Pennsylvania Statewide
Commercial & Industrial End Use & Saturation Study

Submitted to the Pennsylvania Public Utility Commission

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

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1 EXECUTIVE SUMMARY

1.1 OVERVIEW

Nexant, Inc. (Nexant), Mondre Energy and GDS Associates (GDS) – 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 (MetEd)
- Pennsylvania Electric Company (Penelec)
- Pennsylvania Power Company (PennPower)
- West Penn Power Company (WPP)
- PPL Electric Utilities (PPL)
- PECO[1]

The first step in this process is to establish baseline energy usage characteristics for the residential, commercial and industrial sectors. This report documents the findings of that end use and saturation study in the non-residential sector, 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 October 2011 to February 2012[2].

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 a number of end use studies have been conducted on national and broad regional levels, there is a notable absence of data specific to Pennsylvania. To overcome this hurdle, Nexant conducted a survey of Pennsylvania commercial and industrial customers to gather accurate data that is specific to Pennsylvania and the six EDC service territories included in this study (primary on-site data for PECO from Navigant's study was included where possible). In order to maximize the reliability of the survey Nexant aimed to gather information through customer site visits.

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

[2] Primary data was collected for the PECO study during the spring of 2010.

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, Nexant 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 418 commercial and industrial on-site customer surveys in six EDC territories (Nexant did not perform site surveys in the PECO territory, but rather incorporated results from a recent baseline study in its territory where possible). 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 part serving as a primary data source for the energy efficiency potential assessment, Nexant 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 typical EE programs.

To provide statistically relevant results that can be reasonably applied to the C&I population of Pennsylvania, the SWE designed the study sample to produce findings with a 95% confidence level and a 5% margin of error (95/5) for the entire non-residential population (commercial and industrial combined) across the state. Further levels of resolution were developed to characterize differences among EDCs, the commercial and industrial sectors and commercial segments. In developing its survey 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 state-wide non-residential (commercial and industrial combined) sector
- 90/10 for the state-wide industrial sector
- 90/10 for major commercial segments at the state-wide level
- 90/10 for each EDC's non-residential sector

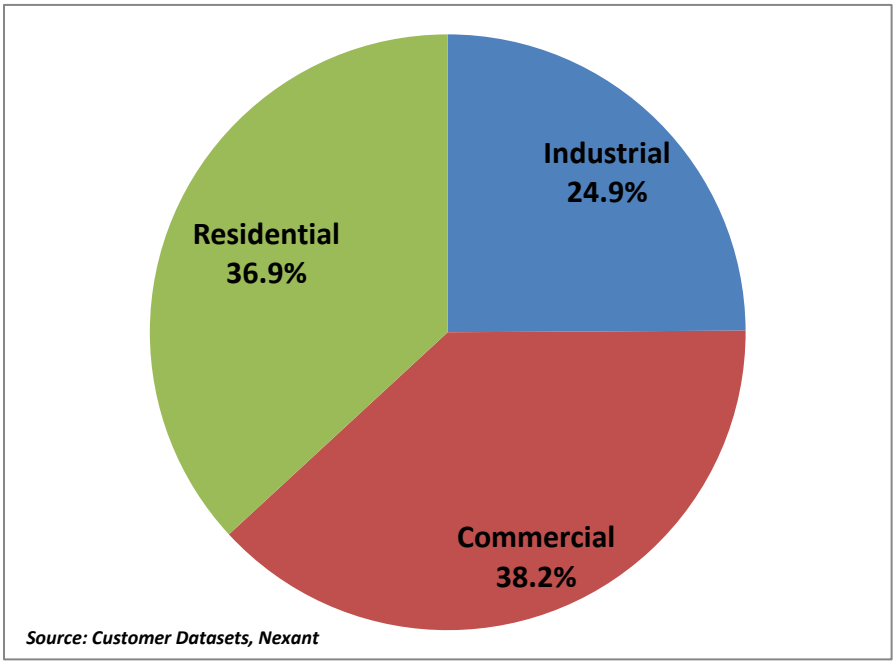
1.3 STATE WIDE FINDINGS RESULTS

This study evaluates customers associated with the non-residential electric supply loads of the seven largest EDC territories, totaling 99.1% of Pennsylvania's total residential and non-residential electrical load from EDCs[1]. Because this study presents findings on building premises, energy findings presented below do not include transmission, substation, irrigation or lighting rate classes. Through analysis of EDC customer databases, on-site surveys, and secondary research, Nexant was able to break out the commercial energy usage by sector, commercial segment and end use. Results are presented below.

1.3.1 Electricity Consumption by Sector

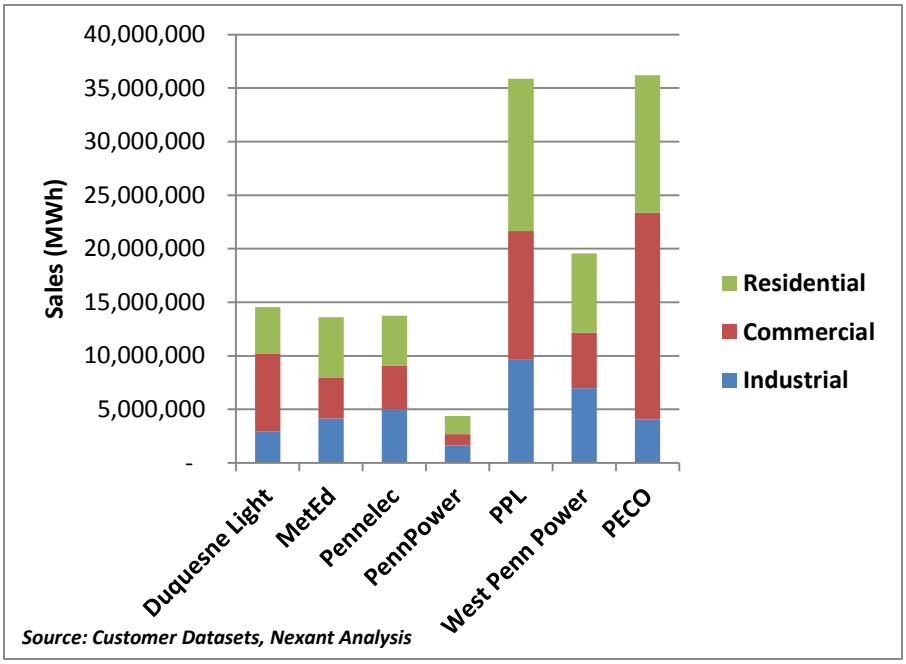
Figure 1-1, Figure 1-2, and Table 1-1 show the overview of the electric sales by sector by EDC in Pennsylvania for calendar year 2010[2]. The commercial sector is the largest sector with 38.2% of electricity sales, followed by residential and industrial. PECO is the largest EDC both in terms of premises and sales.

Figure 1-1: 2010 Statewide Electricity Sales by Sector



[1] Based on 2010 sales. *Electric Power Outlook for Pennsylvania Report*, 2010
[2] PECO figures are for June 2009 to May 2010

Figure 1-2: 2010 Statewide Electricity Sales by Sector, by EDC



Source: Customer Datasets, Nexant Analysis

Table 1-1: 2010 Statewide Premise Counts and Sales by Sector, by EDC

EDC	2010 Premises			
	Industrial	Commercial	Residential	Total
Duquesne Light	1,224	40,348	524,406	565,978
MetEd	6,034	35,780	485,969	527,783
Pennelec	7,759	47,321	505,344	560,424
PennPower	1,964	12,527	140,101	154,592
PPL	10,905	92,112	1,224,602	1,327,619
West Penn Power	6,183	54,024	619,584	679,791
PECO[(1)]	7,688	93,873	1,400,000	1,501,561
Statewide	**41,756**	**375,986**	**4,900,006**	**5,317,748**

EDC	2010 Sales (MWh)			
	Industrial	Commercial	Residential	Total
Duquesne Light	2,908,498	7,314,744	4,326,339	14,549,581
MetEd	4,148,279	3,771,988	5,666,240	13,586,507
Pennelec	5,011,243	4,064,187	4,655,812	13,731,243
PennPower	1,623,329	1,068,515	1,696,442	4,388,286
PPL	9,618,254	12,041,062	14,205,788	35,865,104
West Penn Power	6,979,686	5,168,517	7,407,912	19,556,115
PECO[(1)]	4,059,704	19,271,928	12,880,403	36,212,035
Statewide	**34,348,993**	**52,700,941**	**50,838,937**	**137,888,871**

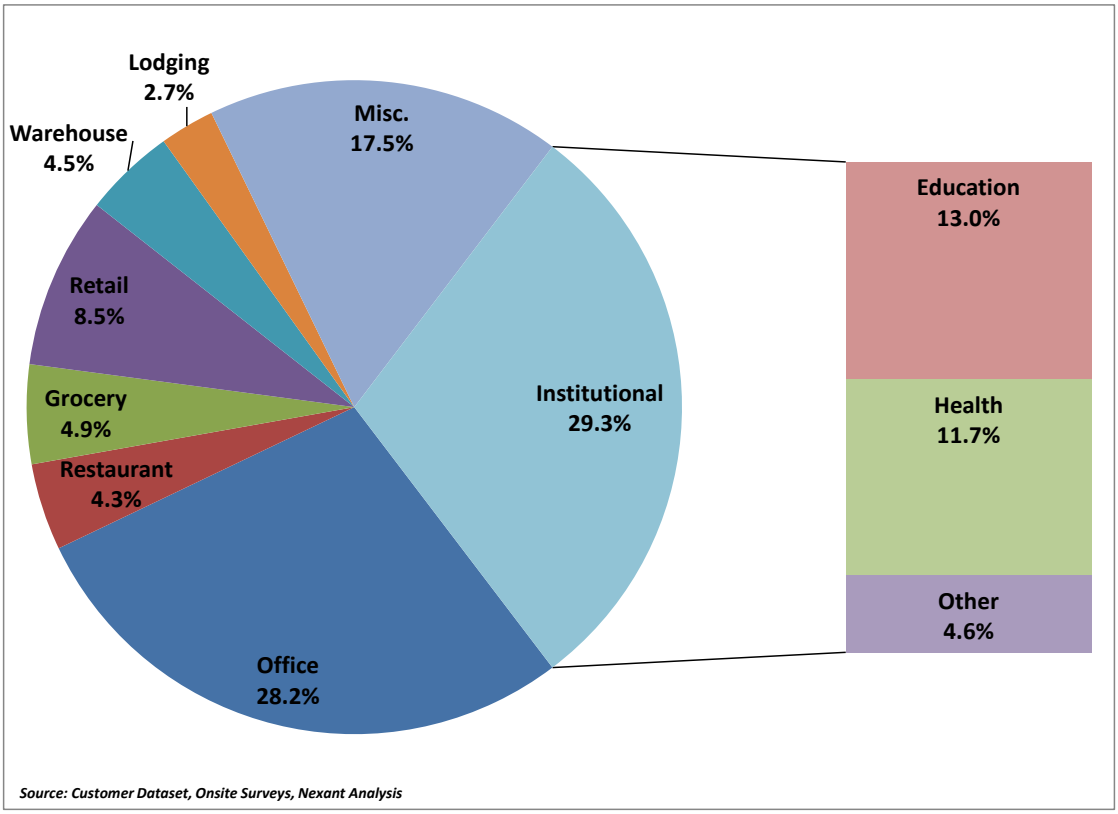
Source: Customer Datasets, Nexant Analysis

(1) PECO residential customer and sales figures are for June 2009 to May 2010

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 industrial segment. The institutional segment consumes the largest share of electricity (29.3%) across the state in the commercial sector, followed by the office segment (28.2%). The office segment also comprises more than one billion square feet of floor space. The manufacturing of metals consumes the largest share of electricity in the industrial sector (29.2%) with a number of steel manufacturers located throughout the state followed by "other" manufacturing at 23.9%[1].

Figure 1-3: 2010 Statewide Electricity Consumption by Commercial Segment



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

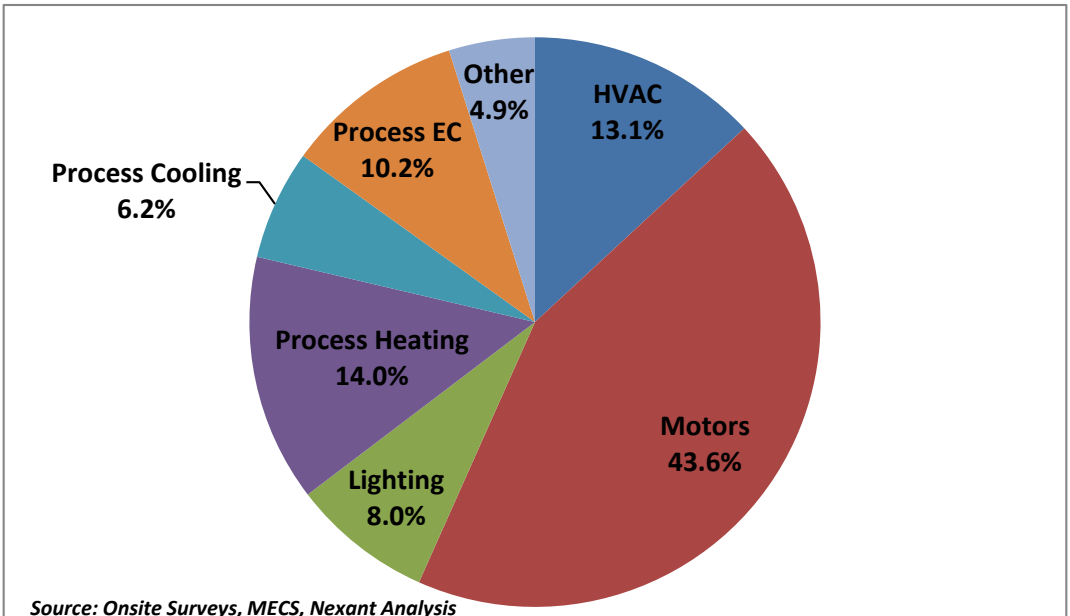
Table 1-2: 2010 Statewide Electricity Consumption by Commercial Segment

Segment	Building Stock (ft²)	Consumption (MWh)	Electricity Share
Institutional	**833,943,779**	**15,460,540**	29.3%
Education	Nx[(1)]	6,858,876	13.0%
Health	276,227,425	6,166,279	11.7%
Other	557,716,354	2,435,385	4.6%
Office	**1,054,798,396**	**14,859,623**	28.2%
Restaurant	**62,191,985**	**2,284,546**	4.3%
Retail	**272,203,100**	**7,050,787**	13.4%
Grocery	55,854,380	2,577,430	4.9%
Retail	216,348,720	4,473,357	8.5%
Warehouse	**355,597,286**	**2,390,718**	4.5%
Misc.	**1,163,797,719**	**10,654,727**	20.2%
Lodging	100,951,063	1,418,697	2.7%
Other	1,062,846,656	9,236,030	17.5%
Total Commercial	**3,742,532,265**	**52,700,941**	100.0%

Source: Customer Dataset, On-site Surveys, Nexant Analysis

[(1)] Specific building stock data unavailable for education – therefore is rolled into the "Other" sub-segment for Institutional

Figure 1-4: 2010 Statewide Electricity Consumption by Industrial Segment



Source: Onsite Surveys, MECS, Nexant Analysis

Table 1-3: 2010 Statewide Electricity Consumption, by Industrial Segment

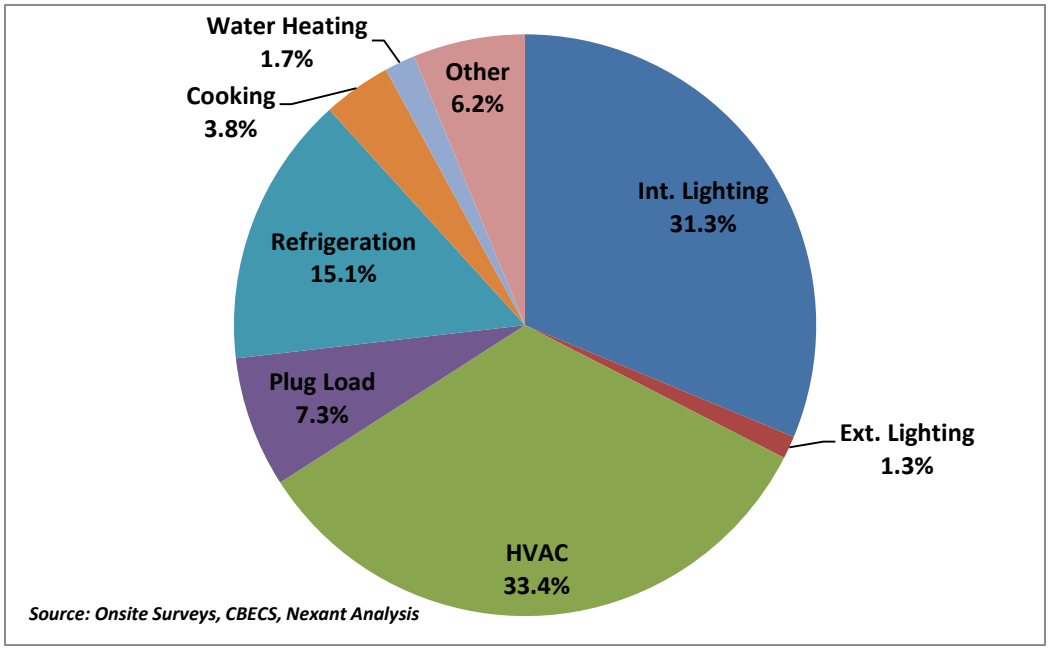
Segment	Consumption (MWh)	Electricity Share
Mfg: Chemicals	2,814,937	8.2%
Mfg: Computers	2,094,323	6.1%
Mfg: Food	3,185,786	9.3%
Mfg: Metals	10,030,211	29.2%
Mfg: Other	8,209,110	23.9%
Mfg: Paper	2,008,114	5.8%
Mfg: Plastics	2,242,259	6.5%
Mining	2,135,127	6.2%
Other Non-Mfg.	1,629,127	4.7%
Total Industrial	**34,348,993**	100.0%

Source: Customer Dataset, Nexant Analysis

1.3.3 Electricity Consumption by End Use

Figure 1-5 and Figure 1-6 show how energy is consumed by end use in the commercial and industrial sector, respectively[1]. HVAC systems consumed the largest share of electricity in buildings (33.4%), followed by interior lighting at over 31% and refrigeration (15.1%). The "Other" end use represents primarily pumps and other miscellaneous loads in buildings. In the industrial sector, motors consume almost half (43.6%) of all the electricity across the state. Process loads (heating, cooling and electro-chemical) make up another 30% of the electricity consumption.

Figure 1-5: 2010 Statewide Commercial System Electricity Usage by End Use[(1)]

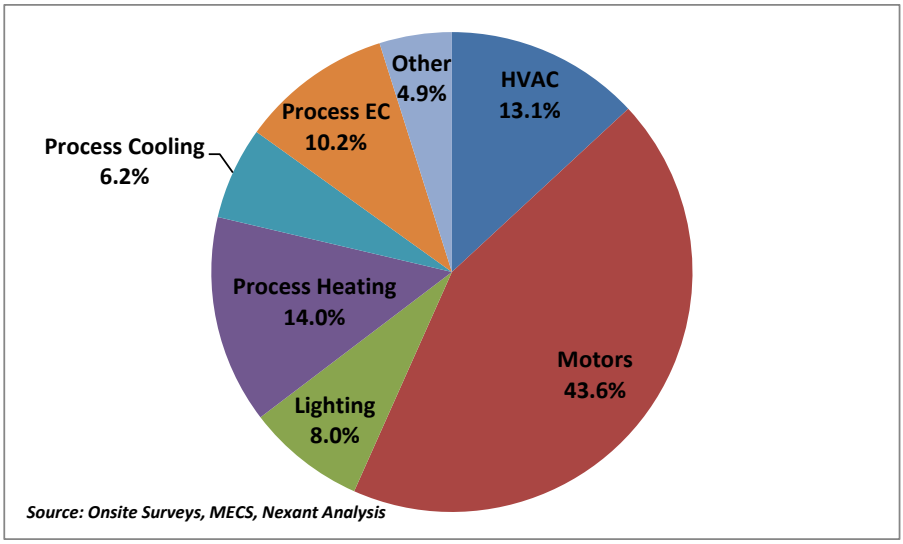


Source: Onsite Surveys, CBECS, Nexant Analysis

(1) Excludes PECO

[1] Note: This data point does not include PECO.

Figure 1-6: 2010 Statewide Industrial System Electricity Usage by End Use



1.3.4 Saturation & Fuel Share

Table 1-4 shows the saturations of different end uses in both the commercial and industrial sector along with fuel shares of those end uses. Saturation is defined as the percentage of buildings with a given end use present. In some cases saturation 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. Space cooling is present in 80.4% of the buildings surveyed with cooking and refrigeration present in 40.6% and 26% 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. Electricity provides only 27.7% of the fuel for space heating and 63.2% for water heating. Electricity fuels about two-thirds of cooking and water heating.

Table 1-4: Non-Residential End use Saturations and Fuel Shares

End Use	Saturation	Fuel Share				
		Electric	Natural Gas	Fuel Oil	Other[3]	n-values
Lighting	100.0%	100.0%	0.0%	0.0%	0.0%	-
Space Heating	100.0%	27.7%	52.0%	13.0%	7.3%	646
Space Cooling	80.4%	100.0%	0.0%	0.0%	0.0%	-
Plug Load	100.0%	100.0%	0.0%	0.0%	0.0%	-
Refrigeration	26.0%	100.0%	0.0%	0.0%	0.0%	-
Cooking	40.6%	65.5%[1]	29.5%	5.1%	0.0%	498
Water Heating	84.5%	63.2%	32.4%	1.6%	2.7%	424
Other[2]	100.0%	100.0%	0.0%	0.0%	0.0%	-

Source: On-site Surveys
[1] Excludes PECO data
[2] "Other" End Use includes pumps and misc. equipment
[3] "Other" fuel share includes LPG, wood, and misc. fuels

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 per square foot of building space and provides insight into how different building types and end uses consume electricity. Nexant calculated the EUI for each end use studied. These findings serve as crucial inputs into the market potential study for the commercial sector and were calculated based on the findings from the on-site surveys and secondary data. Table 1-5 shows the Energy Use Intensity by end use by commercial segment. The grocery segment, with a large refrigeration load, is the most energy-intensive at 50.1 kWh/ft². On the other end of the spectrum, warehouse is the least energy-intensive segment using only 7.1 kWh/ft².

Table 1-5: Energy Use Intensity (kWh/ft²) by End use, Commercial Segment[(1)]

End Use	Grocery	Healthcare	Institutional	Lodging	Misc.	Office	Restaurant	Retail	Warehouse
Lighting	10.6	5.2	3.1	4.1	3.9	5.7	8.2	8.5	3.8
Ext. Lighting	0.4	0.2	0.1	0.2	0.2	0.2	0.3	0.4	0.0
HVAC	7.3	9.8	4.7	5.4	3.9	4.8	9.4	8.3	1.4
Plug Load	0.9	1.2	0.6	0.5	0.6	2.6	0.6	0.6	0.2
Refrigeration	28.6	0.7	0.7	1.0	0.9	0.6	9.9	1.5	1.0
Cooking	0.6	0.4	0.3	0.7	0.3	0.0	10.4	0.0	0.0
Water Heating	0.2	0.1	0.7	0.0	0.1	0.1	0.4	0.9	0.1
Other	1.4	2.2	2.0	0.8	0.9	0.1	1.2	1.2	0.6
Total	**50.1**	**19.9**	**12.2**	**12.7**	**10.7**	**14.1**	**40.4**	**21.3**	**7.1**

Source: On-site Surveys, CBECS, Nexant Analysis
[(1)]Values may not add up to presented total EUIs by segment due to rounding

1.3.6 Appendices

Appendices are included at the end of this report 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 August 2011, GDS and its subcontractors (Nexant, Inc. and Mondre Energy) were selected by the PUC to conduct a EE C&I market potential study to help inform the implementation of Phase 2 of Act 129. As a first step in this process, Nexant and Mondre Energy 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.[1] While a number of end use studies have been conducted on national and broad regional levels, there is a notable absence of data specific to Pennsylvania. To overcome this hurdle, Nexant conducted a survey of Pennsylvania commercial and industrial customers to gather accurate data that is specific to Pennsylvania and the six EDC service territories included in this study (primary on-site data for PECO from Navigant's study was included where possible). In order to maximize the reliability of the survey Nexant 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 requires that seven of the state's largest EDCs deliver energy efficiency programs that reduce their electric load by 1% by May 31, 2011 and by 3% by May 31, 2013. Act 129 also requires a total peak load reduction of 4.5% by May 31, 2013. The PUC is currently considering targets for the possible implementation of Phase 2 of Act 129 starting June 1, 2013.

2.3 STUDY GOALS

While this study aims primarily to provide inputs to the energy efficiency potential calculation, it is also designed to serve as a stand-alone end use study, supplying information useful for EE program development, 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:

- Select a representative random sample of commercial and industrial customers appropriately stratified by segment for participation in the baseline study.
- Profile commercial and industrial (C&I) electric customers at the sector and end use level.

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

- Determine the current saturation of energy using equipment in C&I facilities.
- Determine the current saturation of energy efficiency measures in the C&I sectors.
- Determine average levels of annual energy use by end use.

Using these objectives as a framework, Nexant 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 and Industrial Findings
- Section 5 – EDC Specific Non-residential 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, Nexant 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. Nexant then conducted on-site surveys to gather the equipment and facility characteristics of Pennsylvania C&I customers, plus reviewed regional end use studies such as the "2006 California Commercial End use Survey" and PECO's 2011 Baseline Report as supplemental sources.

Results in this study are presented at varying levels of resolution with varying levels of confidence for different data points. A total of 420 site surveys stratified by EDC and segment were planned across the state. Where appropriate, the number of observations or "n-values" is included with each table and figure. At the state-wide level sufficient numbers of on-site surveys were available to make reasonable conclusions about each of the commercial segments highlighted in this report. Therefore, data in the statewide section presents results by sector, and by commercial 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, due to varying data collection methods (e.g., telephone vs. site visits) it was not always possible to include PECO data in the findings presented in this report. Where possible, PECO is included in all state non-residential findings. Non-residential tables and figures that exclude PECO data are noted in the report.

3.2 CUSTOMER DATA CHARACTERIZATION

Nexant was provided with comprehensive databases of each EDC's commercial and industrial accounts. The first step in this study was to evaluate these data in order to appropriately structure the study's research and focus so a representative sample could be drawn. The databases included rate codes, 2010 annual sales, and SIC codes for non-residential customers.

3.2.1 Segments

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

Table 3-1: Commercial Segments Defined in Study

Commercial Segment
Institutional
Education
Health
Other
Office
Restaurant
Retail
Grocery
Retail
Warehouse
Misc.
Lodging
Other

The sample is thus designed to capture a state-wide, statistically representative sample by segment, allowing for comparisons across segments (e.g., offices vs. retail). Through conversations with PUC staff, it was revealed that Act 129 has special carve-out targets for institutional buildings defined as government, education and non-profit facilities. Nexant therefore created a separate segment for institutional to be included in the sample[1]. 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, Nexant further stratified the segments into large and small buildings (based on kWh consumption) to capture the full spectrum of facilities when defining its sample.

3.2.2 Premise Counts

To accurately describe building energy consumption, it was important to remove non-premise buildings from each EDC customer database. Nexant 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, Nexant removed the following accounts:

[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 church facilities as a proxy.

- All accounts with 2010 annual consumption lower than would be reasonably expected for a building. This cutoff level was set at 2,000 kWh for commercial and industrial accounts.
- All but the top tenth-percentile of Transportation, Communication & Utilities accounts based on kWh consumption.
- Unclassified accounts after SIC mapping and engineering analysis (Nexant ensured their accounts represented less than 10% of total sales; and in most cases represented only a few percentage points of total sales).
- All "final," closed or inactive accounts in 2010.

Consumption values for these removed accounts represented less than 3.0% 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. Nexant was able to use the SIC and NAICS data to assign accounts to the commercial and industrial segments. For the industrial sector this was a straightforward process since industrial segments are defined as business types. However, segments for the commercial sector 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, Nexant 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. **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.

3.2.4 Sampling Approach

To produce a defensible end use survey, Nexant aimed to gather data at a 95% confidence level with a precision interval of less than 5% (95/5) at the state-wide non-residential level and at least a 90/10 confidence for both the state-wide commercial and industrial 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.) Through on-site surveys, Nexant aimed to achieve these confidence levels and margins of error for both the commercial and industrial sectors.

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

Nexant planned to survey a total of 420 customers across the state with 70 surveys in each of the six EDC territories (53 commercial and 17 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, seventeen industrial surveys were targeted for each EDC – which also provides a confidence of 90/20 for each EDC's specific industrial sector. The next step was to allocate the six commercial segments/strata (office, institutional, retail, restaurant, warehouse and misc.) among each EDC's 53 commercial surveys. Nexant assessed the segment distribution based on kWh consumption from the 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, Nexant 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 confidence/ precision targets.

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

Segment	DLC	MetEd	Penelec	PennPower	PPL	WPP	State	Confidence/ Precision
Industrial	16	14	18	13	14	16	**91**	90/10
Institutional	12	12	13	11	13	13	**74**	90/10
Misc.	13	12	11	13	12	14	**75**	90/10
Office	12	14	9	12	13	7	**67**	90/10
Restaurant	3	4	6	5	4	4	**26**	90/15
Retail	10	10	10	12	10	12	**64**	90/10
Warehouse	3	3	2	5	5	3	**21**	90/20
Total Completed	**69**	**69**	**69**	**71**	**71**	**69**	**418**	95/5
Confidence/Precision	90/10	90/10	90/10	90/10	90/10	90/10	95/5	-

Nexant 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). Nexant 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	MetEd	Penelec	PennPower	PPL	WPP
Industrial	38,380	24,181	17,850	23,620	26,188	27,200
Institutional	42,100	39,267	49,712	58,712	27,808	23,916
Misc.	26,960	17,861	13,054	17,800	20,267	14,995
Office	15,710	13,797	12,648	15,478	14,704	14,398
Restaurant	83,725	55,899	48,286	67,996	63,896	59,896
Retail	54,820	23,884	21,116	24,496	30,062	25,389
Warehouse	39,625	17,760	12,186	30,136	13,758	10,496

3.3 PRIMARY DATA COLLECTION

On-site surveys conducted by trained field engineers was the primary method for collecting relevant data on the energy-using characteristics of commercial and industrial 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 Nexant 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, Nexant 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. Nexant 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** & **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, Nexant 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 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 418 completed surveys by a single engineer to further ensure consistency. The complete on-site survey is included in Error! Reference source not found..

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 $50 dollar gift card was offered to small business customers who permitted a site visit. Following the site visit all data were entered into an Access 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 displays the end uses included in this study.

Table 3-4: Commercial and Industrial 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

Nexant contacted 4,836 customers across the state and performed a total of 418 site visits with an average recruitment rate of 8.6%. Table 3-5, below, shows the number of customers involved in this survey.

Table 3-5: Overall Survey Results

EDC	Customers Contacted	Surveys Completed	Recruitment Rate
Duquesne Light	879	69	7.8%
MetEd	893	69	7.7%
Pennelec	849	69	8.1%
PennPower	845	71	8.4%
PPL	674	71	10.5%
WPP	696	69	9.9%
Total	**4,836**	**418**	**8.6%**

Source: Call Lists

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 2010 PECO Baseline Study

Early on in the process of this study it was decided on-site surveys would not be performed in the PECO service territory since a comprehensive Baseline Study was performed on its C&I customers in 2010. Nexant worked with the authors of the PECO Baseline Study Report to review, analyze and incorporate findings from the existing study with findings from this study when possible. It was not always possible to incorporate PECO into all statewide findings included in this report due to varying surveying techniques and scopes of work. Unless otherwise noted, PECO data is only included for the non-residential findings (commercial and industrial combined) at the state-wide level. PECO data is not included for any of the individual commercial, industrial or commercial segment findings. Therefore, the reader should be mindful of when PECO data is included in statewide findings and when it is not.

3.4.2 Other Data Sources

Nexant 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 Nexant 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, Nexant 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 commercial and industrial 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, Nexant compared the segment electricity consumption share in the sample with that of the full population across the state. In other words, Nexant 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 reasonable results for each of the EDC territories, it was decided to sample 70 C&I 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 state-wide level. This approach, therefore, provides more weight to the data for larger EDCs (e.g., PPL) when compared to smaller EDCs (e.g., Penelec) in the statewide findings. These weights were applied at the non-residential and sector (commercial and industrial) level. Weighting factors were not applied to commercial segment findings at the state-wide level. Different weighting factors were used for each EDC's commercial, industrial and non-residential sectors. Furthermore, depending on the availability of PECO data,

weighting factors were calculated with and without PECO. Table 3-6, details the weights that were applied throughout the analysis when rolling up EDC data to statewide findings.

Table 3-6: EDC Weighting Factors by Sector (Premise Counts with and without PECO)

Commercial Premises: Weighting Factors Including PECO								
	Duquesne	MetEd	PECO	Penelec	PennPower	PPL	WPP	Total
Premises	40,348	35,780	93,873	47,321	12,527	92,112	54,024	375,986
Weight	**0.107**	**0.095**	**0.250**	**0.126**	**0.033**	**0.245**	**0.144**	
Industrial Premises: Weighting Factors Including PECO								
	Duquesne	MetEd	PECO	Penelec	PennPower	PPL	WPP	Total
Premises	1,224	6,034	7,688	7,759	1,964	10,905	6,183	41,756
Weight	**0.029**	**0.144**	**0.184**	**0.186**	**0.047**	**0.261**	**0.148**	
Non-Residential (C&I) Premises: Weighting Factors Including PECO								
	Duquesne	MetEd	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	41,572	41,814	101,561	55,080	14,491	103,017	60,207	417,742
Weight	**0.100**	**0.100**	**0.243**	**0.132**	**0.035**	**0.247**	**0.144**	
Commercial Premises: Weighting Factors Excluding PECO								
	Duquesne	MetEd	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	40,348	35,780	-	47,321	12,527	92,112	54,024	282,113
Weight	**0.143**	**0.127**	**0.000**	**0.168**	**0.044**	**0.327**	**0.191**	
Industrial Premises: Weighting Factors Excluding PECO								
	Duquesne	MetEd	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	1,224	6,034	-	7,759	1,964	10,905	6,183	34,068
Weight	**0.036**	**0.177**	**0.000**	**0.228**	**0.058**	**0.320**	**0.181**	
Non-Residential (C&I) Premises: Weighting Factors Excluding PECO								
	Duquesne	MetEd	PECO	Penelec	Penn Power	PPL	WPP	Total
Premises	41,572	41,814	-	55,080	14,491	103,017	60,207	316,181
Weight	**0.131**	**0.132**	**0.000**	**0.174**	**0.046**	**0.326**	**0.190**	

3.5.3 Energy Use Intensity Calculations

For each commercial segment, overall and end use consumption values were calculated as an Energy Use Intensity (EUI) by dividing 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 commercial segment. This data was screened for a bias. For example, if there was an overpopulation of some 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]. Finally,

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

segment EUIs were confirmed by comparing the known segment sales against the calculated consumption found by multiplying EUI against average segment square footage and premise count.

Commercial segment end use EUIs were further developed by utilizing known building EUI shares for non-weather dependent end uses from available regional sources such as CBECS. These values were confirmed by analyzing on-site data collected for lighting power densities, which were converted into lighting EUIs and compared. 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 Nexant to survey the entire population of Pennsylvania commercial and industrial businesses, 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 state-wide 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 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, 0.1

Using this equation, it can be found that the minimum sample size required to achieve 95/5 confidence is 385. Nexant's targeted sample size of 420 customers from commercial and industrial 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 420 C&I 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 420 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 21 surveys vs. 69 surveys in the office segment).

To assist the reader in identifying the level of certainty associated with each finding, we have included a "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. Finally, it should be noted that n-values were not available for PECO's findings so we have denoted those with a "N/A." The reader should therefore be aware that the reported state non-residential n-values do not include PECO sample points and are lower than what was actually performed across the state when factoring in PECO's completed site surveys[1].

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 which 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, Nexant 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, Nexant 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, Nexant believes that the results of the survey can be used to make reasonable assumptions about the characteristics of the overall customer base of the six EDCs included in this study.

[1] A total of 145 on-site surveys were performed in the PECO territory.

4 STATEWIDE COMMERCIAL & INDUSTRIAL FINDINGS

4.1 INTRODUCTION

This section presents results of the on-site survey and the findings of the subsequent data analysis for the non-residential, commercial, industrial sectors, and where possible data is also presented by commercial segment. in the State of Pennsylvania. 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 418 on-site surveys conducted by Nexant and Mondre Energy engineers. Secondary data was used to fill in data gaps when deemed appropriate. All findings, except those in the lighting end-use, are presented by premise. As such the reader should be mindful that the saturation of certain large-scale system types such as chillers may appear low when presented in this manner (as a single chiller can service a very large share of floor stock).

Note: Unless otherwise noted, PECO data is only included for the state non-residential findings (commercial and industrial combined). PECO data is <u>not</u> included for any of the more granular commercial orindustrial findings, or commercial segment findings.

