
3322	MALLEABLE IRON FOUNDRIES	Mfg: Primary Metals	7521	AUTOMOBILE PARKING	Misc
3324	STEEL INVESTMENT FOUNDRIES	Mfg: Primary Metals	7530		Misc
3325	STEEL FOUNDRIES, NEC	Mfg: Primary Metals	7531		Misc
3330		Mfg: Industrial	7532	TOP & BODY REPAIR & PAINT SHOP	Misc
3331	PRIMARY COPPER	Mfg: Primary Metals	7533	AUTO EXHAUST SYSTEM REPAIR SHO	Misc
3332		Mfg: Industrial	7534	TIRE RETREADING AND REPAIR	Misc

				SHO	
3333		Mfg: Industrial	7535		Misc
3334	PRIMARY ALUMINUM	Mfg: Primary Metals	7536	AUTOMOTIVE GLASS REPLACEMENT S	Misc
3339	PRIMARY NONFERROUS METALS, NEC	Mfg: Primary Metals	7537	AUTOMOTIVE TRANSMISSION REPAIR	Misc
3340		Mfg: Industrial	7538	GENERAL AUTOMOTIVE REPAIR SHOP	Misc
3341	SECONDARY NONFERROUS METALS	Mfg: Primary Metals	7539	AUTOMOTIVE REPAIR SHOPS, NEC	Misc
3350		Mfg: Industrial	7540		Misc
3351	COPPER ROLLING AND DRAWING	Mfg: Primary Metals	7542	CARWASHES	Misc
3353	ALUMINUM SHEET, PLATE, AND FOI	Mfg: Primary Metals	7549	AUTOMOTIVE SERVICES, NEC	Misc
3354	ALUMINUM EXTRUDED PRODUCTS	Mfg: Primary Metals	7600		Misc
3355	ALUMINUM ROLLING AND DRAWING,	Mfg: Primary Metals	7620		Misc
3356	NONFERROUS ROLLING AND DRAWING	Mfg: Primary Metals	7622	RADIO AND TELEVISION REPAIR	Misc
3357	NONFERROUS WIREDRAWING & INSUL	Mfg: Primary Metals	7623	REFRIGERATION SERVICE AND REPA	Misc
3360		Mfg: Industrial	7629	ELECTRICAL REPAIR SHOPS, NEC	Misc
3361		Mfg: Industrial	7630		Misc
3362		Mfg: Industrial	7631	WATCH, CLOCK, AND JEWELRY REPA	Misc
3363	ALUMINUM DIE-CASTINGS	Mfg: Primary Metals	7640		Misc
3364	NONFERROUS DIE-CASTINGS EXCEPT	Mfg: Primary Metals	7641	REUPHOLSTERY AND FURNITURE REP	Misc
3365	ALUMINUM FOUNDRIES	Mfg: Primary Metals	7690		Misc
3366	COPPER FOUNDRIES	Mfg: Primary Metals	7692	WELDING REPAIR	Misc
3369	NONFERROUS FOUNDRIES, NEC	Mfg: Primary Metals	7694	ARMATURE REWINDING SHOPS	Misc
3390		Mfg: Industrial	7699	REPAIR SERVICES, NEC	Misc
3398	METAL HEAT TREATING	Mfg: Primary Metals	7800		Misc
3399	PRIMARY METAL PRODUCTS, NEC	Mfg: Primary Metals	7810		Misc
3400		Mfg: Industrial	7812	MOTION PICTURE & VIDEO PRODUCT	Misc
3410		Mfg: Industrial	7813		Misc
3411	METAL CANS	Mfg: Fabricated Metal Products	7814		Misc
3412	METAL BARRELS, DRUMS, AND PAIL	Mfg: Fabricated Metal Products	7819	SERVICES ALLIED TO MOTION PICT	Misc
3420		Mfg: Industrial	7820		Office

3421	CUTLERY	Mfg: Fabricated Metal Products	7822	MOTION PICTURE AND TAPE DISTRI	Office
3423	HAND AND EDGE TOOLS, NEC	Mfg: Fabricated Metal Products	7823		Office
3425	SAW BLADES AND HANDSAWS	Mfg: Fabricated Metal Products	7824		Office
3429	HARDWARE, NEC	Mfg: Fabricated Metal Products	7829	MOTION PICTURE DISTRIBUTION SE	Office
3430		Mfg: Industrial	7830		Misc
3431	METAL SANITARY WARE	Mfg: Fabricated Metal Products	7832	MOTION PICTURE THEATERS, EX DR	Misc
3432	PLUMBING FIXTURE FITTINGS AND	Mfg: Fabricated Metal Products	7833	DRIVE-IN MOTION PICTURE THEATE	Misc
3433	HEATING EQUIPMENT, EXCEPT ELEC	Mfg: Fabricated Metal Products	7840		Misc
