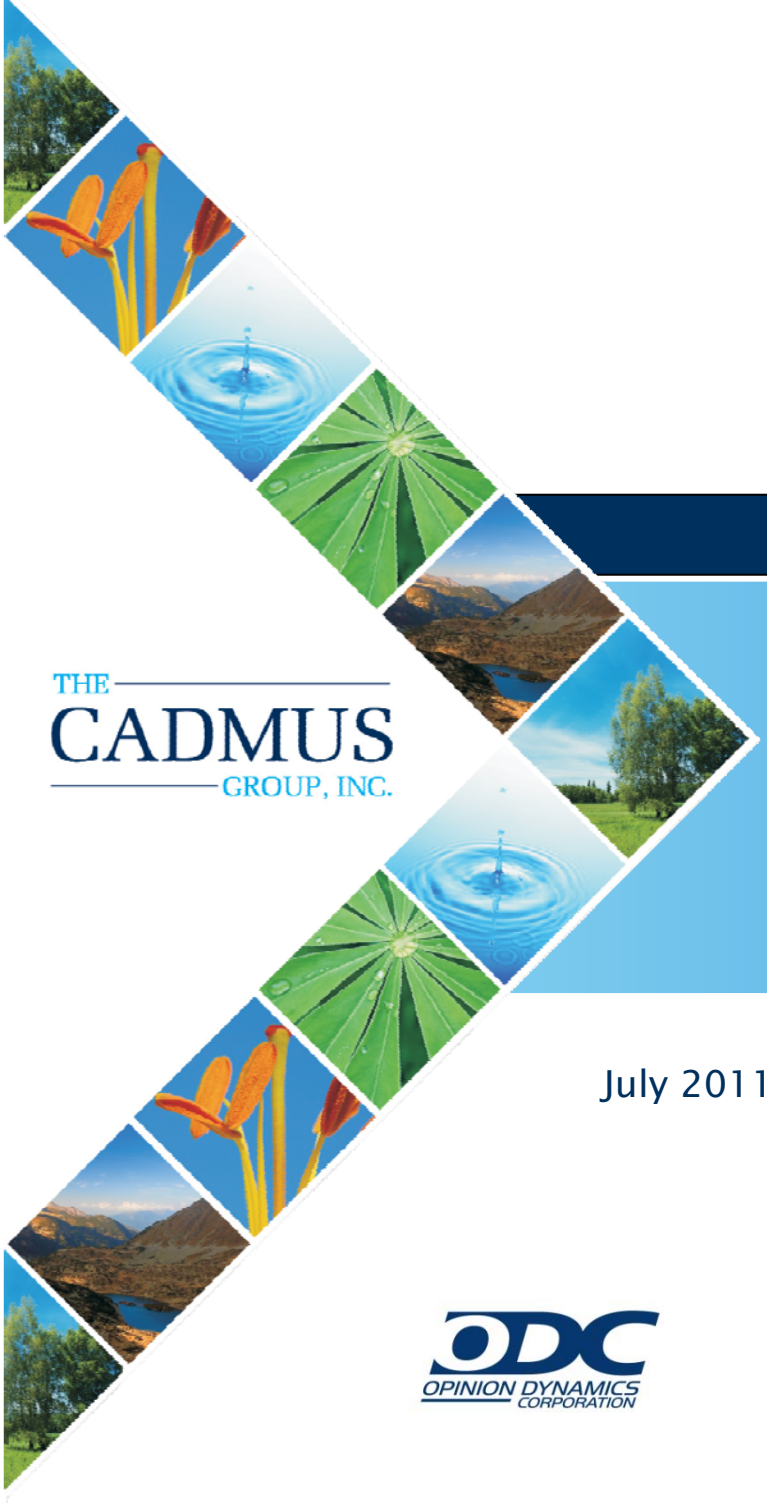

Michigan Baseline Study 2011: Commercial Baseline Report

July 2011

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Introduction

This report presents research results conducted in the state of Michigan by The Cadmus Group and its subcontractors Opinion Dynamics (the Project Team) as part of a commercial baseline study. The baseline energy study's objective was to assess a "market baseline" of existing commercial building and equipment stock in Michigan, with respect to current adoption of energy-efficient technologies.

The investigations utilized telephone (n=1,016) and on-site surveys (n=289) of commercial buildings. Business types were selected as the primary stratification variable for on-site sampling, which included the following market segments: education, health, office, lodging, restaurant, retail, grocery, and warehouse. The audits collected specific information on: equipment and efficiency penetration for all end uses, building envelope data, cooking equipment, consumer electronics, and firmographic variables. The telephone survey collected energy-related attitudes, perceptions, and behaviors of commercial decision makers.

The state of Michigan commercial baseline report compiles two regional efforts, spanning 18 months and beginning in late 2009. The two studies and their sponsors included:

- **Detroit Edison (DTE) Energy Baseline Study:** The study, beginning in November 2009, included telephone and on-site visits for DTE's residential and commercial electric and gas customers. Opinion Dynamics led this study with subcontractors The Cadmus Group and Patrick Engineering.
- **Michigan Public Service Commission Baseline Study:** The study, beginning in September 2010, included telephone and on-site visits for residential and commercial building stock in the Upper Peninsula as well as in regions covered by Consumers Energy. The Cadmus Group led this study with subcontractors Opinion Dynamics.

Using data collected from each of the above studies, this report weights data to represent the state of Michigan's commercial building stock, and energy-related attitudes. This report defines various characteristics, such as geographic regions and business types; its Methodology and Finding sections present specific details.

Methodology

The Michigan commercial sector baseline study relied on two data collection activities: 1) on-site visits; and 2) a telephone survey. The following sections outline the methodologies used for both study components.

On-Site Visits

The Project Team performed commercial site visits in Consumers Energy territory as well as in territories for several utilities' service areas in the Upper Peninsula. The work sought to collect detailed inventories of Michigan commercial customer building and equipment characteristics across many market segments, including: restaurants, offices, education, grocery, lodging, retail, warehouses, and health. Field engineers collected: equipment nameplate information, efficiencies, and fuel types for HVAC, lighting, refrigeration, cooking, and electronics equipment. They also examined building envelope characteristics.

Using telephone surveys, Opinion Dynamics recruited participants and forwarded contact information to Cadmus for scheduling site visits. Between November 2010 and March 2011, Cadmus field engineers conducted 137 site visits in regions of the state not covered as part of the DTE commercial baseline study. All participating customers received a $50 debit card as an incentive to participate in the study.

In 2010, Patrick Engineering conducted similar site work for DTE, collecting nearly identical data. Patrick Engineering recruited DTE Energy customers by telephone to participate in these visits, providing all participating customers with a $100 incentive check. From February 2010 to April 2010, Patrick Engineering staff conducted 152 site visits.

Sample Design

The Project Team conducted on-site assessment surveys within three different Michigan commercial populations: (1) DTE Energy customers; (2) Consumers Energy customers; and (3) commercial customers of Upper Peninsula and regions outside DTE Energy's and Consumers Energy's electric service territories. To achieve specific requirements set forth by each sponsor, the sampling design varied from study to study, but it consistently emphasized standard commercial business types. The sampling design sought to achieving 90 percent confidence with 10 percent precision by business type. Table 1 highlights distributions of on-site visits across the three distinct territories by business type.

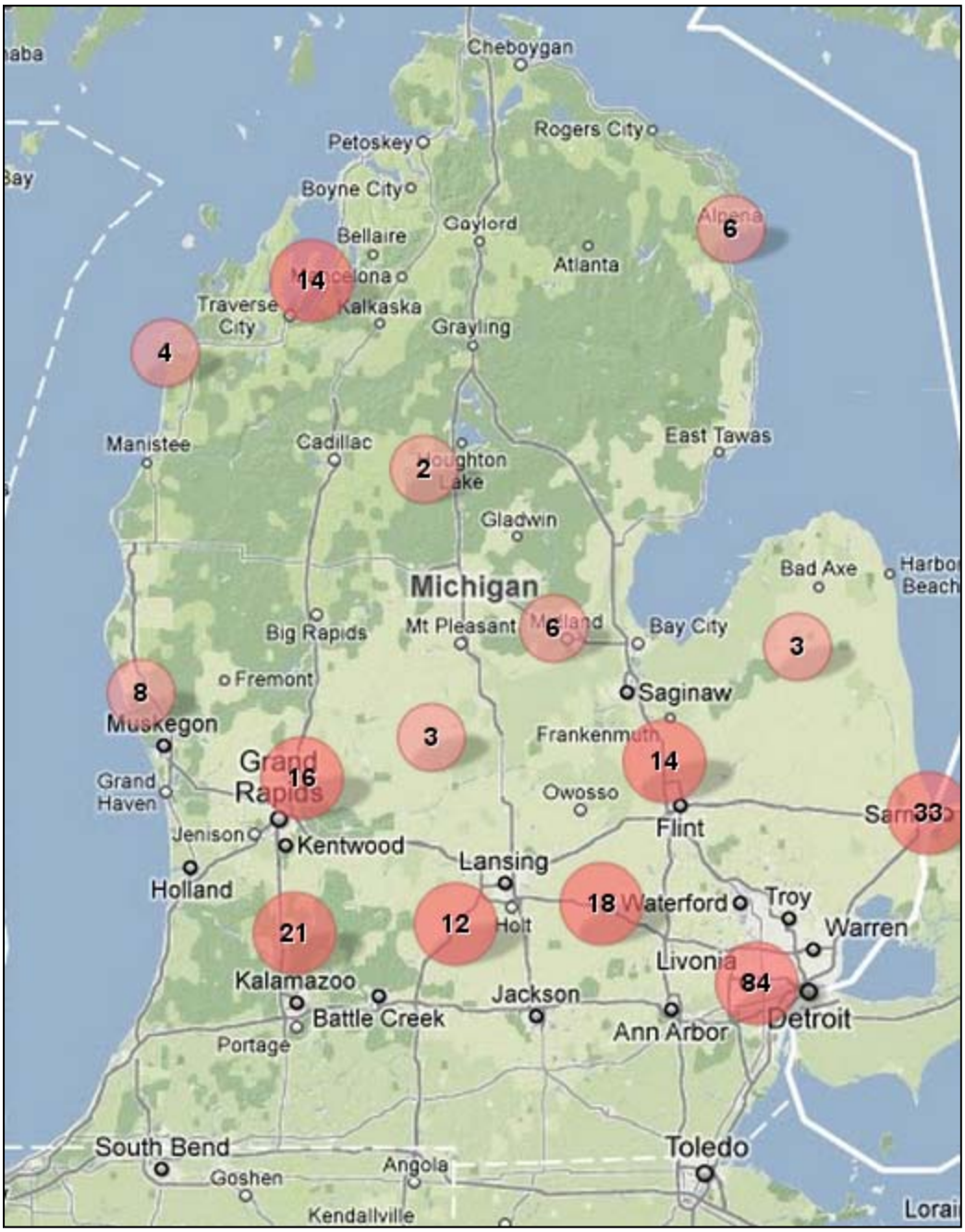
Table 1. On-Site Visit Distribution

Business Type	Completed Site Visits
Education	16
Grocery	14
Health	18
Lodging	32
Office	76
Restaurant	38
Retail	73
Warehouse	22
Total	289

Figure 1 and Figure 2 provide the geographic distribution of site visit samples across the Upper and Lower Peninsulas. As can be seen below, site visits were well dispersed throughout the state.