4.2 STATEWIDE COMMERCIAL & INDUSTRIAL OVERVIEW

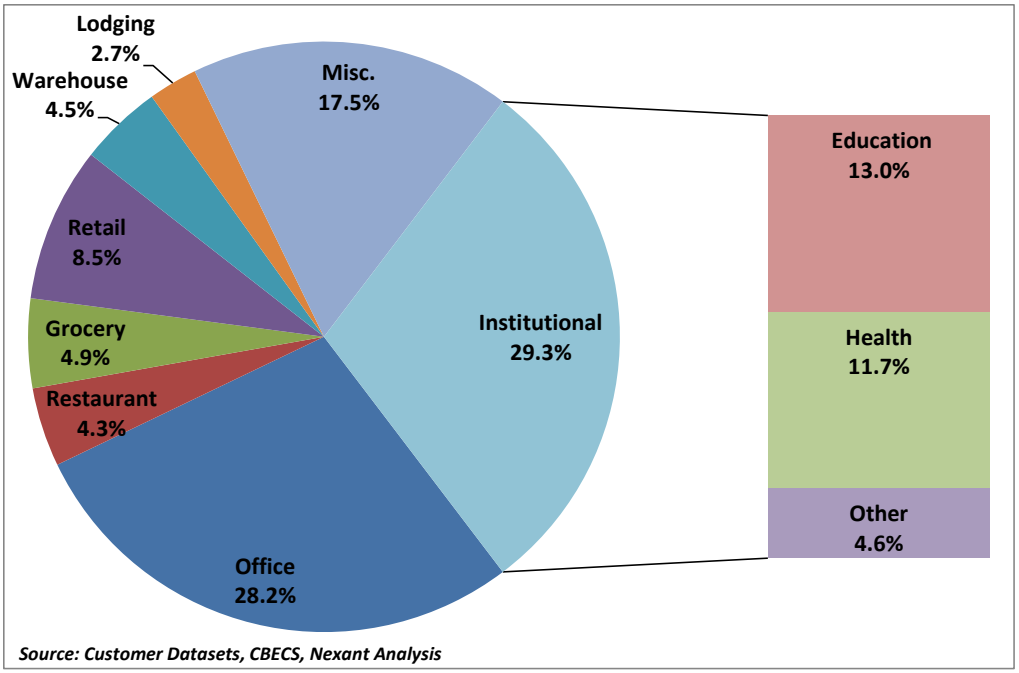
Based on the findings of Nexant's primary and secondary research, the electricity usage of Pennsylvania's commercial and industrial sector has been broken down by segment (type of building) and end use. The findings presented below are primarily derived from on-site survey data, with adjustments made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

4.2.1 Electricity Consumption by Segment

Data presented below are derived from the 2010 customer sales data from each of the EDCs. Figure 4-1 and Table 4-1 show the break-down of electrical usage by commercial segment. Figure 4-2 and Table 4-2 show the same break-down by industrial segment. The institutional segment consumes the largest share of electricity (29.3%) across the state in the commercial sector, followed by the office segment (28.2%). The manufacturing of metals consumes the largest share of electricity in the industrial sector (29.2%) with a number of steel manufacturers located throughout the state followed by "other" manufacturing at 23.9%[1]..

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

Figure 4-1: 2010 Statewide Commercial Electricity Consumption by Segment



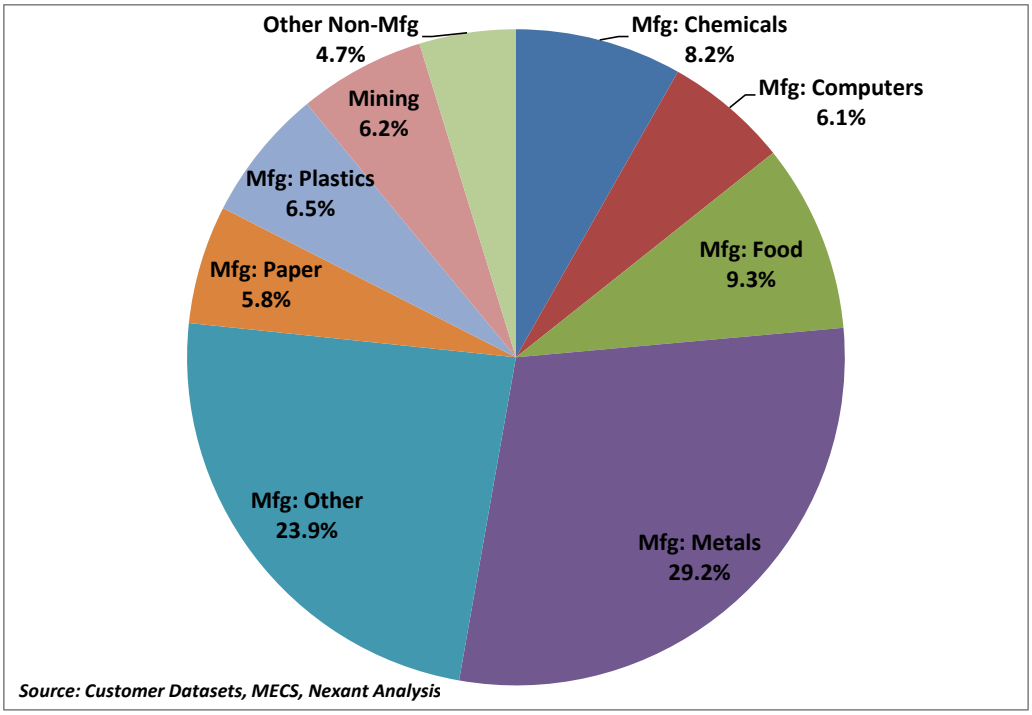
Source: Customer Datasets, CBECS, Nexant Analysis

Table 4-1: 2010 Statewide Commercial Electricity Consumption by Segment

Commercial Segment	Consumption (MWh)	Electricity Share
Institutional	**15,460,540**	**29.3%**
Education	6,858,876	13.0%
Health	6,166,279	11.7%
Other	2,435,385	4.6%
Office	**14,859,623**	**28.2%**
Restaurant	**2,284,546**	**4.3%**
Retail	**7,050,787**	**13.4%**
Grocery	2,577,430	4.9%
Retail	4,473,357	8.5%
Warehouse	**2,390,718**	**4.5%**
Misc.	**10,654,727**	**20.2%**
Lodging	1,418,697	2.7%
Other	9,236,030	17.5%
Total	**52,700,941**	**100.0%**

Source: Customer Dataset, CBECS, Nexant Analysis

Figure 4-2: 2010 Statewide Industrial Electricity Consumption by Segment



Source: Customer Datasets, MECS, Nexant Analysis

Table 4-2: 2010 Statewide Industrial Subsector Energy Consumption by Segment

Industrial Segment	Consumption (MWh)	Electricity Share
Mfg: Chemicals	2,814,937	8.2%
Mfg: Computers	2,094,323	6.1%
Mfg: Food	3,185,786	9.3%
Mfg: Metals	10,030,211	29.2%
Mfg: Other	8,209,110	23.9%
Mfg: Paper	2,008,114	5.8%
Mfg: Plastics	2,242,259	6.5%
Mining	2,135,127	6.2%
Other Non-Mfg.	1,629,127	4.7%
Total	**34,348,993**	**100%**

Source: Customer Dataset, MECS, Nexant Analysis

4.2.2 End Use Saturations & Fuel Shares

Table 4-3 shows the saturation of different end uses in Pennsylvania non-residential facilities. Saturation is defined as the percentage of buildings with a given end use present. In some cases saturation 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. Fuel shares by end use are also presented. Space heating, water heating and cooking fuel shares are also represented, by commercial segment, in Table 4-4 through Table 4-6 below. Space cooling is

present in 80.4% of the buildings surveyed, with cooking and refrigeration present in 40.6% and 26% of the buildings, respectively. This saturation varies significantly by segment, with a much higher saturation of refrigeration and cooking equipment in restaurants. 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. Electricity provides about 28% of the fuel for space heating for all non-residential buildings. Electricity fuels about two-thirds of cooking and water heating, however, the restaurant segment's fuel share for electricity drops down to 44%. Restaurants also have a higher than average electricity fuel share with space heating at just over 56%, with the remaining segments' space heating being fueled primarily by natural gas. Also of note is the relatively high use of LPG fuel in warehouses.

Table 4-3: Non-Residential End use Saturations and Fuel Shares

End Use	Saturation	Fuel Share				
		Electric	Natural Gas	Fuel Oil	Other[3]	n-values
Lighting	100.0%	100.0%	0.0%	0.0%	0.0%	-
Space Heating	100.0%	27.7%	52.0%	13.0%	7.3%	646
Space Cooling	80.4%	100.0%	0.0%	0.0%	0.0%	-
Plug Load	100.0%	100.0%	0.0%	0.0%	0.0%	-
Refrigeration	26.0%	100.0%	0.0%	0.0%	0.0%	-
Cooking	40.6%	65.5%[1]	29.5%	5.1%	0.0%	498
Water Heating	84.5%	63.2%	32.4%	1.6%	2.7%	424
Other[2]	100.0%	100.0%	0.0%	0.0%	0.0%	-

Source: On-site Surveys
[1] Excludes PECO data
[2] "Other" End Use includes motors, pumps and misc. equipment
[3] "Other" fuel share includes LPG, wood, and misc. fuels

Table 4-4: Space Heating Fuel Shares by Commercial Segment

Segment	Fuel Share					
	Electricity	Natural Gas	Fuel Oil	LPG	Other[1]	n-values
Institutional	31.9%	58.5%	8.9%	0.0%	0.7%	135
Office	34.7%	53.5%	6.3%	3.9%	1.6%	127
Restaurant	56.7%	33.3%	6.7%	3.3%	0.0%	30
Retail	23.7%	57.7%	11.3%	1.0%	6.2%	97
Warehouse	25.0%	58.3%	0.0%	12.5%	4.2%	24
Misc.	25.5%	54.1%	12.2%	4.1%	4.1%	98

Source: On-site Surveys
[1] "Other" fuel share includes LPG, wood, and misc. fuels

Table 4-5: Water Heating Fuel Shares by Commercial Segment

Segment	Fuel Share					
	Electricity	Natural Gas	Fuel Oil	LPG	Other[1]	n-values
Institutional	40.4%	51.9%	3.9%	2.9%	1.0%	104
Office	65.7%	34.3%	0.0%	0.0%	0.0%	67
Restaurant	40.0%	56.7%	0.0%	0.0%	3.3%	30
Retail	66.7%	33.3%	0.0%	0.0%	0.0%	54
Warehouse	81.3%	6.3%	0.0%	6.3%	6.3%	16
Misc.	55.2%	35.8%	3.0%	4.5%	1.5%	67

Source: On-site Surveys
[1] "Other" fuel share includes LPG, wood, and misc. fuels

Table 4-6: Cooking Fuel Shares, by Commercial Segment[1]

Segment	Fuel Share			
	Electricity	Natural Gas	Propane	n-values
Institutional	43.9%	51.5%	4.5%	132
Office	100.0%	0.0%	0.0%	19
Restaurant	43.8%	48.2%	8.0%	112
Retail	81.0%	19.0%	0.0%	21
Warehouse	-	-	-	n/a
Misc.	53.7%	35.2%	11.1%	54

Source: On-site Surveys
[1] Excluding residential microwaves

4.2.3 Energy Use Intensities

Energy use intensity (EUI) is a useful metric to measure how much electricity is consumed per square foot of building space and provides insight into how different building types and end uses consume electricity. Nexant calculated the EUI for each end use studied. To come up with EUIs by segment and end use a variety of data points were utilized. Customer sales data for 2010 (kWh) was paired with the square footages of those buildings surveyed by Nexant and Mondre engineers to come up with average EUIs by segment. End use EUIs were calibrated using a combination of national data, on-site data and with the modeling program eQuest. Figure 4-3 and Table 4-7 below summarize the findings for EUIs for each commercial segment and relevant end use. The grocery segment is the most energy-intensive at 50.1 kWh/ft^2, due to the large amounts of electricity used to refrigerate foods. On the other end of the spectrum, warehouse is the least energy-intensive segment using only 7.1 kWh/ft^2. HVAC is the most energy-intensive end use consuming an average of 5.7 kWh/ft^2 across all the segments.

Figure 4-3: Energy Use Intensity (kWh/ft²) by End use, by Commercial Segment

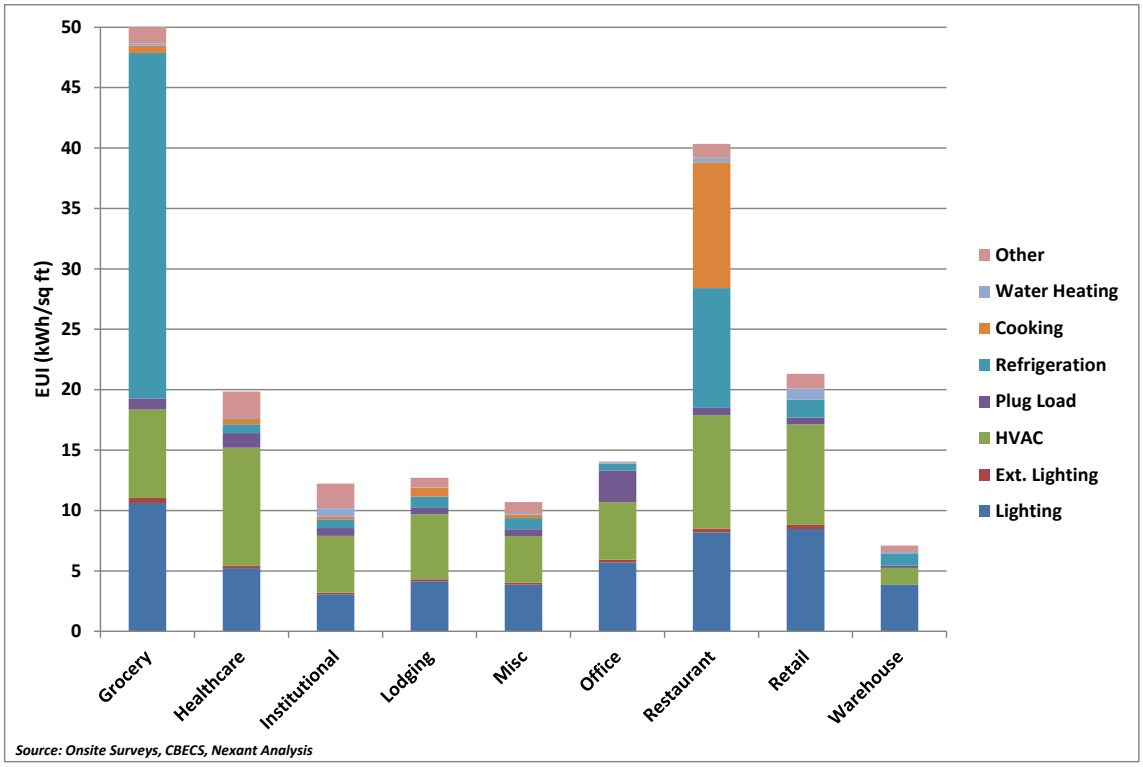


Table 4-7: Energy Use Intensity (kWh/ft²) by End use, by Commercial Segment[(1)]

End Use	Grocery	Healthcare	Institutional	Lodging	Misc.	Office	Restaurant	Retail	Warehouse	Weighted Avg.
Lighting	10.6	5.2	3.1	4.1	3.9	5.7	8.2	8.5	3.8	5.3
Ext. Lighting	0.4	0.2	0.1	0.2	0.2	0.2	0.3	0.4	0.0	0.2
HVAC	7.3	9.8	4.7	5.4	3.9	4.8	9.4	8.3	1.4	5.7
Plug Load	0.9	1.2	0.6	0.5	0.6	2.6	0.6	0.6	0.2	1.2
Refrigeration	28.6	0.7	0.7	1.0	0.9	0.6	9.9	1.5	1.0	2.6
Cooking	0.6	0.4	0.3	0.7	0.3	0.0	10.4	0.0	0.0	0.6
Water Heating	0.2	0.1	0.7	0.0	0.1	0.1	0.4	0.9	0.1	0.3
Other	1.4	2.2	2.0	0.8	0.9	0.1	1.2	1.2	0.6	1.1
Total	**50.1**	**19.9**	**12.2**	**12.7**	**10.7**	**14.1**	**40.4**	**21.3**	**7.1**	**17.0**

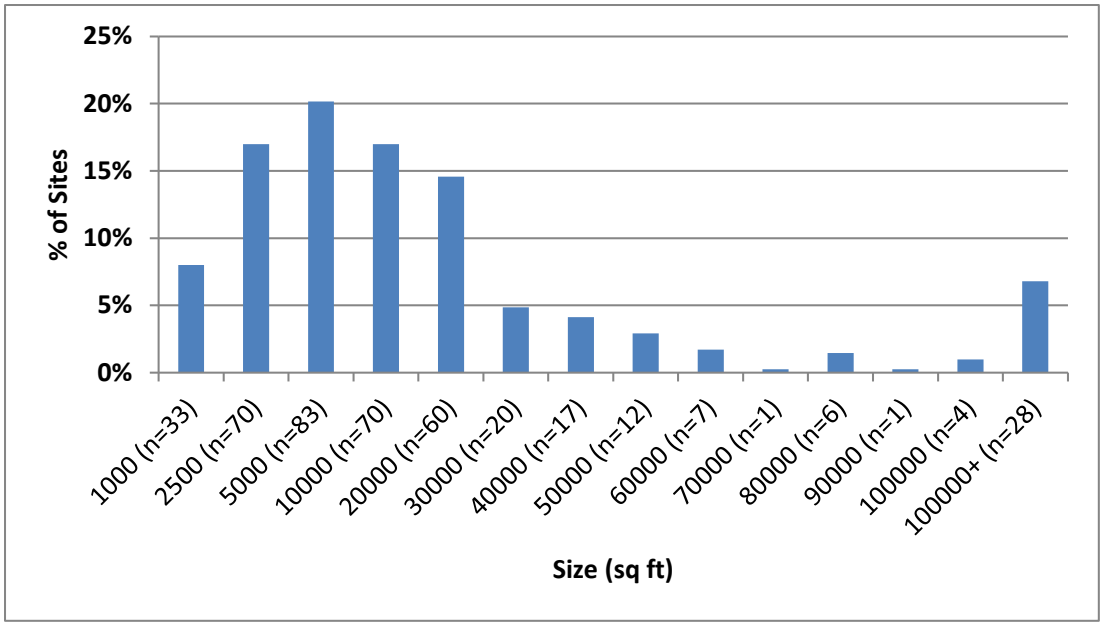
Source: On-site Surveys, CBECS, Nexant Analysis

[(1)] End use EUI values may not add up to total EUIs by segment due to rounding

4.2.4 Building Information

Figure 4-4 shows the distribution of building size for all commercial and industrial buildings surveyed. More than 60% of the buildings visited were between 2,500 ft² and 20,000 ft². A substantial portion (6.8%) of the buildings visited by Nexant and Mondre 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 4-4: Building Size Distribution of Buildings Surveyed(1)



Source: On site surveys

(1) Excludes PECO data

Table 4-8 through Table 4-11 provide an overview of additional characteristics of buildings in the commercial and industrial sector. Average number of occupants recorded was 70.5 and ranged from 16.3 for warehouses up to 211.7 for institutional segments (driven in large part by schools and colleges premises). The average number of floors per premise is 1.8. Over 5% of the buildings across the C&I sectors have been commissioned[1] in the previous five years, with less than 1% being LEED certified. The average R-value of walls is 11.9 across all building types in Pennsylvania.

Table 4-8: Building Characteristics by Sector, by Segment

Parameter	Unit	Non-Residential	n-values[1]	Industrial	Comm-ercial	Institutional	Office	Restaurant	Retail	Warehouse	Misc.
Avg. Age	Years	52.9	385	49.9	53.9	53.7	47.5	70.2	54.3	42.6	52.0
Avg. # of Occupants	-	70.5	394	28.2	76.5	211.7	35.3	30.1	24.6	16.3	44.8
Avg. # of Floors	-	1.8	404	1.3	1.6	1.8	1.8	1.6	1.4	1.1	1.7

Source: On-site Surveys

(1) n-values for non-residential findings only

[1] Commissioning refers to the process of verifying that all building systems (HVAC, lighting, etc.) are functioning properly and as intended by the architect and builder.

Table 4-9: Building Efficiency Levels by Sector

Parameter	Non-Residential[(1)]	n-values[(2)]	Industrial	Commercial
Percentage Building Commissioned	16.5%	418	8.5%	17.9%
Percentage Commissioned in last 5 Years	5.2%	418	5.0%	5.4%
Percentage Buildings LEED Certified	0.2%	418	0.0%	0.3%

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential findings only

Table 4-10: Building Wall Insulation Characteristics by Sector, by Segment[1]

Sector, Segment	Avg. Insulation (R-Value)	n-values
Non-Residential	11.9	166
Industrial	11.9	37
Commercial	14.0	129
Institutional	13.0	26
Office	14.3	29
Restaurant	8.8	7
Retail	12.0	33
Warehouse	7.5	11
Misc.	13.5	23

Source: On-site Surveys

Table 4-11: Building Window Characteristics by Sector

Parameter	Non-Residential	n-values[(2)]	Industrial	Commercial
Glazing Percentage of Walls[(1)]	15.3%	351	7.3%	17.3%
Percentage Double Paned	47.3%	418	36.0%	41.1%
Percentage Metal Framed	57.5%	418	54.2%	51.2%

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential findings only

Figure 4-5 and Table 4-12 illustrate when buildings were constructed across the state broken out by sector and commercial segment. Pennsylvania has a relatively old building stock when compared to other parts of the U.S. with an average building age of 52.9 years. Restaurants were noticeably older than other building types with an average age of 70.2 years and 22% of these buildings being constructed between 1900 and 1920. Just over half of the building stock in Pennsylvania was constructed between 1960 and 2000. Building age follows similar trends within segments.

[1] Note: "Commercial" represents the weighted average of each EDC's combined segment results (e.g. retail, office, warehouse, etc. averaged together). As such, PECO data is not included in this, or any future, state-wide commercial results. PECO data is only included in state-wide Non Residential findings, unless otherwise noted.

Figure 4-5: Year of Building Construction for Non-Residential Buildings (n=383)

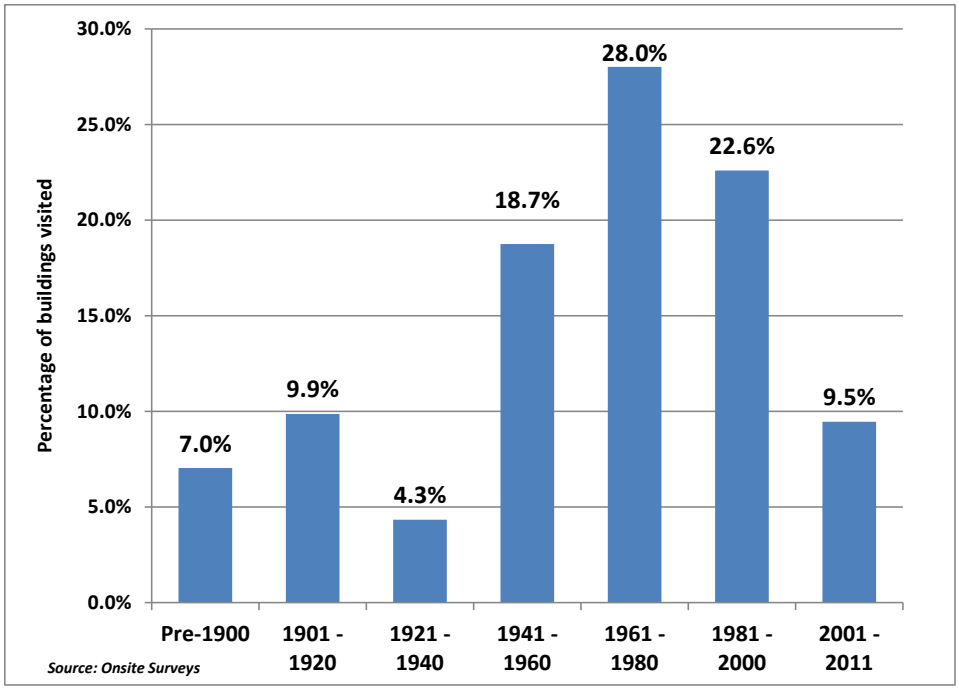


Table 4-12: Year of Building Construction by Sector, by Segment

Year Range	Non-Residential	Industrial	Commercial	Institutional	Office	Restaurant	Retail	Warehouse	Misc.
Pre-1900	7.0%	3.5%	6.9%	7.1%	6.8%	4.5%	6.7%	0.0%	7.5%
1901 - 1920	9.9%	11.6%	10.4%	10.0%	8.5%	22.7%	11.7%	11.1%	7.5%
1921 - 1940	4.3%	5.2%	3.8%	0.0%	3.4%	4.5%	3.3%	5.6%	6.0%
1941 - 1960	18.7%	17.3%	19.3%	31.4%	10.2%	13.6%	16.7%	22.2%	17.9%
1961 - 1980	28.0%	27.3%	27.3%	21.4%	35.6%	27.3%	26.7%	16.7%	34.3%
1981 -2000	22.6%	31.8%	22.5%	21.4%	22.0%	27.3%	31.7%	33.3%	13.4%
2001 - 2011	9.5%	3.3%	9.9%	8.6%	13.6%	0.0%	3.3%	11.1%	13.4%
n-values	383	87	296	70	59	22	60	18	67

Source: On-site Surveys

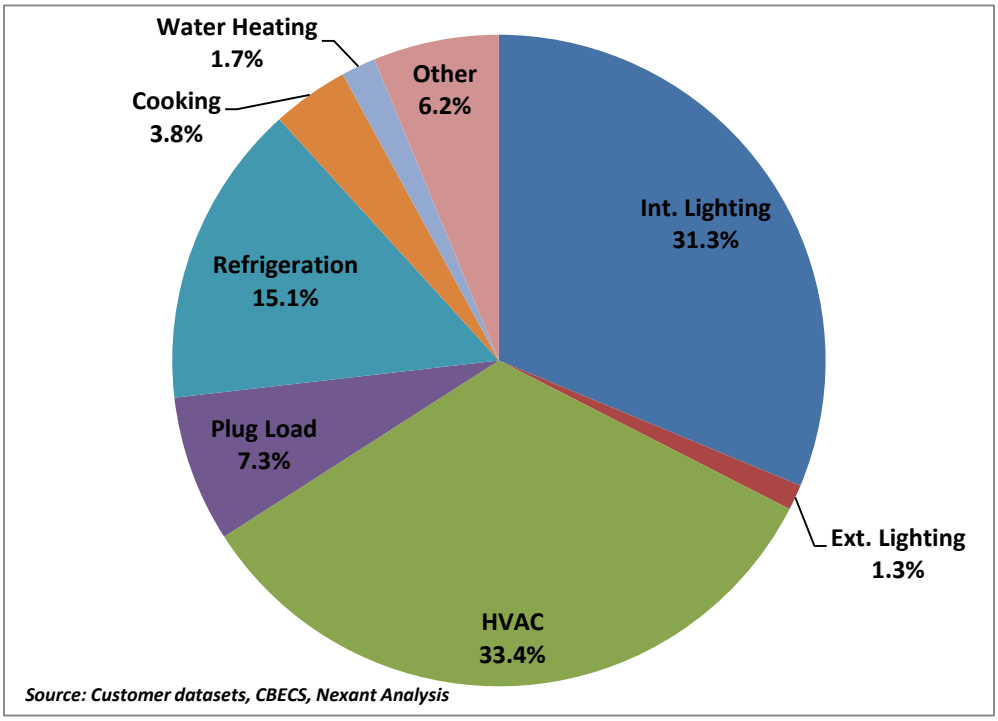
4.3 STATEWIDE COMMERCIAL & INDUSTRIAL END USE FINDINGS

This section provides detailed findings of each end use for the commercial and industrial sectors in Pennsylvania. All findings, except those in the lighting end-use, are presented by premise. As such the reader should be mindful that the saturation of certain large-scale system types such as chillers may appear low (as a single chiller can service a very large share of floor stock).

Figure 4-6, Table 4-13, and Figure 4-7 show the percentage share of electricity consumption for each end use present in the commercial and industrial sectors respectively. The HVAC and interior

lighting end use represents almost two-thirds of all electricity usage in commercial buildings in Pennsylvania (at 33.4% and 31.3% respectively), followed by refrigeration at 15.1%. The "Other" end use represents primarily pumps and other miscellaneous electrical loads in buildings. When broken out by segment, the energy distribution is fairly consistent across end uses except for the restaurant and retail segments. The refrigeration end use consumes the significant share of electricity in the retail segment because grocery stores (with a high saturation of refrigerated cases) are included in this segment. In the industrial sector, motors consume almost half (43.6%) of all the electricity across the state. Process loads (heating, cooling and electro-chemical) make up another 30% of the electricity consumption.

Figure 4-6: Commercial System Electricity Share by End Use



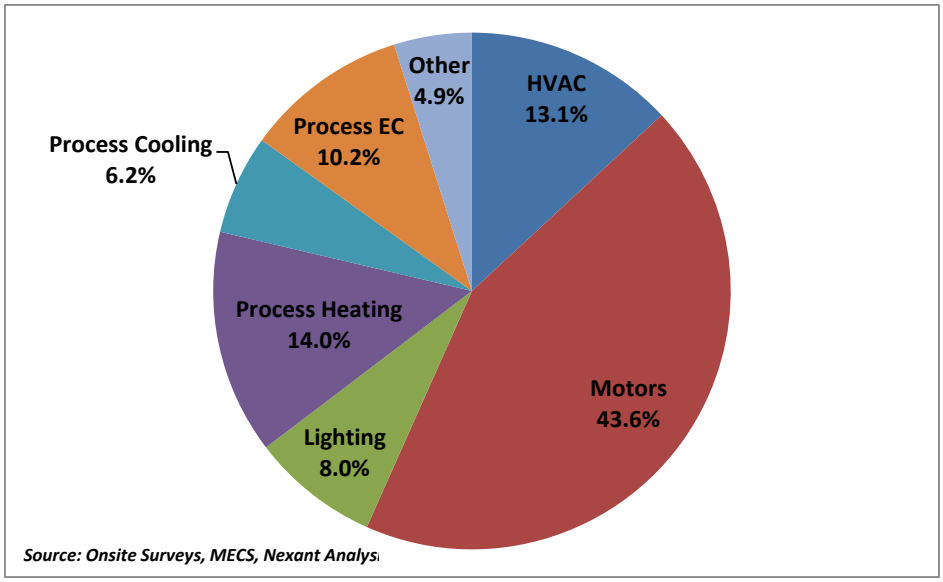
Source: Customer datasets, CBECS, Nexant Analysis

Table 4-13: Electricity Share by End Use, by Commercial Segment

End Use	Institutional	Office	Restaurant	Retail	Warehouse	Misc.
Lighting	25.7%	40.5%	20.3%	29.1%	54.0%	36.1%
Ext. Lighting	1.1%	1.7%	0.8%	1.2%	0.0%	1.5%
HVAC	44.0%	33.8%	23.2%	25.0%	19.8%	36.2%
Plug Load	5.7%	18.8%	1.5%	2.2%	2.5%	5.1%
Refrigeration	4.7%	4.1%	24.6%	35.8%	14.5%	8.8%
Cooking	2.1%	0.0%	25.8%	0.7%	0.0%	2.6%
Water Heating	2.8%	0.8%	0.9%	2.0%	1.3%	1.3%
Other	13.8%	0.4%	2.9%	4.1%	7.9%	8.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: On-site Surveys, CBECS, Nexant Analysis

Figure 4-7: Industrial System Electricity Share by End Use



4.3.1 Heating, Ventilation & Cooling (HVAC)

As shown above, heating and cooling of buildings represents about a third of a commercial 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 4-8 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 (52%), with 27.7% of space heating equipment fueled by electricity.

Figure 4-8: Non-Residential Space Heating Fuel Share (n=386)

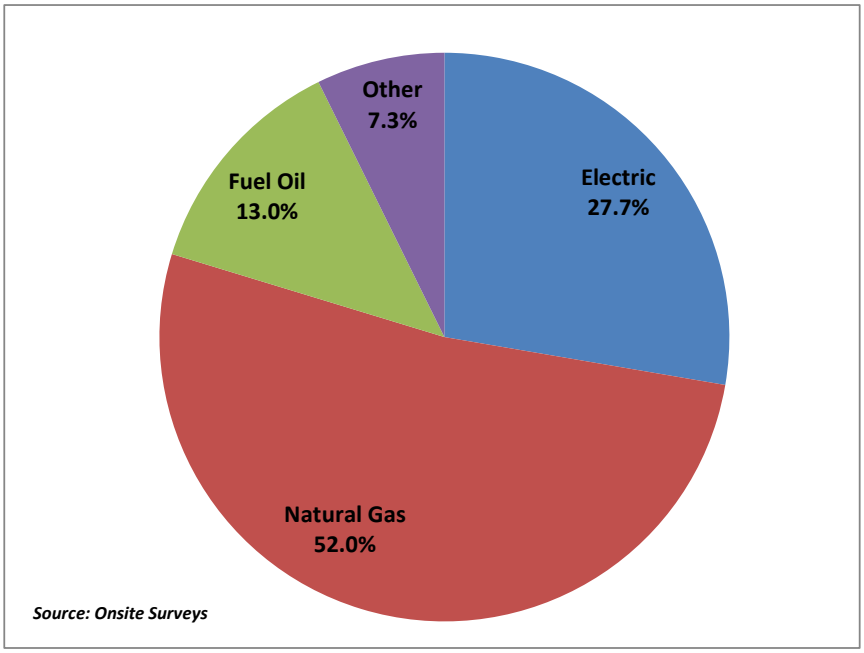
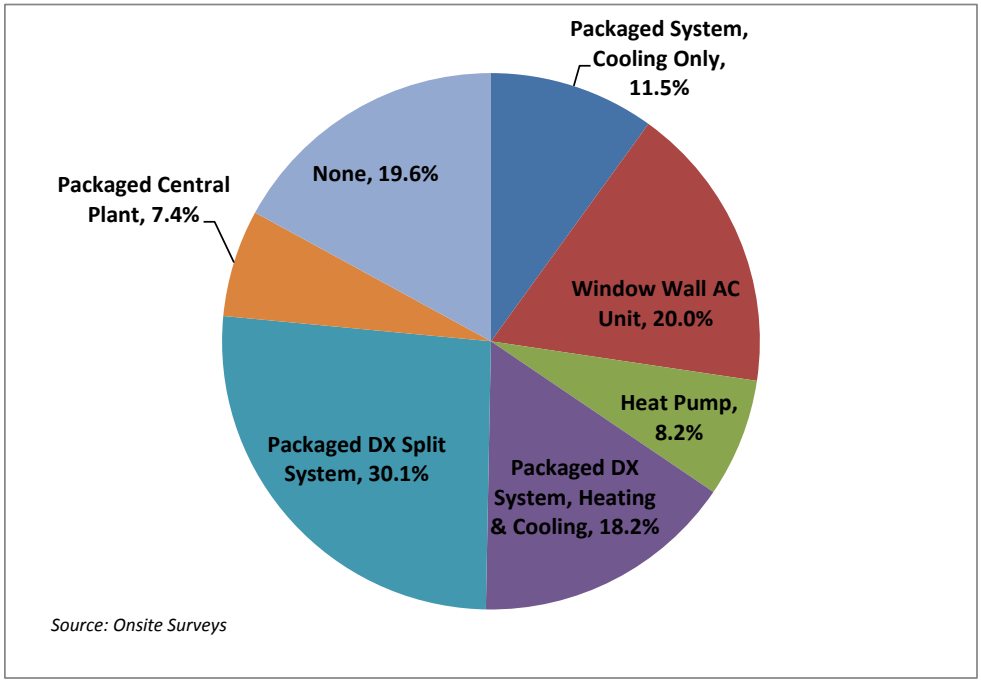


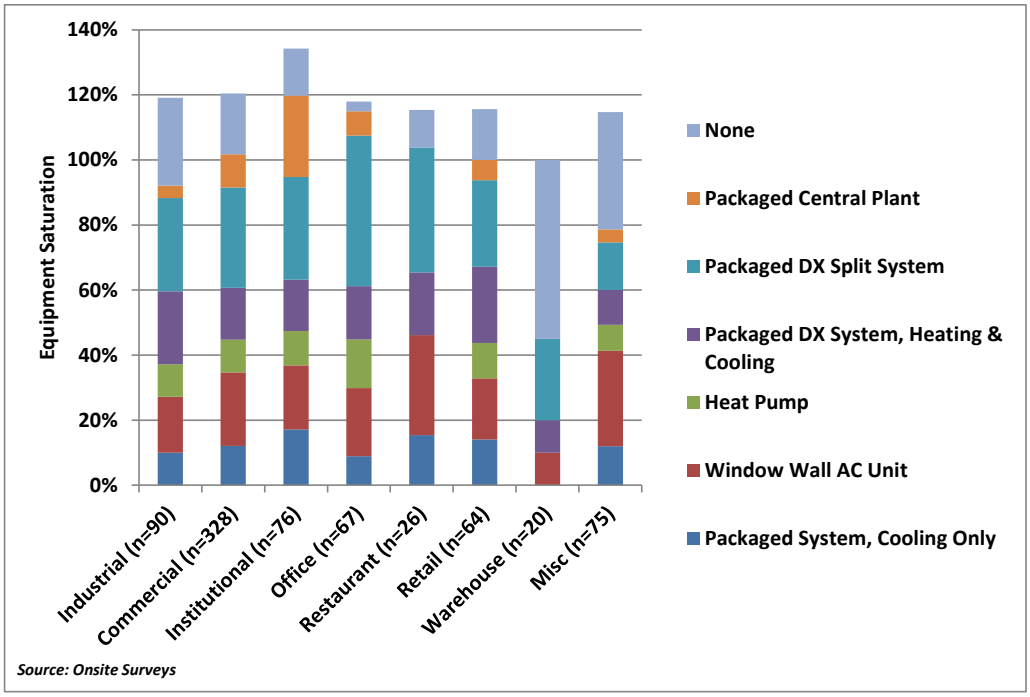
Figure 4-9 and Figure 4-10 show the prevalence of different types of cooling systems across the state, presented statewide and then by industrial sector and commercial segment, respectively. Space cooling findings are presented as the percentage of buildings with a given system type present. For example, if a building had one chiller (packaged central plant), but also 35 window wall A/C units it was counted as simply two system types present in one building . Counts were then divided by the total number of buildings (418) so that a meaningful "none" category could be presented (note: many buildings have multiple cooling systems present so percentages may add up to more than 100%). Packaged DX Split Systems were present in the largest share of buildings (30.1%) surveyed across the state. Also of note is that just over 19% of the 418 surveyed buildings had no cooling systems installed. Differences between saturation shares were minimal when comparing sectors and segments. Warehouses, however, had a significantly higher percentage of buildings (55%) with no cooling systems.