3440		Mfg: Industrial	7841	VIDEO TAPE RENTAL	Misc
3441	FABRICATED STRUCTURAL METAL	Mfg: Fabricated Metal Products	7900		Misc
3442	METAL DOORS, SASH, AND TRIM	Mfg: Fabricated Metal Products	7910		Misc
3443	FABRICATED PLATE WORK (BOILER	Mfg: Fabricated Metal Products	7911	DANCE STUDIOS, SCHOOLS, AND HA	Education
3444	SHEET METAL WORK	Mfg: Fabricated Metal Products	7920		Misc
3446	ARCHITECTURAL METAL WORK	Mfg: Fabricated Metal Products	7922	THEATRICAL PRODUCERS AND SERVI	Misc
3448	PREFABRICATED METAL BUILDINGS	Mfg: Fabricated Metal Products	7929	ENTERTAINERS & ENTERTAINMENT G	Misc
3449	MISCELLANEOUS METAL WORK	Mfg: Fabricated Metal Products	7930		Misc
3450		Mfg: Industrial	7932		Misc
3451	SCREW MACHINE PRODUCTS	Mfg: Fabricated Metal Products	7933	BOWLING CENTERS	Misc
3452	BOLTS, NUTS, RIVETS, AND WASHE	Mfg: Fabricated Metal Products	7940		Misc
3460		Mfg: Industrial	7941	SPORTS CLUBS, MANAGERS, & PROM	Misc
3462	IRON AND STEEL FORGINGS	Mfg: Fabricated Metal Products	7948	RACING, INCLUDING TRACK OPERAT	Misc
3463	NONFERROUS FORGINGS	Mfg: Fabricated Metal Products	7990		Misc
3465	AUTOMOTIVE STAMPINGS	Mfg: Fabricated Metal Products	7991	PHYSICAL FITNESS FACILITIES	Misc
3466	CROWNS AND CLOSURES	Mfg: Fabricated Metal Products	7992	PUBLIC GOLF COURSES	Misc
3469	METAL STAMPINGS, NEC	Mfg: Fabricated Metal Products	7993	COIN-OPERATED AMUSEMENT DEVICE	Misc
3470		Mfg: Industrial	7996	AMUSEMENT PARKS	Misc
3471	PLATING AND POLISHING	Mfg: Fabricated Metal Products	7997	MEMBERSHIP SPORTS & RECREATION	Misc
3479	METAL COATING AND ALLIED SERVI	Mfg: Fabricated Metal Products	7999	AMUSEMENT AND RECREATION, NEC	Misc

3480		Mfg: Industrial	8000		Misc
3482	SMALL ARMS AMMUNITION	Mfg: Fabricated Metal Products	8010		Office
3483	AMMUNITION, EXCEPT FOR SMALL A	Mfg: Fabricated Metal Products	8011	OFFICES & CLINICS OF MEDICAL D	Office
3484	SMALL ARMS	Mfg: Fabricated Metal Products	8020		Office
3489	ORDNANCE AND ACCESSORIES, NEC	Mfg: Fabricated Metal Products	8021	OFFICES AND CLINICS OF DENTIST	Office
3490		Mfg: Industrial	8030		Office
3491	INDUSTRIAL VALVES	Mfg: Fabricated Metal Products	8031	OFFICES OF OSTEOPATHIC PHYSICI	Office
3492	FLUID POWER VALVES & HOSE FITT	Mfg: Fabricated Metal Products	8040		Office
3493	STEEL SPRINGS, EXCEPT WIRE	Mfg: Fabricated Metal Products	8041	OFFICES AND CLINICS OF CHIROPR	Office
3494	VALVES AND PIPE FITTINGS, NEC	Mfg: Fabricated Metal Products	8042	OFFICES AND CLINICS OF OPTOMET	Office
3495	WIRE SPRINGS	Mfg: Fabricated Metal Products	8043	OFFICES AND CLINICS OF PODIATR	Office
3496	MISCELLANEOUS FABRICATED WIRE	Mfg: Fabricated Metal Products	8049	OFFICES OF HEALTH PRACTITIONER	Office
3497	METAL FOIL AND LEAF	Mfg: Fabricated Metal Products	8050		Health
3498	FABRICATED PIPE AND FITTINGS	Mfg: Fabricated Metal Products	8051	SKILLED NURSING CARE FACILITIE	Health
3499	FABRICATED METAL PRODUCTS, NEC	Mfg: Fabricated Metal Products	8052	INTERMEDIATE CARE FACILITIES	Health