Figure 1. Geographic Distribution of Site Visits – Upper Peninsula

Figure 2. Geographic Distribution of Site Visits – Lower Peninsula



The Project Team used an extract of the Consumer's nonresidential customer database to identify sampling targets by business type within Consumer's territory, using the North American Industry Classification System (NAICS) designations. The ultimate sample selected by the Project Team not only accounted for the distribution of numbers of business types within the territory, but also their relative sizes and variances in energy consumption within each business type. This approach excluded "other" or "miscellaneous" business classifications due to irregularities in energy consumption ranges.

The Project Team used a similar approach in selecting site visits in the Upper Peninsula and Alpena. Utilizing customer contact information purchased through Survey Sampling International, LLC, the team recruited site visit participants following the same distribution by building type determined for Consumers. Geographically, sites were targeted within three distinct American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE) climate zones.

One hundred and fifty-two site visits were selected within the DTE service territory as part of DTE Energy Commercial Baseline Study. The site visit sample was stratified using the same business types, based on the distribution of DTE's commercial customers. Site visits were selected geographically, based on considerations of population centers, weather regions, and representation from different regions of the Lower Peninsula.

Weighting

The Project Team applied sample weights to on-site survey data to match populations of customer buildings in the state of Michigan. Population proportions of commercial business types were taken from 2008 US Census Bureau data. Table 2 provides sample weights used for the on-site survey analysis, along with population and sampling distributions.

Table 2. On-Site Survey Weighting – Sample Weights

Business Type	Population	Sample	Weight
Education	1.5%	5.5%	0.28
Grocery	3.9%	4.8%	0.80
Health	14.7%	6.2%	2.36
Lodging	1.2%	11.1%	0.10
Office	35.3%	26.3%	1.34
Restaurant	12.3%	13.1%	0.93
Retail	22.8%	25.3%	0.90
Warehouse	8.4%	7.6%	1.10
Total	100%	100%	

Data Cleaning

Cadmus conducted rigorous data cleaning across site visit data to resolve two primary error sources: outlying responses and data entry errors stemming from compilation of handwritten site forms into fields of an electronic database. Outlying responses were defined in the most conservative sense; that is, a response was considered an outlier if out of the bounds of the possible range.[1]

After electronically entering all site data, we scanned each field for entry errors and outlying responses. This process caught errors such as entering the year of manufacture in a field intended for the age of a piece of equipment, or the capacity of a cooling system entered as Btuh instead of tons. This cleaning process addressed the majority of such errors. Additionally, we performed

[1] For instance, if a refrigerator was recorded as having an age of 100 years, it would be marked as an outlier (given refrigerators did not exist 100 years ago).

checks to assess how reasonable survey results were compared to similar statistics from other regional studies.

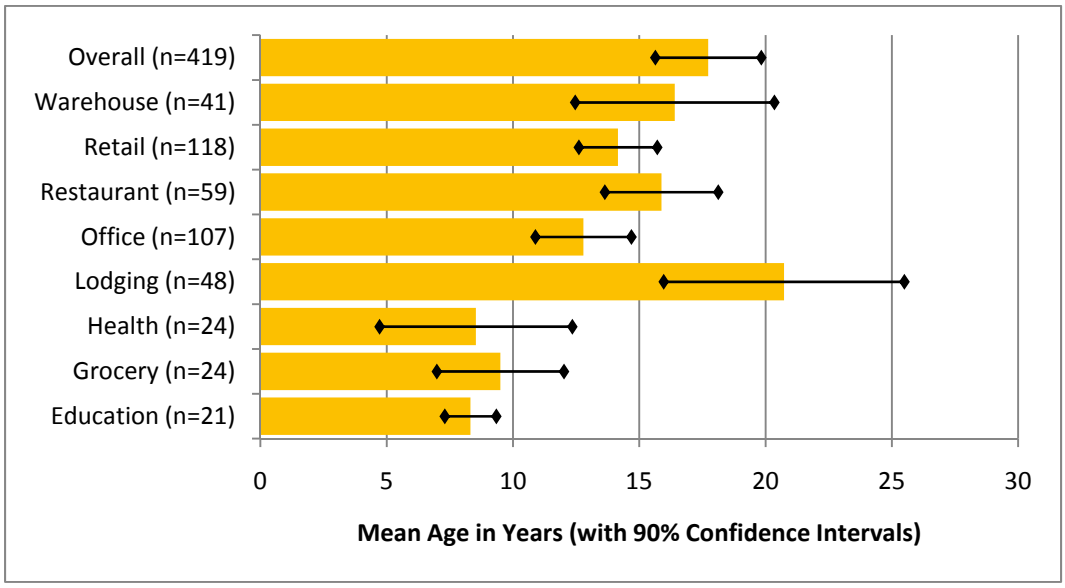
In addition to entry errors and outlying responses, Cadmus verified internal consistencies in recorded responses across fields. For example, buildings with split HVAC systems did not always list both cooling and heating parameters. In such instances, analysts consulted with the engineering team responsible for the given site visit and, where possible, site photos were reviewed. When inconsistencies could not be resolved, we omitted these fields from analysis. These issues were relatively infrequent and did not have a significant impact on the analysis.

Data Analysis

All results were tested for significance at the 90 percent confidence level, and were found to be significant within a ±10 percent relative confidence interval for the vast majority of fields at the sector level. Fields where this precision level was not achieved included measures or characteristics uncommon in the commercial sector (such as compressed air equipment).

The Project Team drew samples by commercial business type, intending to achieve results at 90 percent confidence level within a minimum ±20 percent relative confidence interval. To ensure this uncertainty level remains visible in our analysis, we present confidence intervals for tables and figures that break data out by specific measures or business types. (See Figure 3 for an example.) In figure 2, the education confidence interval (represented by the black line) is small – the range of equipment age for this particular business type is between 7.3 and 9.3 years. That means that we are 90% confident that the true average age is between 7.3 and 9.3 years. The exceptions to this are various measure penetration figures, where the proportion has been taken from the full population and can be ensured to fall within the minimum of a ±10 percent relative confidence interval.

Figure 3. Example Table: Confidence Intervals for Equipment Age



In cases where results with sample sizes fall below 20 percent should be interpreted only qualitatively, as their confidence intervals are likely wider than ±20 percent. These were often in cases of the makeup of some characteristic (such as fuel type) across business types.

The Project Team calculated all confidence intervals using standard formulae to estimate uncertainty for proportions and means. For mean values, we used the following formula:

$$Confidence\ Interval_{mean} = mean \pm 1.645 * \sqrt{\frac{s^2}{n}}$$

Where s^2 is equal to the sample variance, and 1.645 is the z-score for a 90 percent confidence interval. We assumed the normal approximation formula to estimate confidence intervals for proportions:

$$Confidence\ Interval_{proportion} = proportion \pm 1.645 * \sqrt{\frac{proportion * (1 - proportion)}{n}}$$

Due to differences in the overall mix of equipment within each facility, the Project Team did not collect data for every characteristic at every site. Consequently, this report notes field-specific sample sizes for tables and figures populated with site visit data.

Penetration, Mean Units, and Saturation

This report frequently cites three metrics: penetration, mean units, and saturation. These metrics merit some discussion to explain their meaning.

Penetration refers to the proportion of buildings assigned a given equipment type or characteristic. For instance, boilers have a penetration of 12.6 percent. This means 12.6 percent of commercial buildings have at least one boiler (though they could have more). In an energy efficiency context, penetration is often used to convey adoptions levels of a given technology.

In the context of this report, mean units represent the average number of units of a particular piece of equipment for sites where at least one piece of equipment is present. We chose this representation method as the commercial sector covers a wide array of business types, each with unique equipment inventories. For example, only 9.4 percent of businesses have a standard oven. Taking the average from the population means the average site has 0.17 ovens. However, when we subset the average to sites with at least one standard oven, the mean is 1.8. That is, sites with a standard oven have 1.8 on site. Thus, the average number of units across all sites could be derived by simply taking the product of the penetration and the mean units.

The report also uses saturation, which we define as the proportion of a given end use. For instance, the commercial sector had a 14 percent saturation of T-8s. This means, of all lighting in the commercial sector, 14 percent consists of T-8s.

Telephone Survey

The Project team conducted 15-minute telephone surveys of Michigan commercial customers as part of the baseline study. We designed the survey to explore attitudes and barriers regarding energy efficiency that exist among commercial customers.

Sample Design

The telephone survey utilized a random sample, stratified by commercial business type (segment), drawn from a sampling frame developed from the customer information databases of DTE and Consumers Energy, as well as from purchased lists of commercial customers in Alpena County and the Upper Peninsula. Table 3 provides the available sample used for each commercial segment for the telephone survey and the number of completed surveys.