Figure 4-9: Saturation of Cooling Equipment in Non-Residential Buildings[(1)] (n=494)



(1) Percentages add up to more than 100% because buildings may have multiple systems

Figure 4-10: Saturation of Cooling Equipment in Buildings by Sector, by Segment [1]



(1) Percentages add up to more than 100% because buildings may have multiple systems

Table 4-14 summarizes some of the key parameters of cooling systems in the commercial and industrial sectors. The average age of cooling systems in the state is 10.8 years, with an average cooling capacity of 6.2 tons. The average SEER value for DX cooling systems in Pennsylvania is 12.0. The penetration of automatic control systems like programmable thermostats ranges from 0% to 19% 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 4.2% of the buildings surveyed, with a significant saturation in health and education facilities (institutional).

Table 4-14: DX Cooling Parameters

Sector, Segment	Avg. Age (Yrs)	Avg. Cooling Capacity (tons)	Avg Cooling Efficiency (SEER/EER)	Percentage Programmable	Percentage with EMS
Non-Residential[(1)]	10.8	6.2	12.0 / 10.3	13.0%	4.2%
n-values[(2)]	131	210	57 / 45	163	163
Industrial	10.0	5.7	8.5 / 10.4	7.8%	0.0%
Commercial	10.7	6.3	12.0 / 10.3	13.0%	4.2%
Institutional	11.8	11.5	11.9 / 10.8	10.3%	20.5%
Office	10.5	4.9	12.1 / 10.2	19.4%	0.0%
Restaurant	9.4	4.1	16.0 / 10.2	0.0%	0.0%
Retail	11.9	5.3	11.2 / 9.6	8.0%	0.0%
Warehouse	8.7	3.8	13.0 / NA	0.0%	0.0%
Misc.	7.9	4.0	11.6 / 10.4	13.6%	4.5%

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential findings only

Figure 4-11 and Figure 4-12 show the prevalence of different types of heating systems across the state, presented statewide and then by sector and commercial segment, respectively. Space heating findings are presented by equipment type as a percentage of total heating systems. Similar to the cooling, the heating systems are fairly evenly distributed across the business types.

Figure 4-11: Saturation of Heating Equipment Types in Non-Residential Buildings (n=418)

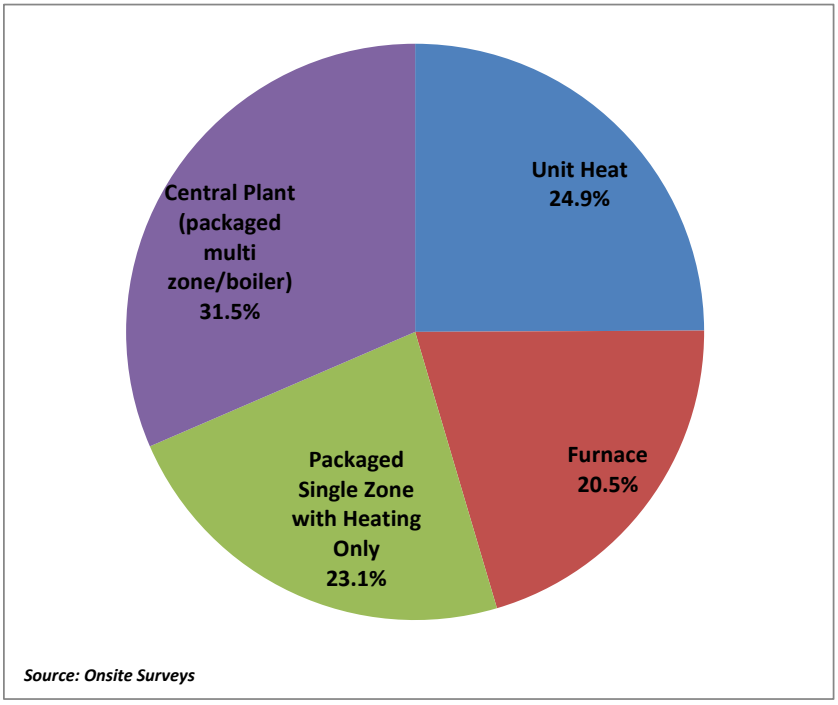


Figure 4-12: Saturation of Heating Equipment Types in Buildings by Sector, by Segment

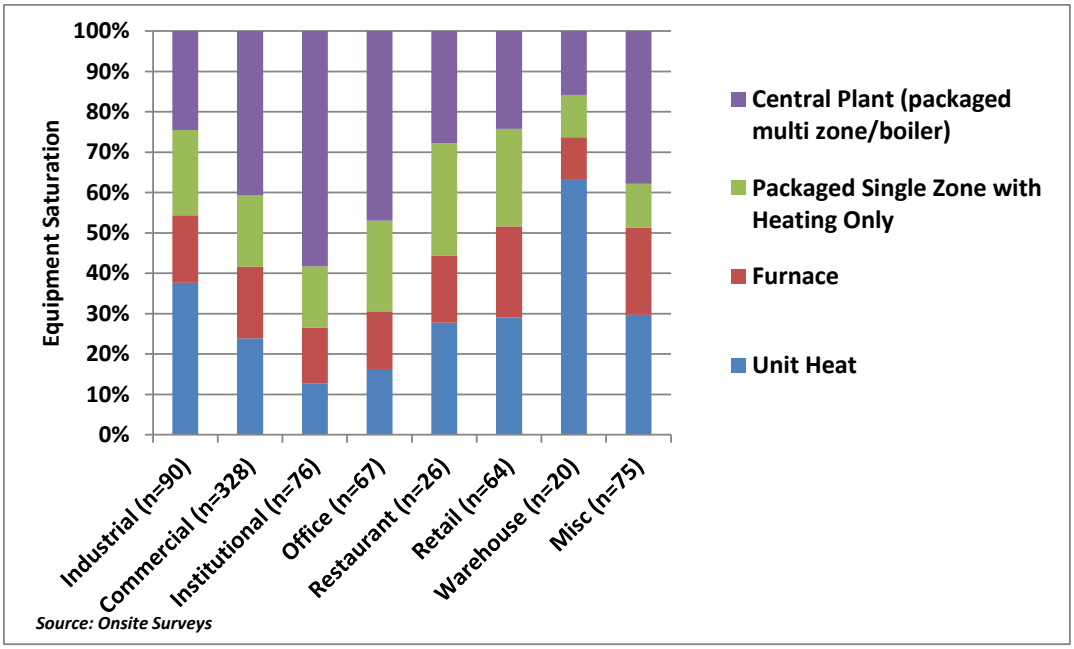


Table 4-15 summarizes some of the key parameters of heating systems (excluding boilers) in the commercial and industrial sectors. Table 4-16 presents the same parameters for just boilers. The average age of heaters and boilers in non-residential buildings across the state is 11.4 and 16.8 years, respectively. Similar to cooling systems, there was a higher saturation of energy management systems in the institutional segment, with more than 30% of boilers being controlled by an EMS.

Table 4-15: Heating Equipment Parameters

Sector, Segment	Avg. Age (Yrs)	Avg. Heating Capacity (Btu/hr)	Heating Efficiency (%)	Percentage Programmable[(1)]	Percentage EMS[(1)]
Non-Residential	11.4	237,169	87.7%	5.8%	2.6%
n-values[(2)]	66	154	12	84	84
Industrial	13.1	322,903	80.0%	0.0%	0.0%
Commercial	10.9	104,312	88.2%	8.4%	3.8%
Institutional	12.4	158,650	94.8%	5.3%	21.1%
Office	10.3	85,278	97.6%	0.0%	0.0%
Restaurant	7.7	101,788	N/A	0.0%	0.0%
Retail	12.7	113,694	87.0%	4.8%	0.0%
Warehouse	9.3	128,962	N/A	0.0%	0.0%
Misc.	11.2	85,298	80.0%	14.3%	4.8%

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential findings only

Table 4-16: Boiler Heating Parameters

Sector, Segment	Avg. Age (Yrs)	Avg. Heating Capacity (Btu/hr)	Heating Efficiency (%)	Percentage Programmable[(1)]	Percentage EMS[(1)]
Non-Residential	16.8	2,439,797	87.7%	19.8%	8.1%
n-values[(2)]	119	117	56	133	133
Industrial	22.3	6,749,347	80.0%	19.7%	0.0%
Commercial	17.3	925,151	88.2%	20.4%	9.4%
Institutional	17.1	1,925,816	94.8%	14.0%	30.2%
Office	14.4	404,696	97.6%	50.0%	0.0%
Restaurant	6.8	150,000	N/A	20.0%	0.0%
Retail	35.1	377,583	87.0%	15.4%	0.0%
Warehouse	7.0	356,000	N/A	0.0%	0.0%
Misc.	18.7	948,389	80.0%	14.3%	3.6%

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential findings only

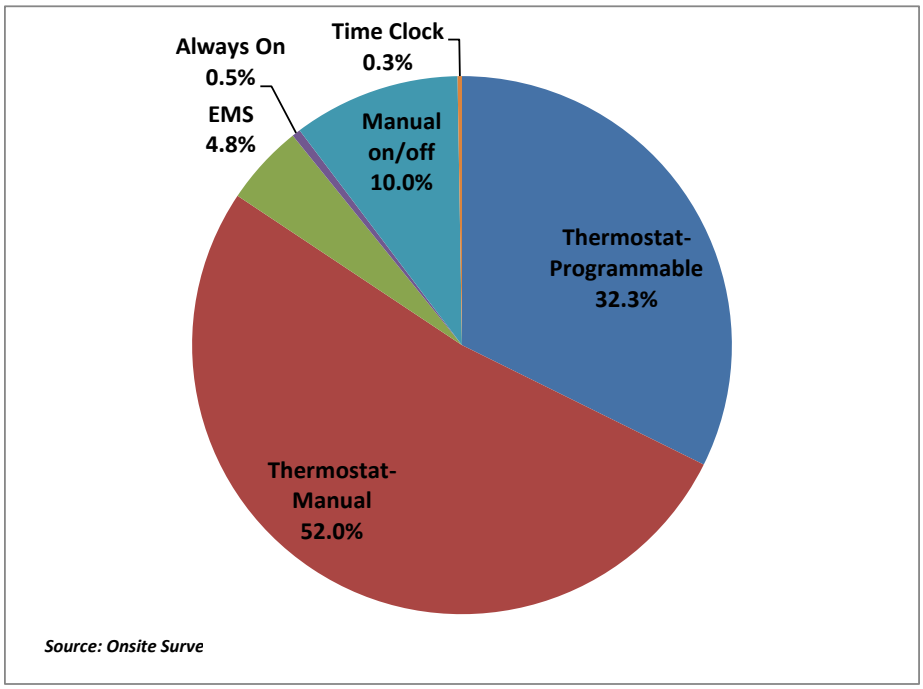
Table 4-17 and Figure 4-13 summarize some of the key parameters of temperature controls and illustrate the prevalence of different types of controls in the commercial and industrial sectors. The high prevalence of manual thermostats suggests that many systems are likely not being set back during times of non-occupancy.

Table 4-17: HVAC Control Parameters

Sector, Segment	Pct. Using Cooling Reset Controls[1]	Avg. Heating Set Back Points (Occupied / Unoccupied)	Avg. Cooling Set Back Points (Occupied / Unoccupied)
Non-Residential	11.0%	69.3 / 65.7	71.2 / 71.7
n-values[2]	418	323 / 239	253 / 168
Industrial	10.8%	66.4 / 61.0	71.2 / 74.2
Commercial	11.4%	68.8 / 62.6	71.9 / 74.3
Institutional	15.8%	69.4 / 61.8	71.7 / 75.5
Office	9.0%	70.0 / 64.8	71.5 / 73.0
Restaurant	7.7%	68.0 / 62.8	72.1 / 75.2
Retail	7.8%	68.1/ 63.2	72.2 / 74.0
Warehouse	0.0%	67.9 / 65.0	73.1 / 75.4
Misc.	6.7%	68.0 / 62.7	70.5 / 75.0

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential findings only

Figure 4-13: Temperature Control Types in Non-Residential Buildings (n=334)



4.3.2 Lighting

Lighting is another significant end use in terms of energy consumption for the non-residential sector. Where noted, findings are presented as percentage of floor space and thus each sample was weighted according to its square footage. Figure 4-14 and Table 4-18 show the saturation of different lighting system technologies. Figure 4-15 and Figure 4-16 shows the break-down of florescent lamp types. Linear florescent lighting illuminates more than 76% of the non-residential floor space in Pennsylvania. Interestingly, CFLs have reached a penetration more than 5.3% of the floor space - double that of the floor space for incandescent fixture (2.6%). High bay applications utilizing metal halide fixtures have a significantly higher saturation in the industrial sector at 25.2%.

Of the non-residential floor space illuminated by linear florescent fixtures, over half (52.8%) are T-8's, and 40% are T-12 lamps. T-8 Plus lamps are only installed in a small fraction (less than 1%) of the linear fluorescent fixtures across Pennsylvania. Findings are fairly variable across sectors and segments. For example, T-8s have a significantly lower penetration in the industrial sector – installed in only 35% of linear fluorescents fixtures compared to more than 66% of fixtures in the commercial sector. Institutional buildings (schools, health facilities and government buildings) have a much higher saturation of T-8s at 88% of floor space illuminated by linear fluorescent fixtures. Finally, there is a significantly higher presence of T-5 fixtures (more than 41%) in warehouses – though this finding is highly influenced by a very large warehouse surveyed that had 70% T5 installed.

Figure 4-14: Non-Residential Lighting System Technology Saturation (% of Floor Space) (n=403)

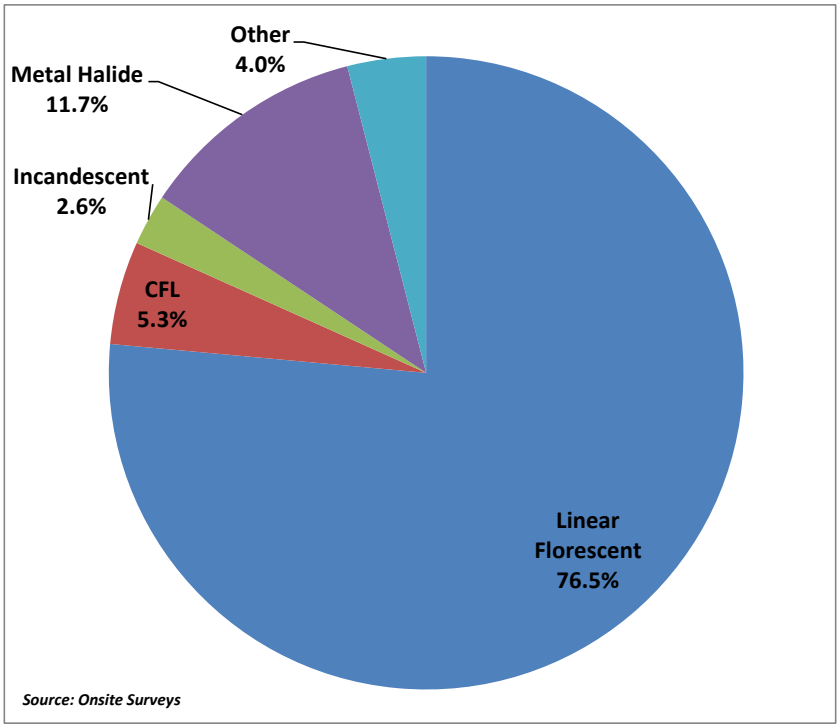


Table 4-18: Lighting System Technology Saturation by Sector by Segment (% of Floorspace)

Type	Non-Residential	Industrial	Commercial	Institutional	Office	Restaurant	Retail	Warehouse	Misc.
Linear Florescent	76.5%	70.0%	82.3%	86.3%	84.9%	48.7%	77.9%	76.4%	77.2%
CFL	5.3%	0.5%	7.6%	7.9%	6.6%	5.8%	5.2%	9.4%	7.2%
Incandescent	2.6%	1.8%	4.1%	1.9%	4.8%	26.2%	7.3%	0.8%	11.2%
Metal Halide	11.7%	25.2%	4.6%	3.0%	2.6%	1.7%	5.1%	13.4%	2.7%
High Pressure Sodium*	4.0%	2.5%	1.4%	1.0%	1.1%	17.6%	4.5%	0.0%	1.6%
Mercury Vapor*	1.9%	1.2%	0.2%	0.1%	0.0%	0.0%	0.8%	0.0%	0.6%
LED*	0.7%	0.6%	0.1%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%
Neon*	0.3%	0.0%	0.1%	0.0%	0.0%	2.0%	0.8%	0.0%	0.1%
Other*	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
n-values	403	89	314	73	66	26	64	19	66

Source: On-site Surveys

** Included as part of the "Other" category in Figure 4-14*

Figure 4-15: Linear Florescent Lamp Types Distribution by Sector (n=390)

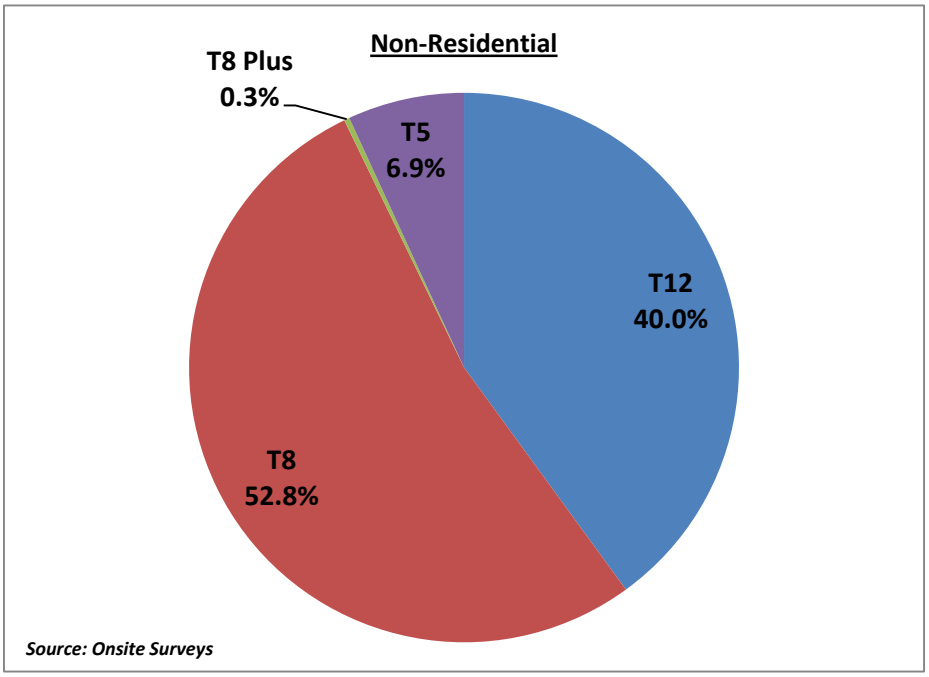
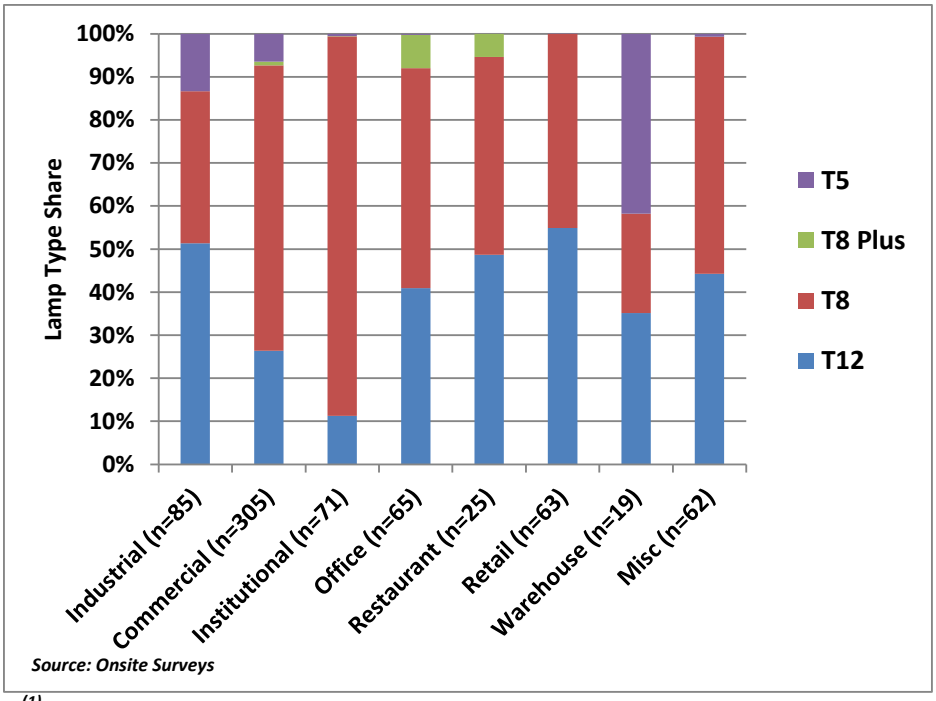


Figure 4-16: Linear Florescent Lamp Type Distribution by Segment[(1)]



(1) T5 saturation in warehouse highly influenced by very large surveyed facility with 70% T5s installed

Table 4-19 shows the saturation of different control types and shows that the majority (75%) of lighting is controlled by a manual on/off switch, with less than 10% being controlled by either timers (1.5%) or occupancy sensors (8.2%). Figure 4-17 through Figure 4-20 show additional characteristics of lighting within the non-residential sector in Pennsylvania. The presence of electronic ballasts generally follows the saturation of the more efficient T-8 lamps across sectors and segments. Exit signs still largely contain incandescent bulbs (51.7%). Also of note is that just over 25% of C&I buildings across Pennsylvania have upgraded their lighting the previous five years, and based on the data above these are largely conversions of T-12 to T-8 lamps. For example, almost 40% of institutional buildings have upgraded their lighting in the previous five years, and the institutional segment had the highest percentage of linear fluorescent floor space with T-8 lamps installed.

Table 4-19: Lighting Control Type Saturation by Sector (% of Floor Space)

Type	Non-Residential	Industrial	Commercial
Manual - Switch	75.0%	62.8%	78.6%
Manual Circuit Breaker	14.4%	29.6%	2.3%
Manual - Dual Level Switch	0.2%	0.0%	0.5%
Dimmer	0.6%	0.0%	0.0%
Timer	1.5%	3.6%	0.8%
Occupancy Sensor	8.2%	4.0%	17.7%
Day Lighting Controls	0.0%	0.0%	0.0%
n-values	386	85	301

Source: On-site Surveys

Figure 4-17: Linear Florescent Lamp Ballast Type Distribution by Sector (n=336)

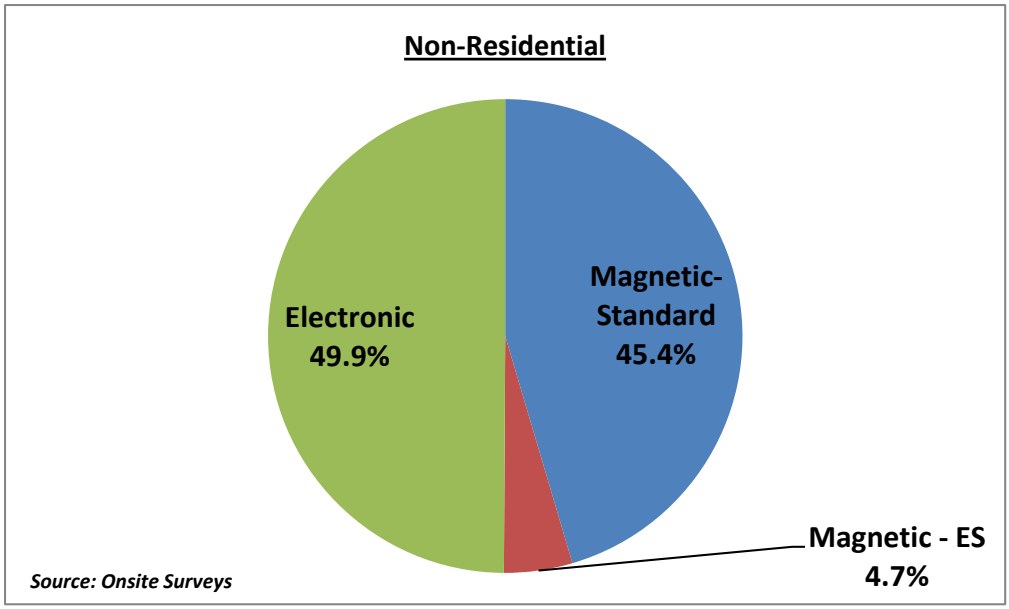


Figure 4-18: Linear Florescent Lamp Ballast Type Distribution by Segment

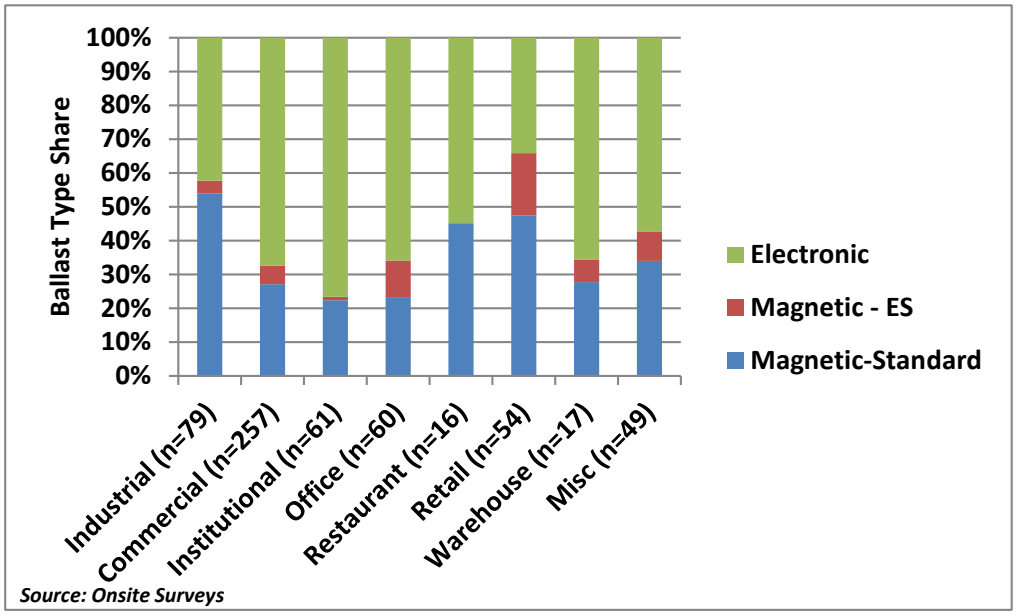
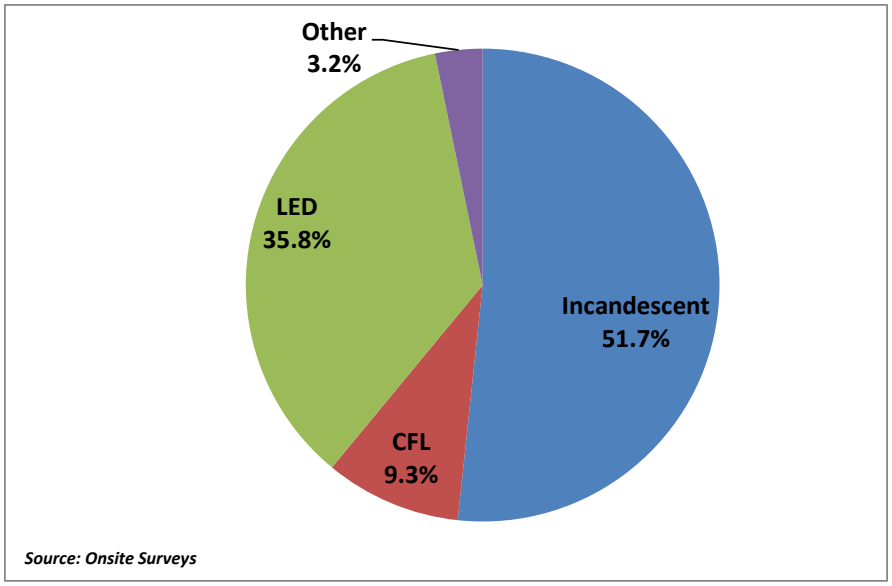
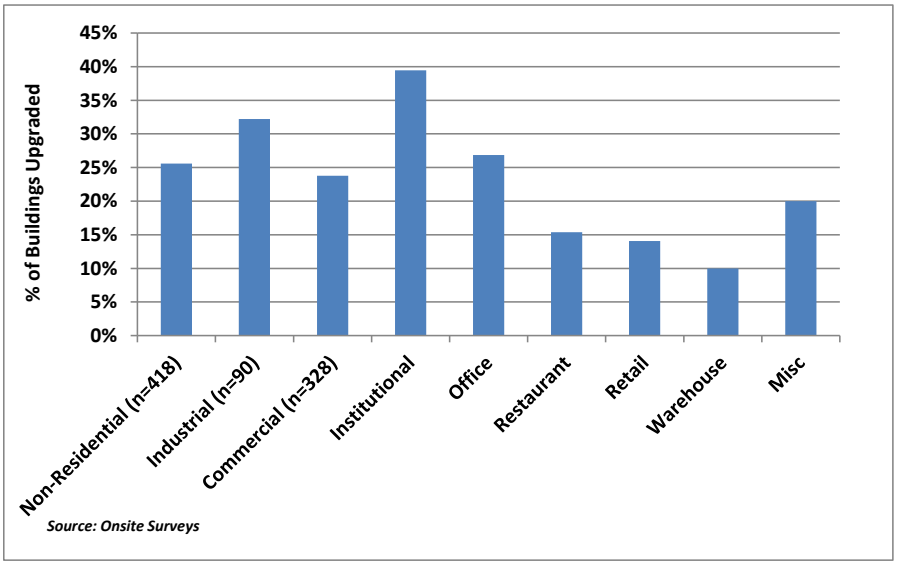


Figure 4-19: Non-Residential Exit Sign Bulb Type Saturation[1] (n=197)



[1] *Does not include PECO*

Figure 4-20: Percent of Buildings that Upgraded Lighting in Past 5 Yrs by Sector, by Segment



4.3.3 Refrigeration

Figure 4-21 below shows that just over 26% of buildings in Pennsylvania have commercial refrigeration equipment installed. Restaurants had the highest saturation of commercial refrigeration equipment (100%) of any segment. Figure 4-22 and Figure 4-23/Figure 4-24 illustrate the type of equipment installed in those buildings with commercial refrigeration equipment present across all segments and for institutional and restaurant buildings, respectively. Solid door

fridge/freezers represent the majority of refrigeration equipment in all segments. Table 4-20 shows the presence of different types of measures in place for refrigeration equipment.

Figure 4-21: Saturation of Commercial Refrigeration Equipment by Sector, by Segment

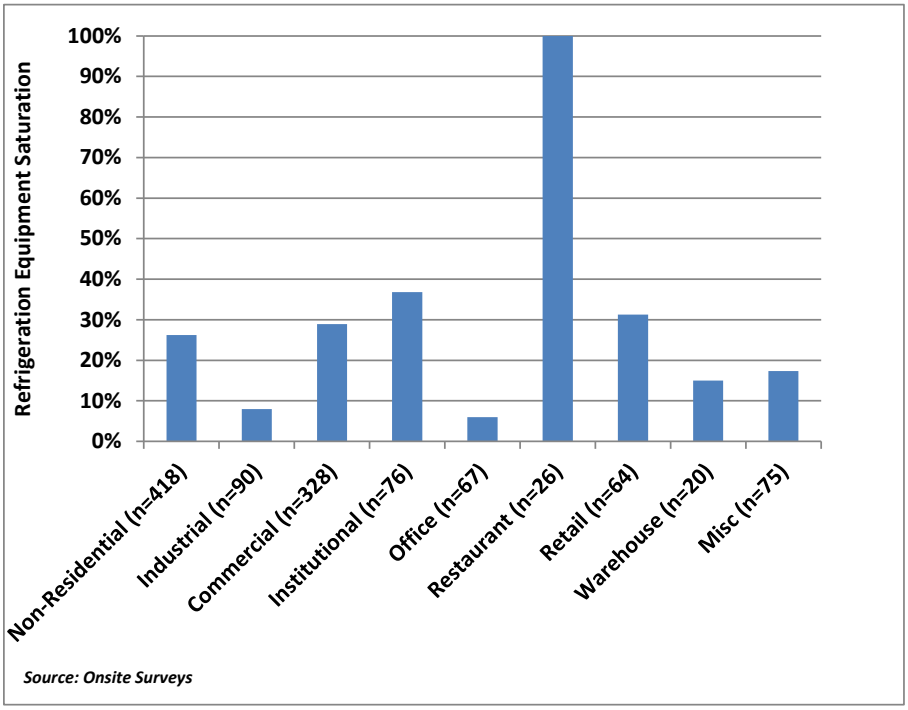


Figure 4-22: Non-Residential Refrigeration Equipment Type Saturation (n=142)

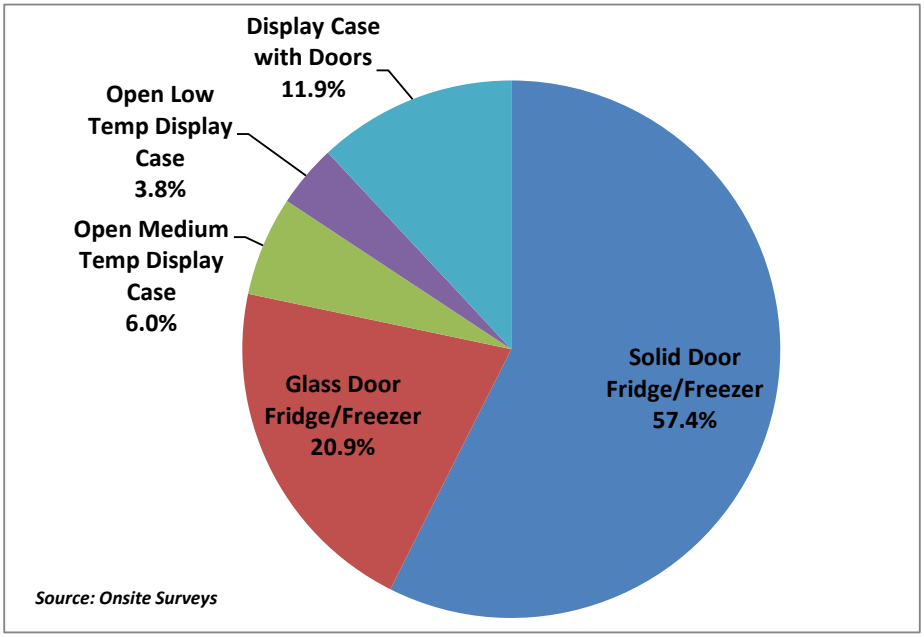


Figure 4-23: Refrigeration Equipment Type for Institutional Buildings (n=32)

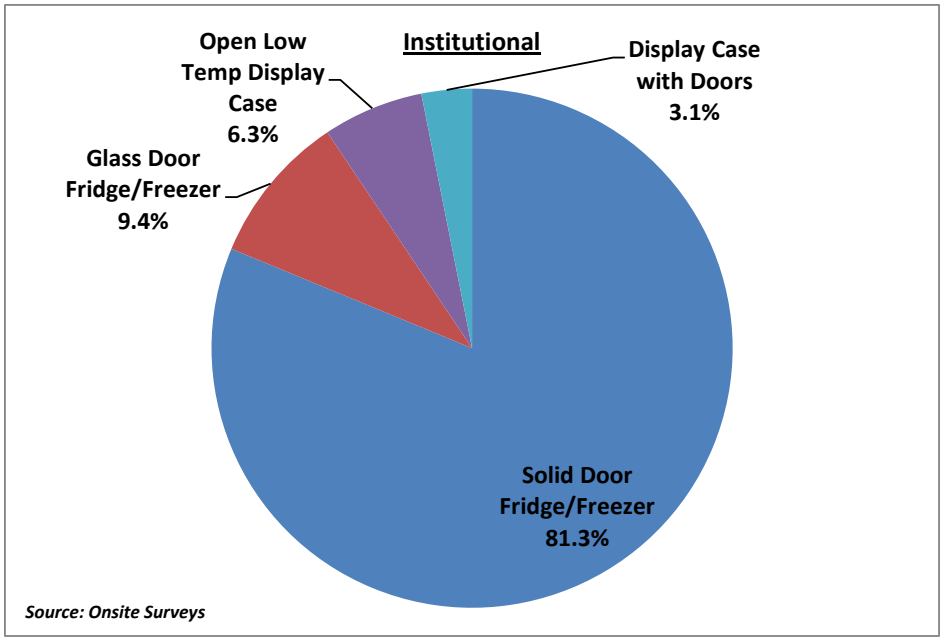


Figure 4-24: Refrigeration Equipment Type for Restaurant Buildings (n=46)

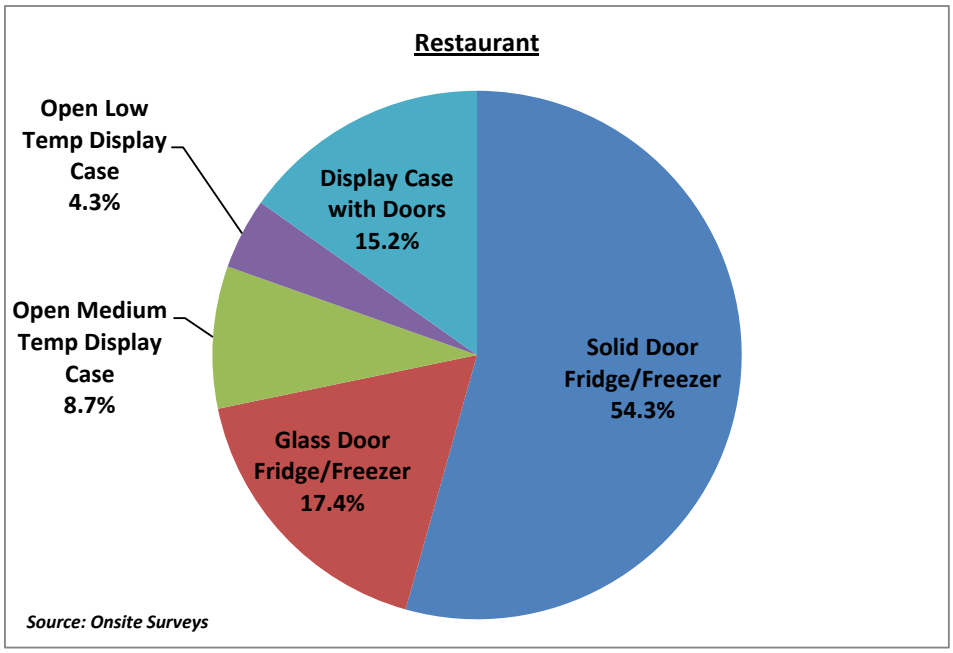


Table 4-20: Presence of Measures for Buildings with Refrigeration Equipment[(1)]

Measure	Institutional	Restaurant
Anti-Sweat Heating Control	3.6%	11.5%
LED Lights for Displays	0.0%	0.0%
VFD's on Compressors	0.0%	0.0%
ECM Motors	0.0%	3.9%
Demand Defrost Controls	0.0%	7.7%
Floating Head Pressure	0.0%	0.0%
High Efficiency Evaporators	0.0%	3.9%
Night Covers	7.1%	0.0%
Evap. Fan Controls	0.0%	0.0%
System Commissioned	10.7%	7.7%
Applicable for Re-Commission	7.1%	23.1%
Heat Recovery	0.0%	0.0%
Special Doors	0.0%	3.9%
Ice Makers	46.4%	57.7%
n-values	28	26

Source: On-site Surveys

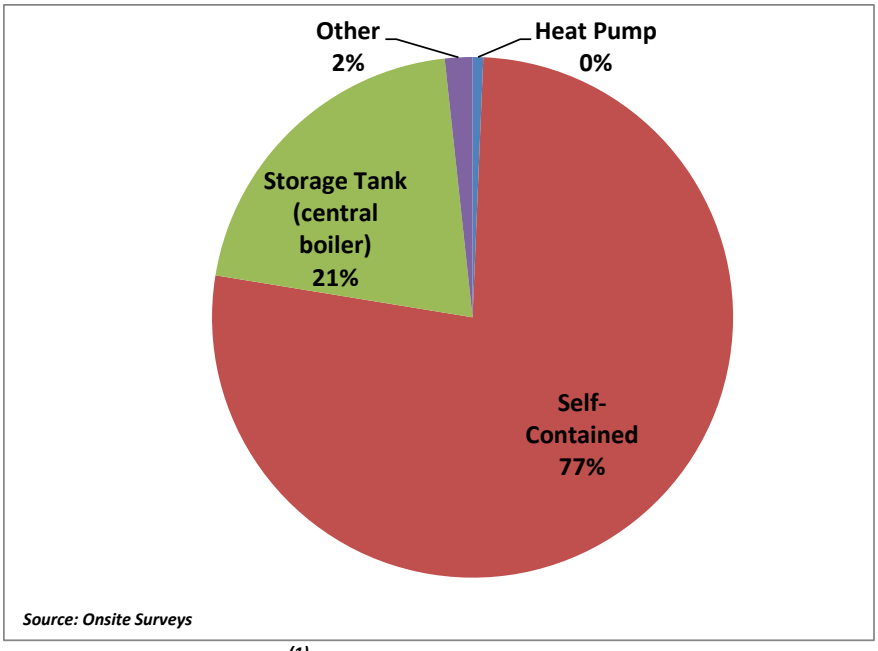
(1) ***Does not include PECO***

4.3.4 Water Heating

As noted in Table 4-3, the majority of non-residential businesses (84.5%) have water heaters. Figure 4-25 shows the distribution of different types of water heating units installed in Pennsylvania businesses that have water heaters. Self-contained water heaters are installed in 77% of non-residential buildings across the state, with storage tanks associated with a central boiler present in just over 20% of buildings[1]. Table 4-21 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 of systems across all non-residential systems is an efficiency factor (EF) of 85.4. Figure 4-26, Figure 4-27, and Figure 4-28 show the fuel share and distribution of system capacity respectively for all non-residential buildings. The majority (63.2%) of all systems are electric. More than half of the water heating systems have a tank capacity of between 21-50 gallons.