3500		Mfg: Industrial	8059	NURSING AND PERSONAL CARE, NEC	Health
3510		Mfg: Industrial	8060		Health
3511	TURBINES AND TURBINE GENERATOR	Mfg: Ind and Com Machinery	8061		Health
3519	INTERNAL COMBUSTION ENGINES, N	Mfg: Ind and Com Machinery	8062	GENERAL MEDICAL & SURGICAL HOS	Health
3520		Mfg: Industrial	8063	PSYCHIATRIC HOSPITALS	Health
3523	FARM MACHINERY AND EQUIPMENT	Mfg: Ind and Com Machinery	8064		Health
3524	LAWN AND GARDEN EQUIPMENT	Mfg: Ind and Com Machinery	8065		Health
3530		Mfg: Industrial	8066		Health
3531	CONSTRUCTION MACHINERY	Mfg: Ind and Com Machinery	8067		Health
3532	MINING MACHINERY	Mfg: Ind and Com Machinery	8068		Health
3533	OIL AND GAS FIELD MACHINERY	Mfg: Ind and Com Machinery	8069	SPECIALTY HOSPITALS EXCEPT PSY	Health
3534	ELEVATORS AND MOVING STAIRWAYS	Mfg: Ind and Com Machinery	8070		Health
3535	CONVEYORS AND CONVEYING EQUIPM	Mfg: Ind and Com Machinery	8071	MEDICAL LABORATORIES	Health

3536	HOISTS, CRANES, AND MONORAILS	Mfg: Ind and Com Machinery	8072	DENTAL LABORATORIES	Health
3537	INDUSTRIAL TRUCKS AND TRACTORS	Mfg: Ind and Com Machinery	8080		Health
3540		Mfg: Industrial	8081		Health
3541	MACHINE TOOLS, METAL CUTTING T	Mfg: Ind and Com Machinery	8082	HOME HEALTH CARE SERVICES	Health
3542	MACHINE TOOLS, METAL FORMING T	Mfg: Ind and Com Machinery	8090		Health
3543	INDUSTRIAL PATTERNS	Mfg: Ind and Com Machinery	8091		Health
3544	SPECIAL DIES, TOOLS, JIGS & FI	Mfg: Ind and Com Machinery	8092	KIDNEY DIALYSIS CENTERS	Health
3545	MACHINE TOOL ACCESSORIES	Mfg: Ind and Com Machinery	8093	SPECIALTY OUTPATIENT CLINICS,	Health
3546	POWER-DRIVEN HANDTOOLS	Mfg: Ind and Com Machinery	8099	HEALTH AND ALLIED SERVICES, NE	Health
3547	ROLLING MILL MACHINERY	Mfg: Ind and Com Machinery	8100		Office
3548	WELDING APPARATUS	Mfg: Ind and Com Machinery	8110		Office
3549	METALWORKING MACHINERY, NEC	Mfg: Ind and Com Machinery	8111	LEGAL SERVICES	Office
3550		Mfg: Industrial	8200		Education
3551		Mfg: Industrial	8210		Education
3552	TEXTILE MACHINERY	Mfg: Ind and Com Machinery	8211	ELEMENTARY AND SECONDARY SCHOO	Education
3553	WOODWORKING MACHINERY	Mfg: Ind and Com Machinery	8212		Education
3554	PAPER INDUSTRIES MACHINERY	Mfg: Ind and Com Machinery	8213		Education
3555	PRINTING TRADES MACHINERY	Mfg: Ind and Com Machinery	8214		Education
3556	FOOD PRODUCTS MACHINERY	Mfg: Ind and Com Machinery	8215		Education
3559	SPECIAL INDUSTRY MACHINERY, NE	Mfg: Ind and Com Machinery	8216		Education
3560		Mfg: Industrial	8217		Education
3561	PUMPS AND PUMPING EQUIPMENT	Mfg: Ind and Com Machinery	8218		Education
3562	BALL AND ROLLER BEARINGS	Mfg: Ind and Com Machinery	8219		Education
3563	AIR AND GAS COMPRESSORS	Mfg: Ind and Com Machinery	8220		Education
3564	BLOWERS AND FANS	Mfg: Ind and Com Machinery	8221	COLLEGES AND UNIVERSITIES	Education
3565	PACKAGING MACHINERY	Mfg: Ind and Com Machinery	8222	JUNIOR COLLEGES	Education
3566	SPEED CHANGES, DRIVES, AND GEA	Mfg: Ind and Com Machinery	8223		Education