Table 3. Sample and Completes by Commercial Business Type

Business Type	DTE Sample	Consumers Energy Sample	Upper Peninsula and Alpena County Sample	Completes
Office	2,100	1,620	974	146
Retail	2,100	2,261	838	153
Warehouse	2,100	758	328	127
Miscellaneous	2,100	0	0	60
Restaurant	1,642	1,199	717	131
Grocery	1,200	316	303	113
Education (K-12)	643	244	326	95
Health	589	1,165	765	102
Lodging	198	117	508	89
Total	12,672	7,680	4,759	1,016

Summary of Survey Statistics

We completed 1,016 telephone interviews with commercial customers in February of 2010 and February 2011. We provide the final survey dispositions in Table 4.

Table 4. Commercial Baseline Survey Dispositions

Disposition	Total
Completed Interviews (I)	1,070
Eligible Non-Interviews	8,726
Refusals (R)	*4,818*
Mid-Interview Terminate (R)	*181*
Respondent Never Available (NC)	*3,694*
Language Problem (NC)	*33*
Not Eligible (e)	3,575
Fax/Data Line	*233*
Non-Working	*1,831*
Wrong Number	*604*
Residential	*574*
Cell Phone	*25*
Duplicate Phone Number	*39*
No Eligible Respondent	*269*
Unknown Eligibility Non-Interview (U)	11,740
No Answer	*2,101*
Answering Machine	*2,278*
Busy	*86*
Call Blocking	*34*
Not Attempted	*7,241*
Total Participants in Sample	25,111

The survey response rate is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. We calculated the response rate using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR).[2] For various reasons, we were unable to determine the eligibility of all sample units through the survey process and chose to use AAPOR Response Rate 3 (RR3). RR3 includes an estimate of eligibility for these unknown sample units. The formulas used to calculate RR3 are presented below. The definitions of the letters used in the formulas are displayed in the Survey Disposition table.

$$E = \frac{(I + R + NC)}{(I + R + NC + e)}$$

$$RR3 = \frac{I}{((I + R + NC) + (E * U))}$$

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

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

$$COOP1 = \frac{I}{(I + R)}$$

As shown in above in Table 5, we obtained a response rate for the survey of 6 percent. This response rate is low but typical of commercial general population surveys. The cooperation rate of 18 percent shows that it was difficult to complete interviews with businesses with whom we were able to establish contact.

Table 5. Commercial Baseline Telephone Survey Response and Cooperation Rates

AAPOR Rate	Percentage
Response Rate (RR3)	6%
Cooperation Rate	18%

Weighting

We conducted sampling and surveying in two waves. For the DTE survey wave, we attempted to complete telephone interviews with at least 70 businesses in each of nine market segments[3]— to reach 90/10 confidence and precision. This sample design provided survey results for each segment at the 90/10 confidence and precision level. For the Consumers Energy and Upper Peninsula and Alpena County survey waves, we sampled proportionate to each segment's presence in the population. Because both waves did not sample segments in proportion to their representation in the overall population, we created a survey design weight to produce results that can be extrapolated to the overall commercial sector population, as shown in Table 6. The weight is the inverse of the sampling fraction of each segment based on population totals of each segment.

$$Design\ Weight = \frac{1}{sampling\ Fraction}$$

$$Sampling\ Fraction = \frac{\%\ of\ Sample}{\%\ of\ Population}$$

Table 6. Telephone Survey Weighting

Segment	Completed Interviews	Percent of Sample	Population N	Percent of Population	Sampling Fraction	Design Weight
Education	95	9%	2,223	1.2%	7.617	0.131
Grocery	113	11%	5,667	3.1%	3.554	0.281
Health	102	10%	21,457	11.8%	0.847	1.180
Lodging	89	9%	1,696	0.9%	9.353	0.107
Miscellaneous	60	6%	35,114	19.4%	0.305	3.284
Office	146	14%	51,594	28.5%	0.504	1.983
Restaurant	131	13%	17,927	9.9%	1.302	0.768
Retail	153	15%	33,210	18.3%	0.821	1.218
Warehouse	127	13%	12,193	6.7%	1.856	0.539

[3] All 8 segments used for the on-site sample, and another "miscellaneous" category.

Segment	Completed Interviews	Percent of Sample	Population N	Percent of Population	Sampling Fraction	Design Weight
Total Customers	1,016	100%	181,081	100%		

Site Visits: Energy-Consuming Equipment Characteristics

This section characterizes energy-consuming equipment in Michigan's commercial sector, achieved through on-site data collection. Table 7 outlines penetrations and mean units for all major equipment types surveyed. This study defines penetration as the proportion of sites with at least one given type of equipment present. Consequently, penetrations can never exceed 100 percent. Mean units are the average number of units for sites containing at least one unit; therefore, they are always larger than one. Additionally, the sample size, n, reflects the number of sites with the given equipment.

Table 7. Summary of Commercial Equipment Penetrations and Mean Units

Appliance/Equipment	Penetration	Mean Units *	n
HVAC Unitary Systems	92.3%		262
Heat Pump - Air Source	0.3%	1.0	1
Heat Pump - Water Source	0.5%	1.0	1
Packaged Multi-Zone	0.3%	1.0	1
Packaged Single Zone A/C Only	2.5%	1.8	11
Packaged Single Zone A/C Only w/ heat	28.7%	1.5	83
Packaged Single-Zone - Heat only	8.3%	1.4	26
Radiant Heat	1.7%	3.8	8
Split System	49.7%	2.3	123
Unit Heater	17.7%	2.1	51
Unit Ventilator	1.6%	1.8	7
Window / Wall AC Unit	7.0%	2.9	36
Window / Wall Heat Pump	0.3%	1.7	2
Boilers	12.6%	1.4	54
HVAC Systems – Air Handlers	4.0%	1.7	12
CV - Dual Duct	0.1%	1.0	1
CV - Multi Zone	0.5%	1.6	3
CV-Single Zone	1.0%	1.3	5
CV-Terminal Reheat	0.8%	1.0	1
FPS-Fan Powered VAV-Series	0.9%	1.0	2
Heat & Vent	0.6%	1.5	2
Radiators	0.1%	1.0	1
Unit Ventilators	0.3%	3.0	1
HVAC Chiller	2.1%	2.6	3
Absorption - Natural Gas	0.8%	2.0	1
Centrifugal	0.5%	1.0	1
Scroll	0.8%	4.0	1

Appliance/Equipment	Penetration	Mean Units *	n
Water Heating	89.7%	1.1	262
Heat Recovery	0.3%	1.0	1
Instantaneous (Tankless)	3.4%	1.2	12
Other	0.8%	1.0	1
Self-Contained	85.9%	1.1	249
Storage Tank (Central Boiler)	0.5%	1.8	5
All Computers	89.6%	8.7	246
Personal Computers	84.4%	8.0	228
Laptops	28.1%	3.6	74
Server	27.2%	2.1	62
Secondary Monitors	8.7%	14.2	17
Office Equipment	86.4%	9.1	232
Combination Printers	59.6%	2.6	154
Photocopiers	28.4%	3.4	67
Printers	59.3%	8.2	151
Fax Machines	32.8%	1.0	84
Scanners	8.9%	1.4	21
Appliances	72.8%	10.9	209
Residential-Style Refrigerators	67.3%	3.3	189
Water Coolers	15.8%	9.0	36
Beverage Machines	8.9%	10.4	40
Battery Chargers	6.3%	41.0	16
Snack Machines	2.2%	38.1	11
Laundry Equipment	12.4%	2.3	49
Washing Machines	12.4%	1.2	49
Front Load Washers	3.3%	1.5	20
Top Load Washers	9.3%	1.1	32
Dryers	11.8%	1.2	47
Commercial Cooking Equipment	15.2%		52
Standard Ovens	9.4%	1.8	32
Griddles	9.6%	1.6	30
Ranges	9.0%	1.4	32
Steam Cookers	3.7%	1.6	10
Fryers	9.0%	2.4	28
Hot Food Holding Cabinets	5.5%	3.1	17
Convection Ovens	5.8%	1.4	20
Conveyor Ovens	3.5%	1.1	11

Appliance/Equipment	Penetration	Mean Units *	n
Commercial Refrigeration Equipment	23.9%		78
Solid Door Refrigerator/Freezer	16.5%	3.1	55
Walk-in Freezer	5.3%	1.1	17
Display Cases with Doors	4.4%	20.5**	15
Glass Door Refrigerator/Freezer	12.3%	2.1	41
Walk-in Refrigerator	17.0%	1.1	56
Ice Makers	10.5%	4.9	38
Dishwashers ***	12.8%		43
Commercial-sized	6.8%		21
Residential-sized	9.1%		27

* Mean units are provided for aggregate appliance/equipment only when subcategories are comparable. For example, a global mean is provided for Water Heating, but not for Commercial Cooking Equipment.

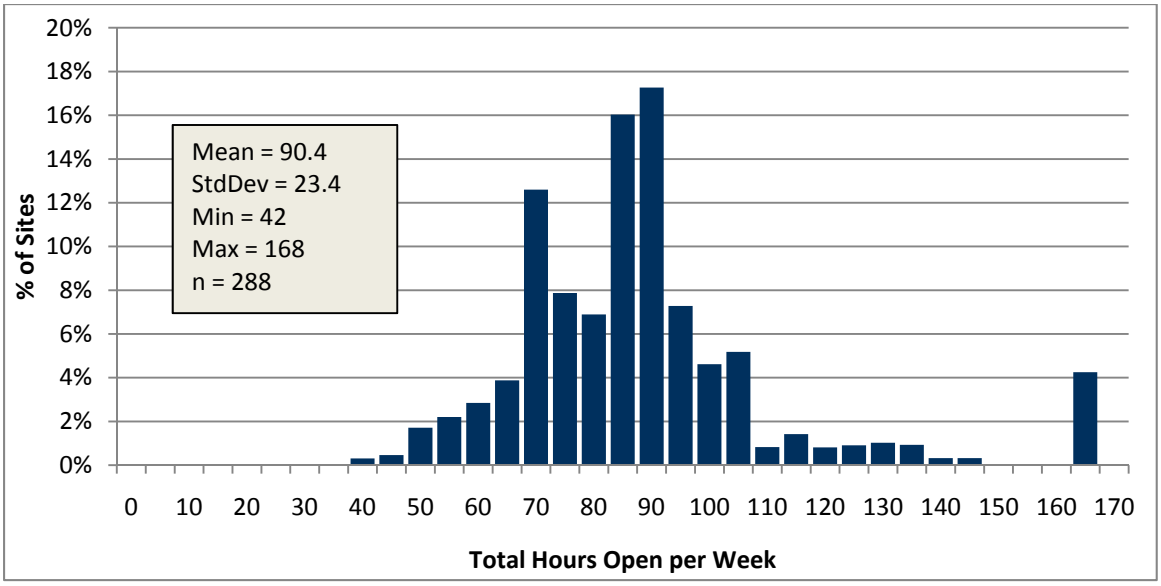
** Display case quantities are expressed in terms of the numbers of doors. Where only linear feet were collected, one door per 2.5 linear feet was assumed.