[1] Water heating type saturation is inclusive of all water heater fuel types.

Figure 4-25: Saturation of Equipment Type in Non-Residential Buildings w/ Water Heating[1] (n=320)



(1) For all water heating fuel types

Table 4-21: Water Heating Parameters

Parameter	Avg. Age (Yrs)	Pct w/tank wrap	Pct w/pipe wrap[1]	Pct w/setback[1]	Avg Tank Capacity (Gal)	Avg Efficiency (EF)[1]	Avg Input Capacity (Btu/hr)
Non-Residential	5.5	6.5%	16.6%	1.8%	55.2	85.4	87,433
n-values[2]	418	341	341	341	299	45	238
Industrial	6.5	2.8%	8.9%	2.5%	42.7	90.0	73,137
Commercial	5.3	7.6%	19.2%	1.6%	58.2	85.3	89,980
Institutional	6.8	6.8%	32.4%	4.1%	89.2	82.3	184,558
Office	5.3	6.9%	13.8%	3.4%	41.4	79.9	49,890
Restaurant	5.8	9.1%	13.6%	0.0%	52.9	88.4	66,423
Retail	4.9	6.3%	10.4%	0.0%	35.5	90.8	21,523
Warehouse	4.0	0.0%	14.3%	0.0%	39.9	N/A	13,289
Misc.	5.7	7.0%	21.1%	0.0%	74.0	85.0	74,725

Source: On-site Surveys
(1) Does not include PECO
(2) n-values for non-residential only

Figure 4-26: Water Heating Fuel Share by Sector (n=423)

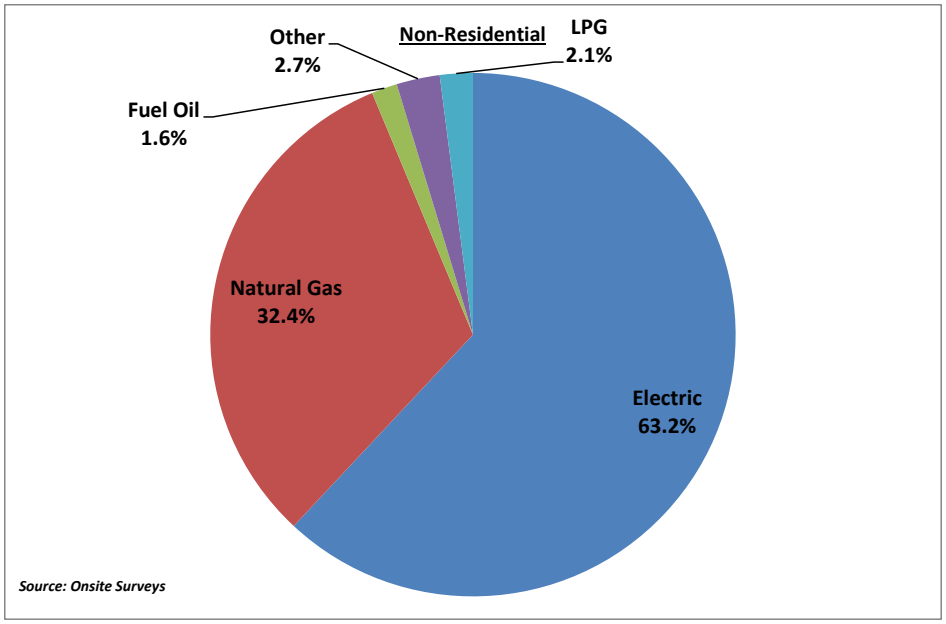


Figure 4-27: Water Heating Fuel Share by Segment

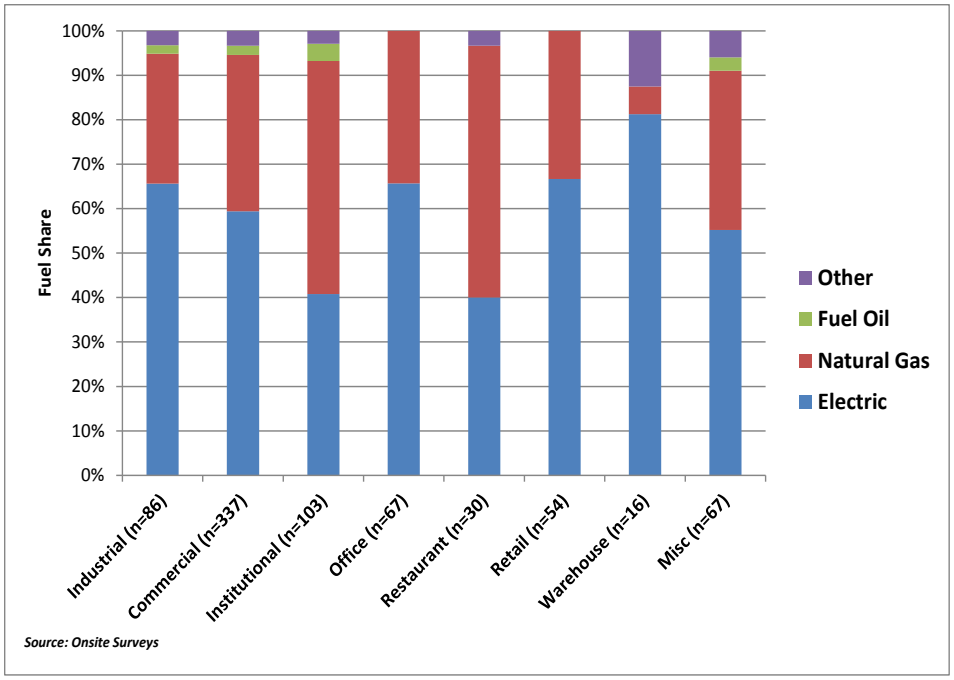
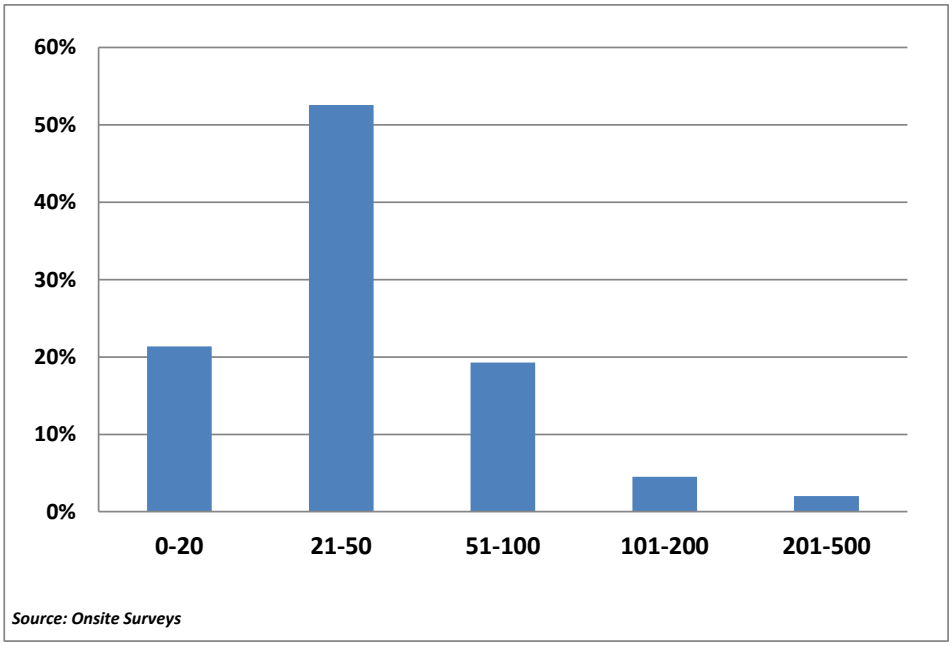


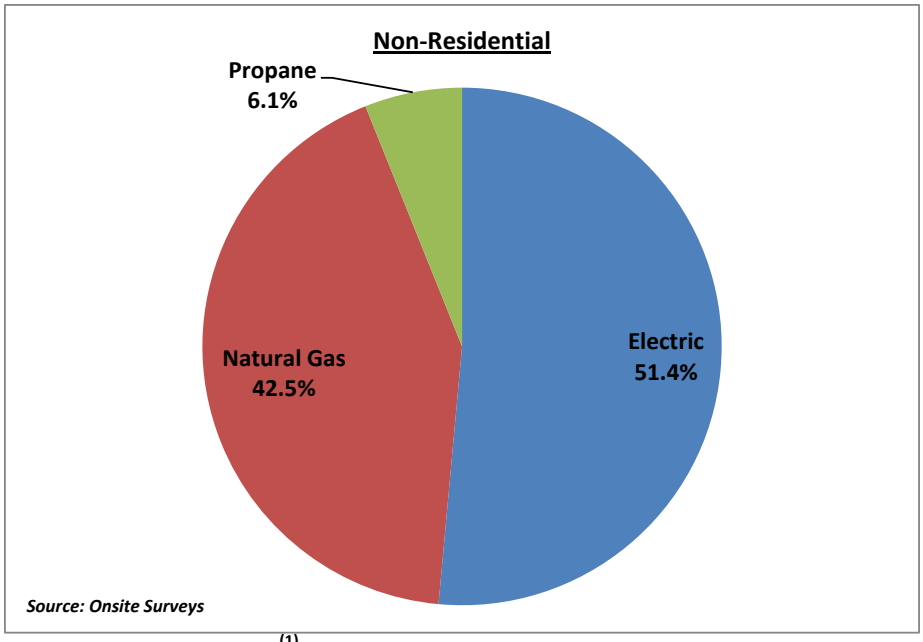
Figure 4-28: Non-Residential Water Heating Tank Capacity Distribution (n=373)



4.3.5 Commercial Cooking

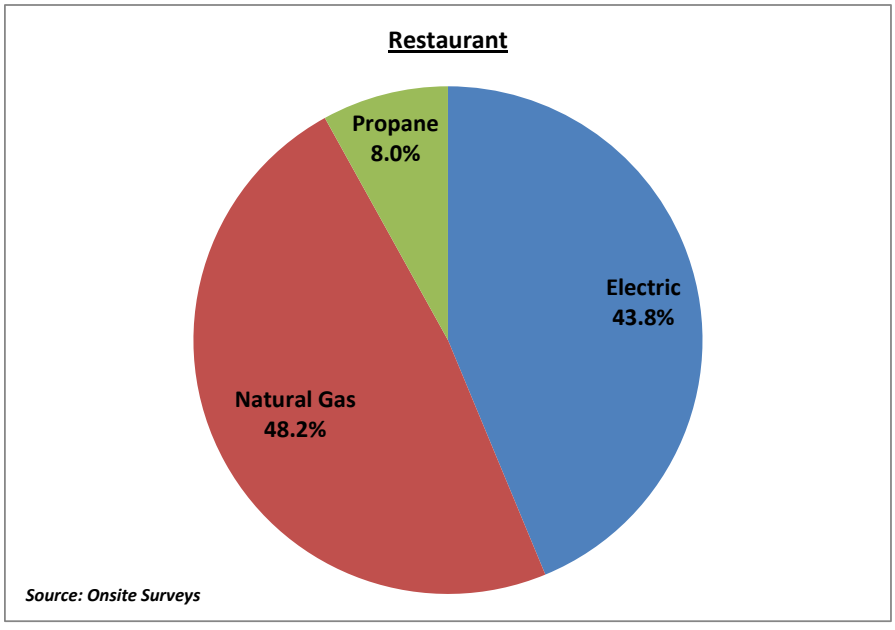
Figure 4-29 and Figure 4-30 shows the fuel share of cooking equipment across all non-residential buildings as well as just for restaurants. While electricity fuels the largest share (51.4%) of cooking equipment in all non-residential buildings that number drops to 43.8% for equipment in restaurants. Figure 4-31 and Figure 4-32 illustrate this decrease as restaurants have a higher saturation of ranges and ovens that typically are fueled by natural gas. Table 4-22 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 4-29: Cooking Fuel Share for Non-Residential Buildings[1] (n=498)



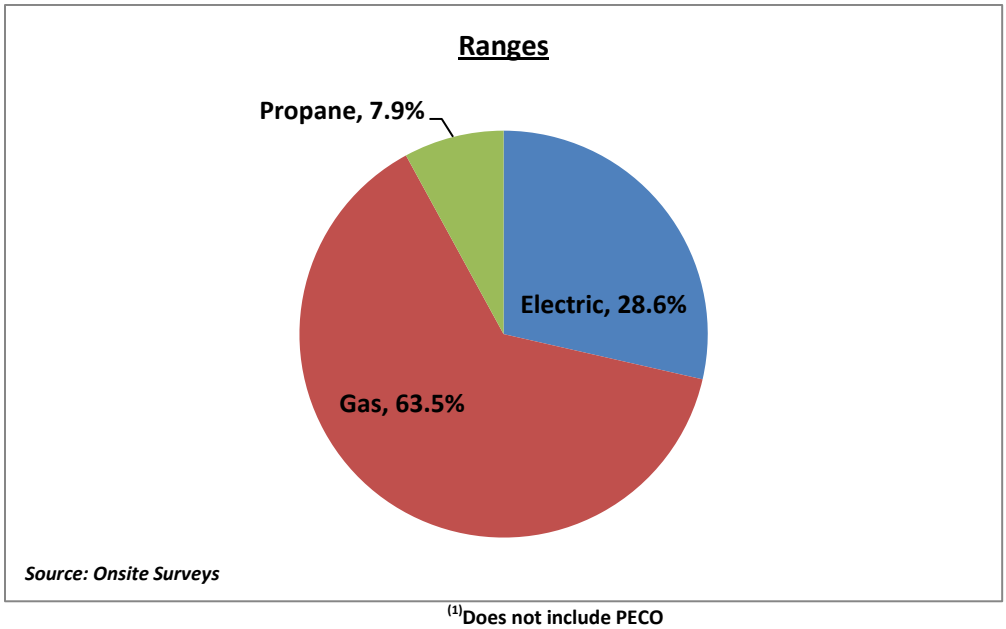
[1] *Excluding residential-style microwaves*

Figure 4-30: Cooking Fuel Share for Restaurant Buildings[1] (n=112)



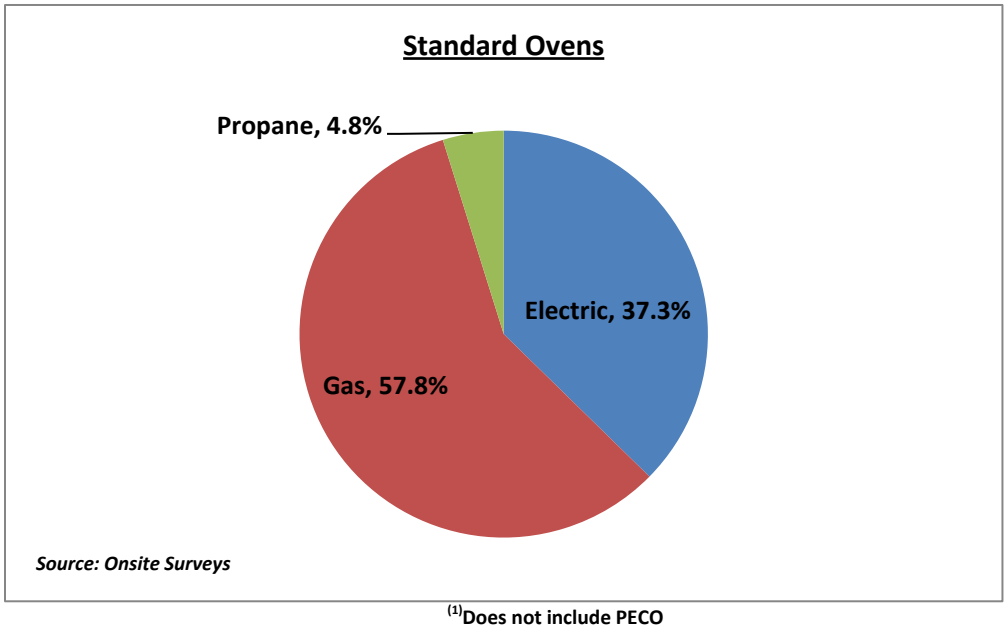
[1] **Does not include PECO**

Figure 4-31: Fuel Share of Commercial Ranges[(1)] (n=63)



[(1)]Does not include PECO

Figure 4-32: Fuel Share of Commercial Standard Ovens[(1)] (n=83)



[(1)]Does not include PECO

Table 4-22: Saturation of Electric Cooking Equipment in Building with Cooking Equipment

Type	Non-Residential	Commercial	Institutional	Restaurant
Standard Oven	11.7%	10.0%	12.0%	8.0%
Convection Oven	7.7%	8.5%	4.0%	4.0%
Range	11.1%	21.4%	12.0%	0.0%
Fryer	4.3%	11.6%	2.0%	12.0%
Hot Food	11.7%	10.5%	16.0%	12.0%
Steam Cooker	7.7%	8.0%	8.0%	12.0%
Griddle	3.6%	10.0%	4.0%	4.0%
Pizza Oven	5.3%	10.6%	2.0%	4.0%
Warming Table	16.3%	15.2%	28.0%	16.0%
Heat Lamp	10.2%	7.3%	14.0%	20.0%
Soup Pot	8.4%	5.8%	6.0%	16.0%
Continuous Toaster	9.9%	7.7%	8.0%	16.0%
Microwave	92.0%	81.9%	78.0%	72.0%
n-values	171	151	50	25

Source: On-site Surveys

4.3.6 Plug Load

Table 4-23 shows the percentage of sites with at least one piece of each plug load equipment type by sector. Table 4-24 shows the average number of each plug load type per site by sector, respectively.

Table 4-23: Percentage of Sites with One or More Pieces of Plug Load Equipment by Sector

Type	Non-Residential[(1)]	Industrial	Commercial
Desktop Computers	62.6%	66.9%	60.8%
Laptops	21.4%	20.7%	22.0%
Secondary Monitors	10.3%	7.0%	11.1%
Servers	10.7%	12.2%	11.0%
Printers	48.0%	57.1%	45.3%
Scanners	12.5%	11.3%	12.7%
Photocopiers	21.5%	23.2%	20.7%
Fax Machines	10.2%	12.6%	9.5%
Water Coolers	15.6%	23.2%	13.5%
Air Purifiers	1.2%	1.1%	1.2%
Security Cameras	17.0%	14.9%	17.7%
Battery Chargers	10.8%	22.6%	8.0%
Snack Machines	4.7%	12.3%	2.8%
Beverage Machines	10.0%	13.1%	9.1%
Space Heaters	15.7%	21.9%	13.8%
Residential Style Refrigerators	27.4%	36.7%	24.9%
Clothes Washers	15.2%	8.6%	17.0%
Electric Dryers	9.2%	5.9%	10.3%
Dishwashers	9.6%	5.5%	11.2%
n-values	418	90	328

Source: On-site Surveys
[(1)]Does not include PECO data

Table 4-24: Average Number of Plug Load Equipment per Site by Sector

Type	Non-Residential[(1)]	Industrial	Commercial
Personal Computers	15.5	9.1	17.0
Laptops	12.8	2.5	15.2
Secondary Monitors	8.1	4.4	8.5
Servers	3.4	1.7	3.7
Printers	5.4	5.2	5.5
Scanners	3.6	1.7	4.4
Photocopiers	2.9	2.0	3.1
Fax Machines	2.4	1.3	2.8
Water Coolers	3.2	1.9	3.5
Air Purifiers	3.6	0.5	4.4
Security Cameras	8.6	3.7	10.0
Battery Chargers	5.7	3.7	6.4
Snack Machines	2.8	1.4	3.6
Beverage Machines	2.9	1.5	3.3
Space Heaters	4.1	5.6	3.5
Residential Style Refrigerators	3.8	2.0	4.4
n-values	418	90	328

Source: On-site Surveys
[(1)]Does not include PECO data

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 both the commercial and industrial sectors. Data was collected primarily from the 418 on-site surveys conducted by Nexant and Mondre Energy engineers. Secondary data was used to fill in data gaps when deemed appropriate. All findings, except those in the lighting end-use, are presented at the premise-level. As such the reader should be mindful that the saturation of certain large-scale system types such as chillers may appear low (as a single chiller can service a very large share of floor stock).

While PECO was not included as part of the on-site data collection for this study, findings from PECO's *2011 Baseline Study Report* by Navigant were included where possible. Observation counts (n-values) were not available from the PECO study. If data was not available, it is noted with a "N/A."

5.2 COMMERCIAL & INDUSTRIAL OVERVIEW BY EDC

Based on the findings of Nexant'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 2010 customer sales data from each of the EDCs. Table 5-1 and Table 5-2 show the break-down of electrical usage by EDC for the commercial and industrial sectors, respectively. PECO and PPL represent almost 60% of the commercial electricity sales in Pennsylvania. The institutional segment (which includes education, health, and government buildings) also comprises a large share of the electricity sales for each of the EDCs. As expected, the office segment's share of sales increases for EDCs with a larger metropolitan population – namely Duquesne, PPL, and PECO. Also of note is the smaller share of state-wide industrial electricity sales for PECO at just over 4,000,000 MWh – compared to PPL's 9,600,000 MWh. WPP also has a sizeable industrial sector with just under 7,000,000 MWh of sales. This is driven in large part by the metal manufacturing segment which makes up 37.6% of its industrial sales.

Table 5-1: Statewide Commercial Energy Use, by EDC

Commercial Subsector	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Institutional	**2,304,242**	**926,402**	**1,251,091**	**250,939**	**2,925,689**	**1,250,709**	**6,551,468**
Education	966,232	484,815	568,731	104,308	1,386,078	720,887	2,627,825
Health	776,820	360,074	472,630	87,962	1,215,475	380,300	2,873,018
Other	561,190	81,513	209,730	58,669	324,136	149,523	1,050,625
Office	**2,994,849**	**889,394**	**839,814**	**255,161**	**2,570,492**	**741,486**	**6,568,425**
Restaurant	**170,476**	**200,958**	**255,942**	**70,108**	**615,132**	**313,535**	**658,394**
Retail	**661,910**	**637,215**	**696,238**	**193,478**	**2,174,837**	**998,499**	**1,688,610**
Grocery	195,372	283,960	289,228	67,214	994,387	199,523	547,746
Retail	466,538	353,256	407,009	126,264	1,180,450	798,976	1,140,865
Warehouse	**83,863**	**297,697**	**234,122**	**64,319**	**995,319**	**346,025**	**369,373**
Misc.	**1,099,404**	**820,322**	**786,979**	**234,510**	**2,759,593**	**1,518,262**	**3,435,657**
Lodging	72,764	80,334	94,437	30,121	403,405	189,177	548,460
Other	1,026,640	739,988	692,542	204,390	2,356,189	1,329,084	2,887,197
Total	**7,314,744**	**3,771,988**	**4,064,187**	**1,068,515**	**12,041,062**	**5,168,517**	**19,271,928**

Source: Customer Datasets, CBECS, Nexant Analysis

Table 5-2: Statewide Industrial Energy Use, by EDC

Industrial Subsector	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO[(1)]
Mfg: Chemicals	573,548	181,165	83,814	23,596	1,222,577	397,540	332,697
Mfg: Computers	102,182	621,250	151,849	43,292	454,964	473,258	247,528
Mfg: Food	61,961	522,232	231,286	77,225	1,810,926	105,629	376,528
Mfg: Metals	1,603,371	781,314	1,088,000	1,108,216	1,636,592	2,627,249	1,185,470
Mfg: Other	350,336	998,240	1,905,365	299,577	2,311,361	1,373,996	970,234
Mfg: Paper	1,109	178,077	687,590	740	584,383	318,876	237,339
Mfg: Plastics	31,187	348,037	428,208	1,936	1,061,135	106,744	265,012
Mining	5,142	232,834	263,972	14,762	126,343	1,239,724	252,350
Other Non-Mfg.	179,661	285,129	171,160	53,985	409,974	336,671	192,546
Total	**2,908,498**	**4,148,279**	**5,011,243**	**1,623,329**	**9,618,254**	**6,979,686**	**4,059,704**

Source: Customer Datasets, MECS, Nexant Analysis

(1) ***PECO industrial segmentation based off statewide average***

5.2.2 End Use Saturations & Fuel Shares

Table 5-3 shows the saturation of different end uses in non-residential premises by EDC. Lighting, space heating, and plug load equipment was found in virtually all buildings visited across the state. Space cooling equipment was found slightly less frequently in WPP and Penelec buildings than it was for other EDCs – possibly due to the more rural nature of their territories. Refrigeration and cooking equipment was found in fewer buildings, 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 significantly more saturation in the Duquesne and PECO territories – 91% and 95% respectively.

Table 5-3: Commercial & Industrial End Use Saturations, by EDC

End Use	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
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	82.6%	88.4%	73.9%	74.6%	81.7%	73.9%	83.1%
Plug Load	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Refrigeration	15.9%	26.1%	27.5%	29.6%	22.5%	26.1%	32.4%
Cooking	53.6%	33.3%	29.0%	52.1%	33.8%	43.5%	48.3%
Water Heating	91.3%	81.2%	73.9%	83.1%	81.7%	78.3%	95.5%
n-values	69	69	69	71	71	69	n/a

Source: On-site Surveys

5.2.3 Building Information

Table 5-4 and Figure 5-1 presents the total building stock and average square footages of commercial buildings in each EDC. With the greatest number of customers, PECO and PPL also have the greatest amount of buildings stock in their territories. PECO and Duquesne – the EDCs serving primarily metropolitan customers – have a noticeably larger average square footage than the other EDCs at 15,298 and 12,810 respectively.

Table 5-4: Square Footage Overview of Commercial Buildings by EDC

EDC	Building Stock (ft^2)	Avg. Square Footage	n-values[(1)]
Duquesne	507,222,036	12,810	69
MetEd	307,533,195	7,774	69
Penelec	295,886,219	5,942	69
PennPower	76,603,552	6,589	71
PPL	897,123,546	9,263	71
WPP	385,319,854	6,709	69
PECO	1,272,843,862	15,298	n/a

Source: On-site Surveys

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

Figure 5-1: Square Footage Overview of Commercial Buildings by EDC

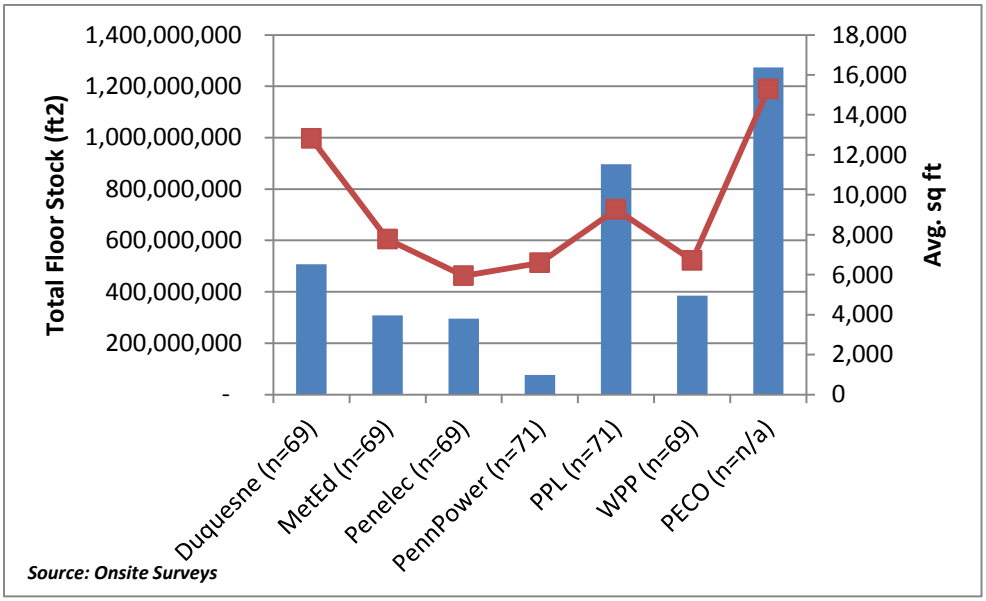


Table 5-5 through Table 5-8 provide an overview of the characteristics of non-residential buildings broken out by EDC. The average age for buildings across all EDCs was between 45.1 years for PennPower and 61.8 years for Penelec. Duquesne and PennPower had a significantly higher percentage of buildings commissioned at 40.6% and 33.8% respectively. The only EDC in which any LEED-certified green buildings were found in our sample was in Duquesne.

Findings from PECO's *2011 Baseline Study Report* by Navigant are included where possible. If data was not available, it is noted with a "Nx."

Table 5-5: Building Characteristics by EDC

Parameter	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Avg Age	Year	57.6	54.8	61.8	45.1	53.5	44.8	50.7
Avg Occupants	-	37.2	67.5	86.7	67.8	69.6	54.5	87.3
Avg # of Floors	-	1.7	1.6	1.6	1.6	1.6	1.4	2.6
n-values		69	69	69	71	71	69	n/a

Source: On-site Surveys

Table 5-6: Building Efficiency Levels by EDC

Parameter	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Percentage Building Commissioned	40.6%	10.1%	13.0%	33.8%	9.9%	14.5%	Nx
Percentage Commissioned in last 5 Years	4.3%	4.3%	8.7%	7.0%	4.2%	4.3%	Nx
Percentage Buildings LEED Certified	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	Nx
n-values	69	69	69	71	71	69	n/a

Source: On-site Surveys

Table 5-7: Building Wall Insulation R-Value by EDC

Parameter	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Avg Insulation	R-Value	15.8	11.1	21.0	11.8	13.3	8.0	6.4
n-values		8	14	7	36	24	22	n/a

Source: On-site Surveys

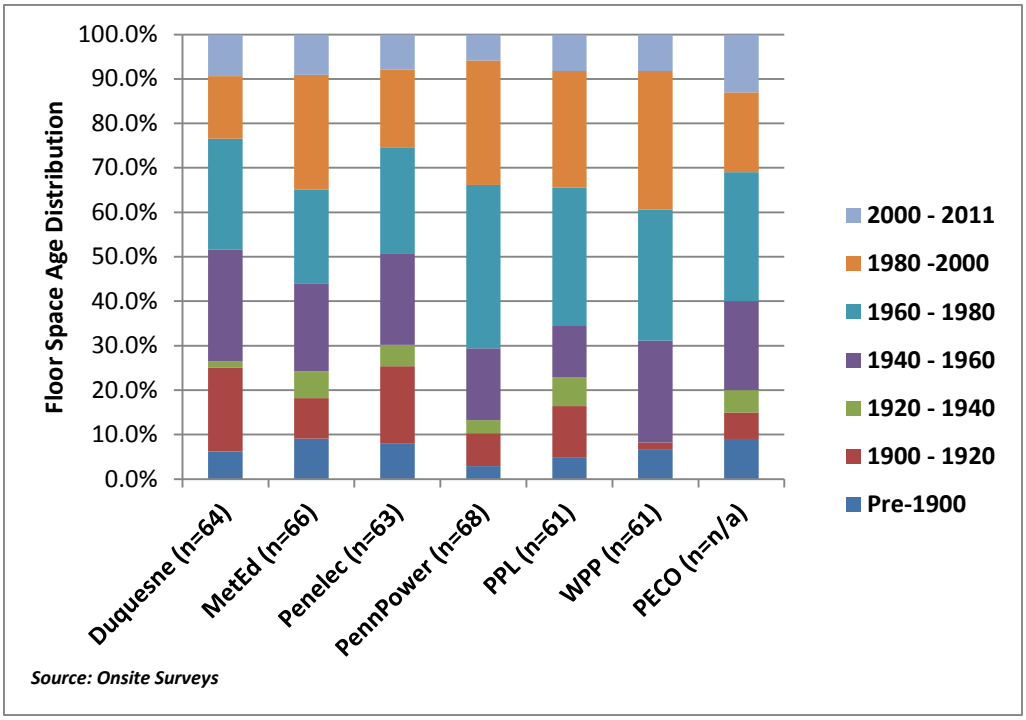
Table 5-8: Building Window Characteristics by EDC

Parameter	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Glazing Pct of Walls	12.3%	16.3%	14.9%	15.7%	16.9%	13.9%	Nx
Pct. Double Paned	56.5%	34.8%	36.2%	45.1%	42.3%	27.5%	72.0%
Pct. Metal Framed	75.4%	44.9%	43.5%	42.3%	56.3%	47.8%	72.0%
n-values	69	69	69	71	71	69	n/a

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 pre-1920 and after 2000. The 1920-1940 time period also had a noticeable drop in building construction, coinciding with the 1930's depression. 25% to 30% of all commercial buildings across all EDCs were built in the 1960-1980 time-frame.

Figure 5-2: Year of Building Construction by EDC



5.3 COMMERCIAL & INDUSTRIAL END USE FINDINGS BY EDC

This next section provides detailed findings of each non-residential end use by EDC in Pennsylvania. Again, PECO was not included as part of the on-site data collection for this study. All findings, except those in the lighting end-use, are presented by premise. As such the reader should be mindful that the saturation of certain large-scale system types such as chillers may appear low (as a single chiller can service a very large share of floor stock).