3567	INDUSTRIAL FURNACES AND OVENS	Mfg: Ind and Com Machinery	8224		Education
3568	POWER TRANSMISSION EQUIPMENT,	Mfg: Ind and Com Machinery	8230		Education
3569	GENERAL INDUSTRIAL MACHINERY,	Mfg: Ind and Com Machinery	8231	LIBRARIES	Public Service

3570		Mfg: Ind and Com Machinery	8240		Education
3571	ELECTRONIC COMPUTERS	Mfg: Ind and Com Machinery	8241		Education
3572	COMPUTER STORAGE DEVICES	Mfg: Ind and Com Machinery	8243	DATA PROCESSING SCHOOLS	Education
3573		Mfg: Ind and Com Machinery	8244	BUSINESS AND SECRETARIAL SCHOO	Education
3574		Mfg: Ind and Com Machinery	8249	VOCATIONAL SCHOOLS, NEC	Education
3575	COMPUTER TERMINALS	Mfg: Ind and Com Machinery	8290		Education
3576		Mfg: Ind and Com Machinery	8299	SCHOOLS & EDUCATIONAL SERVICES	Education
3577	COMPUTER PERIPHERAL EQUIPMENT,	Mfg: Ind and Com Machinery	8300		Misc
3578	CALCULATING AND ACCOUNTING EQU	Mfg: Ind and Com Machinery	8320		Office
3579	OFFICE MACHINES, NEC	Mfg: Ind and Com Machinery	8321		Office
3580		Mfg: Ind and Com Machinery	8322	INDIVIDUAL AND FAMILY SERVICES	Office
3581	AUTOMATIC VENDING MACHINES	Mfg: Ind and Com Machinery	8330		Office
3582	COMMERCIAL LAUNDRY EQUIPMENT	Mfg: Ind and Com Machinery	8331	JOB TRAINING AND RELATED SERVI	Office
3585	REFRIGERATION AND HEATING EQUI	Mfg: Ind and Com Machinery	8350		Education
3586	MEASURING AND DISPENSING PUMPS	Mfg: Ind and Com Machinery	8351	CHILD DAY CARE SERVICES	Education
3589	SERVICE INDUSTRY MACHINERY, NE	Mfg: Ind and Com Machinery	8360		Health
3590		Mfg: Ind and Com Machinery	8361	RESIDENTIAL CARE	Health
3592	CARBURETORS, PISTONS, RINGS, V	Mfg: Ind and Com Machinery	8390		Office
3593	FLUID POWER CYLINDERS & ACTUAT	Mfg: Ind and Com Machinery	8399	SOCIAL SERVICES, NEC	Office
3594	FLUID POWER PUMPS AND MOTORS	Mfg: Ind and Com Machinery	8400		Misc
3596	SCALES AND BALANCES, EXCEPT LA	Mfg: Ind and Com Machinery	8410		Misc
3599	INDUSTRIAL MACHINERY, NEC	Mfg: Ind and Com Machinery	8411		Misc
3600		Mfg: Electronic Equipment	8412	MUSEUMS AND ART GALLERIES	Misc
3610		Mfg: Electronic Equipment	8420		Misc
3612	TRANSFORMERS, EXCEPT ELECTRONI	Mfg: Electronic Equipment	8421		Misc
3613	SWITCHGEAR AND SWITCHBOARD APP	Mfg: Electronic Equipment	8422	BOTANICAL AND ZOOLOGICAL GARDE	Misc
3620		Mfg: Electronic Equipment	8600		Institutional
3621	MOTORS AND GENERATORS	Mfg: Electronic Equipment	8610		Institutional
3622		Mfg: Electronic Equipment	8611	BUSINESS ASSOCIATIONS	Institutional

3623		Mfg: Electronic Equipment	8620		Institutional
3624	CARBON AND GRAPHITE PRODUCTS	Mfg: Electronic Equipment	8621	PROFESSIONAL ORGANIZATIONS	Institutional
3625	RELAYS AND INDUSTRIAL CONTROLS	Mfg: Electronic Equipment	8630		Institutional
3629	ELECTRICAL INDUSTRIAL APPARATU	Mfg: Electronic Equipment	8631	LABOR ORGANIZATIONS	Institutional
3630		Mfg: Electronic Equipment	8640		Institutional
3631	HOUSEHOLD COOKING EQUIPMENT	Mfg: Electronic Equipment	8641	CIVIC AND SOCIAL ASSOCIATIONS	Institutional