*** Mean units are not provided for dishwashers due to inconsistencies in data collection.

General Building Information

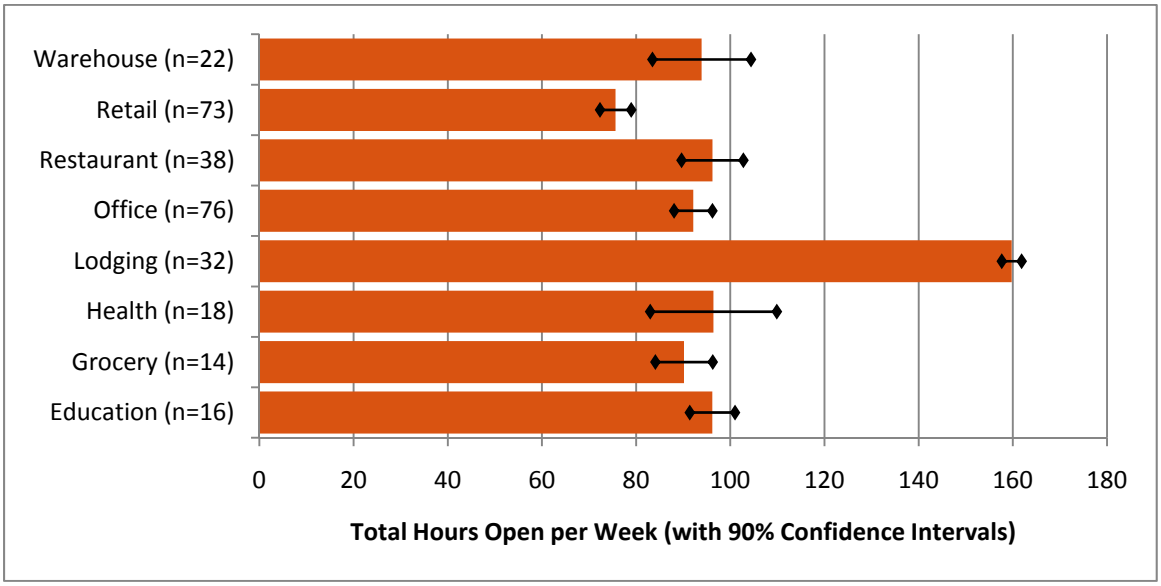
As shown in Figure 4, surveyed buildings are open an average of roughly 90 hours per week, or around 13 hours a day. Just over 4 percent of businesses are open 24 hours a day, seven days a week (168 hours per week). Approximately 99 percent of businesses are open year-round. Of sites not open year-round, most are schools (40 percent); the remaining sites are related to the service industry (restaurants, lodging, and retail facilities), which open only seasonally.

Figure 4. Distribution of Open Hours



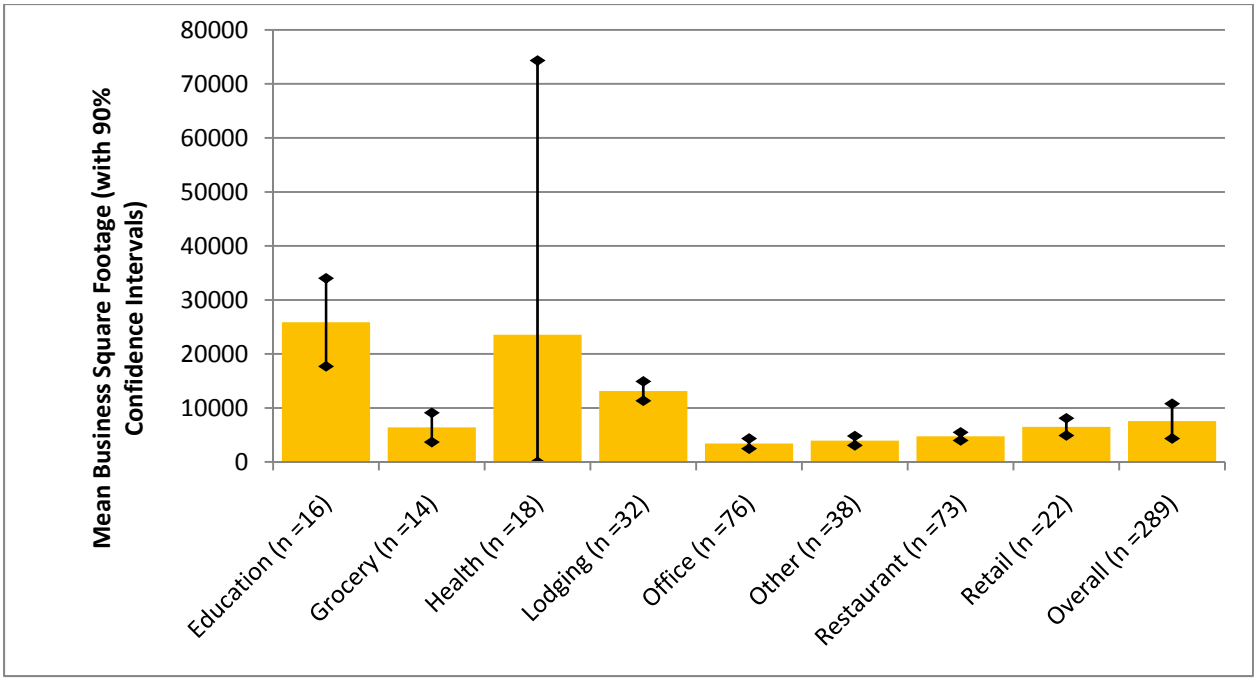
Mean open hours remain relatively constant across business types. As seen in Figure 5, lodging facilities are an exception to this, which (for obvious reasons) are substantially higher on average.

Figure 5. Open Hours by Business Type



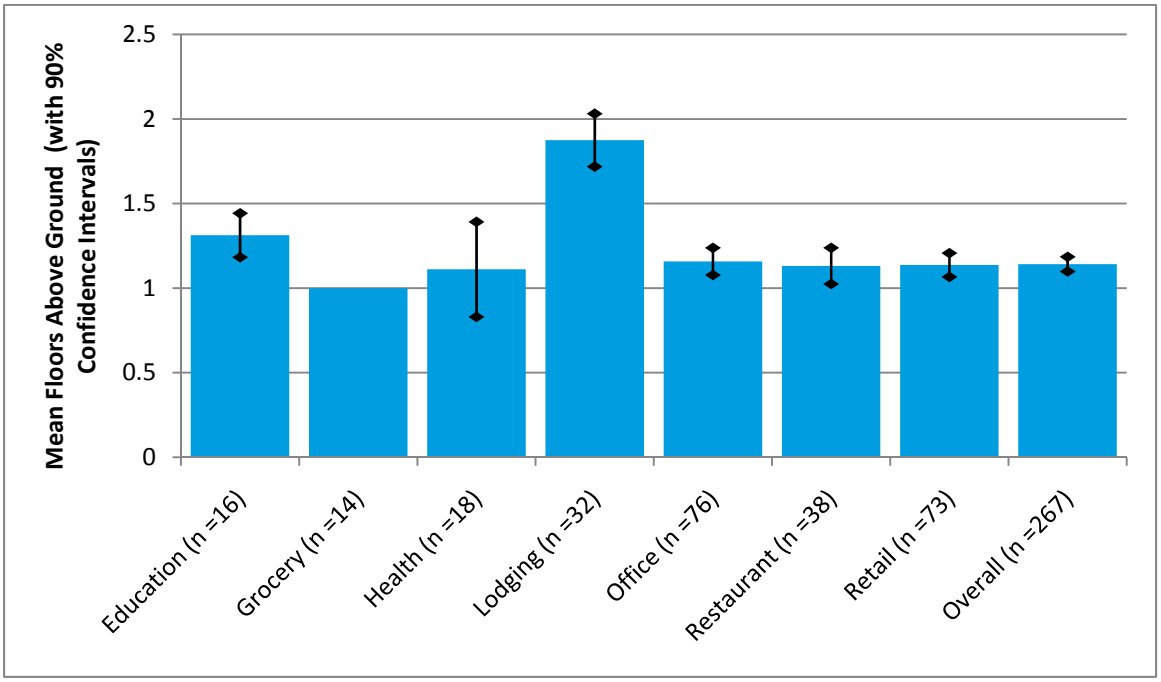
Building sizes vary considerably between and among individual business types. Unsurprisingly, schools (including K-12 and university) and health facilities (including outpatient care and hospitals) are average largest sizes and exhibit the highest degree of variation (as shown in Figure 6).

Figure 6. Building Square Footage by Business Type



The vast majority of buildings are single story, with a sector-level average of 1.1 floors. Figure 7 summarizes average above-ground floors across business types. Lodging facilities have the tallest buildings, averaging 1.9 floors. Most buildings do not have floors below ground, with a mean of 0.33 floors below ground and a maximum of one.

Figure 7. Floors Above Ground by Business Type



As shown in Figure 8, average occupancy levels also vary considerably. Health, lodging, and educations all have significantly higher occupancy levels than other business types, and show a high degree of variability. Health facilities, for instance, have a mean occupancy level of 77.8 people, but have a median of 10 people, due to the wide variety of businesses classified as health facilities (from hospitals to dentists' offices).