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 heating systems fueled by electricity by EDC. Natural gas fuels the majority of space heating systems for each of the EDCs, with a significantly higher share of systems for Duquesne at 81%. Fuel oil plays a substantial role in the MetEd 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

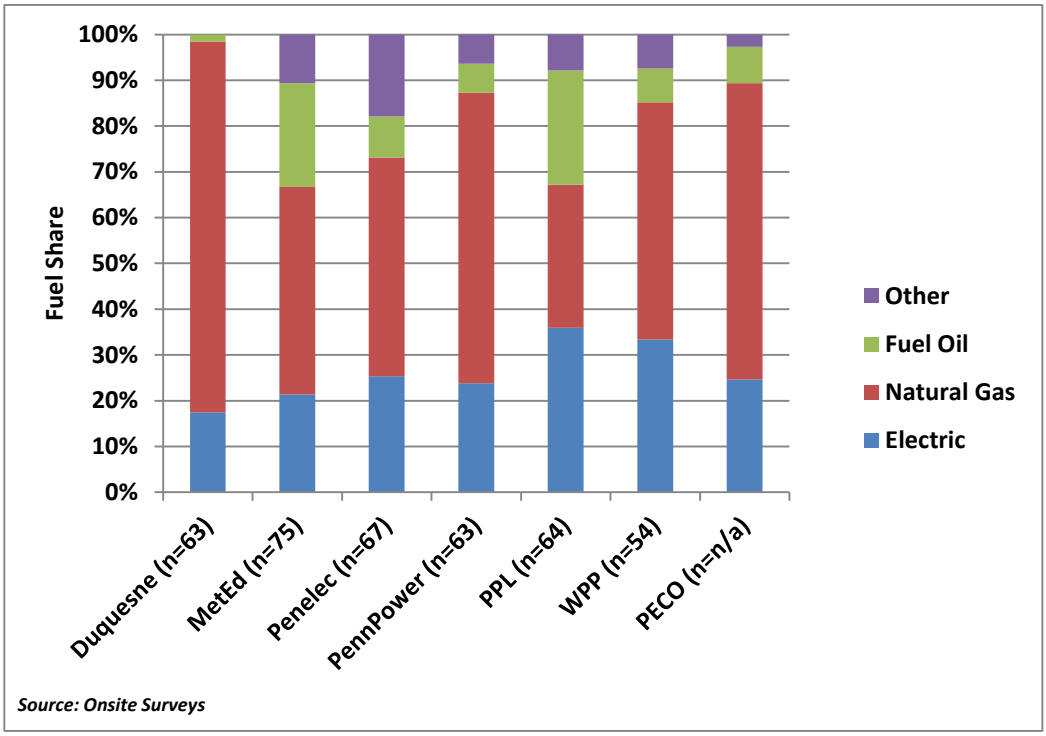
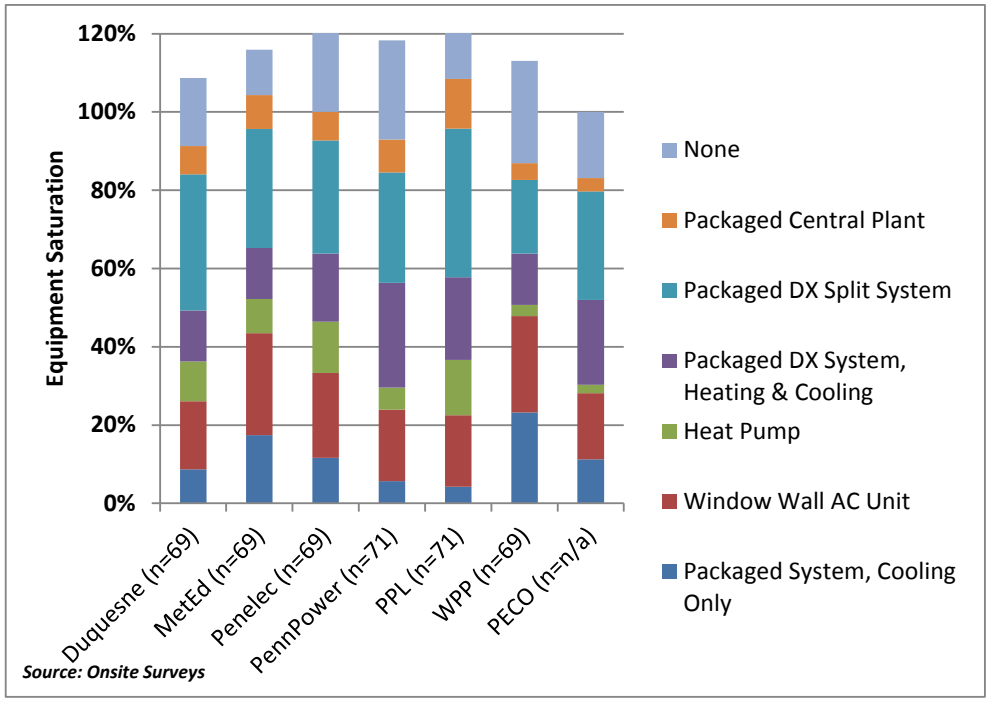


Figure 5-4 shows the prevalence of different types of cooling systems in the non-residential sector across the state, presented by EDC. Space cooling findings are presented as the percentage of buildings with a given system type present. For example, if a building had one chiller (packaged central plant), but also 35 window wall A/C units it was counted as simply two system types present in one building. Counts were then divided by the total number of buildings (418) so that a meaningful "none" category could be presented (note: many buildings have multiple cooling systems present so percentages may add up to more than 100%). The distribution of cooling system types is fairly consistent across each of the EDCs with Packaged DX Split Systems present in the largest share of buildings for all EDCs except West Penn Power. While packaged central plants (e.g. chillers) are present in only 3.5% to 12.7% of surveyed buildings (depending on the EDC), they tend to service larger buildings and thus would have a large share of electricity load. West Penn Power and Penelec have the greatest percentage of buildings with no cooling system at just over 26%.

Figure 5-4: Saturation of Cooling Equipment in Buildings by EDC[(1)]



(1) Percentages add up to more than 100% because buildings may have multiple systems installed

Table 5-9 summarizes some of the key parameters of cooling systems in the non-residential sector presented by EDC. The average cooling efficiencies for all of the EDCs are consistently in the 11 to 12 SEER range. The wide variation in the penetration of automatically controlled cooling systems is noteworthy. For example, almost one-third of DX cooling systems in Penelec's service territory are controlled by programmable thermostats or energy management systems (EMS), whereas in WPP's territory very few automating systems were found.

Table 5-9: DX Cooling Parameters by EDC

Parameter	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Avg Age	Yrs	9.4	10.5	13.0	10.8	10.4	10.9	Nx
Avg Cooling Capacity	Tons	6.4	4.1	8.3	6.1	5.7	6.5	Nx
Avg Cooling Efficiency	SEER/ EER	11.7 / 10.6	12.4 / 10.2	12.8 / 10.4	12.0 / 9.6	11.4 / 10.0	11.7 / 11.0	11.1 / 11.8
Pct Programmable	%	3.9%	14.7%	20.0%	3.2%	18.2%	5.3%	Nx
Pct EMS	%	3.9%	2.9%	10.0%	12.9%	3.0%	0.0%	Nx

Source: On-site Surveys

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 possible exception of a low saturation of furnaces in PennPower and PPL's territories.

Figure 5-5: Heating Types in the Non-Residential Sector by EDC

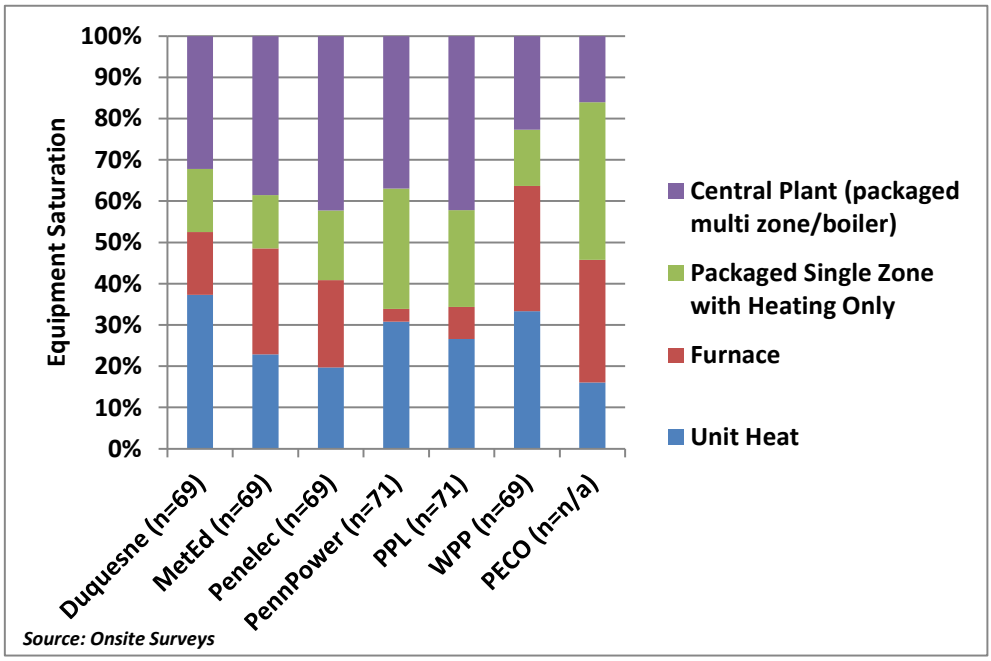


Table 5-10 and Table 5-11 below summarize some of the key parameters of heating systems in the non-residential sector presented by EDC. It should be noted that the WPP service territory contains some of the oldest equipment in the state with the average age of boilers (25.5) being past the expected useful life of that equipment type.

Table 5-10: Heating Equipment Parameters by EDC

Parameter	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Avg Age	Yrs	9.2	11.8	8.5	11.9	12.2	14.1	Nx
Avg Heating Capacity	Btu/ hr	103,930	140,845	75,442	118,077	174,862	149,903	551,000
Avg Heating Efficiency	%	96.2%	80.0%	85.8%	93.3%	80.5%	N/A	Nx
Pct Programmable	%	6.3%	5.6%	6.7%	0.0%	7.1%	3.8%	Nx
Pct EMS	%	0.0%	5.6%	6.7%	14.3%	0.0%	0.0%	Nx

Source: On-site Surveys

Table 5-11: Boiler Heating Parameters, by EDC

Parameter	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Avg Age	Yrs	21.5	21.8	13.9	17.1	13.4	25.5	12.7
Avg Heating Capacity	Btu/ hr	936,364	953,125	2,058,150	1,648,743	3,570,768	2,137,752	3,019,000
Avg Heating Efficiency	%	83.0%	81.5%	80.7%	80.6%	79.7%	83.8%	87.0%
Pct Programmable	%	17.6%	26.9%	20.0%	13.0%	26.1%	7.1%	Nx
Pct EMS	%	11.8%	7.7%	10.0%	21.7%	8.7%	0.0%	Nx

Source: On-site Surveys

Table 5-12 and Table 5-13 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 5-12: HVAC Control Parameters by EDC

Parameters	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Pct Using Cooling Reset Controls	%	7.2%	2.9%	13.0%	5.6%	21.1%	1.4%	Nx
Avg Cooling Set Back Points (Occupied / Unoccupied)	Degrees F	72.7 / 77.0	71.5 / 73.5	71.3 / 77.0	70.6 / 78.5	72.3 / 74.3	71.7 / 73.6	72.3 / 75.6
Avg Heating Set Back Points (Occupied / Unoccupied)	Degrees F	68.5 / 62.5	68.1 / 63.5	67.6 / 62.5	68.6 / 63.3	69.3 / 62.9	67.5 / 60.3	69.0 / 64.0

Source: On-site Surveys

Table 5-13: Temperature Control Types by EDC

Control Type	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Thermostat-Programmable	35.6%	30.4%	29.5%	35.4%	43.1%	19.2%	29.7%
Thermostat-Manual	45.8%	51.8%	54.5%	58.5%	39.7%	61.5%	59.4%
EMS	5.1%	3.6%	4.5%	4.6%	1.7%	3.8%	9.2%
Always On	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	1.4%
Manual on/off	13.6%	10.7%	11.4%	1.5%	15.5%	15.4%	Nx
Time Clock	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.3%
n-values	59	56	44	65	58	52	n/a

Source: On-site Surveys

5.3.2 Lighting

As mentioned in the state-wide 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 5-14 and Figure 5-6 show the saturation of different lighting system technologies as a percentage of floor space and the break-down of florescent lamp types, respectively, presented by EDC. Linear fluorescents illuminate the majority of floor space found in non-residential buildings, comprising between 65% of floor space for Duquesne and 90% of floor space for MetEd. T12 lamps still have a large market share for linear fluorescents, but T8 lamps have made significant penetrations into the market, especially in the MetEd and PPL territories where more than 70% of the linear florescent lamps were T8s (though this is due in part to the fact that some very large college campuses visited had a large share of T8s installed). Survey results also show a relatively low saturation of T5s with the exception of the WPP territory, however, this is due in part to the presence of a single very large warehouse surveyed with 70% T5 installed. Very few fixtures had T8 Plus lamps.

Table 5-14: Lighting System Technology by EDC (% of Floor Space)

Type	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO[(1)]
Linear Florescent	64.5%	90.1%	68.3%	80.8%	75.7%	75.7%	76.0%
CFL	8.4%	1.1%	1.8%	3.4%	7.6%	6.4%	15.0%
Incandescent	3.7%	3.3%	2.2%	2.3%	3.8%	3.9%	4.0%
Metal Halide	17.7%	3.3%	24.4%	12.7%	11.8%	13.5%	1.0%
High Pressure Sodium	4.4%	0.0%	0.4%	0.3%	0.3%	0.1%	0.8%
Mercury Vapor	0.7%	0.0%	1.3%	0.0%	0.2%	0.0%	0.8%
LED	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.8%
Neon	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%
Other	0.4%	2.1%	1.6%	0.5%	0.4%	0.4%	1.0%
n-values	66	68	62	70	69	68	N/A

Source: On-site Surveys

(1) *PECO percentages represent share of fixture counts*

Figure 5-6: Linear Florescent Lamp Type Distribution by EDC

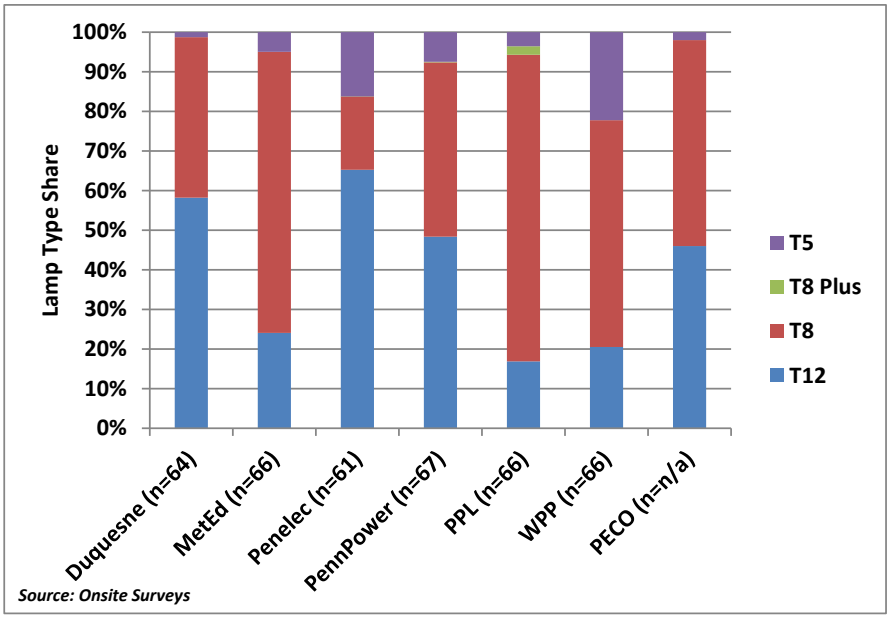


Figure 5-7 through

Figure **5-9** and Table 5-15 show additional characteristics of lighting within the non-residential sector for each EDC. In line with the higher saturation of T8s in the MetEd and PPL territories, there also exists a higher saturation of electronic ballasts in those territories. The control types for all EDCs are still vastly manually controlled, leaving significant opportunities for occupancy sensors, timers and EMS systems. On average, only about 25% to 30% of the buildings visited in each of the EDCs have had their lighting systems upgraded in the past five years.

Figure 5-7: Linear Florescent Lamp Ballast Type Distribution by EDC

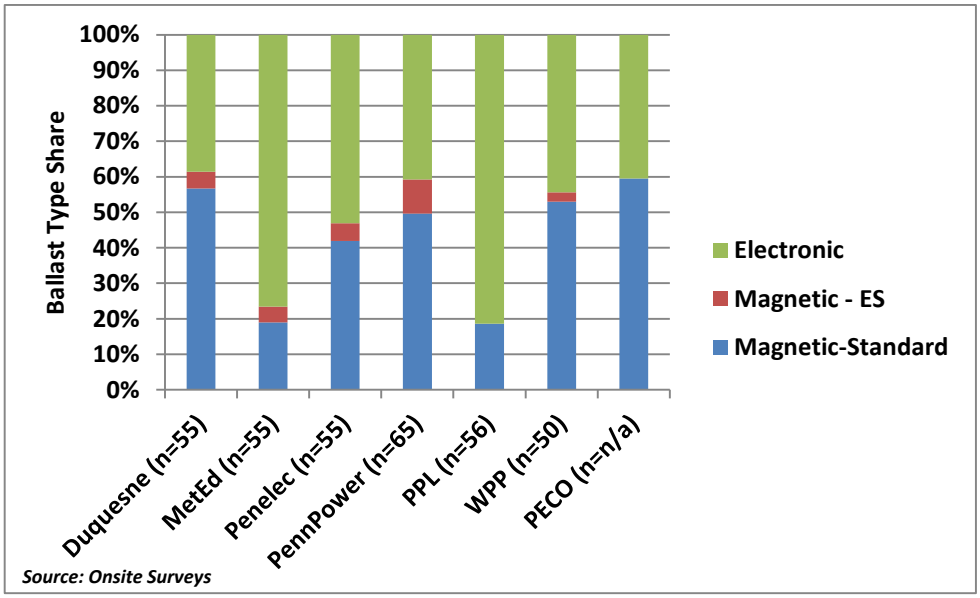


Figure 5-8: Exit Sign Bulb Type Distribution by EDC

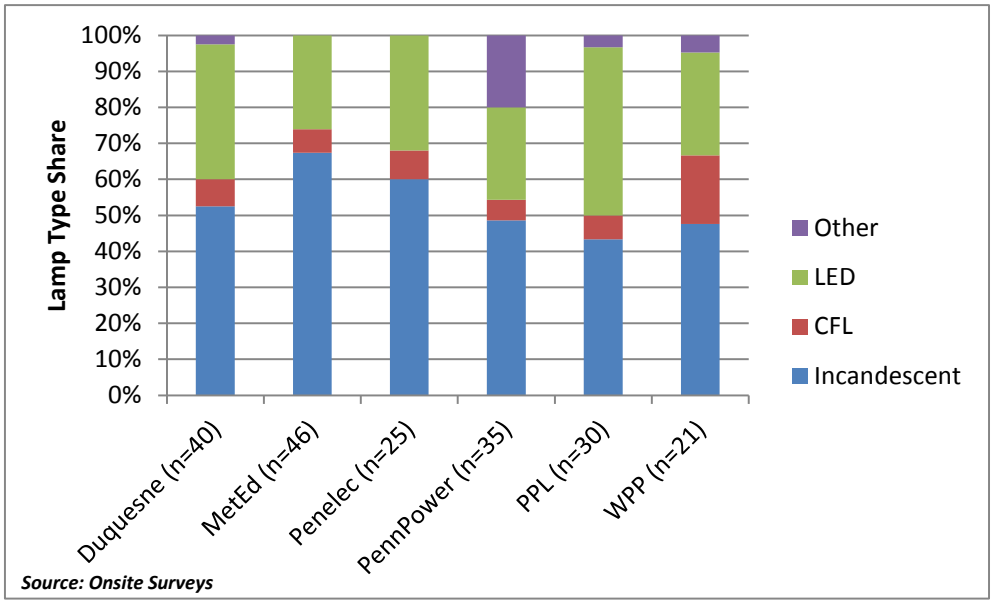


Figure 5-9: Percent of Buildings that Upgraded Lighting in Past Five Years by EDC

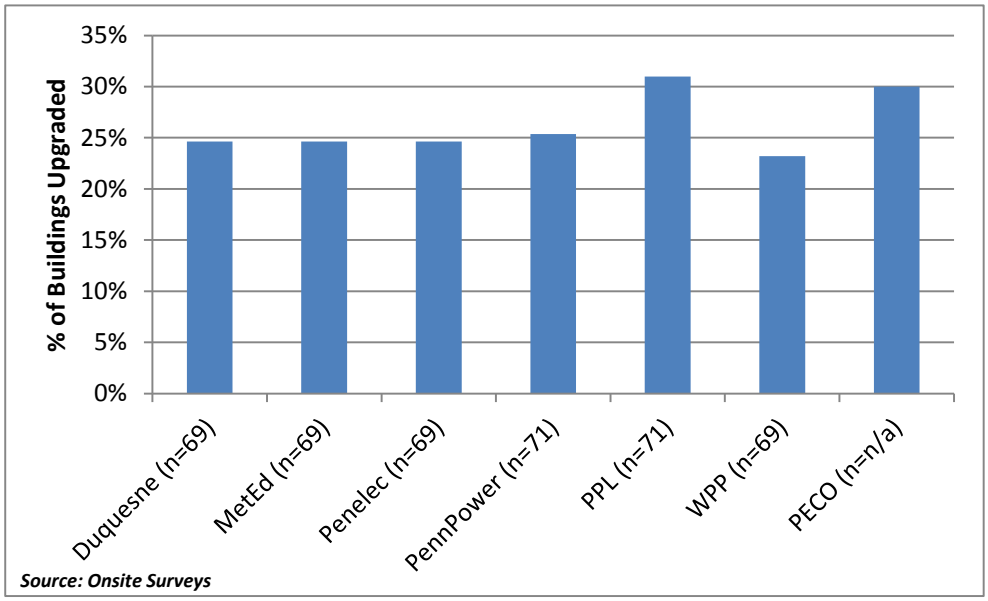


Table 5-15: Control Type Distribution by EDC (% of Floor Space,)

Type	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Manual - Switch	68.8%	59.7%	98.2%	66.2%	62.5%	73.1%	92.0%
Manual Circuit Breaker	23.6%	18.0%	0.8%	31.2%	10.3%	0.4%	-
Manual - Dual Level Switch	1.3%	0.0%	0.0%	0.0%	1.0%	0.0%	-
Dimmer	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	1.9%
Timer	0.0%	2.4%	0.0%	0.0%	0.0%	9.2%	2.8%
Occupancy Sensor	6.3%	19.9%	0.9%	2.5%	26.2%	17.4%	3.3%
n-values	63	65	62	70	63	63	n/a

Source: On-site Surveys

5.3.3 Refrigeration

Figure 5-10 and Figure 5-11 show the saturation of refrigeration equipment in non-residential buildings and the breakdown of refrigeration equipment type by EDC. Duquesne has the lowest percentage of sites with refrigeration equipment at just over 15% while PECO has the highest with just over 30%. The most common type of refrigeration equipment across all EDCs was the solid-door fridge/freezer.

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

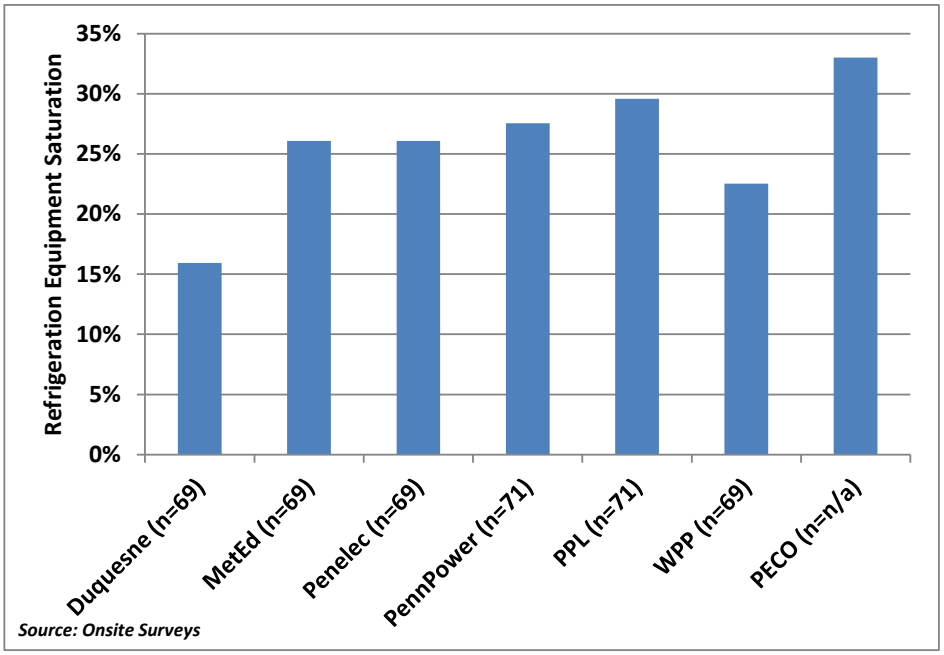
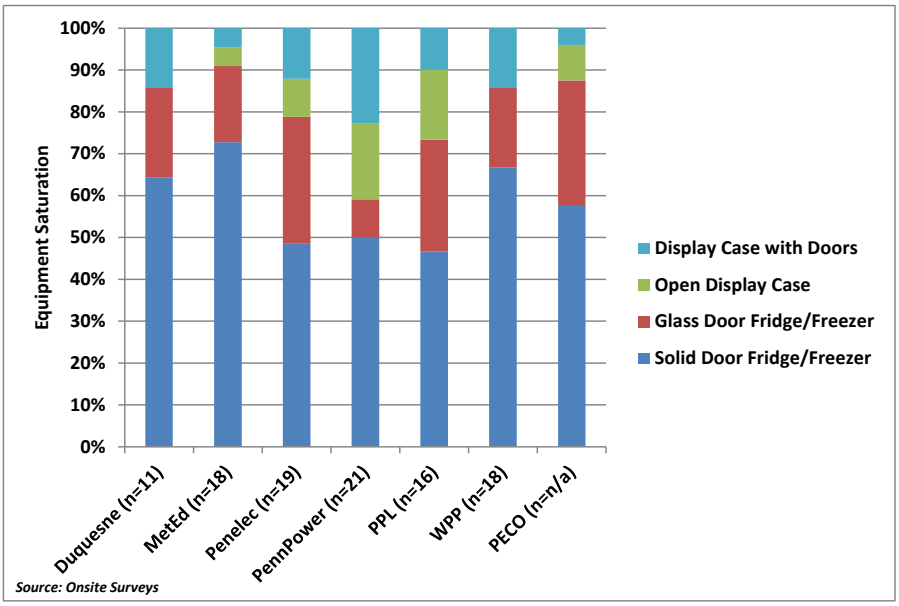


Figure 5-11: Saturation of Equipment Type for Buildings w/ Refrigeration Equipment by EDC



5.3.4 Water Heating

Figure 5-12 shows the distribution of different types of water heating units installed in Pennsylvania businesses broken out by EDC. The vast majority of systems across all EDCs were self-contained and storage tanks associated with a central boiler. Table 5-16 shows some of the characteristics of water heaters for each of the EDCs.

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

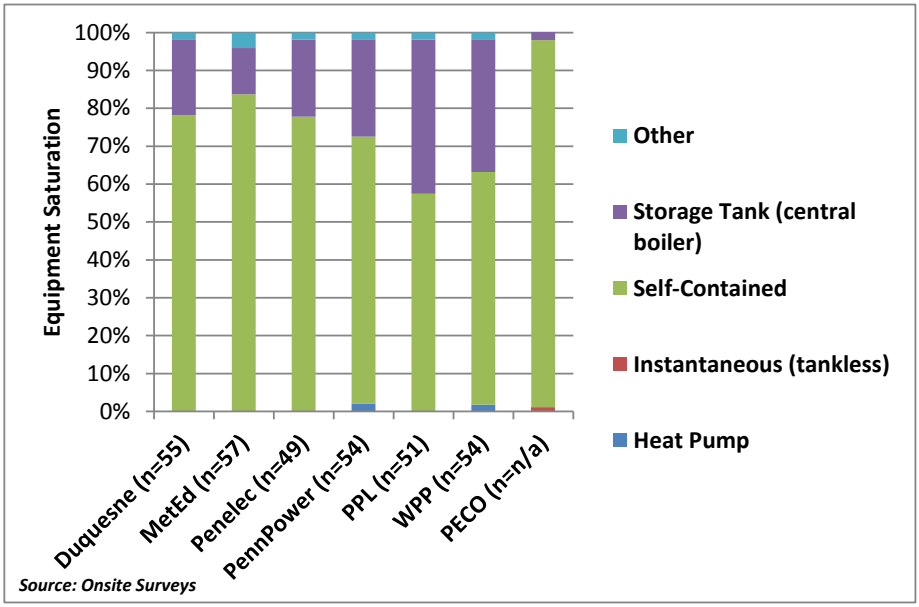


Table 5-16: Water Heating Parameters by EDC

Parameter	Unit	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Avg Age	Yrs	5.2	5.5	4.9	6.8	5.1	6.7	9.5
Pct w/tank wrap	%	3.2%	1.8%	17.6%	1.7%	5.2%	5.6%	Nx
Pct w/pipe wrap	%	14.3%	25.0%	27.5%	13.6%	12.1%	11.1%	Nx
Pct w/setback	%	3.2%	3.6%	0.0%	0.0%	1.7%	1.9%	Nx
Avg Tank Capacity	Gal	53.0	52.0	60.7	55.9	43.2	74.5	35.1
Avg Efficiency	EF	78.8	81.3	84.8	87.3	88.3	87.8	Nx
Avg Input Capacity	Btu/ hr	97,762	120,373	72,649	48,833	85,565	83,438	98,400

Source: Onsite Surveys

Figure 5-13 and Table 5-17 show the fuel share and distribution of system capacity by EDC, respectively. Similar to space heating, PPL has the highest saturation of electric water heaters of all the EDCs at 81.3%. The "Other" fuel types are comprised of LPG, hot water/steam, wood, and misc. About 50% of all water heaters had a tank capacity between 21-50 gallons for each of the EDCs.

Figure 5-13: Water Heating Fuel Share by EDC

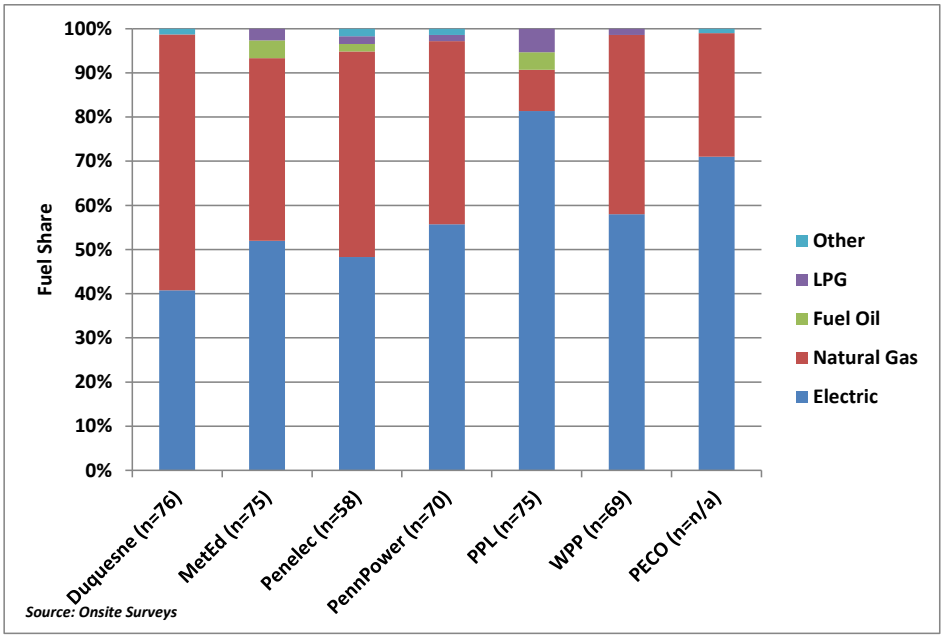


Table 5-17: Water Heating Capacity Distribution by EDC

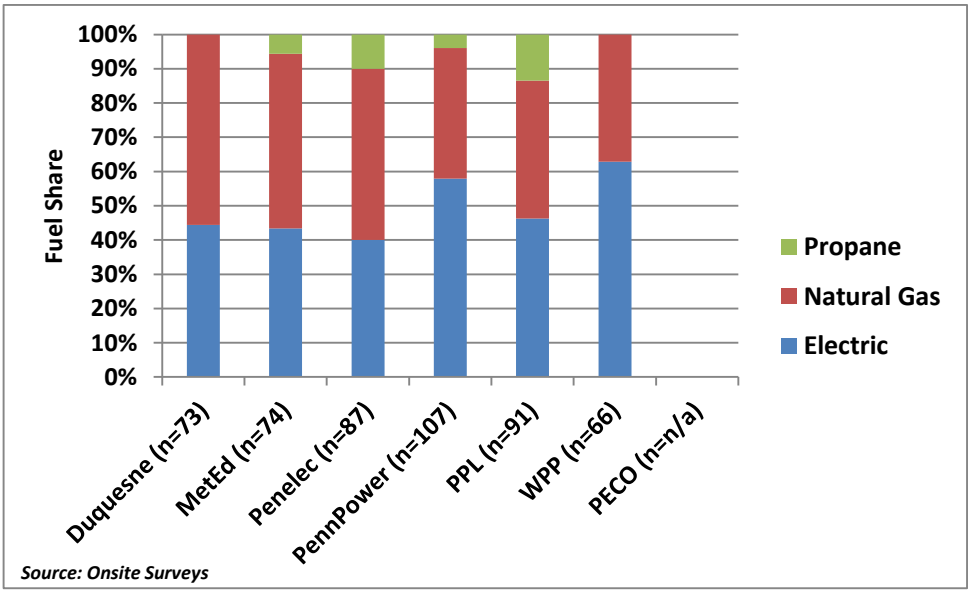
Capacity (gal)	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
0-20	16.4%	30.9%	7.5%	22.2%	26.9%	14.5%	25.3%
21-50	49.3%	47.1%	64.2%	55.6%	53.7%	58.2%	45.0%
51-100	26.9%	16.2%	24.5%	17.5%	14.9%	21.8%	17.7%
101-200	4.5%	2.9%	0.0%	3.2%	3.0%	1.8%	11.0%
201-500	3.0%	2.9%	3.8%	1.6%	1.5%	3.6%	-
n-values	67	68	53	63	67	55	N/A

Source: Onsite Surveys

5.3.5 Commercial Cooking

Electricity typically fuels between 40% and 60% of the all cooking equipment across all of the EDCs, with natural gas and propane making up the remainder. Figure 5-14 shows the fuel share breakdown for cooking equipment by EDC.

Figure 5-14: Cooking Fuel Share by EDC[1]



[1] *Excludes residential microwaves*

5.3.6 Plug Load

Table 5-18 and Table 5-19 show the percentage of sites with at least one piece of each plug load equipment type by EDC and the average number of each plug load type per site by EDC, respectively.

Table 5-18: Percentage of Sites with One or More Pieces of Plug Load Equipment by EDC

Type	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Personal Computers	78.3%	68.1%	65.2%	70.4%	57.7%	52.2%	Nx
Laptops	10.1%	30.4%	21.7%	12.7%	28.2%	13.0%	Nx
Secondary Monitors	8.7%	17.4%	7.2%	5.6%	11.3%	8.7%	Nx
Servers	10.1%	17.4%	10.1%	9.9%	9.9%	8.7%	Nx
Printers	56.5%	55.1%	50.7%	39.4%	53.5%	27.5%	Nx
Scanners	5.8%	5.8%	15.9%	1.4%	19.7%	8.7%	Nx
Photocopiers	21.7%	29.0%	15.9%	23.9%	26.8%	11.6%	Nx
Fax Machines	5.8%	2.9%	11.6%	4.2%	14.1%	11.6%	Nx
Water Coolers	17.4%	20.3%	8.7%	19.7%	18.3%	11.6%	Nx
Air Purifiers	0.0%	1.4%	0.0%	0.0%	1.4%	2.9%	Nx
Security Cameras	14.5%	20.3%	21.7%	9.9%	18.3%	11.6%	Nx
Battery Chargers	4.3%	21.7%	7.2%	4.2%	15.5%	4.3%	Nx
Snack Machines	2.9%	5.8%	2.9%	4.2%	7.0%	2.9%	Nx
Beverage Machines	8.7%	13.0%	10.1%	8.5%	8.5%	11.6%	Nx
Space Heaters	8.7%	21.7%	13.0%	4.2%	19.7%	14.5%	Nx
Residential Style Refrigerators	24.6%	39.1%	23.2%	31.0%	25.4%	27.5%	Nx
Clothes Washers	14.5%	21.7%	27.5%	12.7%	7.0%	14.5%	Nx
Electric Dryers	8.7%	13.0%	11.6%	4.2%	8.5%	7.2%	Nx
Dishwashers	8.7%	15.9%	10.1%	4.2%	8.5%	8.7%	Nx
n-values	69	69	69	71	71	69	n/a

Source: Onsite Surveys

Table 5-19: Average Number of Plug Load Equipment per Site by EDC

Type	Duquesne	MetEd	Penelec	PennPower	PPL	WPP	PECO
Personal Computers	11.0	19.5	23.3	29.9	12.1	10.8	Nx
Laptops	5.3	8.0	23.1	8.9	12.7	12.9	Nx
Secondary Monitors	6.3	2.2	6.5	3.0	14.7	4.7	Nx
Servers	4.5	1.3	2.2	9.2	4.6	1.5	Nx
Printers	3.7	4.7	4.7	6.6	8.4	2.4	Nx
Scanners	2.8	0.8	2.8	3.0	7.1	1.3	Nx
Photocopiers	2.0	1.8	1.6	3.1	5.3	1.3	Nx
Fax Machines	1.3	0.8	1.4	1.7	4.7	1.5	Nx
Water Coolers	1.8	2.0	1.6	3.3	5.0	3.2	Nx
Air Purifiers	0.0	0.1	0.5	0.0	10.1	1.0	Nx
Security Cameras	3.4	5.5	14.1	4.3	9.2	9.3	Nx
Battery Chargers	7.0	3.7	3.1	5.4	10.1	1.4	Nx
Snack Machines	1.4	0.5	1.2	1.4	6.5	0.9	Nx
Beverage Machines	1.8	0.9	1.4	2.1	5.7	1.6	Nx
Space Heaters	2.8	1.8	1.8	2.9	8.0	2.4	Nx
Residential Style Refrigerators	2.2	2.1	3.1	3.3	3.9	7.0	Nx
n-values	69	69	69	71	71	69	n/a

Source: Onsite Survey

6 CONCLUDING REMARKS

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

It was through the use of on-site data collection that the SWE team was able to collect accurate information regarding not only the type of equipment installed in 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 2011; PECO data collection occurred during Spring 2010) captures these equipment types and efficiency levels during similar periods of EDC energy efficiency program maturity. These factors help to provide justification for the inputs of the energy efficiency potential assessment as well as confidence in the ultimate estimates of electric energy efficiency savings potential.