3632	HOUSEHOLD REFRIGERATORS AND FR	Mfg: Electronic Equipment	8650		Institutional
3633	HOUSEHOLD LAUNDRY EQUIPMENT	Mfg: Electronic Equipment	8651	POLITICAL ORGANIZATIONS	Institutional
3634	ELECTRIC HOUSEWARES AND FANS	Mfg: Electronic Equipment	8660		Institutional
3635	HOUSEHOLD VACUUM CLEANERS	Mfg: Electronic Equipment	8661	RELIGIOUS ORGANIZATIONS	Church
3636		Mfg: Electronic Equipment	8690		Church
3639	HOUSEHOLD APPLIANCES, NEC	Mfg: Electronic Equipment	8699	MEMBERSHIP ORGANIZATIONS, NEC	Institutional
3640		Mfg: Electronic Equipment	8700		Office
3641	ELECTRIC LAMPS	Mfg: Electronic Equipment	8710		Office
3643	CURRENT-CARRYING WIRING DEVICE	Mfg: Electronic Equipment	8711	ENGINEERING SERVICES	Office
3644	NONCURRENT-CARRYING WIRING DEV	Mfg: Electronic Equipment	8712	ARCHITECTURAL SERVICES	Office
3645	RESIDENTIAL LIGHTING FIXTURES	Mfg: Electronic Equipment	8713	SURVEYING SERVICES	Office
3646	COMMERCIAL LIGHTING FIXTURES	Mfg: Electronic Equipment	8720		Office
3647	VEHICULAR LIGHTING EQUIPMENT	Mfg: Electronic Equipment	8721	ACCOUNTING, AUDITING, & BOOKKE	Office
3648	LIGHTING EQUIPMENT, NEC	Mfg: Electronic Equipment	8730		Misc
3650		Mfg: Electronic Equipment	8731	COMMERCIAL PHYSICAL RESEARCH	Misc
3651	HOUSEHOLD AUDIO AND VIDEO EQUI	Mfg: Electronic Equipment	8732	COMMERCIAL NONPHYSICAL RESEARC	Office
3652	PRERECORDED RECORDS AND TAPES	Mfg: Electronic Equipment	8733	NONCOMMERCIAL RESEARCH ORGANIZ	Office
3660		Mfg: Electronic Equipment	8734	TESTING LABORATORIES	Misc
3661	TELEPHONE AND TELEGRAPH APPARA	Mfg: Electronic Equipment	8740		Office
3662		Mfg: Electronic Equipment	8741	MANAGEMENT SERVICES	Office
3663	RADIO & TV COMMUNICATIONS EQUI	Mfg: Electronic Equipment	8742	MANAGEMENT CONSULTING SERVICES	Office

3669	COMMUNICATIONS EQUIPMENT, NEC	Mfg: Electronic Equipment	8743	PUBLIC RELATIONS SERVICES	Office
3670		Mfg: Electronic Equipment	8744	FACILITIES SUPPORT SERVICES	Misc
3671	ELECTRON TUBES	Mfg: Electronic Equipment	8748	BUSINESS CONSULTING, NEC	Office
3672	PRINTED CIRCUIT BOARDS	Mfg: Electronic Equipment	8800		Residential
3673		Mfg: Electronic Equipment	8810		Residential
3674	SEMICONDUCTORS ND RELATED DEVI	Mfg: Electronic Equipment	8811	PRIVATE HOUSEHOLDS	Residential
3675	ELECTRONIC CAPACITORS	Mfg: Electronic Equipment	8900		Misc
3676	ELECTRONIC RESISTORS	Mfg: Electronic Equipment	8990		Misc
3677	ELECTRONIC COILS AND TRANSFORM	Mfg: Electronic Equipment	8999	SERVICES, NEC	Misc
3678	ELECTRONIC CONNECTORS	Mfg: Electronic Equipment	9100		Public Service
3679	ELECTRONIC COMPONENTS, NEC	Mfg: Electronic Equipment	9110		Public Service
3690		Mfg: Electronic Equipment	9111	EXECUTIVE OFFICES	Public Service
3691	STORAGE BATTERIES	Mfg: Electronic Equipment	9120		Public Service
3692	PRIMARY BATTERIES, DRY AND WET	Mfg: Electronic Equipment	9121	LEGISLATIVE BODIES	Public Service
3693		Mfg: Electronic Equipment	9130		Public Service