Figure 8. Mean Occupancy by Business Type

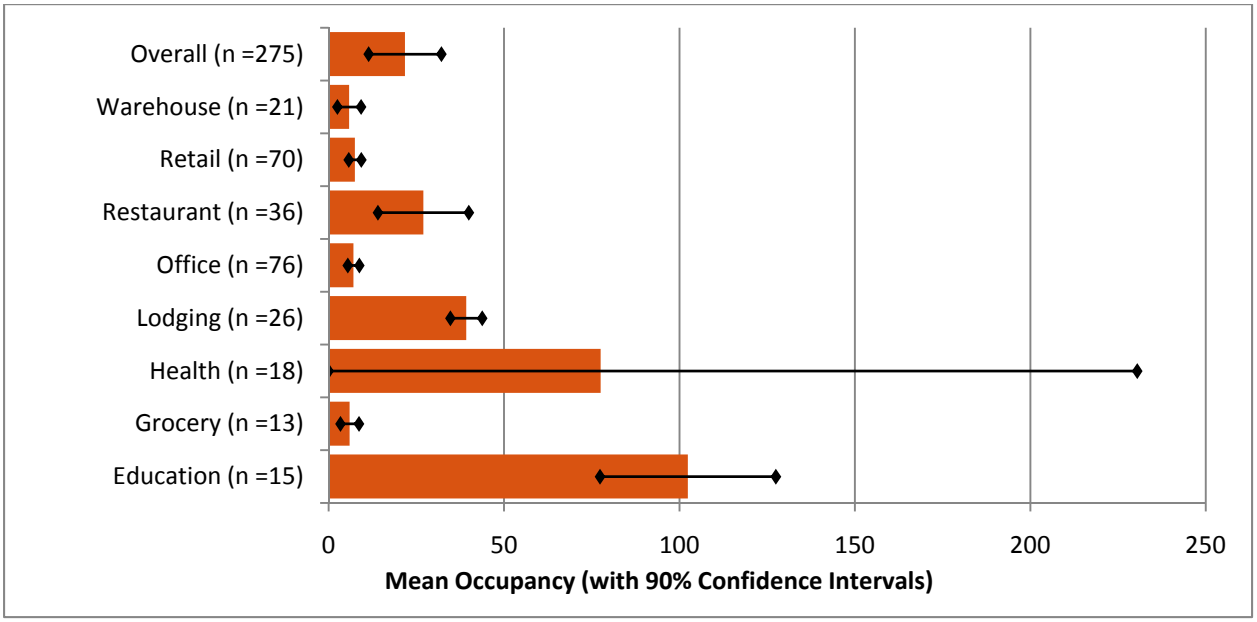


Table 8 presents means and medians for square footage and occupancy levels, by business type.

Table 8. Mean and Median Square Footage and Occupancy Levels by Business Type

	Square Footage		Average Occupancy	
Business Type*	Mean	Median	Mean	Median
Education (n=16)	25,866	9,434	102	75
Grocery (n=14)	6,396	3,150	6	5
Health (n=18)	23,568	3,250	78	10
Lodging (n=32)	13,139	5,700	39	24
Office (n=76)	3,410	2,021	7	4
Restaurant (n=38)	3,945	2,782	27	15
Retail (n=73)	4,741	3,200	8	4
Warehouse (n=22)	6,510	5,000	6	3
Overall (n=289)	7,572	3,000	22	5

* Sample sizes in this table are the maximums of the two fields (square footage and average occupancy).

Building Envelope

Table 9 shows 89 percent of average buildings have conditioned interior floor space, whereas health and education facilities have levels closer to 95 percent or more. Notably, health and education facilities are often larger than other commercial buildings.

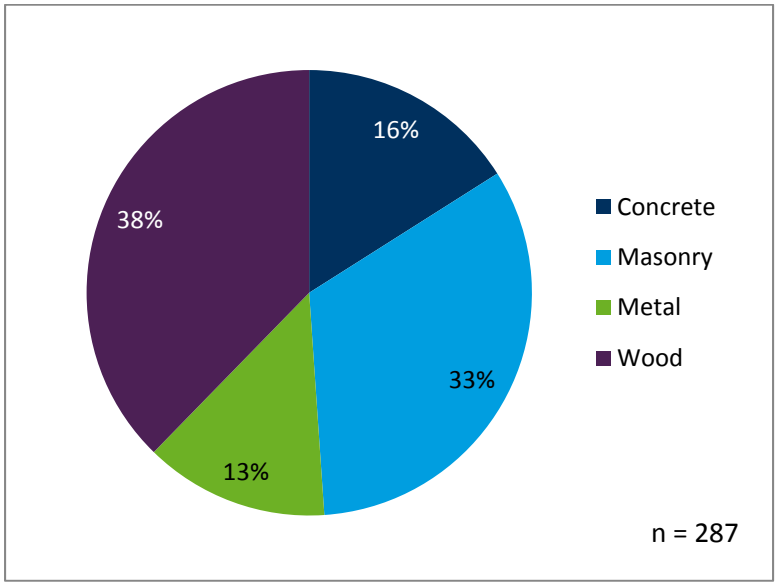
Table 9. Unconditioned Space by Business Type

Business Type	Unconditioned Percent of Space
Education (n=16)	3%
Grocery (n=14)	9%
Health (n=18)	8%
Lodging (n=32)	15%
Office (n=76)	9%
Restaurant (n=38)	18%
Retail (n=73)	12%
Warehouse (n=22)	15%
Overall (n=289)	11%

Wall Framing and Insulation

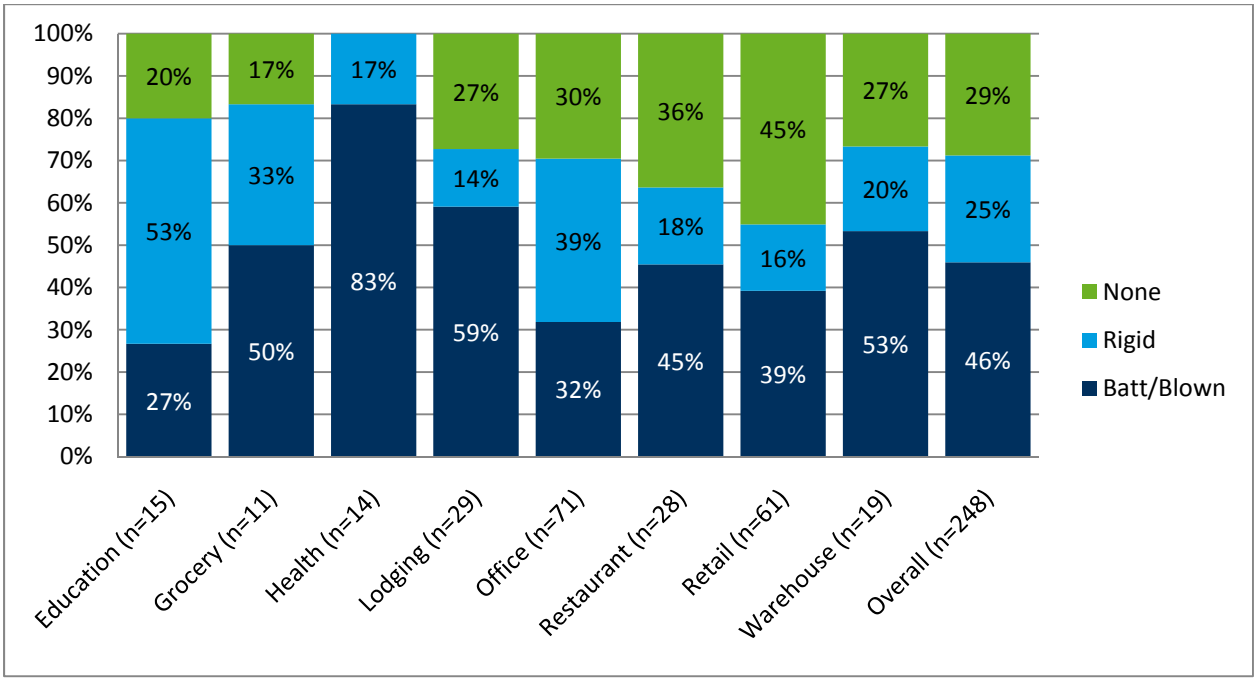
Figure 9 provides evenly distributed wall framing types across commercial buildings. Masonry and wood are most common, with combined metal and concrete accounting for 30 percent of wall framing.

Figure 9. Wall Framing Type



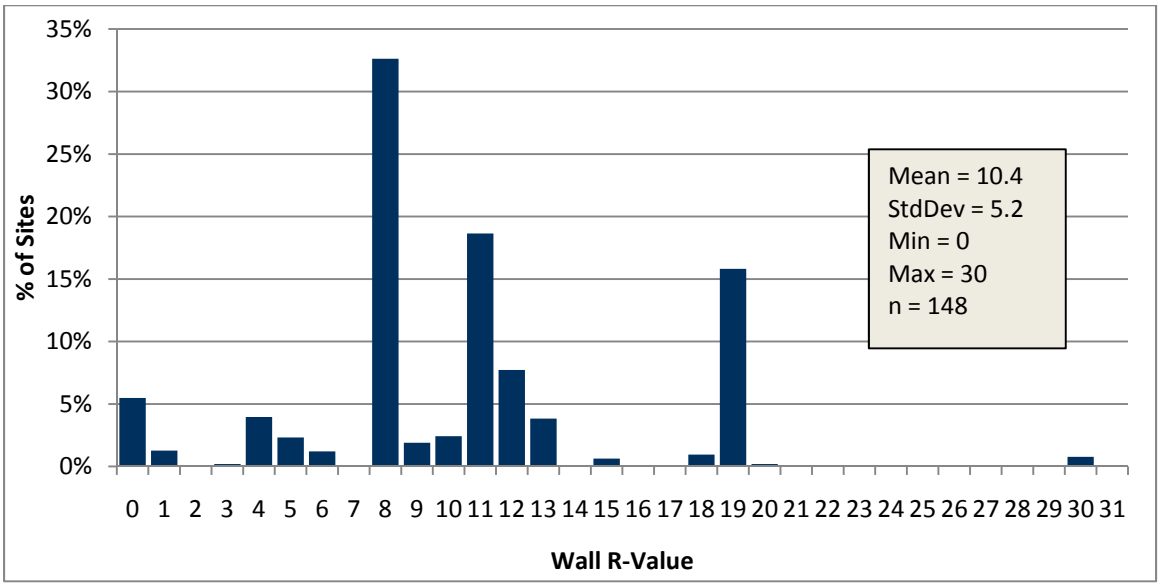
As shown in Figure 10, the majority of commercial buildings have some sort of wall insulation, though types and distributions vary across business types. Rigid insulation accounts for the majority of insulation in schools, while batted/blown insulation is more common in other commercial buildings. Health facilities are the only business type always having insulation present.