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

Commercial On-site Survey

Nexant/*<EDC Name>*

General Info (Complete before visit):

Company Name:	_____	Unique ID	_____
Contact Name:	_____	No. Electric Meters:	_____
Contact Phone Number:	_____	~~No. Gas Meters:~~	_____
Address:	_____	Annual kWh:	_____
City, State, Zip:	_____	~~Annual dKt:~~	_____

Engineer: _____
Site Visit Date: _____
Site Visit Time: _____
Notes: _____

Survey Key

N/A = Not Applicable
NX = Not Available

General Info

1. Our records indicate that you have an account with *<EDC Name>* with _____(# electric meters) electric meters ~~and _____(# gas meters) gas meters~~. Is this correct? Y / N

2. If no, please indicate the actual number of meters:

Electric		~~Gas~~	N/A

3. Do you have any other energy service providers? If yes, please check which services apply to this business:

Electric		~~Gas~~	N/A	~~Propane~~	N/A

~~4. If you do not have natural gas service, is natural gas available nearby? Y / N~~

5. How many people occupy this building? _____

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 (e.g. holidays)? Y / N
(If yes, fill out tables below otherwise leave blank)

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: ____	□	□

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: ____	□	□

9. Of the following options, what is the primary use of your building? [Check appropriate space]

Education	Grocery	Health	Lodging	Office	Restaurant	Retail	Warehouse	Industrial	Multifamily	Other

10. If Other: Please describe: _____

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

12. If Restaurant: How many meals are served per day? _____

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

Building Information

14. How old is this building? _____ years

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

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

17. How many floors is this building? _____

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

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

20. What level of LEED certification does this building have?
(1=certified, 2=silver, 3=gold, 4=platinum) _____

Envelope

21.

Building Envelope		
Walls		
Orientation	*(N,S,E,W)*	
Surface Type	*1=Brick* *2=Concrete* *3=Concrete Block* *4=Wood* *5=Metal*	
Framing Type	*1=Metal* *2=Wood*	
Insulation Type	*1=Batt/Blown* *2=Rigid* *3=None* *4=Unknown*	
Estimated R-Value		
Windows		
% of Wall Area	*(%)*	
Layers of Glazing	*(1,2,3)*	
Glazing Type	*1=Clear* *2=Reflective* *3=Tinted* *4=Low E* *5=Gas Filled*	
Frame Type	*1=Metal* *2=Wood* *3=Vinyl*	
Window Type	*1=Fixed* *2=Operable*	
Roofs		
Total Roof Area	*(Ft^2)*	
Roof Type	*1=Flat* *2=Pitched*	
Surface Material	*1=Built-up* *2=Cool Roof* *3=Membrane* *4=Metal* *5=Shingles/Flat*	
Deck Material	*1=Concrete* *2=Metal* *3=Wood*	
Insulation Type	*1=Batt/Blown* *2=Rigid* *3=None* *4=Unknown*	
Skylights	*(Circle One)*	Y / N
Green Roof	*(Circle One)*	Y / N
Floors		
Floor Type	*1=Basement* *2=Crawl* *3=Slab* *4=Unconditioned*	
Material Type	*1=Concrete* *2=Metal* *3=Wood* *4=Other*	
Insulation Type	*1=Batt/Blown* *2=Rigid* *3=None* *4=Unknown*	

HVAC System

22. Does this building have a Packaged HVAC System? Y / N

Packaged HVAC System				
		System 1	System 2	System 3
HVAC System Type	*(See Table Below)*			
HVAC 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)*			
Rated Heating Capacity	*(Btu/hr)*			
Performance Rating	*(Circle One)*	EER SEER	EER SEER	EER SEER
Performance Rating Value				
Compressors:				
Quantity				
HP or Volts/Phase/FL Amps				
Supply Fans:				
Motor HP				
Motor Efficiency	*(%)*			
VFD?		(Y/N)	(Y/N)	(Y/N)
Return Fan:				
Motor HP				
Motor Efficiency	*(%)*			
VFD?		(Y/N)	(Y/N)	(Y/N)
Primary Heat:				
Fuel Type	*(See Table Below)*			
Efficiency	*(%)*			
Supplemental Heat:				
Fuel Type	*(See Table Below)*			
Efficiency	*(%)*			
Terminal Reheat Type	*(See Table Below)*			
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

Packaged HVAC System Types		
1=Packaged Single Zone-A/C Only	6=Heat Pump, Air Source	11=Unit Ventilator
2=Packaged Single Zone-A/C w/ Heat	7=Heat Pump, Ground Source	12=Window/ Wall A/C Unit
3=Packaged Multi Zone	8=Heat Pump, Water Source	13=Window/ Wall Heat Pump
4=Packaged VAV	9=Split System	14=Packaged Single Zone-Heat Only
5=Evaporative Cooler	10=Unit Heater	

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

Terminal Reheat Types
1=Electric
2=Hot Water
3=Steam
4=Other

23. Does this building have a central HVAC System Air Handler? Y / N

Central HVAC System-Air Handler				
		System 1	System 2	System 3
HVAC System Type	*(See Table Below)*			
HVAC 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				
Manufacturer				
Model Name				
Model Number				
Serial Number				
Cooling Coils	*(Circle One)*	Y / N	Y / N	Y / N
Heating Coils	*(Circle One)*	Y / N	Y / N	Y / N
Supply Fans:				
Volume Control	*1=Discharge Damper 2=Inlet Vain 3=VFD*			
Motor HP				
Volts/Phase/FL Amps				
Motor Efficiency	*(%)*			
Return Fan:				
Volume Control	*1=Discharge Damper 2=Inlet Vain 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

HVAC System Type		
1=CV-Single Zone	7=VAV-Cooling Only	13=Hydronic Heat Pump
2=CV-Multi Zone	8=VAV-Terminal Reheat	14=Induction
3=CV-Dual Duct	9=VAV-Dual Duct	15= Radiant Slab Heat
4=CV-Terminal Reheat	10=Fan Coil	16=PTAC
5=FPS-Fan Powered VAV-Series	11=Baseboard	17=Unit Ventilators
6=FPP-Fan Powered VAV-Parallel	12=Heat & Vent	18=Radiators

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

24. Does this building have a central HVAC System Boiler? Y / N

Central HVAC System-Boiler				
		System 1	System 2	System 3
Fuel Type	*(See Table Below)*			
Heating 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				
Input Capacity	*(Btu/h)*			
Efficiency	*(%)*			
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	5=Purchase HW or Steam
2=Natural Gas	6=Wood
3=Fuel Oil	7=Other (Make Note)
4=LPG	

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

25. Does this building have a central HVAC System 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	*(% 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	

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

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

Chilled Water Pumps				
Pump Use	*1=Primary 2=Secondary*			
Quantity				
Motor HP				
Motor Efficiency				
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

26. Heating set-points and schedules:

	System 1		System 2		System 3		System 4	
	Time	Temp	Time	Temp	Time	Temp	Time	Temp
Occupied								
Unoccupied								

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

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

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

29. Cooling set-points and schedule:

	System 1		System 2		System 3		System 4	
	Time	Temp	Time	Temp	Time	Temp	Time	Temp
Occupied								
Unoccupied								

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

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

31. If 'Lodging' type facility: Is a key card energy control system used? Y / N

Ventilation

32. Is an indoor parking garage with ventilation present? Y / N
33. If yes, how large is the parking garage? _____ ft^2
34. If yes, is the garage ventilation system controlled with CO sensors? Y / N
35. For interior spaces, is any demand-controlled ventilation system employed? Y / N
36. Are ventilation hoods used? Y / N
37. Are any demand based controls used on the ventilation hoods? Y / N
38. Are the ventilation hoods variable volume? Y / N
39. Is make-up air provided directly at the ventilation hood? Y / N

Domestic Hot Water

40. 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	*(KW or Btu/hr)*			
Recovery	*(Gal/hr)*			
Efficiency	*(EF)*			
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
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	

41. 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?				

Lighting

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

43. What is the estimated interior lighting power density for the building[s]? _____ W/ft^2
(Use worksheet in Appendix to calculate!)

44. What is the estimated exterior lighting power density for the building[s]? _____ W/ft^2

Please fill out the tables below:

45. **Lighting Type**		
	By Percent	
	Interior	Exterior
Linear Fluorescent		
Compact Fluorescent		
Incandescent		
Metal Halide		
High Pressure Sodium		
Mercury Vapor		
LED		
Neon (Cold Cathode)		
Other		

46. **Fluorescent Lamp Types**	
	By Percent
T12	
T8	
T10	
T8 Plus (25W/28W)	
T5	
T5HO	
47. **Ballast Types**	
Magnetic-Standard	
Magnetic-ES	
Electronic	
Electronic Dimming	
Emergency	

48. **Control Type**		
	By Percent	
	Interior	Exterior
Manual:		
Switch		
Circuit Breaker		
Dual Level Switch		
Dimmer Switch		
Timer		
Occupancy Sensor		
Daylighting Controls		
Energy Management System		

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

50. What type of exit signs does this building have? _____
(1=Incandescent, 2=Compact fluorescent, 3=LED, 4=Other, 5=Don't Know)

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

Plug Loads

Appliances: If there is more than one type of appliance in the building, note the average age, frequency of use, and EnergyStar rating.

	Number	Age (years)	Frequency of Use (hrs/wk)	EnergyStar?
52. Personal Computers				Y / N
53. Laptops				Y / N
54. Secondary Monitors				Y / N
55. Servers				Y / N
56. Printers				Y / N
57. Scanners				Y / N
58. Photocopiers				Y / N
59. Fax Machine				Y / N
60. Water coolers				Y / N
61. Air purifiers				Y / N
62. Security Cameras				Y / N
63. Battery Chargers				Y / N
64. Snack Machines				Y / N
65. Beverage Machines				Y / N
66. Space Heaters				Y / N
67. Residential Style Refrigerators				Y / N

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

69. Are power supplies 80% efficiency (80 Plus) Y / N

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

71. If residential style refrigerators are used, do they have eCubes installed? Y / N

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

	Commercial		Residential	
	Washer	Dryer	Washer	Dryer
Type (1=front load, 2=top load)				
Ozonating Cycle?	Y / N	--	Y / N	--
Age (years)				
Manufacturer				
Model Name				
Model Number				
Serial Number				
Loads per week				
EnergyStar?	Y / N	Y / N	Y / N	Y / N
Dryer fuel type (1=electric, 2=natural gas, 3=propane)	--		--	
Efficiency (MEF)				

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

Age (years)	
Manufacturer	
Model Name	
Model Number	
Loads per week	
EnergyStar?	Y / N
Efficiency (EF)	

Cooking

74. 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, frequency of use, and EnergyStar rating

	Fuel	Number	Age (years)	Frequency of Use (hrs/wk)	EnergyStar?
75. Standard Oven	E / G / P				Y / N
76. Convection Oven	E / G / P				Y / N
77. Range	E / G / P				Y / N
78. Fryer	E / G / P				Y / N
79. Hot food holding cabinet	E / G / P				Y / N
80. Electric Steam Cooker	E / G / P				Y / N
81. Griddle	E / G / P				Y / N
82. Pizza Oven	E / G / P				Y / N
83. Warming Table	E / G / P				Y / N
84. Heat Lamps	E / G / P				Y / N
85. Soup Pots	E / G / P				Y / N
86. Continuous Toaster	E / G / P				Y / N
87. Microwave	E / G / P				Y / N

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

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Type					
Qty					
Age (years)					
Fuel (E / G / P)					
Wattage/Input					
Usage (Hrs/wk)					

89. Are commercial dishwashers used? Y / N

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

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

92. 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

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

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

	Type	Size (ft^3)	Qty	Stand alone?	Age (years)	Energy-Star?
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

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

	Type	Size (ft^2)	Qty	Age (years)	Lighting (Fluorescent, LED, Incand, None)	Compressor (hp)	
System 1							
System 2							
System 3							
System 4							
System 5							
System 6							
System 7							
System 8							
System 9							
System 10							

If a multiplex compressor system is used describe it below:

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

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

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

96. Are VFDs used on compressors? Y / N

97. Are ECM Motors in use? Y / N

98. Are demand defrost controls used? Y / N

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

100. Are high-efficiency evaporator fans used? Y / N

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

102. Are evaporator fan controls used? Y / N

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

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

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

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

107. 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

108. 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 (%)			
Control Type: (1=Manual, 2=Timer, 3='Smart' Controller, 4=Other)			

Does this building have a pool? Y / N

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

Electricity	
Natural Gas	
Propane	
Other	

110. Pool pump details:

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

111. How is the pool pump controlled?

Runs continuously	
Timer	
VSD	
Other	

112. When is the pool used?

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

Other Process Loads

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

114. Briefly describe each process load:

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

Process Load Details

	Age (years)	Mfg	Model Number	Fuel Type (see table below)	Operating hrs	KWh	Other Details
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)

Renewable Energy

115. Does this building have any renewable energy systems? Y / N

116. If so what type? _____

117. What is the nameplate capacity of the system (kW)? _____

Appendix

Lighting Sample Summary

Typical Lighting Configuration 1					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Typical Lighting Configuration 2					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Typical Lighting Configuration 3					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Typical Lighting Configuration 4					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Lighting Sample Summary

Typical Lighting Configuration 5					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Typical Lighting Configuration 6					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Typical Lighting Configuration 7					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Typical Lighting Configuration 8					
Lamp Type	# of Fixtures	Lamps/Fixture	Fixture Wattage	Sq. Footage	W/ft^2

Packaged HVAC System				
		System 4	System 5	System 6
HVAC System Type	*(See Table Below)*			
HVAC 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				
Rated Cooling Capacity	*(Tons)*			
Rated Heating Capacity	*(Btu/hr)*			
Performance Rating	*(Circle One)*	EER SEER	EER SEER	EER SEER
Performance Rating Value				
Compressors:				
Quantity				
HP or Volts/Phase/FL Amps				
Supply Fans:				
Motor HP				
Motor Efficiency	*(%)*			
Return Fan:				
Motor HP				
Motor Efficiency	*(%)*			
Primary Heat:				
Fuel Type	*(See Table Below)*			
Efficiency	*(%)*			
Supplemental Heat:				
Fuel Type	*(See Table Below)*			
Efficiency	*(%)*			
Terminal Reheat Type	*(See Table Below)*			
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

Packaged HVAC System Types		
1=Packaged Single Zone-A/C Only	6=Heat Pump, Air Source	11=Unit Ventilator
2=Packaged Single Zone-A/C w/ Heat	7=Heat Pump, Ground Source	12=Window/Wall A/C Unit
3=Packaged Multi Zone	8=Heat Pump, Water Source	13=Window/Wall Heat Pump
4=Packaged VAV	9=Split System	
5=Evaporative Cooler	10=Unit Heater	

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

Terminal Reheat Types
1=Electric
2=Hot Water
3=Steam
4=Other

Central HVAC System-Air Handler				
		System 4	System 5	System 6
HVAC System Type	*(See Table Below)*			
HVAC 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				
Cooling Coils	*(Circle One)*	Y / N	Y / N	Y / N
Heating Coils	*(Circle One)*	Y / N	Y / N	Y / N
Supply Fans:				
Volume Control	*1=Discharge Damper 2=Inlet Vain 3=VFD*			
Motor HP				
Volts/Phase/FL Amps				
Motor Efficiency	*(%)*			
Return Fan:				
Volume Control	*1=Discharge Damper 2=Inlet Vain 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

HVAC System Type		
1=CV-Single Zone	7=VAV-Cooling Only	13=Hydronic Heat Pump
2=CV-Multi Zone	8=VAV-Terminal Reheat	14=Induction
3=CV-Dual Duct	9=VAV-Dual Duct	15= Radiant Slab Heat
4=CV-Terminal Reheat	10=Fan Coil	16=PTAC
5=FPS-Fan Powered VAV-Series	11=Baseboard	17=Unit Ventilators
6=FPP-Fan Powered VAV-Parallel	12=Heat & Vent	18=Radiators

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

Notes:

Appendix B RECRUITMENT LETTER

<<LOGO>>

<DATE>

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

Dear Mr. /Mrs. /Ms. <Last Name>,

In order to support energy-efficiency planning associated with PA Act 129 of 2008, your company has been randomly chosen as a potential participant in a state-wide study to gather information on the energy-using equipment installed in commercial facilities. The Pennsylvania Public Utility Commission (PA PUC) is conducting this research to find ways to help Pennsylvania businesses save on energy.

This letter is to inform you that you will 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. The Nexant representative will call to conduct a 5-10 minute survey about the energy systems in your facility, as well as to ask for your participation in an on-site survey. During this on-site survey, a Nexant representative will visit your facility to gather information about the energy systems installed in your building(s).

All data collected for this study will be kept anonymous and simply 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, please feel free to contact PA PUC at 717-425-7584 or through email (ra-act129@pa.gov). You may also contact <EDC NAME> customer call center at X-XXX-XXX-XXXX. Please be sure to reference the "Energy Usage" survey. Thank you.

Best regards,

<EDC Representative>

Commercial Phone Survey

General Info (Complete before Interview):

Company Name:
Contact Name:
Contact Phone Number:
Address:
City, State, Zip:
Unique ID

1st Contact Attempt
Interviewer:_____
Date: _____
Spoke With:_____
Notes: _____

2nd Contact Attempt
Interviewer:_____
Date:_____
Spoke With:_____
Notes: _____

Phone Message:

Hello, my name is _____, and I'm calling on behalf of the Pennsylvania Public Utilities Commission. I am calling because we are partnering with your utility <INSERT EDC> to assess how businesses are using energy with the aim to better design incentive and rebate programs for businesses in PA. If this is something you would be willing to participate in we would appreciate your help. (For Small business: As a sign of our appreciation, if you choose to participate we will provide you a free $50 Visa Gift Card.)
If you are interested in participating, please contact Heidi Farmer with Nexant at 1-855-828-7745.

Thank you, and have a good day.

Introduction:
Hello, my name is _____, and I'm calling on behalf of the Pennsylvania Public Utilities Commission. May I speak to a facility manager or someone who is familiar with your building's energy using equipment and systems?

Cont'd: I am calling because we are partnering with your utility <INSERT EDC> to assess how businesses are using energy with the aim to better design incentive and rebate programs for businesses in PA. We are looking for businesses to volunteer to participate in this study. Time commitment is minimal on your end and would simply involve us sending an engineer to your

business to take a look at your energy using equipment. Is this something you think you would be interested in helping out with? (For Small business: As a sign of our appreciation, if you choose to participate we will provide you a free $50 Visa Gift Card.)

a) 'Yes': Thank you for your participation. If you have a few minutes, I'd like to ask you some questions about the energy systems in your building. This will take approximately 10 to 15 minutes. [Proceed to survey and record scheduled time]

b) 'No': Thank you for your time [Terminate call]

Do you have time to speak now?

a) 'Yes': [Proceed to survey].

b) 'No': Would there be a better time to call back?

b1) 'Yes': [Get time and date: _____.] Someone will call you back on _____. Thank you for your time.

b2) 'No': Thank you for your time [Terminate call]

General Information

1. Before we begin, I would like to confirm your name and contact information. I have you listed as [Read company name and address]. Is this correct?
   a. Yes [Proceed to question 2.]
   b. No [Record correct name and address]

_____
_____
_____

2. Can you please provide your email address so that we can send you a confirmation notice of your scheduled survey time?

_____

3. Of the following options, what is the primary use of your building? [Check appropriate space]

__Education
__Grocery
__Health
__Lodging
__Office
__Restaurant
__Retail
__Warehouse
__Multifamily

__Industrial
__Other_____

Building Information

4. How large is [are] the building[s] on this account?

Square Ft

Primary Building_____
Building 2_____
Building 3_____
Building 4_____
Building 5_____

5. How many floors does [do] the building[s] have?

Floors

Primary Building_____
Building 2_____
Building 3_____
Building 4_____
Building 5_____

6. What is the primary type and fuel of the heating system in the building[s]?
(Type: 1=Boiler, 2=Furnace, 3=Rooftop Unit, 4=Unit Heater)
(Fuel:1=Electric, 2=Natural Gas, 3=Propane, 4=Oil, 5=Wood, 6=Other)

Heating Type Fuel

Primary Building_____
Building 2_____
Building 3_____
Building 4_____
Building 5_____

7. What is the primary type of cooling system in the building[s]?
(1=Rooftop Unit, 2=Split system, 3=Chiller, 4=Through-the-wall AC, 5=Heat pump)
(If rooftop unit, will there be access for the site visit?)

Cooling Type

Primary Building_____
Building 2_____
Building 3_____
Building 4_____
Building 5_____

8. What is the primary type of lighting in the building[s]?
(1=Fluorescent, 2=Incandescent, 3=High Intensity Discharge)

Primary Building_____

Building 2_____
Building 3_____
Building 4_____
Building 5_____

9. Does this building [do these buildings] have any commercial kitchen equipment?

	Commercial Kitchen
Primary Building	Y / N
Building 2	Y / N
Building 3	Y / N
Building 4	Y / N
Building 5	Y / N

10. Does this building [do these buildings] produce any renewable energy?

	Renewable
Primary Building	Y / N
Building 2	Y / N
Building 3	Y / N
Building 4	Y / N
Building 5	Y / N

Schedule Site Visit:

a) Thank you for your help. Surveyors will be in your area between <START DATE> and <END DATE>. Is there a time that works for your schedule during this period? [Schedule time and date _____]. A representative from our office will come to [read address] at [read time] on [read date] and will provide you with proper identification from the Pennsylvania Public Utility Commission. It will be necessary to have a knowledgeable facilities manager available to assist the engineer at all times.

Who will be the contact for this visit? Based on your facility size, we expect the site visit to last <NUMBER OF HOURS>

If you should need to cancel or reschedule, please contact Heidi Farmer at 1-855-828-7745 and we will be happy to accommodate you.

We will need access to the mechanical rooms, rooftop, or basement where the equipment is located? Will that be possible? Y / N

Will any safety equipment such as hard-hats or ear plugs be required to conduct a walk-through? Y / N

If you have access to blueprints of your facility, please have it available for the engineer when he arrives, it will expedite the time in your business.

If you have any questions, you can contact the PA PUC by calling 717-425-7584 and refer to the "Energy Usage" survey. We appreciate your time, have a nice day.

Commercial Facilities	
Size (sq. ft.)	Time Est.
< 25000	~ 1 hour
25,000 - 50,000	~ 2 hours
50,000 - 100,000	~ 3 hours
100,000 - 200,000	~ 4 hours
* Grocery Stores last 2 hours plus * Commercial Kitchen add 1 hour	
Industrial Facilities	
Size (sq. ft.)	Time Est.
< 250,000	~ 3-4 hours
> 250,000	4 - 8 hours

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: 100%

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
Church	Institutional
Education	Institutional
Grocery	Retail
Health	Institutional
Lodging	Misc.
Government	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 assigned each SIC code to a building type by adopting the SIC-building type mapping used by the *California Commercial End use Survey*. 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		2646		Mfg: Industrial
11		Unclassified		2647		Mfg: Industrial
12		Unclassified		2648		Mfg: Industrial
13		Unclassified		2649		Mfg: Industrial
14		Unclassified		2650		Mfg: Industrial
16		Unclassified		2651		Mfg: Industrial
17		Unclassified		2652	SETUP PAPERBOARD BOXES	Mfg: Paper and Allied Products
19		Unclassified		2653	CORRUGATED AND SOLID FIBER BOX	Mfg: Paper and Allied Products
20		Unclassified		2654		Mfg: Industrial
21		Unclassified		2655	FIBER CANS, DRUMS & SIMILAR PR	Mfg: Paper and Allied Products
22		Unclassified		2656	SANITARY FOOD CONTAINERS	Mfg: Paper and Allied Products
23		Unclassified		2657	FOLDING PAPERBOARD BOXES	Mfg: Paper and Allied Products
24		Unclassified		2660		Mfg: Industrial
27		Unclassified		2661		Mfg: Industrial
29		Unclassified		2670		Mfg: Industrial
30		Unclassified		2671	PAPER COATED & LAMINATED, PACK	Mfg: Paper and Allied Products
31		Unclassified		2672	PAPER COATED AND LAMINATED, NE	Mfg: Paper and Allied Products
32		Unclassified		2673	BAGS: PLASTICS, LAMINATED, & C	Mfg: Paper and Allied Products
33		Unclassified		2674	BAGS: UNCOATED PAPER & MULTIWA	Mfg: Paper and Allied Products
34		Unclassified		2675	DIE-CUT PAPER AND BOARD	Mfg: Paper and Allied Products
37		Unclassified		2676	SANITARY PAPER PRODUCTS	Mfg: Paper and Allied Products
39		Unclassified		2677	ENVELOPES	Mfg: Paper and Allied Products
100		Ag & Pumping		2678	STATIONERY PRODUCTS	Mfg: Paper and Allied Products
110		Ag & Pumping		2679	CONVERTED PAPER PRODUCTS, NEC	Mfg: Paper and Allied Products
111	WHEAT	Ag & Pumping		2700		Mfg: Industrial
112	RICE	Ag & Pumping		2710		Mfg: Industrial
115	CORN	Ag & Pumping		2711	NEWSPAPERS	Mfg: Printing
116	SOYBEANS	Ag & Pumping		2720		Mfg: Industrial
119	CASH GRAINS, NEC	Ag & Pumping		2721	PERIODICALS	Mfg: Printing
130		Ag & Pumping		2730		Mfg: Industrial
131	COTTON	Ag & Pumping		2731	BOOK PUBLISHING	Mfg: Printing
132	TOBACCO	Ag & Pumping		2732	BOOK PRINTING	Mfg: Printing
133	SUGARCANE AND SUGAR BEETS	Ag & Pumping		2740		Mfg: Industrial
134	IRISH POTATOES	Ag & Pumping		2741	MISCELLANEOUS PUBLISHING	Mfg: Printing
139	FIELD CROPS, EXCEPT CASH GRAIN	Ag & Pumping		2750		Mfg: Industrial
160		Ag & Pumping		2751		Mfg: Industrial
161	VEGETABLES AND MELONS	Ag & Pumping		2752	COMMERCIAL PRINTING, LITHOGRAP	Mfg: Printing
170		Ag & Pumping		2753		Mfg: Industrial
171	BERRY CROPS	Ag & Pumping		2754	COMMERCIAL PRINTING, GRAVURE	Mfg: Printing
172	GRAPES	Ag & Pumping		2759	COMMERCIAL PRINTING, NEC	Mfg: Printing

173	TREE NUTS	Ag & Pumping		2760		Mfg: Industrial
174	CITRUS FRUITS	Ag & Pumping		2761	MANIFOLD BUSINESS FORMS	Mfg: Printing
175	DECIDUOUS TREE FRUITS	Ag & Pumping		2770		Mfg: Industrial
179	FRUITS AND TREE NUTS, NEC	Ag & Pumping		2771	GREETING CARDS	Mfg: Printing
180		Ag & Pumping		2780		Mfg: Industrial
181	ORNAMENTAL NURSERY PRODUCTS	Ag & Pumping		2782	BLANKBOOKS AND LOOSELEAF BINDE	Mfg: Printing
182	FOOD CROPS GROWN UNDER COVER	Ag & Pumping		2789	BOOKBINDING AND RELATED WORK	Mfg: Printing
189		Ag & Pumping		2790		Mfg: Industrial
190		Ag & Pumping		2791	TYPESETTING	Mfg: Printing
191	GENERAL FARMS, PRIMARILY CROP	Ag & Pumping		2793		Mfg: Industrial
200		Ag & Pumping		2794		Mfg: Industrial
210		Ag & Pumping		2795		Mfg: Industrial
211	BEEF CATTLE FEEDLOTS	Ag & Pumping		2796	PLATEMAKING SERVICES	Mfg: Printing
212	BEEF CATTLE, EXCEPT FEEDLOTS	Ag & Pumping		2800		Mfg: Industrial
213	HOGS	Ag & Pumping		2810		Mfg: Industrial
214	SHEEP AND GOATS	Ag & Pumping		2812	ALKALIES AND CHLORINE	Mfg: Chemicals and Allied Products
219	GENERAL LIVESTOCK, NEC	Ag & Pumping		2813	INDUSTRIAL GASES	Mfg: Chemicals and Allied Products
240		Ag & Pumping		2816	INORGANIC PIGMENTS	Mfg: Chemicals and Allied Products
241	DAIRY FARMS	Ag & Pumping		2819	INDUSTRIAL INORGANIC CHEMICALS	Mfg: Chemicals and Allied Products
250		Ag & Pumping		2820		Mfg: Industrial
251	BROILER, FRYER, AND ROASTER CH	Ag & Pumping		2821	PLASTICS MATERIALS AND RESINS	Mfg: Chemicals and Allied Products
252	CHICKEN EGGS	Ag & Pumping		2822	SYNTHETIC RUBBER	Mfg: Chemicals and Allied Products
253	TURKEYS AND TURKEY EGGS	Ag & Pumping		2823	CELLULOSIC MANMADE FIBERS	Mfg: Chemicals and Allied Products
254	POULTRY HATCHERIES	Ag & Pumping		2824	ORGANIC FIBERS, NONCELLULOSIC	Mfg: Chemicals and Allied Products
259	POULTRY AND EGGS, NEC	Ag & Pumping		2830		Mfg: Industrial
270		Ag & Pumping		2831		Mfg: Industrial
271	FUR-BEARING ANIMALS AND RABBIT	Ag & Pumping		2833	MEDICINALS AND BOTANICALS	Mfg: Chemicals and Allied Products
272	HORSES AND OTHER EQUINES	Ag & Pumping		2834	PHARMACEUTICAL PREPARATIONS	Mfg: Chemicals and Allied Products
273	ANIMAL AQUACULTURE	Ag & Pumping		2835	DIAGNOSTIC SUBSTANCES	Mfg: Chemicals and Allied Products
279	ANIMAL SPECIALTIES, NEC	Ag & Pumping		2836	BIOLOGICAL PRODUCTS EXCEPT DIA	Mfg: Chemicals and Allied Products
290		Ag & Pumping		2840		Mfg: Industrial
291	GENERAL FARMS, PRIMARILY ANIMA	Ag & Pumping		2841	SOAP AND OTHER DETERGENTS	Mfg: Chemicals and Allied Products
700		Ag & Pumping		2842	POLISHES AND SANITATION GOODS	Mfg: Chemicals and Allied Products
710		Ag & Pumping		2843	SURFACE ACTIVE AGENTS	Mfg: Chemicals and Allied Products
711	SOIL PREPARATION SERVICES	Ag & Pumping		2844	TOILET PREPARATIONS	Mfg: Chemicals and Allied Products
720		Ag & Pumping		2850		Mfg: Industrial
721	CROP PLANTING AND	Ag & Pumping		2851	PAINTS AND ALLIED	Mfg: Chemicals and Allied

	PROTECTING				PRODUCTS	Products
722	CROP HARVESTING	Ag & Pumping		2860		Mfg: Industrial
723	CROP HARVESTING SERVICES FOR M	Ag & Pumping		2861	GUM AND WOOD CHEMICALS	Mfg: Chemicals and Allied Products
724	COTTON GINNING	Ag & Pumping		2865	CYCLIC CRUDES AND INTERMEDIATE	Mfg: Chemicals and Allied Products
729		Ag & Pumping		2869	INDUSTRIAL ORGANIC CHEMICALS,	Mfg: Chemicals and Allied Products
740		Office		2870		Mfg: Industrial
741	VETERINARY SERVICES FOR LIVEST	Office		2873	NITROGENOUS FERTILIZERS	Mfg: Chemicals and Allied Products
742	VETERINARY SERVICES, SPECIALTI	Office		2874	PHOSPHATIC FERTILIZERS	Mfg: Chemicals and Allied Products
750		Ag & Pumping		2875	FERTILIZERS, MIXING ONLY	Mfg: Chemicals and Allied Products
751	LIVESTOCK SERVICES, EXCEPT VET	Ag & Pumping		2879	AGRICULTURAL CHEMICALS, NEC	Mfg: Chemicals and Allied Products
752	ANIMAL SPECIALTY SERVICES	Ag & Pumping		2890		Mfg: Chemicals and Allied Products
760		Office		2891	ADHESIVES AND SEALANTS	Mfg: Chemicals and Allied Products
761	FARM LABOR CONTRACTORS	Office		2892	EXPLOSIVES	Mfg: Chemicals and Allied Products
762	FARM MANAGEMENT SERVICES	Office		2893	PRINTING INK	Mfg: Chemicals and Allied Products
780		Office		2895	CARBON BLACK	Mfg: Chemicals and Allied Products
781	LANDSCAPE COUNSELING AND PLANN	Office		2899	CHEMICAL PREPARATIONS, NEC	Mfg: Chemicals and Allied Products
782	LAWN AND GARDEN SERVICES	Office		2900		Mfg: Industrial
783	ORNAMENTAL SHRUB AND TREE SERV	Office		2910		Mfg: Industrial
800		Forestry		2911	PETROLEUM REFINING	Mfg: Petroleum Refining and Related Industries
810		Forestry		2950		Mfg: Industrial
811	TIMBER TRACTS	Forestry		2951	ASPHALT PAVING MIXTURES AND BL	Mfg: Petroleum Refining and Related Industries
820		Forestry		2952	ASPHALT FELTS AND COATINGS	Mfg: Petroleum Refining and Related Industries
821		Forestry		2990		Mfg: Industrial
830		Forestry		2992	LUBRICATING OILS AND GREASES	Mfg: Petroleum Refining and Related Industries
831	FOREST PRODUCTS	Forestry		2999	PETROLEUM AND COAL PRODUCTS, N	Mfg: Petroleum Refining and Related Industries
840		Forestry		3000		Mfg: Industrial
843		Forestry		3010		Mfg: Industrial
849		Forestry		3011	TIRES AND INNER TUBES	Mfg: Rubber and Mixed Plastics
850		Forestry		3020		Mfg: Industrial
851	FORESTRY SERVICES	Forestry		3021	RUBBER AND PLASTICS FOOTWEAR	Mfg: Rubber and Mixed Plastics
900		Fishing		3030		Mfg: Industrial
910		Fishing		3031		Mfg: Industrial
912	FINFISH	Fishing		3040		Mfg: Industrial
913	SHELLFISH	Fishing		3041		Mfg: Industrial
919	MISCELLANEOUS MARINE PRODUCTS	Fishing		3050		Mfg: Industrial
920		Fishing		3052	RUBBER & PLASTICS HOSE & BELTI	Mfg: Rubber and Mixed Plastics

921	FISH HATCHERIES AND PRESERVES	Fishing		3053	GASKETS, PACKING AND SEALING D	Mfg: Rubber and Mixed Plastics
970		Fishing		3060		Mfg: Industrial
971	HUNTING, TRAPPING, GAME PROPAG	Fishing		3061	MECHANICAL RUBBER GOODS	Mfg: Rubber and Mixed Plastics
1000		Mining & Extraction		3069	FABRICATED RUBBER PRODUCTS, NE	Mfg: Rubber and Mixed Plastics
1010		Mining & Extraction		3070		Mfg: Industrial
1011	IRON ORES	Mining & Extraction		3079		Mfg: Industrial
1020		Mining & Extraction		3080		Mfg: Industrial
1021	COPPER ORES	Mining & Extraction		3081	UNSUPPORTED PLASTICS FILM & SH	Mfg: Rubber and Mixed Plastics
1030		Mining & Extraction		3082	UNSUPPORTED PLASTICS PROFILE S	Mfg: Rubber and Mixed Plastics
1031	LEAD AND ZINC ORES	Mining & Extraction		3083	LAMINATED PLASTICS PLATE & SHE	Mfg: Rubber and Mixed Plastics
1040		Mining & Extraction		3084	PLASTICS PIPE	Mfg: Rubber and Mixed Plastics
1041	GOLD ORES	Mining & Extraction		3085	PLASTICS BOTTLES	Mfg: Rubber and Mixed Plastics
1044	SILVER ORES	Mining & Extraction		3086	PLASTICS FOAM PRODUCTS	Mfg: Rubber and Mixed Plastics
1050		Mining & Extraction		3087	CUSTOM COMPOUND PURCHASED RESI	Mfg: Rubber and Mixed Plastics
1051		Mining & Extraction		3088	PLASTICS PLUMBING FIXTURES	Mfg: Rubber and Mixed Plastics
1060		Mining & Extraction		3089	PLASTICS PRODUCTS, NEC	Mfg: Rubber and Mixed Plastics
1061	FERROALLOY ORES, EXCEPT VANADI	Mining & Extraction		3100		Mfg: Industrial
1080		Mining & Extraction		3110		Mfg: Industrial
1081	METAL MINING SERVICES	Mining & Extraction		3111	LEATHER TANNING AND FINISHING	Mfg: Leather
1090		Mining & Extraction		3130		Mfg: Industrial
1092		Mining & Extraction		3131	FOOTWEAR CUT STOCK	Mfg: Leather
1094	URANIUM-RADIUM-VANADIUM ORES	Mining & Extraction		3140		Mfg: Industrial
1099	METAL ORES, NEC	Mining & Extraction		3142	HOUSE SLIPPERS	Mfg: Leather
1100		Mining & Extraction		3143	MEN'S FOOTWEAR, EXCEPT ATHLETI	Mfg: Leather
1110		Mining & Extraction		3144	WOMEN'S FOOTWEAR, EXCEPT ATHLE	Mfg: Leather
1111		Mining & Extraction		3149	FOOTWEAR, EXCEPT RUBBER, NEC	Mfg: Leather
1112		Mining & Extraction		3150		Mfg: Leather
1200		Mining & Extraction		3151	LEATHER GLOVES AND MITTENS	Mfg: Leather
1210		Mining & Extraction		3160		Mfg: Industrial
1211		Mining & Extraction		3161	LUGGAGE	Mfg: Leather
1213		Mining & Extraction		3170		Mfg: Industrial
1220		Mining & Extraction		3171	WOMEN'S HANDBAGS AND PURSES	Mfg: Leather
1221	BITUMINOUS COAL AND LIGNITE-SU	Mining & Extraction		3172	PERSONAL LEATHER GOODS, NEC	Mfg: Leather
1222	BITUMINOUS COAL-UNDERGROUND	Mining & Extraction		3190		Mfg: Industrial
1230		Mining & Extraction		3199	LEATHER GOODS, NEC	Mfg: Leather
1231	ANTHRACITE MINING	Mining & Extraction		3200		Mfg: Industrial
1240		Mining & Extraction		3210		Mfg: Industrial
1241	COAL MINING SERVICES	Mining & Extraction		3211	FLAT GLASS	Mfg: Stone Clay Glass and Concrete
1300		Mining & Extraction		3220		Mfg: Industrial