3694	ENGINE ELECTRICAL EQUIPMENT	Mfg: Electronic Equipment	9131	EXECUTIVE AND LEGISLATIVE COMB	Public Service
3695	MAGNETIC AND OPTICAL RECORDING	Mfg: Electronic Equipment	9190		Public Service
3699	ELECTRICAL EQUIPMENT & SUPPLIE	Mfg: Electronic Equipment	9199	GENERAL GOVERNMENT, NEC	Public Service
3700		Mfg: Transportation Equipment	9200		Public Service
3710		Mfg: Transportation Equipment	9210		Public Service
3711	MOTOR VEHICLES AND CAR BODIES	Mfg: Transportation Equipment	9211	COURTS	Public Service
3713	TRUCK AND BUS BODIES	Mfg: Transportation Equipment	9220		Public Service
3714	MOTOR VEHICLE PARTS AND ACCESS	Mfg: Transportation Equipment	9221	POLICE PROTECTION	Public Service
3715	TRUCK TRAILERS	Mfg: Transportation Equipment	9222	LEGAL COUNSEL AND PROSECUTION	Public Service
3716	MOTOR HOMES	Mfg: Transportation Equipment	9223	CORRECTIONAL INSTITUTIONS	Public Service
3720		Mfg: Transportation Equipment	9224	FIRE PROTECTION	Public Service
3721	AIRCRAFT	Mfg: Transportation Equipment	9225		Public

					Service
3724	AIRCRAFT ENGINES AND ENGINE PA	Mfg: Transportation Equipment	9226		Public Service
3728	AIRCRAFT PARTS AND EQUIPMENT,	Mfg: Transportation Equipment	9227		Public Service
3730		Mfg: Transportation Equipment	9228		Public Service
3731	SHIP BUILDING AND REPAIRING	Mfg: Transportation Equipment	9229	PUBLIC ORDER AND SAFETY, NEC	Public Service
3732	BOAT BUILDING AND REPAIRING	Mfg: Transportation Equipment	9300		Public Service
3740		Mfg: Transportation Equipment	9310		Public Service
3743	RAILROAD EQUIPMENT	Mfg: Transportation Equipment	9311	FINANCE, TAXATION, & MONETARY	Public Service
3750		Mfg: Transportation Equipment	9400		Public Service
3751	MOTORCYCLES, BICYCLES, AND PAR	Mfg: Transportation Equipment	9410		Public Service
3760		Mfg: Transportation Equipment	9411	ADMINISTRATION OF EDUCATIONAL	Public Service
3761	GUIDED MISSILES AND SPACE VEHI	Mfg: Transportation Equipment	9430		Public Service
3764	SPACE PROPULSION UNITS AND PAR	Mfg: Transportation Equipment	9431	ADMINISTRATION OF PUBLIC HEALT	Public Service
3769	SPACE VEHICLE EQUIPMENT, NEC	Mfg: Transportation Equipment	9440		Public Service
3790		Mfg: Transportation Equipment	9441	ADMINISTRATION OF SOCIAL & MAN	Public Service
3792	TRAVEL TRAILERS AND CAMPERS	Mfg: Transportation Equipment	9450		Public Service
3795	TANKS AND TANK COMPONENTS	Mfg: Transportation Equipment	9451	ADMINISTRATION OF VETERANS' AF	Public Service
3799	TRANSPORTATION EQUIPMENT, NEC	Mfg: Transportation Equipment	9500		Public Service
3800		Mfg: Measurement and Control Equipment	9510		Public Service
3810		Mfg: Measurement and Control Equipment	9511	AIR, WATER, & SOLID WASTE MANA	Public Service
3811		Mfg: Measurement and Control Equipment	9512	LAND, MINERAL, WILDLIFE CONSER	Public Service
3812	SEARCH AND NAVIGATION EQUIPMEN	Mfg: Measurement and Control Equipment	9530		Public Service
3820		Mfg: Measurement and Control Equipment	9531	HOUSING PROGRAMS	Public Service