Figure 10. Wall Insulation Type by Business Type



Engineers estimated R-values for roof, wall, and flooring on site where possible. As shown in Figure 11, 14.4 percent of commercial sites have wall insulation at an R-value below R-8. Thirty-seven percent of sites have wall insulation at R-8, R-9, or R-10. Around 31.8 percent have R-11 up to R-18; the remaining 16.8 percent have R-19 or higher.

Figure 11. Distribution of Wall R-Values



R-values for wall insulation did not vary substantially across business types. Table 10 provides a more detailed summary of wall insulation by business type. Warehouses have the highest average wall insulation levels.

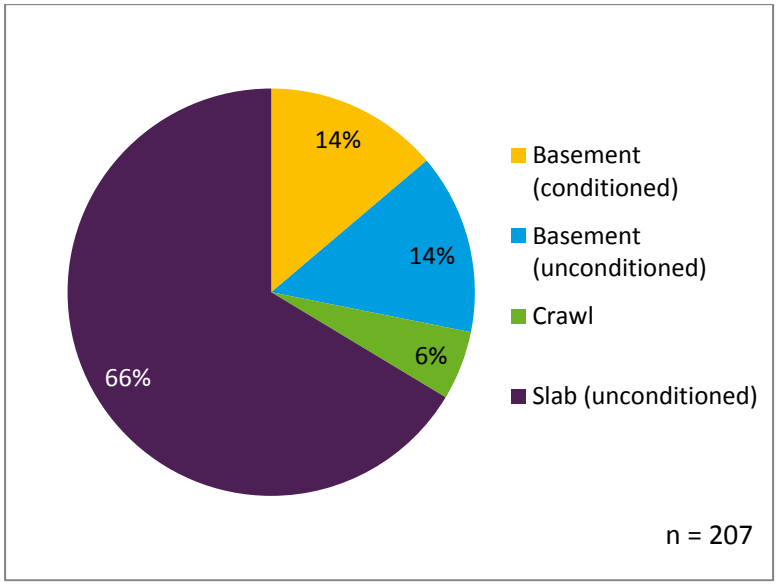
Table 10. Wall Insulation R-Value by Business Type

Business Type	n	Mean	Std Dev	Min	Max	Precision (90%)
Education	14	10.1	2.5	0	20	± 1.1
Grocery	8	8.9	4.7	0	19	± 2.7
Health	9	10.9	8.1	4	19	± 4.4
Lodging	21	11.0	2.2	0	25	± 0.8
Office	43	9.5	4.6	0	19	± 1.2
Restaurant	12	11.1	6.5	0	19	± 3.1
Retail	27	10.9	5.6	0	19	± 1.8
Warehouse	14	12.8	7.5	0	30	± 3.3
Overall	148	10.4	5.2	0	30	± 0.7

Foundation and Roofing

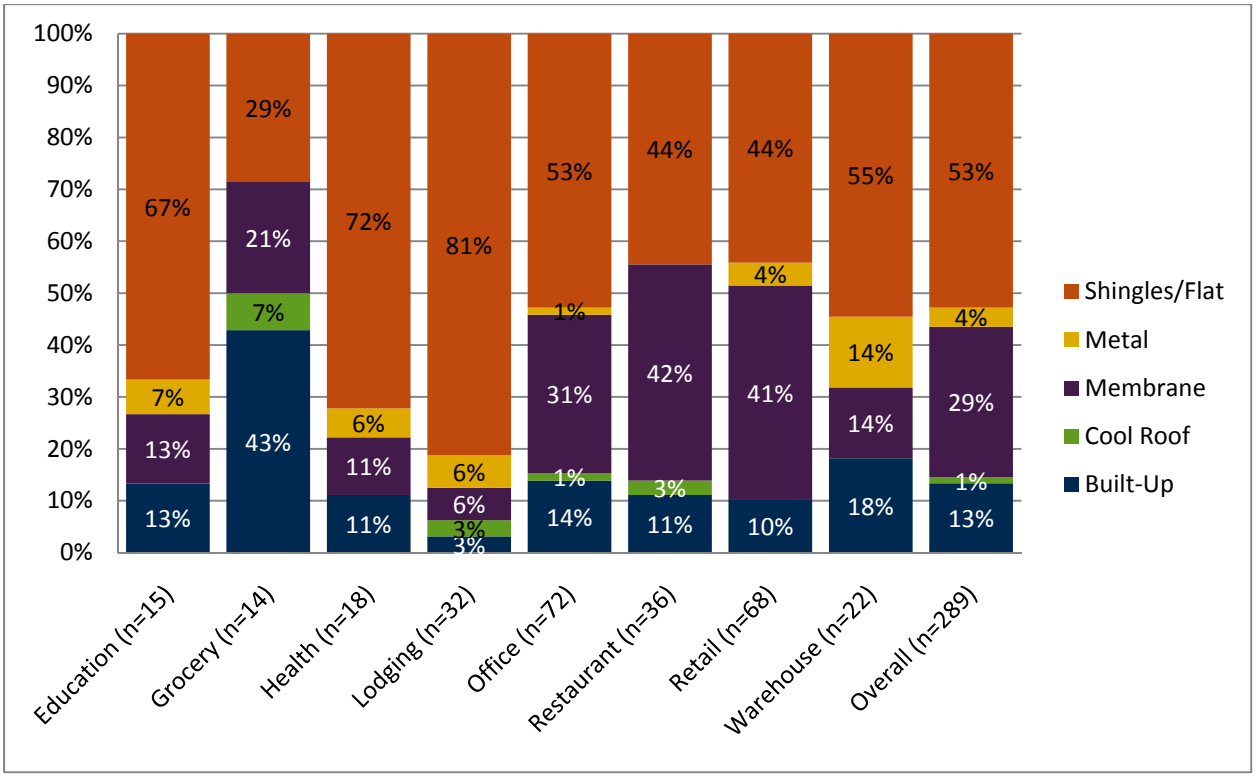
As shown in Figure 12, the majority of commercial buildings have unconditioned slab foundations. Across all business types, only 14 percent have conditioned basements.

Figure 12. Foundation Type



As shown in Figure 13, the majority of commercial buildings have shingled roofs, though much variation occurs between business types. For instance, grocery facilities are much more likely to have built-up or membrane roofs, whereas more than four in five lodging facilities have shingled roofs.

Figure 13. Roofing Materials by Business Type



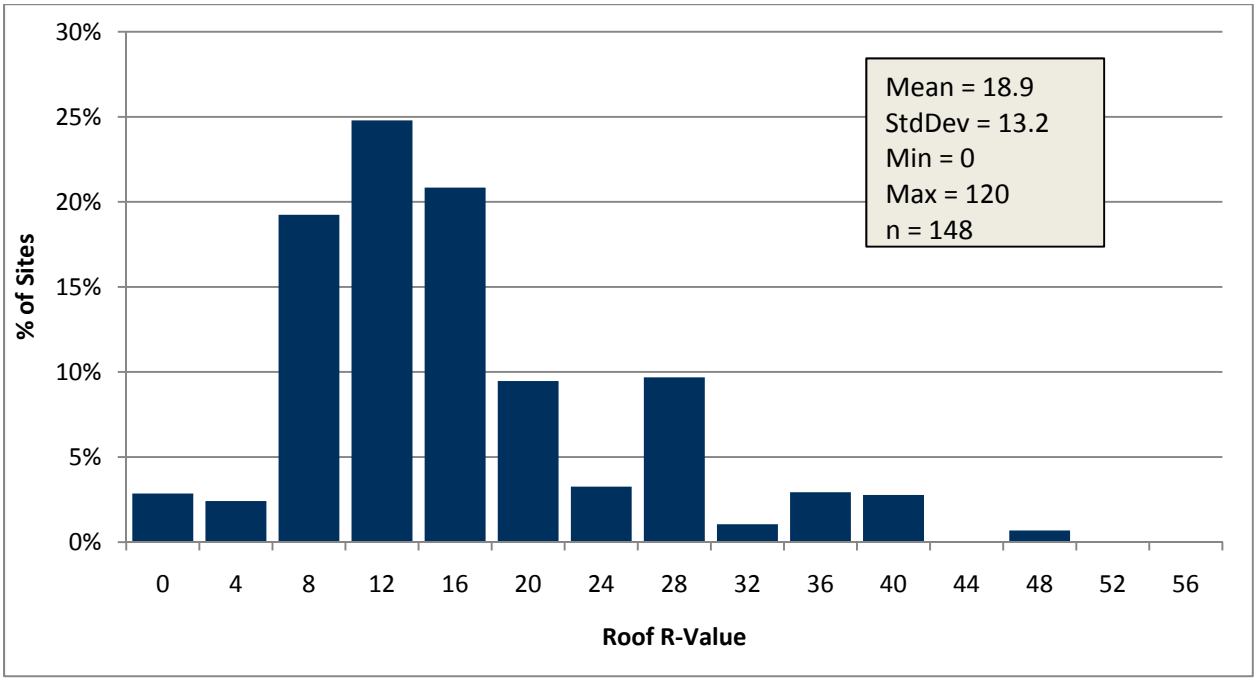
Roof insulation distributions are similar to wall insulation, except restaurants have higher levels of roof insulation. Table 11 provides a detailed summary of roof insulation R-values by business types.