1310		Mining & Extraction		3221	GLASS CONTAINERS	Mfg: Stone Clay Glass and Concrete
1311	CRUDE PETROLEUM AND NATURAL GA	Mining & Extraction		3229	PRESSED AND BLOWN GLASS, NEC	Mfg: Stone Clay Glass and Concrete
1320		Mining & Extraction		3230		Mfg: Industrial
1321	NATURAL GAS LIQUIDS	Mining & Extraction		3231	PRODUCTS OF PURCHASED GLASS	Mfg: Stone Clay Glass and Concrete
1380		Mining & Extraction		3240		Mfg: Industrial
1381	DRILLING OIL AND GAS WELLS	Mining & Extraction		3241	CEMENT, HYDRAULIC	Mfg: Stone Clay Glass and Concrete
1382	OIL AND GAS EXPLORATION SERVIC	Mining & Extraction		3250		Mfg: Industrial
1389	OIL AND GAS FIELD SERVICES, NE	Mining & Extraction		3251	BRICK AND STRUCTURAL CLAY TILE	Mfg: Stone Clay Glass and Concrete
1400		Mining & Extraction		3253	CERAMIC WALL AND FLOOR TILE	Mfg: Stone Clay Glass and Concrete
1410		Mining & Extraction		3255	CLAY REFRACTORIES	Mfg: Stone Clay Glass and Concrete
1411	DIMENSION STONE	Mining & Extraction		3259	STRUCTURAL CLAY PRODUCTS, NEC	Mfg: Stone Clay Glass and Concrete
1420		Mining & Extraction		3260		Mfg: Industrial
1422	CRUSHED AND BROKEN LIMESTONE	Mining & Extraction		3261	VITREOUS PLUMBING FIXTURES	Mfg: Stone Clay Glass and Concrete
1423	CRUSHED AND BROKEN GRANITE	Mining & Extraction		3262	VITREOUS CHINA TABLE & KITCHEN	Mfg: Stone Clay Glass and Concrete
1429	CRUSHED AND BROKEN STONE, NEC	Mining & Extraction		3263	SEMIVITREOUS TABLE & KITCHENWA	Mfg: Stone Clay Glass and Concrete
1440		Mining & Extraction		3264	PORCELAIN ELECTRICAL SUPPLIES	Mfg: Stone Clay Glass and Concrete
1442	CONSTRUCTION SAND AND GRAVEL	Mining & Extraction		3269	POTTERY PRODUCTS, NEC	Mfg: Stone Clay Glass and Concrete
1446	INDUSTRIAL SAND	Mining & Extraction		3270		Mfg: Industrial
1450		Mining & Extraction		3271	CONCRETE BLOCK AND BRICK	Mfg: Stone Clay Glass and Concrete
1452		Mining & Extraction		3272	CONCRETE PRODUCTS, NEC	Mfg: Stone Clay Glass and Concrete
1453		Mining & Extraction		3273	READY-MIXED CONCRETE	Mfg: Stone Clay Glass and Concrete
1454		Mining & Extraction		3274	LIME	Mfg: Stone Clay Glass and Concrete
1455	KAOLIN AND BALL CLAY	Mining & Extraction		3275	GYPSUM PRODUCTS	Mfg: Stone Clay Glass and Concrete
1459	CLAY AND RELATED MINERALS, NEC	Mining & Extraction		3280		Mfg: Industrial
1470		Mining & Extraction		3281	CUT STONE AND STONE PRODUCTS	Mfg: Stone Clay Glass and Concrete
1472		Mining & Extraction		3290		Mfg: Industrial
1473		Mining & Extraction		3291	ABRASIVE PRODUCTS	Mfg: Stone Clay Glass and Concrete
1474	POTASH, SODA, AND BORATE MINER	Mining & Extraction		3292	ASBESTOS PRODUCTS	Mfg: Stone Clay Glass and Concrete
1475	PHOSPHATE ROCK	Mining & Extraction		3293		Mfg: Industrial
1476		Mining & Extraction		3295	MINERALS, GROUND OR TREATED	Mfg: Stone Clay Glass and Concrete
1477		Mining & Extraction		3296	MINERAL WOOL	Mfg: Stone Clay Glass and Concrete
1479	CHEMICAL AND FERTILIZER MINING	Mining & Extraction		3297	NONCLAY REFRACTORIES	Mfg: Stone Clay Glass and Concrete
1480		Mining & Extraction		3299	NONMETALLIC MINERAL PRODUCTS,	Mfg: Stone Clay Glass and Concrete

1481	NONMETALLIC MINERALS SERVICES	Mining & Extraction		3300		Mfg: Industrial
1490		Mining & Extraction		3310		Mfg: Industrial
1492		Mining & Extraction		3312	BLAST FURNACES AND STEEL MILLS	Mfg: Primary Metals
1496		Mining & Extraction		3313	ELECTROMETALLURGICAL PRODUCTS	Mfg: Primary Metals
1499	MISCELLANEOUS NONMETALLIC MINE	Mining & Extraction		3315	STEEL WIRE AND RELATED PRODUCT	Mfg: Primary Metals
1500		Construction		3316	COLD FINISHING OF STEEL SHAPES	Mfg: Primary Metals
1520		Construction		3317	STEEL PIPE AND TUBES	Mfg: Primary Metals
1521	SINGLE-FAMILY HOUSING CONSTRUC	Construction		3320		Mfg: Industrial
1522	RESIDENTIAL CONSTRUCTION, NEC	Construction		3321	GRAY AND DUCTILE IRON FOUNDRIE	Mfg: Primary Metals
1530		Construction		3322	MALLEABLE IRON FOUNDRIES	Mfg: Primary Metals
1531	OPERATIVE BUILDERS	Construction		3324	STEEL INVESTMENT FOUNDRIES	Mfg: Primary Metals
1540		Construction		3325	STEEL FOUNDRIES, NEC	Mfg: Primary Metals
1541	INDUSTRIAL BUILDINGS AND WAREH	Construction		3330		Mfg: Industrial
1542	NONRESIDENTIAL CONSTRUCTION, N	Construction		3331	PRIMARY COPPER	Mfg: Primary Metals
1543		Construction		3332		Mfg: Industrial
1600		Construction		3333		Mfg: Industrial
1610		Construction		3334	PRIMARY ALUMINUM	Mfg: Primary Metals
1611	HIGHWAY AND STREET CONSTRUCTIO	Construction		3339	PRIMARY NONFERROUS METALS, NEC	Mfg: Primary Metals
1620		Construction		3340		Mfg: Industrial
1622	BRIDGE, TUNNEL, & ELEVATED HIG	Construction		3341	SECONDARY NONFERROUS METALS	Mfg: Primary Metals
1623	WATER, SEWER, AND UTILITY LINE	Construction		3350		Mfg: Industrial
1629	HEAVY CONSTRUCTION, NEC	Construction		3351	COPPER ROLLING AND DRAWING	Mfg: Primary Metals
1700		Construction		3353	ALUMINUM SHEET, PLATE, AND FOI	Mfg: Primary Metals
1710		Construction		3354	ALUMINUM EXTRUDED PRODUCTS	Mfg: Primary Metals
1711	PLUMBING, HEATING, AIR-CONDITI	Construction		3355	ALUMINUM ROLLING AND DRAWING,	Mfg: Primary Metals
1720		Construction		3356	NONFERROUS ROLLING AND DRAWING	Mfg: Primary Metals
1721	PAINTING AND PAPER HANGING	Construction		3357	NONFERROUS WIREDRAWING & INSUL	Mfg: Primary Metals
1730		Construction		3360		Mfg: Industrial
1731	ELECTRICAL WORK	Construction		3361		Mfg: Industrial
1740		Construction		3362		Mfg: Industrial
1741	MASONRY AND OTHER STONEWORK	Construction		3363	ALUMINUM DIE-CASTINGS	Mfg: Primary Metals
1742	PLASTERING, DRYWALL, AND INSUL	Construction		3364	NONFERROUS DIE-CASTINGS EXCEPT	Mfg: Primary Metals
1743	TERRAZZO, TILE, MARBLE, MOSAIC	Construction		3365	ALUMINUM FOUNDRIES	Mfg: Primary Metals
1750		Construction		3366	COPPER FOUNDRIES	Mfg: Primary Metals
1751	CARPENTRY WORK	Construction		3369	NONFERROUS FOUNDRIES, NEC	Mfg: Primary Metals

1752	FLOOR LAYING AND FLOOR WORK, N	Construction		3390		Mfg: Industrial
1760		Construction		3398	METAL HEAT TREATING	Mfg: Primary Metals
1761	ROOFING, SIDING, AND SHEET MET	Construction		3399	PRIMARY METAL PRODUCTS, NEC	Mfg: Primary Metals
1770		Construction		3400		Mfg: Industrial
1771	CONCRETE WORK	Construction		3410		Mfg: Industrial
1780		Construction		3411	METAL CANS	Mfg: Fabricated Metal Products
1781	WATER WELL DRILLING	Construction		3412	METAL BARRELS, DRUMS, AND PAIL	Mfg: Fabricated Metal Products
1790		Construction		3420		Mfg: Industrial
1791	STRUCTURAL STEEL ERECTION	Construction		3421	CUTLERY	Mfg: Fabricated Metal Products
1793	GLASS AND GLAZING WORK	Construction		3423	HAND AND EDGE TOOLS, NEC	Mfg: Fabricated Metal Products
1794	EXCAVATION WORK	Construction		3425	SAW BLADES AND HANDSAWS	Mfg: Fabricated Metal Products
1795	WRECKING AND DEMOLITION WORK	Construction		3429	HARDWARE, NEC	Mfg: Fabricated Metal Products
1796	INSTALLING BUILDING EQUIPMENT,	Construction		3430		Mfg: Industrial
1799	SPECIAL TRADE CONTRACTORS, NEC	Construction		3431	METAL SANITARY WARE	Mfg: Fabricated Metal Products
2000		Mfg: Industrial		3432	PLUMBING FIXTURE FITTINGS AND	Mfg: Fabricated Metal Products
2010		Mfg: Industrial		3433	HEATING EQUIPMENT, EXCEPT ELEC	Mfg: Fabricated Metal Products
2011	MEAT PACKING PLANTS	Mfg: Food		3440		Mfg: Industrial
2013	SAUSAGES AND OTHER PREPARED ME	Mfg: Food		3441	FABRICATED STRUCTURAL METAL	Mfg: Fabricated Metal Products
2015	POULTRY SLAUGHTERING AND PROCE	Mfg: Food		3442	METAL DOORS, SASH, AND TRIM	Mfg: Fabricated Metal Products
2016		Mfg: Industrial		3443	FABRICATED PLATE WORK (BOILER	Mfg: Fabricated Metal Products
2017		Mfg: Industrial		3444	SHEET METAL WORK	Mfg: Fabricated Metal Products
2020		Mfg: Industrial		3446	ARCHITECTURAL METAL WORK	Mfg: Fabricated Metal Products
2021	CREAMERY BUTTER	Mfg: Food		3448	PREFABRICATED METAL BUILDINGS	Mfg: Fabricated Metal Products
2022	CHEESE, NATURAL AND PROCESSED	Mfg: Food		3449	MISCELLANEOUS METAL WORK	Mfg: Fabricated Metal Products
2023	DRY, CONDENSED, EVAPORATED PRO	Mfg: Food		3450		Mfg: Industrial
2024	ICE CREAM AND FROZEN DESSERTS	Mfg: Food		3451	SCREW MACHINE PRODUCTS	Mfg: Fabricated Metal Products
2026	FLUID MILK	Mfg: Food		3452	BOLTS, NUTS, RIVETS, AND WASHE	Mfg: Fabricated Metal Products
2030		Mfg: Industrial		3460		Mfg: Industrial
2032	CANNED SPECIALTIES	Mfg: Food		3462	IRON AND STEEL FORGINGS	Mfg: Fabricated Metal Products
2033	CANNED FRUITS AND VEGETABLES	Mfg: Food		3463	NONFERROUS FORGINGS	Mfg: Fabricated Metal Products
2034	DEHYDRATED FRUITS, VEGETABLES,	Mfg: Food		3465	AUTOMOTIVE STAMPINGS	Mfg: Fabricated Metal Products
2035	PICKLES, SAUCES, AND SALAD DRE	Mfg: Food		3466	CROWNS AND CLOSURES	Mfg: Fabricated Metal Products
2037	FROZEN FRUITS AND VEGETABLES	Mfg: Food		3469	METAL STAMPINGS, NEC	Mfg: Fabricated Metal Products
2038	FROZEN SPECIALTIES, NEC	Mfg: Food		3470		Mfg: Industrial
2040		Mfg: Industrial		3471	PLATING AND POLISHING	Mfg: Fabricated Metal Products

2041	FLOUR AND OTHER GRAIN MILL PRO	Mfg: Food		3479	METAL COATING AND ALLIED SERVI	Mfg: Fabricated Metal Products
2043	CEREAL BREAKFAST FOODS	Mfg: Food		3480		Mfg: Industrial
2044	RICE MILLING	Mfg: Food		3482	SMALL ARMS AMMUNITION	Mfg: Fabricated Metal Products
2045	PREPARED FLOUR MIXES AND DOUGH	Mfg: Food		3483	AMMUNITION, EXCEPT FOR SMALL A	Mfg: Fabricated Metal Products
2046	WET CORN MILLING	Mfg: Food		3484	SMALL ARMS	Mfg: Fabricated Metal Products
2047	DOG AND CAT FOOD	Mfg: Food		3489	ORDNANCE AND ACCESSORIES, NEC	Mfg: Fabricated Metal Products
2048	PREPARED FEEDS, NEC	Mfg: Food		3490		Mfg: Industrial
2050		Mfg: Industrial		3491	INDUSTRIAL VALVES	Mfg: Fabricated Metal Products
2051	BREAD, CAKE, AND RELATED PRODU	Mfg: Food		3492	FLUID POWER VALVES & HOSE FITT	Mfg: Fabricated Metal Products
2052	COOKIES AND CRACKERS	Mfg: Food		3493	STEEL SPRINGS, EXCEPT WIRE	Mfg: Fabricated Metal Products
2053	FROZEN BAKERY PRODUCTS, EXCEPT	Mfg: Food		3494	VALVES AND PIPE FITTINGS, NEC	Mfg: Fabricated Metal Products
2060		Mfg: Industrial		3495	WIRE SPRINGS	Mfg: Fabricated Metal Products
2061	RAW CANE SUGAR	Mfg: Food		3496	MISCELLANEOUS FABRICATED WIRE	Mfg: Fabricated Metal Products
2062	CANE SUGAR REFINING	Mfg: Food		3497	METAL FOIL AND LEAF	Mfg: Fabricated Metal Products
2063	BEET SUGAR	Mfg: Food		3498	FABRICATED PIPE AND FITTINGS	Mfg: Fabricated Metal Products
2064	CANDY & OTHER CONFECTIONERY PR	Mfg: Food		3499	FABRICATED METAL PRODUCTS, NEC	Mfg: Fabricated Metal Products
2065		Mfg: Industrial		3500		Mfg: Industrial
2066	CHOCOLATE AND COCOA PRODUCTS	Mfg: Food		3510		Mfg: Industrial
2067	CHEWING GUN	Mfg: Food		3511	TURBINES AND TURBINE GENERATOR	Mfg: Ind and Com Machinery
2068	SALTED AND ROASTED NUTS AND SE	Mfg: Food		3519	INTERNAL COMBUSTION ENGINES, N	Mfg: Ind and Com Machinery
2070		Mfg: Industrial		3520		Mfg: Industrial
2074	COTTONSEED OIL MILLS	Mfg: Food		3523	FARM MACHINERY AND EQUIPMENT	Mfg: Ind and Com Machinery
2075	SOYBEAN OIL MILLS	Mfg: Food		3524	LAWN AND GARDEN EQUIPMENT	Mfg: Ind and Com Machinery
2076	VEGETABLE OIL MILLS, NEC	Mfg: Food		3530		Mfg: Industrial
2077	ANIMAL AND MARINE FATS AND OIL	Mfg: Food		3531	CONSTRUCTION MACHINERY	Mfg: Ind and Com Machinery
2079	EDIBLE FATS AND OILS, NEC	Mfg: Food		3532	MINING MACHINERY	Mfg: Ind and Com Machinery
2080		Mfg: Industrial		3533	OIL AND GAS FIELD MACHINERY	Mfg: Ind and Com Machinery
2082	MALT BEVERAGES	Mfg: Food		3534	ELEVATORS AND MOVING STAIRWAYS	Mfg: Ind and Com Machinery
2083	MALT	Mfg: Food		3535	CONVEYORS AND CONVEYING EQUIPM	Mfg: Ind and Com Machinery
2084	WINES, BRANDY, AND BRANDY SPIR	Mfg: Food		3536	HOISTS, CRANES, AND MONORAILS	Mfg: Ind and Com Machinery
2085	DISTILLED AND BLENDED LIQUORS	Mfg: Food		3537	INDUSTRIAL TRUCKS AND TRACTORS	Mfg: Ind and Com Machinery
2086	BOTTLED AND CANNED SOFT DRINKS	Mfg: Food		3540		Mfg: Industrial
2087	FLAVORING EXTRACTS AND SYRUPS,	Mfg: Food		3541	MACHINE TOOLS, METAL CUTTING T	Mfg: Ind and Com Machinery
2090		Mfg: Industrial		3542	MACHINE TOOLS, METAL FORMING T	Mfg: Ind and Com Machinery
2091	CANNED AND CURED FISH	Mfg: Food		3543	INDUSTRIAL PATTERNS	Mfg: Ind and Com Machinery

	AND SEAF					
2092	FRESH OR FROZEN PREPARED FISH	Mfg: Food		3544	SPECIAL DIES, TOOLS, JIGS & FI	Mfg: Ind and Com Machinery
2095	ROASTED COFFEE	Mfg: Food		3545	MACHINE TOOL ACCESSORIES	Mfg: Ind and Com Machinery
2096	POTATO CHIPS AND SIMILAR SNACK	Mfg: Food		3546	POWER-DRIVEN HANDTOOLS	Mfg: Ind and Com Machinery
2097	MANUFACTURED ICE	Mfg: Food		3547	ROLLING MILL MACHINERY	Mfg: Ind and Com Machinery
2098	MACARONI AND SPAGHETTI	Mfg: Food		3548	WELDING APPARATUS	Mfg: Ind and Com Machinery
2099	FOOD PREPARATIONS, NEC	Mfg: Food		3549	METALWORKING MACHINERY, NEC	Mfg: Ind and Com Machinery
2100		Mfg: Industrial		3550		Mfg: Industrial
2110		Mfg: Industrial		3551		Mfg: Industrial
2111	CIGARETTES	Mfg: Tobacco		3552	TEXTILE MACHINERY	Mfg: Ind and Com Machinery
2120		Mfg: Industrial		3553	WOODWORKING MACHINERY	Mfg: Ind and Com Machinery
2121	CIGARS	Mfg: Tobacco		3554	PAPER INDUSTRIES MACHINERY	Mfg: Ind and Com Machinery
2130		Mfg: Industrial		3555	PRINTING TRADES MACHINERY	Mfg: Ind and Com Machinery
2131	CHEWING AND SMOKING TOBACCO	Mfg: Tobacco		3556	FOOD PRODUCTS MACHINERY	Mfg: Ind and Com Machinery
2140		Mfg: Industrial		3559	SPECIAL INDUSTRY MACHINERY, NE	Mfg: Ind and Com Machinery
2141	TOBACCO STEMMING AND REDRYING	Mfg: Tobacco		3560		Mfg: Industrial
2200		Mfg: Industrial		3561	PUMPS AND PUMPING EQUIPMENT	Mfg: Ind and Com Machinery
2210		Mfg: Industrial		3562	BALL AND ROLLER BEARINGS	Mfg: Ind and Com Machinery
2211	BROADWOVEN FABRIC MILLS, COTTO	Mfg: Textile		3563	AIR AND GAS COMPRESSORS	Mfg: Ind and Com Machinery
2220		Mfg: Industrial		3564	BLOWERS AND FANS	Mfg: Ind and Com Machinery
2221	BROADWOVEN FABRIC MILLS, MANMA	Mfg: Textile		3565	PACKAGING MACHINERY	Mfg: Ind and Com Machinery
2230		Mfg: Industrial		3566	SPEED CHANGES, DRIVES, AND GEA	Mfg: Ind and Com Machinery
2231	BROADWOVEN FABRIC MILLS, WOOL	Mfg: Textile		3567	INDUSTRIAL FURNACES AND OVENS	Mfg: Ind and Com Machinery
2240		Mfg: Industrial		3568	POWER TRANSMISSION EQUIPMENT,	Mfg: Ind and Com Machinery
2241	NARROW FABRIC MILLS	Mfg: Textile		3569	GENERAL INDUSTRIAL MACHINERY,	Mfg: Ind and Com Machinery
2250		Mfg: Industrial		3570		Mfg: Ind and Com Machinery
2251	WOMEN'S HOSIERY, EXCEPT SOCKS	Mfg: Textile		3571	ELECTRONIC COMPUTERS	Mfg: Ind and Com Machinery
2252	HOSIERY, NEC	Mfg: Textile		3572	COMPUTER STORAGE DEVICES	Mfg: Ind and Com Machinery
2253	KNIT OUTERWEAR MILLS	Mfg: Textile		3573		Mfg: Ind and Com Machinery
2254	KNIT UNDERWEAR MILLS	Mfg: Textile		3574		Mfg: Ind and Com Machinery
2257	WEFT KNIT FABRIC MILLS	Mfg: Textile		3575	COMPUTER TERMINALS	Mfg: Ind and Com Machinery
2258	LACE & WARP KNIT FABRIC MILLS	Mfg: Textile		3576		Mfg: Ind and Com Machinery
2259	KNITTING MILLS, NEC	Mfg: Textile		3577	COMPUTER PERIPHERAL EQUIPMENT,	Mfg: Ind and Com Machinery
2260		Mfg: Industrial		3578	CALCULATING AND ACCOUNTING EQU	Mfg: Ind and Com Machinery
2261	FINISHING PLANTS, COTTON	Mfg: Textile		3579	OFFICE MACHINES, NEC	Mfg: Ind and Com Machinery

2262	FINISHING PLANTS, MANMADE	Mfg: Textile		3580		Mfg: Ind and Com Machinery
2269	FINISHING PLANTS, NEC	Mfg: Textile		3581	AUTOMATIC VENDING MACHINES	Mfg: Ind and Com Machinery
2270		Mfg: Industrial		3582	COMMERCIAL LAUNDRY EQUIPMENT	Mfg: Ind and Com Machinery
2271		Mfg: Industrial		3585	REFRIGERATION AND HEATING EQUI	Mfg: Ind and Com Machinery
2272		Mfg: Industrial		3586	MEASURING AND DISPENSING PUMPS	Mfg: Ind and Com Machinery
2273	CARPETS AND RUGS	Mfg: Textile		3589	SERVICE INDUSTRY MACHINERY, NE	Mfg: Ind and Com Machinery
2279		Mfg: Industrial		3590		Mfg: Ind and Com Machinery
2280		Mfg: Industrial		3592	CARBURETORS, PISTONS, RINGS, V	Mfg: Ind and Com Machinery
2281	YARN SPINNING MILLS	Mfg: Textile		3593	FLUID POWER CYLINDERS & ACTUAT	Mfg: Ind and Com Machinery
2282	THROWING AND WINDING MILLS	Mfg: Textile		3594	FLUID POWER PUMPS AND MOTORS	Mfg: Ind and Com Machinery
2283		Mfg: Industrial		3596	SCALES AND BALANCES, EXCEPT LA	Mfg: Ind and Com Machinery
2284	THREAD MILLS	Mfg: Textile		3599	INDUSTRIAL MACHINERY, NEC	Mfg: Ind and Com Machinery
2290		Mfg: Industrial		3600		Mfg: Electronic Equipment
2291		Mfg: Industrial		3610		Mfg: Electronic Equipment
2292		Mfg: Industrial		3612	TRANSFORMERS, EXCEPT ELECTRONI	Mfg: Electronic Equipment
2293		Mfg: Industrial		3613	SWITCHGEAR AND SWITCHBOARD APP	Mfg: Electronic Equipment
2294		Mfg: Industrial		3620		Mfg: Electronic Equipment
2295	COATED FABRICS, NOT RUBBERIZED	Mfg: Textile		3621	MOTORS AND GENERATORS	Mfg: Electronic Equipment
2296	TIRE CORD AND FABRICS	Mfg: Textile		3622		Mfg: Electronic Equipment
2297	NONWOVEN FABRICS	Mfg: Textile		3623		Mfg: Electronic Equipment
2298	CORDAGE AND TWINE	Mfg: Textile		3624	CARBON AND GRAPHITE PRODUCTS	Mfg: Electronic Equipment
2299	TEXTILE GOODS, NEC	Mfg: Textile		3625	RELAYS AND INDUSTRIAL CONTROLS	Mfg: Electronic Equipment
2300		Mfg: Industrial		3629	ELECTRICAL INDUSTRIAL APPARATU	Mfg: Electronic Equipment
2310		Mfg: Industrial		3630		Mfg: Electronic Equipment
2311	MEN'S AND BOYS' SUITS AND COAT	Mfg: Apparel		3631	HOUSEHOLD COOKING EQUIPMENT	Mfg: Electronic Equipment
2320		Mfg: Industrial		3632	HOUSEHOLD REFRIGERATORS AND FR	Mfg: Electronic Equipment
2321	MEN'S AND BOYS' SHIRTS	Mfg: Apparel		3633	HOUSEHOLD LAUNDRY EQUIPMENT	Mfg: Electronic Equipment
2322	MEN'S AND BOYS' UNDERWEAR & NI	Mfg: Apparel		3634	ELECTRIC HOUSEWARES AND FANS	Mfg: Electronic Equipment
2323	MEN'S AND BOYS' NECKWEAR	Mfg: Apparel		3635	HOUSEHOLD VACUUM CLEANERS	Mfg: Electronic Equipment
2325	MEN'S AND BOYS' TROUSERS AND S	Mfg: Apparel		3636		Mfg: Electronic Equipment
2326	MEN'S AND BOYS' WORK CLOTHING	Mfg: Apparel		3639	HOUSEHOLD APPLIANCES, NEC	Mfg: Electronic Equipment
2327		Mfg: Industrial		3640		Mfg: Electronic Equipment
2328		Mfg: Industrial		3641	ELECTRIC LAMPS	Mfg: Electronic Equipment
2329	MEN'S AND BOYS' CLOTHING, NEC	Mfg: Apparel		3643	CURRENT-CARRYING WIRING DEVICE	Mfg: Electronic Equipment
2330		Mfg: Industrial		3644	NONCURRENT-CARRYING	Mfg: Electronic Equipment

					WIRING DEV	
2331	WOMEN'S & MISSES' BLOUSES & SH	Mfg: Apparel		3645	RESIDENTIAL LIGHTING FIXTURES	Mfg: Electronic Equipment
2335	WOMEN'S, JUNIORS', & MISSES' D	Mfg: Apparel		3646	COMMERCIAL LIGHTING FIXTURES	Mfg: Electronic Equipment
2337	WOMEN'S AND MISSES' SUITS AND	Mfg: Apparel		3647	VEHICULAR LIGHTING EQUIPMENT	Mfg: Electronic Equipment
2339	WOMEN'S AND MISSES' OUTERWEAR,	Mfg: Apparel		3648	LIGHTING EQUIPMENT, NEC	Mfg: Electronic Equipment
2340		Mfg: Industrial		3650		Mfg: Electronic Equipment
2341	WOMEN'S AND CHILDREN'S UNDERWE	Mfg: Apparel		3651	HOUSEHOLD AUDIO AND VIDEO EQUI	Mfg: Electronic Equipment
2342	BRAS, GIRDLES, AND ALLIED GARM	Mfg: Apparel		3652	PRERECORDED RECORDS AND TAPES	Mfg: Electronic Equipment
2343		Mfg: Industrial		3660		Mfg: Electronic Equipment
2350		Mfg: Industrial		3661	TELEPHONE AND TELEGRAPH APPARA	Mfg: Electronic Equipment
2351		Mfg: Industrial		3662		Mfg: Electronic Equipment
2352		Mfg: Industrial		3663	RADIO & TV COMMUNICATIONS EQUI	Mfg: Electronic Equipment
2353	HATS, CAPS, AND MILLINERY	Mfg: Apparel		3669	COMMUNICATIONS EQUIPMENT, NEC	Mfg: Electronic Equipment
2360		Mfg: Apparel		3670		Mfg: Electronic Equipment
2361	GIRLS' & CHILDREN'S DRESSES, B	Mfg: Apparel		3671	ELECTRON TUBES	Mfg: Electronic Equipment
2363		Mfg: Industrial		3672	PRINTED CIRCUIT BOARDS	Mfg: Electronic Equipment
2369	GIRLS' AND CHILDREN'S OUTERWEA	Mfg: Apparel		3673		Mfg: Electronic Equipment
2370		Mfg: Industrial		3674	SEMICONDUCTORS ND RELATED DEVI	Mfg: Electronic Equipment
2371	FUR GOODS	Mfg: Apparel		3675	ELECTRONIC CAPACITORS	Mfg: Electronic Equipment
2380		Mfg: Industrial		3676	ELECTRONIC RESISTORS	Mfg: Electronic Equipment
2381	FABRIC DRESS AND WORK GLOVES	Mfg: Apparel		3677	ELECTRONIC COILS AND TRANSFORM	Mfg: Electronic Equipment
2384	ROBES AND DRESSING GOWNS	Mfg: Apparel		3678	ELECTRONIC CONNECTORS	Mfg: Electronic Equipment
2385	WATERPROOF OUTERWEAR	Mfg: Apparel		3679	ELECTRONIC COMPONENTS, NEC	Mfg: Electronic Equipment
2386	LEATHER AND SHEEP-LINED CLOTHI	Mfg: Apparel		3690		Mfg: Electronic Equipment
2387	APPAREL BELTS	Mfg: Apparel		3691	STORAGE BATTERIES	Mfg: Electronic Equipment
2389	APPAREL AND ACCESSORIES, NEC	Mfg: Apparel		3692	PRIMARY BATTERIES, DRY AND WET	Mfg: Electronic Equipment
2390		Mfg: Industrial		3693		Mfg: Electronic Equipment
2391	CURTAINS AND DRAPERIES	Mfg: Apparel		3694	ENGINE ELECTRICAL EQUIPMENT	Mfg: Electronic Equipment
2392	HOUSEFURNISHINGS, NEC	Mfg: Apparel		3695	MAGNETIC AND OPTICAL RECORDING	Mfg: Electronic Equipment
2393	TEXTILE BAGS	Mfg: Apparel		3699	ELECTRICAL EQUIPMENT & SUPPLIE	Mfg: Electronic Equipment
2394	CANVAS AND RELATED PRODUCTS	Mfg: Apparel		3700		Mfg: Transportation Equipment
2395	PLEATING AND STITCHING	Mfg: Apparel		3710		Mfg: Transportation Equipment
2396	AUTOMOTIVE AND APPAREL TRIMMIN	Mfg: Apparel		3711	MOTOR VEHICLES AND CAR BODIES	Mfg: Transportation Equipment
2397	SCHIFFLI MACHINE EMBROIDERIES	Mfg: Apparel		3713	TRUCK AND BUS BODIES	Mfg: Transportation Equipment
2399	FABRICATED TEXTILE PRODUCTS, N	Mfg: Apparel		3714	MOTOR VEHICLE PARTS AND ACCESS	Mfg: Transportation Equipment

2400		Mfg: Industrial		3715	TRUCK TRAILERS	Mfg: Transportation Equipment
2410		Mfg: Industrial		3716	MOTOR HOMES	Mfg: Transportation Equipment
2411	LOGGING	Mfg: Lumber and Wood Products		3720		Mfg: Transportation Equipment
2420		Mfg: Industrial		3721	AIRCRAFT	Mfg: Transportation Equipment
2421	SAWMILLS AND PLANING MILLS, GE	Mfg: Lumber and Wood Products		3724	AIRCRAFT ENGINES AND ENGINE PA	Mfg: Transportation Equipment
2426	HARDWOOD DIMENSION & FLOORING	Mfg: Lumber and Wood Products		3728	AIRCRAFT PARTS AND EQUIPMENT,	Mfg: Transportation Equipment
2429	SPECIAL PRODUCT SAWMILLS, NEC	Mfg: Lumber and Wood Products		3730		Mfg: Transportation Equipment
2430		Mfg: Industrial		3731	SHIP BUILDING AND REPAIRING	Mfg: Transportation Equipment
2431	MILLWORK	Mfg: Lumber and Wood Products		3732	BOAT BUILDING AND REPAIRING	Mfg: Transportation Equipment
2434	WOOD KITCHEN CABINETS	Mfg: Lumber and Wood Products		3740		Mfg: Transportation Equipment
2435	HARDWOOD VENEER AND PLYWOOD	Mfg: Lumber and Wood Products		3743	RAILROAD EQUIPMENT	Mfg: Transportation Equipment
2436	SOFTWOOD VENEER AND PLYWOOD	Mfg: Lumber and Wood Products		3750		Mfg: Transportation Equipment
2439	STRUCTURAL WOOD MEMBERS, NEC	Mfg: Lumber and Wood Products		3751	MOTORCYCLES, BICYCLES, AND PAR	Mfg: Transportation Equipment
2440		Mfg: Industrial		3760		Mfg: Transportation Equipment
2441	NAILED WOOD BOXES AND SHOOK	Mfg: Lumber and Wood Products		3761	GUIDED MISSILES AND SPACE VEHI	Mfg: Transportation Equipment
2448	WOOD PALLETS AND SKIDS	Mfg: Lumber and Wood Products		3764	SPACE PROPULSION UNITS AND PAR	Mfg: Transportation Equipment
2449	WOOD CONTAINERS, NEC	Mfg: Lumber and Wood Products		3769	SPACE VEHICLE EQUIPMENT, NEC	Mfg: Transportation Equipment
2450		Mfg: Industrial		3790		Mfg: Transportation Equipment
2451	MOBILE HOMES	Mfg: Lumber and Wood Products		3792	TRAVEL TRAILERS AND CAMPERS	Mfg: Transportation Equipment
2452	PREFABRICATED WOOD BUILDINGS	Mfg: Lumber and Wood Products		3795	TANKS AND TANK COMPONENTS	Mfg: Transportation Equipment
2490		Mfg: Industrial		3799	TRANSPORTATION EQUIPMENT, NEC	Mfg: Transportation Equipment
2491	WOOD PRESERVING	Mfg: Lumber and Wood Products		3800		Mfg: Measurement and Control Equipment
2492		Mfg: Industrial		3810		Mfg: Measurement and Control Equipment
2493	RECONSTITUTED WOOD PRODUCTS	Mfg: Lumber and Wood Products		3811		Mfg: Measurement and Control Equipment
2499	WOOD PRODUCTS, NEC	Mfg: Lumber and Wood Products		3812	SEARCH AND NAVIGATION EQUIPMEN	Mfg: Measurement and Control Equipment
2500		Mfg: Industrial		3820		Mfg: Measurement and Control Equipment
2510		Mfg: Industrial		3821	LABORATORY APPARATUS AND FURNI	Mfg: Measurement and Control Equipment
2511	WOOD HOUSEHOLD FURNITURE	Mfg: Furniture and Fixtures		3822	ENVIRONMENTAL CONTROLS	Mfg: Measurement and Control Equipment
2512	UPHOLSTERED HOUSEHOLD FURNITUR	Mfg: Furniture and Fixtures		3823	PROCESS CONTROL INSTRUMENTS	Mfg: Measurement and Control Equipment
2514	METAL HOUSEHOLD FURNITURE	Mfg: Furniture and Fixtures		3824	FLUID METERS AND COUNTING DEVI	Mfg: Measurement and Control Equipment
2515	MATTRESSES AND BEDSPRINGS	Mfg: Furniture and Fixtures		3825	INSTRUMENTS TO MEASURE ELECTRI	Mfg: Measurement and Control Equipment
2517	WOOD TV AND RADIO CABINETS	Mfg: Furniture and Fixtures		3826	ANALYTICAL INSTRUMENTS	Mfg: Measurement and Control Equipment
2519	HOUSEHOLD FURNITURE,	Mfg: Furniture and		3827	OPTICAL INSTRUMENTS	Mfg: Measurement and Control