3821	LABORATORY APPARATUS AND FURNI	Mfg: Measurement and Control Equipment	9532	URBAN AND COMMUNITY DEVELOPMEN	Public Service
3822	ENVIRONMENTAL CONTROLS	Mfg: Measurement and Control	9600		Public

		Equipment			Service
3823	PROCESS CONTROL INSTRUMENTS	Mfg: Measurement and Control Equipment	9610		Public Service
3824	FLUID METERS AND COUNTING DEVI	Mfg: Measurement and Control Equipment	9611	ADMINISTRATION OF GENERAL ECON	Public Service
3825	INSTRUMENTS TO MEASURE ELECTRI	Mfg: Measurement and Control Equipment	9620		Public Service
3826	ANALYTICAL INSTRUMENTS	Mfg: Measurement and Control Equipment	9621	REGULATION, ADMINISTRATION OF	Public Service
3827	OPTICAL INSTRUMENTS AND LENSES	Mfg: Measurement and Control Equipment	9630		Public Service
3829	MEASURING & CONTROLLING DEVICE	Mfg: Measurement and Control Equipment	9631	REGULATION, ADMINISTRATION OF	Public Service
3830		Mfg: Measurement and Control Equipment	9640		Public Service
3832		Mfg: Measurement and Control Equipment	9641	REGULATION OF AGRICULTURAL MAR	Public Service
3840		Mfg: Measurement and Control Equipment	9650		Public Service
3841	SURGICAL AND MEDICAL INSTRUMEN	Mfg: Measurement and Control Equipment	9651	REGULATION MISCELLANEOUS COMME	Public Service
3842	SURGICAL APPLIANCES AND SUPPLI	Mfg: Measurement and Control Equipment	9660		Public Service
3843	DENTAL EQUIPMENT AND SUPPLIES	Mfg: Measurement and Control Equipment	9661	SPACE RESEARCH AND TECHNOLOGY	Public Service
3844	X-RAY APPARATUS AND TUBES	Mfg: Measurement and Control Equipment	9700		National Security
3845	ELECTROMEDICAL EQUIPMENT	Mfg: Measurement and Control Equipment	9710		National Security
3850		Mfg: Measurement and Control Equipment	9711	NATIONAL SECURITY	National Security
3851	OPHTHALMIC GOODS	Mfg: Measurement and Control Equipment	9720		Office
3860		Mfg: Measurement and Control Equipment	9721	INTERNATIONAL AFFAIRS	Office
3861	PHOTOGRAPHIC EQUIPMENT AND SUP	Mfg: Measurement and Control Equipment	9900		Unclassified
3870		Mfg: Measurement and Control Equipment	9980		Unclassified
3873	WATCHES, CLOCKS, WATCHCASES &	Mfg: Measurement and Control Equipment	9981		Unclassified
3900		Mfg: Measurement and Control Equipment	9982		Unclassified
3910		Mfg: Measurement and Control Equipment	9983		Unclassified
3911	JEWELRY PRECIOUS METAL	Mfg: Misc Mfg	9990		Unclassified
3914	SILVERWARE AND PLATED WARE	Mfg: Misc Mfg	9991	MISC NON BUILDING; SIRENS, MIC	Unclassified

3915	JEWELERS'MATERIALS & LAPIDARY	Mfg: Misc Mfg	9992	ALL FLAT CONSUMPTION ACCOUNTS	Unclassified
3930		Mfg: Misc Mfg	9993	VACANT BUT ACTIVE (MPC CODE 7	Vacant
3931	MUSICAL INSTRUMENTS	Mfg: Misc Mfg	9995	PUMPING LOADS	Unclassified
3940		Mfg: Misc Mfg	9996	RESIDENCES	Residential
3942	DOLLS AND STUFFED TOYS	Mfg: Misc Mfg	9997	MISC OUTDOOR LIGHTS: YARD LIGH	Light
3944	GAMES, TOYS, AND CHILDREN'S VE	Mfg: Misc Mfg	9998	RESIDENTIAL GARAGES	Residential
3949	SPORTING AND ATHLETIC GOODS, N	Mfg: Misc Mfg	9999		Unclassified
3950		Mfg: Misc Mfg			