Table 11. Roof Insulation by Business Type

Business Type	n	Mean	Std Dev	Min	Max	Precision (90%)
Education	13	14.0	5.3	0	42	± 2.4
Grocery	11	12.5	8.2	5	38	± 4.1
Health	8	27.0	22.1	10	58	± 12.9
Lodging	22	16.0	3.6	0	38	± 1.2
Office	44	16.1	9.3	0	40	± 2.3
Restaurant	11	28.8	31.6	10.5	120	± 15.7
Retail	25	17.5	6.3	0	30	± 2.1
Warehouse	14	19.9	14.8	0	40	± 6.5
Overall	148	18.9	13.2	0	120	± 1.8

As shown in Figure 14, overall distributions of roof insulation R-values follow a relatively central distribution, with a mean of 18.9 and a median of 18.5. Forty nine percent of commercial sites have roof insulation with an R-value of R-12 or below.

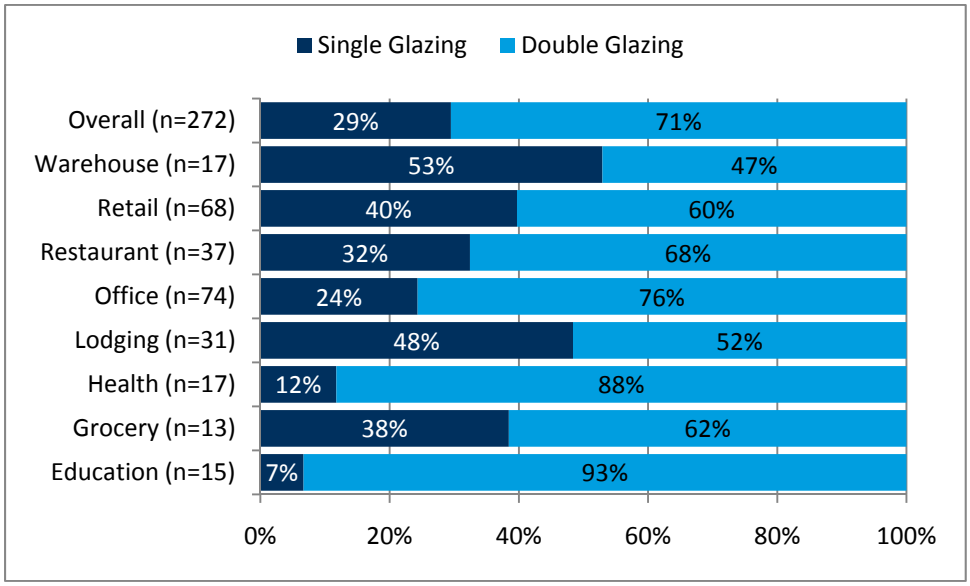
Figure 14. Distribution of Roof R-Values



Windows

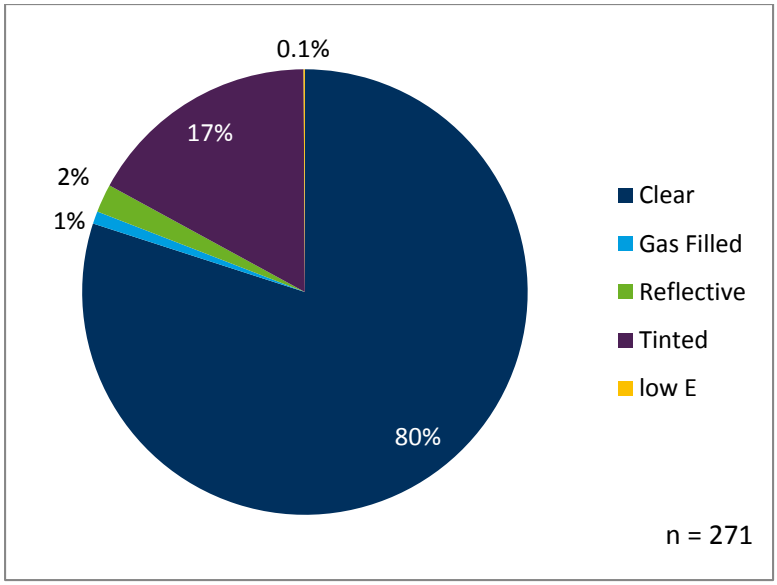
Ninety-four percent of commercial buildings have windows; most without windows are warehouses. The majority of building windows are double-glazed, providing a greater degree of insulation than single glazing, with health and education facilities much more likely to have double-glazed windows. Figure 15 provides distributions of window glazing layers by business type.

Figure 15. Layers of Window Glazing by Business Type



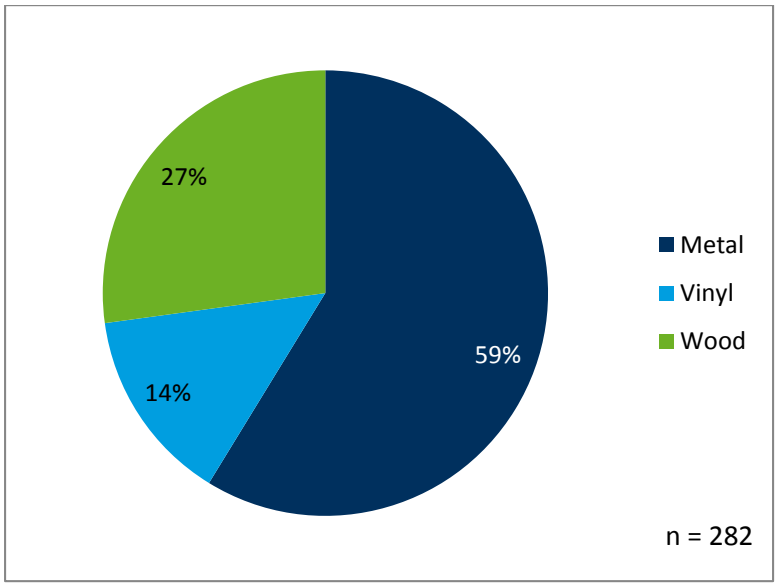
Glazing methods used also affect windows' insulation effectiveness. Clear glazing results in the highest levels of radiant heat transfer, decreasing the overall U-value. As seen in Figure 16, the majority of commercial buildings use clear window glazing.

Figure 16. Window Glazing Type



Window framing methods can also affect window performance. Metal frames have higher heat transfer levels, compared to vinyl or wood-framed windows. As shown in Figure 17, across all commercial buildings, metal window framing is dominant, used for 59 percent of all windows.

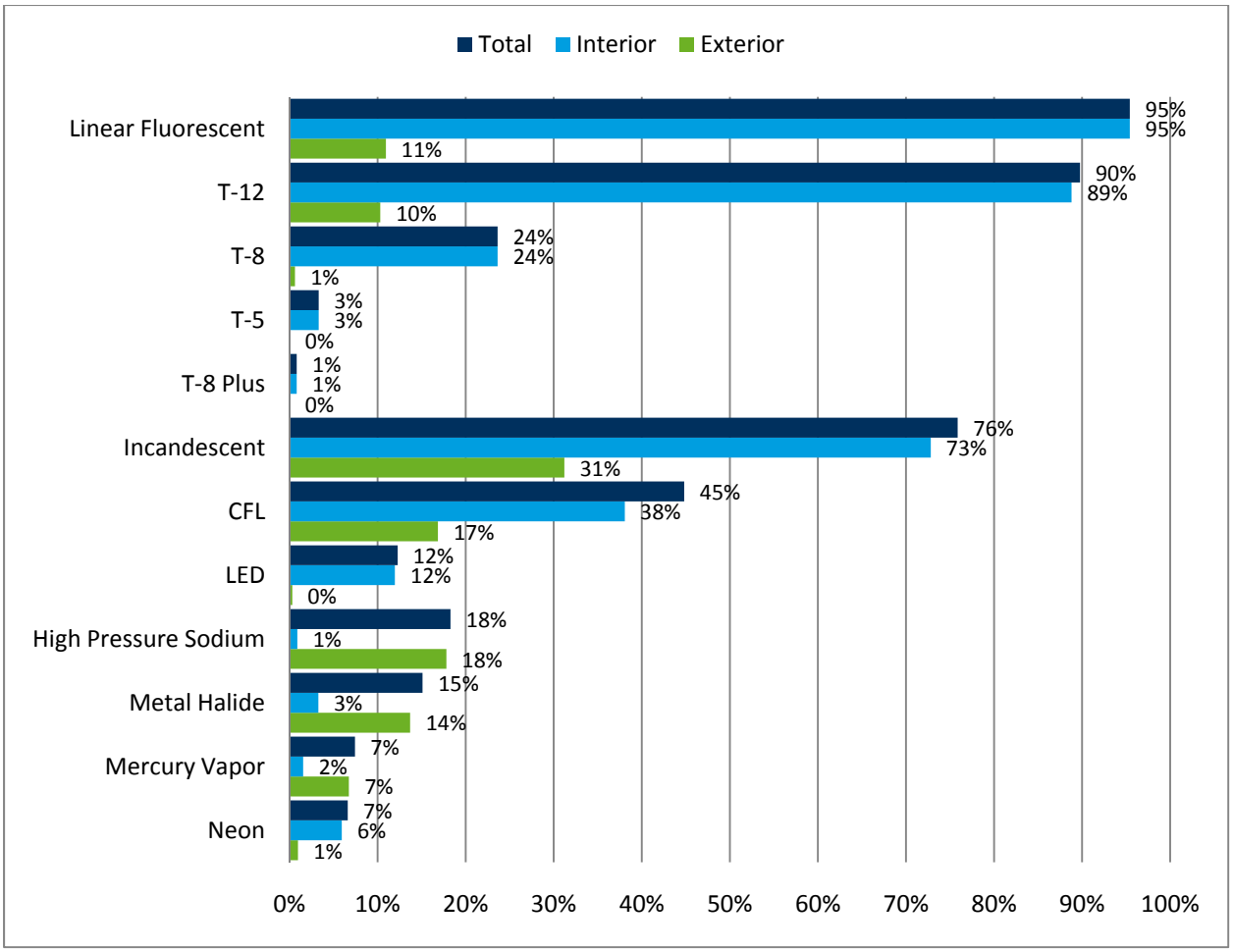
Figure 17. Window Framing Type



Lighting

Figure 18 shows penetration of different bulb types for the commercial sector. In commercial buildings, linear fluorescents clearly dominate, with 95 percent of commercial buildings having some form of linear fluorescent lighting. Notably, 90 percent of buildings use highly inefficient T-12s.