	NEC	Fixtures			AND LENSES	Equipment
2520		Mfg: Industrial		3829	MEASURING & CONTROLLING DEVICE	Mfg: Measurement and Control Equipment
2521	WOOD OFFICE FURNITURE	Mfg: Furniture and Fixtures		3830		Mfg: Measurement and Control Equipment
2522	OFFICE FURNITURE, EXCEPT WOOD	Mfg: Furniture and Fixtures		3832		Mfg: Measurement and Control Equipment
2530		Mfg: Industrial		3840		Mfg: Measurement and Control Equipment
2531	PUBLIC BUILDING & RELATED FURN	Mfg: Furniture and Fixtures		3841	SURGICAL AND MEDICAL INSTRUMEN	Mfg: Measurement and Control Equipment
2540		Mfg: Industrial		3842	SURGICAL APPLIANCES AND SUPPLI	Mfg: Measurement and Control Equipment
2541	WOOD PARTITIONS AND FIXTURES	Mfg: Furniture and Fixtures		3843	DENTAL EQUIPMENT AND SUPPLIES	Mfg: Measurement and Control Equipment
2542	PARTITIONS AND FIXTURES, EXCEP	Mfg: Furniture and Fixtures		3844	X-RAY APPARATUS AND TUBES	Mfg: Measurement and Control Equipment
2590		Mfg: Industrial		3845	ELECTROMEDICAL EQUIPMENT	Mfg: Measurement and Control Equipment
2591	DRAPERY HARDWARE & BLINDS & SH	Mfg: Furniture and Fixtures		3850		Mfg: Measurement and Control Equipment
2599	FURNITURE AND FIXTURES, NEC	Mfg: Furniture and Fixtures		3851	OPHTHALMIC GOODS	Mfg: Measurement and Control Equipment
2600		Mfg: Industrial		3860		Mfg: Measurement and Control Equipment
2610		Mfg: Industrial		3861	PHOTOGRAPHIC EQUIPMENT AND SUP	Mfg: Measurement and Control Equipment
2611	PULP MILLS	Mfg: Paper and Allied Products		3870		Mfg: Measurement and Control Equipment
2620		Mfg: Industrial		3873	WATCHES, CLOCKS, WATCHCASES &	Mfg: Measurement and Control Equipment
2621	PAPER MILLS	Mfg: Paper and Allied Products		3900		Mfg: Measurement and Control Equipment
2630		Mfg: Industrial		3910		Mfg: Measurement and Control Equipment
2631	PAPERBOARD MILLS	Mfg: Paper and Allied Products		3911	JEWELRY PRECIOUS METAL	Mfg: Misc Mfg
2640		Mfg: Industrial		3914	SILVERWARE AND PLATED WARE	Mfg: Misc Mfg
2641		Mfg: Industrial		3915	JEWELERS'MATERIALS & LAPIDARY	Mfg: Misc Mfg
2642		Mfg: Industrial		3930		Mfg: Misc Mfg
2643		Mfg: Industrial		3931	MUSICAL INSTRUMENTS	Mfg: Misc Mfg
2645		Mfg: Industrial		3940		Mfg: Misc Mfg
				3942	DOLLS AND STUFFED TOYS	Mfg: Misc Mfg
				3944	GAMES, TOYS, AND CHILDREN'S VE	Mfg: Misc Mfg
SIC Code	SIC Description	Building Type		SIC Code	SIC Description	Building Type
3949	SPORTING AND ATHLETIC GOODS, N	Mfg: Misc Mfg		6110		Office
3950		Mfg: Misc Mfg		6111	FEDERAL & FEDERAL SPONSORED CR	Office
3951	PENS AND MECHANICAL PENCILS	Mfg: Misc Mfg		6112		Office
3952	LEAD PENCILS AND ART GOODS	Mfg: Misc Mfg		6113		Office
3953	MARKING DEVICES	Mfg: Misc Mfg		6120		Office
3955	CARBON PAPER AND INKED RIBBONS	Mfg: Misc Mfg		6122		Office

3960		Mfg: Misc Mfg		6123		Office
3961	COSTUME JEWELRY	Mfg: Misc Mfg		6124		Office
3962		Mfg: Misc Mfg		6125		Office
3963		Mfg: Misc Mfg		6130		Office
3964		Mfg: Misc Mfg		6131		Office
3965	FASTENERS, BUTTONS, NEEDLES, &	Mfg: Misc Mfg		6140		Office
3990		Mfg: Misc Mfg		6141	PERSONAL CREDIT INSTITUTIONS	Office
3991	BROOMS AND BRUSHES	Mfg: Misc Mfg		6142		Office
3993	SIGNS AND ADVERTISING SPECIALI	Mfg: Misc Mfg		6143		Office
3995	BURIAL CASKETS	Mfg: Misc Mfg		6144		Office
3996	HARD SURFACE FLOOR COVERINGS,	Mfg: Misc Mfg		6145		Office
3999	MANUFACTURING INDUSTRIES, NEC	Mfg: Misc Mfg		6146		Office
4000		TCU		6149		Office
4010		TCU		6150		Office
4011	RAILROADS, LINE-HAUL OPERATING	TCU		6153	SHORT-TERM BUSINESS CREDIT	Office
4013	SWITCHING AND TERMINAL SERVICE	TCU		6159	MISCELLANEOUS BUSINESS CREDIT	Office
4018		TCU		6160		Office
4040		TCU		6162	MORTGAGE BANKERS AND CORRESPON	Office
4041		TCU		6163	LOAN BROKERS	Office
4100		TCU		6200		Office
4110		TCU		6210		Office
4111	LOCAL AND SUBURBAN TRANSIT	TCU		6211	SECURITY BROKERS AND DEALERS	Office
4119	LOCAL PASSENGER TRANSPORTATION	TCU		6220		Office
4120		TCU		6221	COMMODITY CONTRACTS BROKERS, D	Office
4121	TAXICABS	TCU		6230		Office
4130		TCU		6231	SECURITY AND COMMODITY EXCHANG	Office
4131	INTERCITY & RURAL BUS TRANSPOR	TCU		6280		Office
4140		TCU		6281		Office
4141	LOCAL BUS CHARTER SERVICE	TCU		6282	INVESTMENT ADVICE	Office
4142	BUS CHARTER SERVICE, EXCEPT LO	TCU		6289	SECURITY & COMMODITY SERVICES,	Office
4150		TCU		6300		Office
4151	SCHOOL BUSES	TCU		6310		Office
4170		TCU		6311	LIFE INSURANCE	Office
4171		TCU		6320		Office
4172		TCU		6321	ACCIDENT AND HEALTH INSURANCE	Office
4173	BUS TERMINAL AND SERVICE FACIL	TCU		6324	HOSPITAL AND MEDICAL SERVICE P	Office
4200		TCU		6330		Office
4210		TCU		6331	FIRE, MARINE, AND CASUALTY INS	Office
4212	LOCAL TRUCKING, WITHOUT STORAG	TCU		6350		Office

4213	TRUCKING, EXCEPT LOCAL	TCU		6351	SURETY INSURANCE	Office
4214	LOCAL TRUCKING WITH STORAGE	Warehouse		6360		Office
4215	COURIER SERVICES, EXCEPT BY AI	TCU		6361	TITLE INSURANCE	Office
4220		Warehouse		6370		Office
4221	FARM PRODUCT WAREHOUSING AND S	Warehouse		6371	PENSION, HEALTH, AND WELFARE F	Office
4222	REFRIGERATED WAREHOUSING AND S	Warehouse		6390		Office
4224		Warehouse		6399	INSURANCE CARRIERS, NEC	Office
4225	GENERAL WAREHOUSING AND STORAG	Warehouse		6400		Office
4226	SPECIAL WAREHOUSING AND STORAG	Warehouse		6410		Office
4230		TCU		6411	INSURANCE AGENTS, BROKERS, & S	Office
4231	TRUCKING TERMINAL FACILITIES	TCU		6500		Office
4300		TCU		6510		Office
4310		TCU		6511	PROFESSIONAL CENTER/ OFFICES (	Office
4311	U.S. POSTAL SERVICE	TCU		6512	NONRESIDENTIAL BLDG OPERATORS;	Office
4400		TCU		6513	APARTMENTS - CONDOS > 4 UNITS	Office
4410		TCU		6514	APARTMENTS - CONDOS < 5 UNITS	Office
4411		TCU		6515	MOBILE HOME SITE OPERATORS, RV	Office
4412	DEEP SEA FOREIGN TRANSPORTATIO	TCU		6517	RAILROAD PROPERTY LESSORS	Office
4420		TCU		6519	REAL PROPERTY LESSORS, NEC	Office
4421		TCU		6520		Office
4422		TCU		6521		Office
4423		TCU		6522		Office
4424	DEEP SEA DOMESTIC TRANSPORTATI	TCU		6530		Office
4430		TCU		6531	REAL ESTATE AGENTS AND MANAGER	Office
4431		TCU		6540		Office
4432	FREIGHT TRANSPORTATION ON THE	TCU		6541	TITLE ABSTRACT OFFICES	Office
4440		TCU		6550		Office
4441		TCU		6552	SUBDIVIDERS AND DEVELOPERS, NE	Office
4449	WATER TRANSPORTATION OF FREIGH	TCU		6553	CEMETERY SUBDIVIDERS AND DEVEL	Office
4450		TCU		6560		Office
4452		TCU		6561		Office
4453		TCU		6600		Office
4454		TCU		6610		Office
4459		TCU		6611		Office
4460		TCU		6620		Office
4463		TCU		6621		Office
4464		TCU		6700		Office
4469		TCU		6710		Office
4480		TCU		6711		Office

4481	DEEP SEA PASSENGER TRANSPORTAT	TCU		6712	BANK HOLDING COMPANIES	Office
4482	FERRIES	TCU		6719	HOLDING COMPANIES, NEC	Office
4489	WATER PASSENGER TRANSPORTATION	TCU		6720		Office
4490		TCU		6722	MANAGEMENT INVESTMENT, OPEN-EN	Office
4491	MARINE CARGO HANDLING	TCU		6723		Office
4492	TOWING AND TUGBOAT SERVICE	TCU		6724		Office
4493	MARINAS	TCU		6725		Office
4499	WATER TRANSPORTATION SERVICES,	TCU		6726	INVESTMENT OFFICES, NEC	Office
4500		TCU		6730		Office
4510		TCU		6732	EDUCATIONAL, RELIGIOUS, ETC. T	Office
4511		TCU		6733	TRUSTS, NEC	Office
4512	AIR TRANSPORTATION, SCHEDULED	TCU		6790		Office
4513	AIR COURIER SERVICES	TCU		6792	OIL ROYALTY TRADERS	Office
4520		TCU		6793		Office
4521		TCU		6794	PATENT OWNERS AND LESSORS	Office
4522	AIR TRANSPORTATION, NONSCHEDUL	TCU		6798	REAL ESTATE INVESTMENT TRUSTS	Office
4580		TCU		6799	INVESTORS, NEC	Office
4581	AIRPORTS, FLYING FIELDS, & SER	TCU		7000		Lodging
4582		TCU		7010		Lodging
4583		TCU		7011	HOTELS AND MOTELS	Lodging
4600		TCU		7020		Lodging
4610		TCU		7021	ROOMING AND BOARDING HOUSES	Lodging
4612	CRUDE PETROLEUM PIPELINES	TCU		7030		Misc
4613	REFINED PETROLEUM PIPELINES	TCU		7032	SPORTING AND RECREATIONAL CAMP	Misc
4619	PIPELINES, NEC	TCU		7033	TRAILER PARKS AND CAMPSITES	Misc
4700		TCU		7040		Lodging
4710		TCU		7041	MEMBERSHIP-BASIS ORGANIZATION	Lodging
4712		TCU		7200		Misc
4720		TCU		7210		Misc
4722		TCU		7211	POWER LAUNDRIES, FAMILY & COMM	Misc
4723		TCU		7212	GARMENT PRESSING & CLEANERS' A	Misc
4724	TRAVEL AGENCIES	TCU		7213	LINEN SUPPLY	Misc
4725	TOUR OPERATORS	TCU		7214		Misc
4729	PASSENGER TRANSPORT ARRANGEMEN	TCU		7215	COIN-OPERATED LAUNDRIES AND CL	Misc
4730		TCU		7216	DRYCLEANING PLANTS, EXCEPT RUG	Misc
4731	FREIGHT TRANSPORTATION ARRANGE	TCU		7217	CARPET AND UPHOLSTERY CLEANING	Misc
4740		TCU		7218	INDUSTRIAL LAUNDERERS	Misc

4741	RENTAL OF RAILROAD CARS	TCU		7219	LAUNDRY AND GARMENT SERVICES,	Misc
4742		TCU		7220		Misc
4743		TCU		7221	PHOTOGRAPHIC STUDIOS, PORTRAIT	Misc
4780		TCU		7230		Misc
4782		TCU		7231	BEAUTY SHOPS	Misc
4783	PACKING AND CRATING	TCU		7240		Misc
4784		TCU		7241	BARBER SHOPS	Misc
4785	INSPECTION & FIXED FACILITIES	TCU		7250		Misc
4789	TRANSPORTATION SERVICES, NEC	TCU		7251	SHOE REPAIR AND SHOESHINE PARL	Misc
4800		TCU		7260		Misc
4810		TCU		7261	FUNERAL SERVICE AND CREMATORIE	Misc
4811		TCU		7290		Misc
4812	RADIOTELEPHONE COMMUNICATIONS	TCU		7291	TAX RETURN PREPARATION SERVICE	Office
4813	TELEPHONE COMMUNICATIONS, EXCE	TCU		7299	MISCELLANEOUS PERSONAL SERVICE	Misc
4820		TCU		7300		Office
4821		TCU		7310		Office
4822	TELEGRAPH & OTHER COMMUNICATIO	TCU		7311	ADVERTISING AGENCIES	Office
4830		TCU		7312	OUTDOOR ADVERTISING AND BILLBO	Office
4832	RADIO BROADCASTING STATIONS	TCU		7313	RADIO, TV, PUBLISHER REPRESENT	Office
4833	TELEVISION BROADCASTING STATIO	TCU		7318		Office
4840		TCU		7319	ADVERTISING, NEC	Office
4841	CABLE AND OTHER PAY TV SERVICE	TCU		7320		Office
4890		TCU		7321		Office
4899	COMMUNICATIONS SERVICES, NEC	TCU		7322	ADJUSTMENT & COLLECTION SERVIC	Office
4900		TCU		7323	CREDIT REPORTING SERVICES	Office
4910		TCU		7330		Office
4911	ELECTRIC SERVICES	TCU		7331	DIRECT MAIL ADVERTISING SERVIC	Office
4912		TCU		7332		Office
4913		TCU		7333		Office
4914		TCU		7334	PHOTOCOPYING & DUPLICATING SER	Office
4915		TCU		7335	COMMERCIAL PHOTOGRAPHY	Office
4916		TCU		7336	COMMERCIAL ART AND GRAPHIC DES	Office
4917		TCU		7338	SECRETARIAL & COURT REPORTING	Office
4918		TCU		7339		Office
4919		TCU		7340		Office
4920		TCU		7341		Office
4922	NATURAL GAS TRANSMISSION	TCU		7342	DISINFECTING & PEST CONTROL SE	Office
4923	GAS TRANSMISSION AND DISTRIBUT	TCU		7343		Office

4924	NATURAL GAS DISTRIBUTION	TCU		7349	BUILDING MAINTENANCE SERVICES,	Office
4925	GAS PRODUCTION AND/OR DISTRIBU	TCU		7350		Office
4926		TCU		7351		Office
4927		TCU		7352	MEDICAL EQUIPMENT RENTAL	Office
4928		TCU		7353	HEAVY CONSTRUCTION EQUIPMENT R	Office
4930		TCU		7359	EQUIPMENT RENTAL & LEASING, NE	Office
4931	ELECTRIC AND OTHER SERVICES CO	TCU		7360		Office
4932	GAS AND OTHER SERVICES COMBINE	TCU		7361	EMPLOYMENT AGENCIES	Office
4933		TCU		7362		Office
4934		TCU		7363	HELP SUPPLY SERVICES	Office
4935		TCU		7369		Office
4937		TCU		7370		Office
4939	COMBINATION UTILITIES, NEC	TCU		7371	COMPUTER PROGRAMMING SERVICES	Office
4940		TCU		7372	PREPACKAGED SOFTWARE	Office
4941	PUBLIC WATER SYSTEM	TCU		7373	COMPUTER INTEGRATED SYSTEMS DE	Office
4949	DOMESTIC PUMPING (MPC CODE)	TCU		7374	DATA PROCESSING AND PREPARATIO	Office
4950		TCU		7375	INFORMATION RETRIEVAL SERVICES	Office
4952	SEWER SYSTEMS	TCU		7376	COMPUTER FACILITIES MANAGEMENT	Office
4953	REFUSE SYSTEMS	TCU		7377	COMPUTER RENTAL & LEASING	Office
4959	SANITARY SERVICES, NEC	TCU		7378	COMPUTER MAINTENANCE & REPAIR	Office
4960		TCU		7379	COMPUTER RELATED SERVICES, NEC	Office
4961	STEAM AND AIR-CONDITIONING SUP	TCU		7380		Office
4970		TCU		7381	DETECTIVE & ARMORED CAR SERVIC	Office
4971	IRRIGATION SYSTEMS	TCU		7382	SECURITY SYSTEMS SERVICES	Office
4980		TCU		7383	NEWS SYNDICATES	Office
4981		TCU		7384	PHOTOFINISHING LABORATORIES	Office
4982		TCU		7389	BUSINESS SERVICES, NEC	Office
4983		TCU		7500		Misc
4988		TCU		7510		Misc
5000		Warehouse		7512		Misc
5010		Warehouse		7513	TRUCK RENTAL AND LEASING, NO D	Misc
5012	AUTOMOBILES AND OTHER MOTOR VE	Warehouse		7514	PASSENGER CAR RENTAL	Misc
5013	MOTOR VEHICLE SUPPLIES AND NEW	Warehouse		7515	PASSENGER CAR LEASING	Misc
5014	TIRES AND TUBES	Warehouse		7519	UTILITY TRAILER RENTAL	Misc
5015	MOTOR VEHICLE PARTS, USED	Warehouse		7520		Misc
5020		Warehouse		7521	AUTOMOBILE PARKING	Misc

5021	FURNITURE	Warehouse		7530		Misc
5023	HOMEFURNISHINGS	Warehouse		7531		Misc
5030		Warehouse		7532	TOP & BODY REPAIR & PAINT SHOP	Misc
5031	LUMBER, PLYWOOD, AND MILLWORK	Warehouse		7533	AUTO EXHAUST SYSTEM REPAIR SHO	Misc
5032	BRICK, STONE, & RELATED MATERI	Warehouse		7534	TIRE RETREADING AND REPAIR SHO	Misc
5033	ROOFING, SIDING, & INSULATION	Warehouse		7535		Misc
5039	CONSTRUCTION MATERIALS, NEC	Warehouse		7536	AUTOMOTIVE GLASS REPLACEMENT S	Misc
5040		Warehouse		7537	AUTOMOTIVE TRANSMISSION REPAIR	Misc
5041		Warehouse		7538	GENERAL AUTOMOTIVE REPAIR SHOP	Misc
5042		Warehouse		7539	AUTOMOTIVE REPAIR SHOPS, NEC	Misc
5043	PHOTOGRAPHIC EQUIPMENT AND SUP	Warehouse		7540		Misc
5044	OFFICE EQUIPMENT	Warehouse		7542	CARWASHES	Misc
5045	COMPUTERS, PERIPHERALS & SOFTW	Warehouse		7549	AUTOMOTIVE SERVICES, NEC	Misc
5046	COMMERCIAL EQUIPMENT, NEC	Warehouse		7600		Misc
5047	MEDICAL AND HOSPITAL EQUIPMENT	Warehouse		7620		Misc
5048	OPHTHALMIC GOODS	Warehouse		7622	RADIO AND TELEVISION REPAIR	Misc
5049	PROFESSIONAL EQUIPMENT, NEC	Warehouse		7623	REFRIGERATION SERVICE AND REPA	Misc
5050		Warehouse		7629	ELECTRICAL REPAIR SHOPS, NEC	Misc
5051	METALS SERVICE CENTERS AND OFF	Warehouse		7630		Misc
5052	COAL AND OTHER MINERALS AND OR	Warehouse		7631	WATCH, CLOCK, AND JEWELRY REPA	Misc
5060		Warehouse		7640		Misc
5063	ELECTRICAL APPARATUS AND EQUIP	Warehouse		7641	REUPHOLSTERY AND FURNITURE REP	Misc
5064	ELECTRICAL APPLIANCES, TV & RA	Warehouse		7690		Misc
5065	ELECTRONIC PARTS AND EQUIPMENT	Warehouse		7692	WELDING REPAIR	Misc
5070		Warehouse		7694	ARMATURE REWINDING SHOPS	Misc
5072	HARDWARE	Warehouse		7699	REPAIR SERVICES, NEC	Misc
5074	PLUMBING & HYDRONIC HEATING SU	Warehouse		7800		Misc
5075	WARM AIR HEATING & AIR-CONDITI	Warehouse		7810		Misc
5078	REFRIGERATION EQUIPMENT AND SU	Warehouse		7812	MOTION PICTURE & VIDEO PRODUCT	Misc
5080		Warehouse		7813		Misc
5081		Warehouse		7814		Misc
5082	CONSTRUCTION AND MINING MACHIN	Warehouse		7819	SERVICES ALLIED TO MOTION PICT	Misc
5083	FARM AND GARDEN MACHINERY	Warehouse		7820		Office
5084	INDUSTRIAL MACHINERY	Warehouse		7822	MOTION PICTURE AND	Office

	AND EQUIP				TAPE DISTRI	
5085	INDUSTRIAL SUPPLIES	Warehouse		7823		Office
5086		Warehouse		7824		Office
5087	SERVICE ESTABLISHMENT EQUIPMEN	Warehouse		7829	MOTION PICTURE DISTRIBUTION SE	Office
5088	TRANSPORTATION EQUIPMENT & SUP	Warehouse		7830		Misc
5090		Warehouse		7832	MOTION PICTURE THEATERS, EX DR	Misc
5091	SPORTING & RECREATIONAL GOODS	Warehouse		7833	DRIVE-IN MOTION PICTURE THEATE	Misc
5092	TOYS AND HOBBY GOODS AND SUPPL	Warehouse		7840		Misc
5093	SCRAP AND WASTE MATERIALS	Warehouse		7841	VIDEO TAPE RENTAL	Misc
5094	JEWELRY & PRECIOUS STONES	Warehouse		7900		Misc
5099	DURABLE GOODS, NEC	Warehouse		7910		Misc
5100		Warehouse		7911	DANCE STUDIOS, SCHOOLS, AND HA	Education
5110		Warehouse		7920		Misc
5111	PRINTING AND WRITING PAPER	Warehouse		7922	THEATRICAL PRODUCERS AND SERVI	Misc
5112	STATIONERY AND OFFICE SUPPLIES	Warehouse		7929	ENTERTAINERS & ENTERTAINMENT G	Misc
5113	INDUSTRIAL & PERSONAL SERVICE	Warehouse		7930		Misc
5120		Warehouse		7932		Misc
5122	DRUGS, PROPRIETARIES, AND SUND	Warehouse		7933	BOWLING CENTERS	Misc
5130		Warehouse		7940		Misc
5131	PIECE GOODS & NOTIONS	Warehouse		7941	SPORTS CLUBS, MANAGERS, & PROM	Misc
5133		Warehouse		7948	RACING, INCLUDING TRACK OPERAT	Misc
5134		Warehouse		7990		Misc
5136	MEN'S AND BOYS'CLOTHING	Warehouse		7991	PHYSICAL FITNESS FACILITIES	Misc
5137	WOMEN'S AND CHILDREN'S CLOTHIN	Warehouse		7992	PUBLIC GOLF COURSES	Misc
5139	FOOTWEAR	Warehouse		7993	COIN-OPERATED AMUSEMENT DEVICE	Misc
5140		Warehouse		7996	AMUSEMENT PARKS	Misc
5141	GROCERIES, GENERAL LINE	Warehouse		7997	MEMBERSHIP SPORTS & RECREATION	Misc
5142	PACKAGED FROZEN FOODS	Warehouse		7999	AMUSEMENT AND RECREATION, NEC	Misc
5143	DAIRY PRODUCTS, EXCEPT DRIED O	Warehouse		8000		Misc
5144	POULTRY AND POULTRY PRODUCTS	Warehouse		8010		Office
5145	CONFECTIONERY	Warehouse		8011	OFFICES & CLINICS OF MEDICAL D	Office
5146	FISH AND SEAFOODS	Warehouse		8020		Office
5147	MEATS AND MEAT PRODUCTS	Warehouse		8021	OFFICES AND CLINICS OF DENTIST	Office
5148	FRESH FRUITS AND VEGETABLES	Warehouse		8030		Office
5149	GROCERIES AND RELATED PRODUCTS	Warehouse		8031	OFFICES OF OSTEOPATHIC PHYSICI	Office

5150		Warehouse		8040		Office
5152		Warehouse		8041	OFFICES AND CLINICS OF CHIROPR	Office
5153	GRAIN AND FIELD BEANS	Warehouse		8042	OFFICES AND CLINICS OF OPTOMET	Office
5154	LIVESTOCK	Warehouse		8043	OFFICES AND CLINICS OF PODIATR	Office
5159	FARM-PRODUCT RAW MATERIALS, NE	Warehouse		8049	OFFICES OF HEALTH PRACTITIONER	Office
5160		Warehouse		8050		Health
5161		Warehouse		8051	SKILLED NURSING CARE FACILITIE	Health
5162	PLASTICS MATERIALS & BASIC SHA	Warehouse		8052	INTERMEDIATE CARE FACILITIES	Health
5169	CHEMICALS & ALLIED PRODUCTS, N	Warehouse		8059	NURSING AND PERSONAL CARE, NEC	Health
5170		Warehouse		8060		Health
5171	PETROLEUM BULK STATIONS & TERM	Warehouse		8061		Health
5172	PETROLEUM PRODUCTS, NEC	Warehouse		8062	GENERAL MEDICAL & SURGICAL HOS	Health
5180		Warehouse		8063	PSYCHIATRIC HOSPITALS	Health
5181	BEER AND ALE	Warehouse		8064		Health
5182	WINE AND DISTILLED BEVERAGES	Warehouse		8065		Health
5190		Warehouse		8066		Health
5191	FARM SUPPLIES	Warehouse		8067		Health
5192	BOOKS, PERIODICALS, & NEWSPAPE	Warehouse		8068		Health
5193	FLOWERS & FLORISTS' SUPPLIES	Warehouse		8069	SPECIALTY HOSPITALS EXCEPT PSY	Health
5194	TOBACCO AND TOBACCO PRODUCTS	Warehouse		8070		Health
5198	PAINTS, VARNISHES, AND SUPPLIE	Warehouse		8071	MEDICAL LABORATORIES	Health
5199	NONDURABLE GOODS, NEC	Warehouse		8072	DENTAL LABORATORIES	Health
5200		Retail		8080		Health
5210		Retail		8081		Health
5211	LUMBER AND OTHER BUILDING MATE	Retail		8082	HOME HEALTH CARE SERVICES	Health
5230		Retail		8090		Health
5231	PAINT, GLASS, AND WALLPAPER ST	Retail		8091		Health
5250		Retail		8092	KIDNEY DIALYSIS CENTERS	Health
5251	HARDWARE STORES	Retail		8093	SPECIALTY OUTPATIENT CLINICS,	Health
5260		Retail		8099	HEALTH AND ALLIED SERVICES, NE	Health
5261	RETAIL NURSERIES AND GARDEN ST	Retail		8100		Office
5270		Retail		8110		Office
5271	MOBILE HOME DEALERS	Retail		8111	LEGAL SERVICES	Office
5300		Retail		8200		Education
5310		Retail		8210		Education
5311	DEPARTMENT STORES	Retail		8211	ELEMENTARY AND SECONDARY SCHOO	Education
5318		Retail		8212		Education
5330		Retail		8213		Education

5331	VARIETY STORES	Retail		8214		Education
5390		Retail		8215		Education
5399	MISCELLANEOUS GENERAL MERCHAND	Retail		8216		Education
5400		Grocery		8217		Education
5410		Grocery		8218		Education
5411	GROCERY STORES	Grocery		8219		Education
5420		Grocery		8220		Education
5421	MEAT AND FISH MARKETS	Grocery		8221	COLLEGES AND UNIVERSITIES	Education
5422		Grocery		8222	JUNIOR COLLEGES	Education
5423		Grocery		8223		Education
5430		Grocery		8224		Education
5431	FRUIT AND VEGETABLE MARKETS	Grocery		8230		Education
5440		Grocery		8231	LIBRARIES	Misc
5441	CANDY, NUT, AND CONFECTIONERY	Grocery		8240		Education
5450		Grocery		8241		Education
5451	DAIRY PRODUCTS STORES	Grocery		8243	DATA PROCESSING SCHOOLS	Education
5460		Grocery		8244	BUSINESS AND SECRETARIAL SCHOO	Education
5461	RETAIL BAKERIES	Grocery		8249	VOCATIONAL SCHOOLS, NEC	Education
5462		Grocery		8290		Education
5463		Grocery		8299	SCHOOLS & EDUCATIONAL SERVICES	Education
5490		Grocery		8300		Misc
5499	MISCELLANEOUS FOOD STORES	Grocery		8320		Office
5500		Retail		8321		Office
5510		Retail		8322	INDIVIDUAL AND FAMILY SERVICES	Office
5511	NEW AND USED CAR DEALERS	Retail		8330		Office
5520		Retail		8331	JOB TRAINING AND RELATED SERVI	Office
5521	USED CAR DEALERS	Retail		8350		Education
5530		Retail		8351	CHILD DAY CARE SERVICES	Education
5531	AUTO AND HOME SUPPLY STORES	Retail		8360		Health
5540		Misc		8361	RESIDENTIAL CARE	Health
5541	GASOLINE SERVICE STATIONS	Misc		8390		Office
5550		Retail		8399	SOCIAL SERVICES, NEC	Office
5551	BOAT DEALERS	Retail		8400		Misc
5560		Retail		8410		Misc
5561	RECREATIONAL VEHICLE DEALERS	Retail		8411		Misc
5570		Retail		8412	MUSEUMS AND ART GALLERIES	Misc
5571	MOTORCYCLE DEALERS	Retail		8420		Misc
5590		Retail		8421		Misc
5599	AUTOMOTIVE DEALERS, NEC	Retail		8422	BOTANICAL AND ZOOLOGICAL GARDE	Misc
5600		Retail		8600		Misc
5610		Retail		8610		Office

5611	MEN'S & BOYS' CLOTHING STORES	Retail		8611	BUSINESS ASSOCIATIONS	Office
5620		Retail		8620		Office
5621	WOMEN'S CLOTHING STORES	Retail		8621	PROFESSIONAL ORGANIZATIONS	Office
5630		Retail		8630		Office
5631		Retail		8631	LABOR ORGANIZATIONS	Office
5632	WOMEN'S ACCESSORY & SPECIALTY	Retail		8640		Misc
5640		Retail		8641	CIVIC AND SOCIAL ASSOCIATIONS	Misc
5641	CHILDREN'S AND INFANTS' WEAR S	Retail		8650		Office
5650		Retail		8651	POLITICAL ORGANIZATIONS	Office
5651	FAMILY CLOTHING STORES	Retail		8660		Misc
5660		Retail		8661	RELIGIOUS ORGANIZATIONS	Misc
5661	SHOE STORES	Retail		8690		Misc
5680		Retail		8699	MEMBERSHIP ORGANIZATIONS, NEC	Misc
5681		Retail		8700		Office
5690		Retail		8710		Office
5699	MISCELLANEOUS APPAREL & ACCESS	Retail		8711	ENGINEERING SERVICES	Office
5700		Retail		8712	ARCHITECTURAL SERVICES	Office
5710		Retail		8713	SURVEYING SERVICES	Office
5712	FURNITURE STORES	Retail		8720		Office
5713	FLOOR COVERING STORES	Retail		8721	ACCOUNTING, AUDITING, & BOOKKE	Office
5714	DRAPERY AND UPHOLSTERY STORES	Retail		8730		Misc
5719	MISCELLANEOUS HOMEFURNISHINGS	Retail		8731	COMMERCIAL PHYSICAL RESEARCH	Misc
5720		Retail		8732	COMMERCIAL NONPHYSICAL RESEARC	Office
5722	HOUSEHOLD APPLIANCE STORES	Retail		8733	NONCOMMERCIAL RESEARCH ORGANIZ	Office
5730		Retail		8734	TESTING LABORATORIES	Misc
5731	RADIO, TV, & ELECTRONIC STORES	Retail		8740		Office
5732		Retail		8741	MANAGEMENT SERVICES	Office
5733		Retail		8742	MANAGEMENT CONSULTING SERVICES	Office
5734	COMPUTER AND SOFTWARE STORES	Retail		8743	PUBLIC RELATIONS SERVICES	Office
5735	RECORD & PRERECORDED TAPE STOR	Retail		8744	FACILITIES SUPPORT SERVICES	Misc
5736	MUSICAL INSTRUMENT STORES	Retail		8748	BUSINESS CONSULTING, NEC	Office
5800		Restaurant		8800		Residential
5810		Restaurant		8810		Residential
5812	EATING PLACES	Restaurant		8811	PRIVATE HOUSEHOLDS	Residential
5813	DRINKING PLACES	Restaurant		8900		Misc
5900		Retail		8990		Misc
5910		Retail		8999	SERVICES, NEC	Misc
5912	DRUG STORES AND PROPRIETARY ST	Retail		9100		Office
5920		Grocery		9110		Office
5921	LIQUOR STORES	Grocery		9111	EXECUTIVE OFFICES	Office

5930		Retail		9120		Office
5931		Retail		9121	LEGISLATIVE BODIES	Office
5932	USED MERCHANDISE STORES	Retail		9130		Office
5940		Retail		9131	EXECUTIVE AND LEGISLATIVE COMB	Office
5941	SPORTING GOODS AND BICYCLE SHO	Retail		9190		Office
5942	BOOK STORES	Retail		9199	GENERAL GOVERNMENT, NEC	Office
5943	STATIONERY STORES	Retail		9200		Office
5944	JEWELRY STORES	Retail		9210		Office
5945	HOBBY, TOY, AND GAME SHOPS	Retail		9211	COURTS	Misc
5946	CAMERA & PHOTOGRAPHIC SUPPLY S	Retail		9220		Misc
5947	GIFT, NOVELTY, AND SOUVENIR SH	Retail		9221	POLICE PROTECTION	Misc
5948	LUGGAGE AND LEATHER GOODS STOR	Retail		9222	LEGAL COUNSEL AND PROSECUTION	Office
5949	SEWING, NEEDLEWORK, AND PIECE	Retail		9223	CORRECTIONAL INSTITUTIONS	Misc
5960		Retail		9224	FIRE PROTECTION	Misc
5961	CATALOG AND MAIL-ORDER HOUSES	Retail		9225		Light
5962	MERCHANDISING MACHINE OPERATOR	Retail		9226		Light
5963	DIRECT SELLING ESTABLISHMENTS	Retail		9227		Light
5980		Retail		9228		Misc
5982		Retail		9229	PUBLIC ORDER AND SAFETY, NEC	Misc
5983	FUEL OIL DEALERS	Retail		9300		Office
5984	LIQUEFIED PETROLEUM GAS DEALER	Retail		9310		Office
5989	FUEL DEALERS, NEC	Retail		9311	FINANCE, TAXATION, & MONETARY	Office
5990		Retail		9400		Office
5992	FLORISTS	Retail		9410		Office
5993	TOBACCO STORES AND STANDS	Retail		9411	ADMINISTRATION OF EDUCATIONAL	Office
5994	NEWS DEALERS AND NEWSSTANDS	Retail		9430		Office
5995	OPTICAL GOOD STORES	Retail		9431	ADMINISTRATION OF PUBLIC HEALT	Office
5999	MISCELLANEOUS RETAIL STORES, N	Retail		9440		Office
6000		Office		9441	ADMINISTRATION OF SOCIAL & MAN	Office
6010		Office		9450		Office
6011	FEDERAL RESERVE BANKS	Office		9451	ADMINISTRATION OF VETERANS' AF	Office
6019	CENTRAL RESERVE DEPOSITORY, NE	Office		9500		Office
6020		Office		9510		Office
6021	NATIONAL COMMERCIAL BANKS	Office		9511	AIR, WATER, & SOLID WASTE MANA	Office
6022	STATE COMMERCIAL BANKS	Office		9512	LAND, MINERAL, WILDLIFE CONSER	Office

6023		Office		9530		Office
6024		Office		9531	HOUSING PROGRAMS	Office
6025		Office		9532	URBAN AND COMMUNITY DEVELOPMEN	Office
6026		Office		9600		Office
6027		Office		9610		Office
6028		Office		9611	ADMINISTRATION OF GENERAL ECON	Office
6029	COMMERCIAL BANKS, NEC	Office		9620		Office
6030		Office		9621	REGULATION, ADMINISTRATION OF	Office
6032		Office		9630		Office
6033		Office		9631	REGULATION, ADMINISTRATION OF	Office
6034		Office		9640		Office
6035	FEDERAL SAVINGS INSTITUTIONS	Office		9641	REGULATION OF AGRICULTURAL MAR	Office
6036	SAVINGS INSTITUTIONS, EXCEPT F	Office		9650		Office
6040		Office		9651	REGULATION MISCELLANEOUS COMME	Office
6042		Office		9660		Misc
6044		Office		9661	SPACE RESEARCH AND TECHNOLOGY	Misc
6050		Office		9700		National Security
6052		Office		9710		National Security
6054		Office		9711	NATIONAL SECURITY	National Security
6055		Office		9720		Office
6056		Office		9721	INTERNATIONAL AFFAIRS	Office
6059		Office		9900		Unclassified
6060		Office		9980		Unclassified
6061	FEDERAL CREDIT UNIONS	Office		9981		Unclassified
6062	STATE CREDIT UNIONS	Office		9982		Unclassified
6080		Office		9983		Unclassified
6081	FOREIGN BANK & BRANCHES & AGEN	Office		9990		Unclassified
6082	FOREIGN TRADE & INTERNATIONAL	Office		9991	MISC NON BUILDING; SIRENS, MIC	Unclassified
6090		Office		9992	ALL FLAT CONSUMPTION ACCOUNTS	Unclassified
6091	NONDEPOSIT TRUST FACILITIES	Office		9993	VACANT BUT ACTIVE (MPC CODE 7	Vacant
6099	FUNCTIONS RELATED TO DEPOSIT B	Office		9995	PUMPING LOADS	Unclassified
6100		Office		9996	RESIDENCES	Residential
				9997	MISC OUTDOOR LIGHTS: YARD LIGH	Light
				9998	RESIDENTIAL GARAGES	Residential
				9999		Unclassified

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