Figure 18. Lighting Penetrations by Bulb Type*



* "T-8 Plus" refers to high efficiency T-8s, also called "Super T-8s" or "T-8HOs."

In addition to high T-12 penetration levels, Table 12 shows buildings with linear fluorescents tend to have many units. For instance, buildings with T-12s average 105 bulbs installed, whereas compact fluorescent light bulbs (CFLs) average approximately 25 bulbs when present.

Table 12. Mean Bulbs by Type

Lighting Type	Total	Interior	Exterior
Linear Fluorescent	206.1	204.6	12.6
T-12	105.0	104.6	12.6
T-8	133.8	133.5	11.0
T-5	1,635.4	1635.4	0.0
Incandescent	20.5	18.3	7.2
CFL	24.7	26.4	6.1
LED	9.1	9.2	4.0
High Pressure Sodium	3.8	6.3	3.5
Metal Halide	13.5	15.2	11.2
Mercury Vapor	4.5	11.3	2.4
Neon	4.4	4.7	1.3

Considering overall distribution of bulb types, shown in Figure 19, T-12s make up 41 percent of all commercial bulbs.

Figure 19. Distribution of Bulb Types (Interior and Exterior)

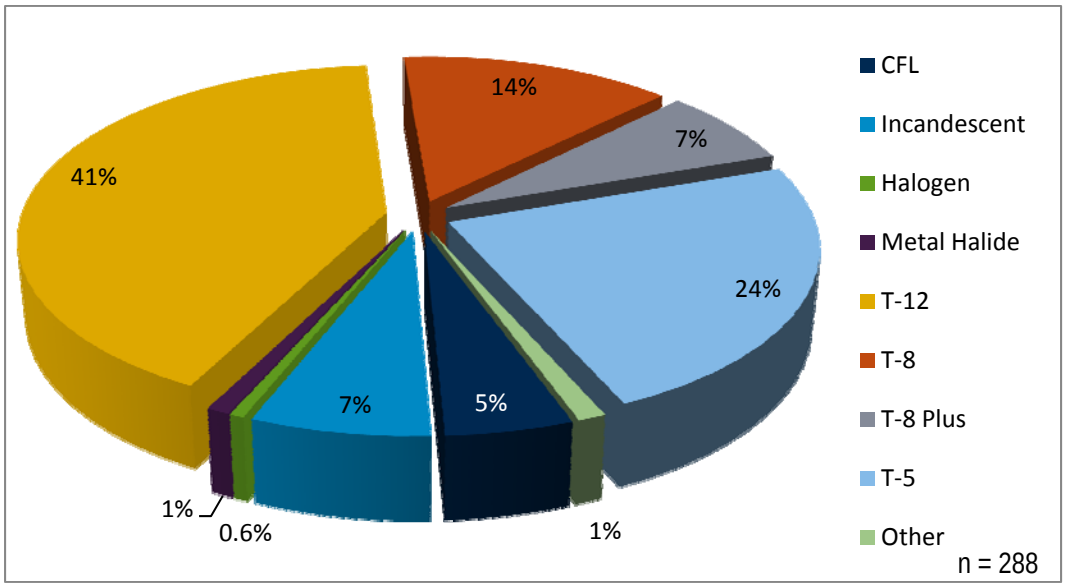
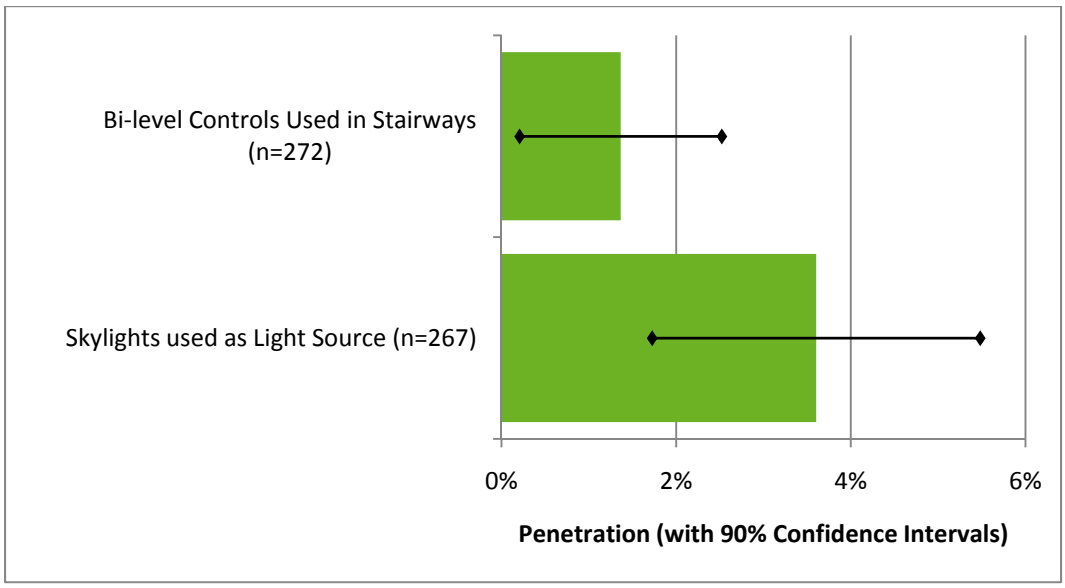


Figure 20 shows penetration of selected energy-efficiency measures used in lighting applications. Though relatively few business types use these measures (less than 5 percent), a high percentage of building managers (26 percent) have updated lighting systems.

Figure 20. Penetration of Lighting Efficiency Measures

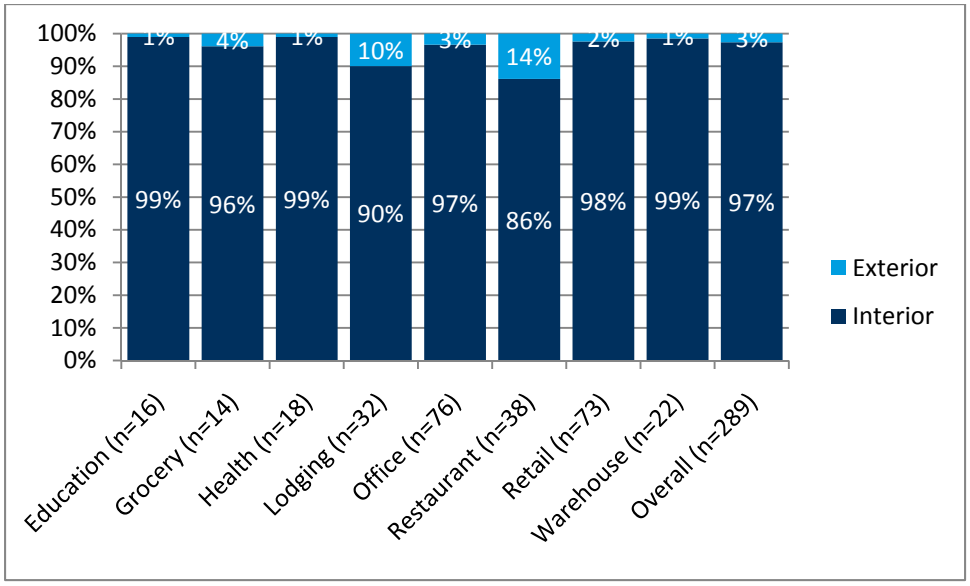


During the site visits, our auditors counted lamps and total wattages at each site. We then summed these totals across sites for each business type, obtaining estimates of the total proportion of lighting characteristics (e.g., location, bulb type, controls). Unless otherwise noted, the figures and tables below represent proportions of total bulbs.

Interior Lighting

As shown in Figure 21, the overwhelming majority of lighting is used indoors. Restaurants and hotels tend to have higher proportions of outdoor lighting (14 and 10 percent, respectively).

Figure 21. Distribution of Lighting Type by Business Type



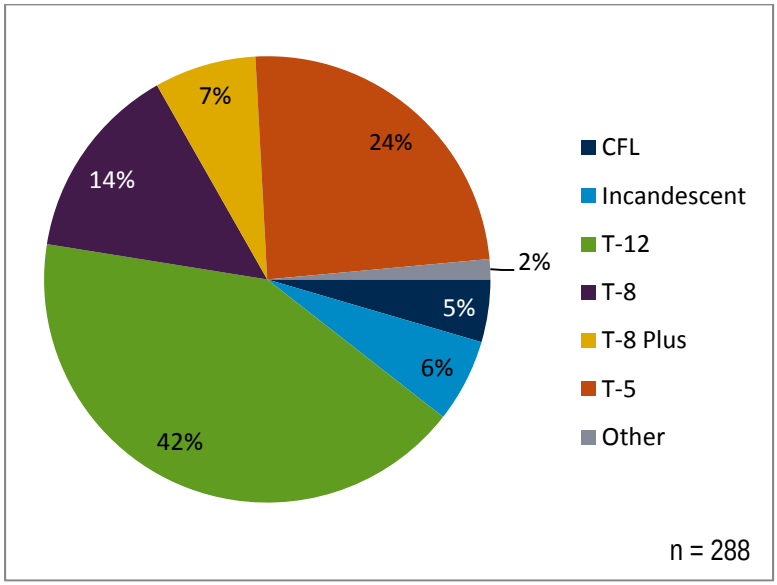
Commercial buildings have low rates of high bay lighting (defined as lighting more than 25 feet above the floor). Table 13 shows penetrations of high bay lighting relative to standard interior lighting by business type. Groceries and warehouse facilities use the highest rates of high bay lighting (10 percent and 11 percent, respectively).

Table 13. Proportion of High Bay Lighting by Business Type

Lighting Type	High Bay	Standard Interior
Education (n=16)	5%	95%
Grocery (n=14)	10%	90%
Health (n=18)	0%	100%
Lodging (n=32)	0%	100%
Office (n=76)	4%	96%
Restaurant (n=37)	6%	94%
Retail (n=73)	0%	100%
Warehouse (n=22)	11%	89%
Overall (n=288)	2%	98%

As shown in Figure 22, most commercial sector indoor lighting uses linear fluorescents, with T-12s making up 42 percent of all indoor bulbs, and T-5s accounting for approximately 25 percent.

Figure 22. Distribution of Interior Bulb Types



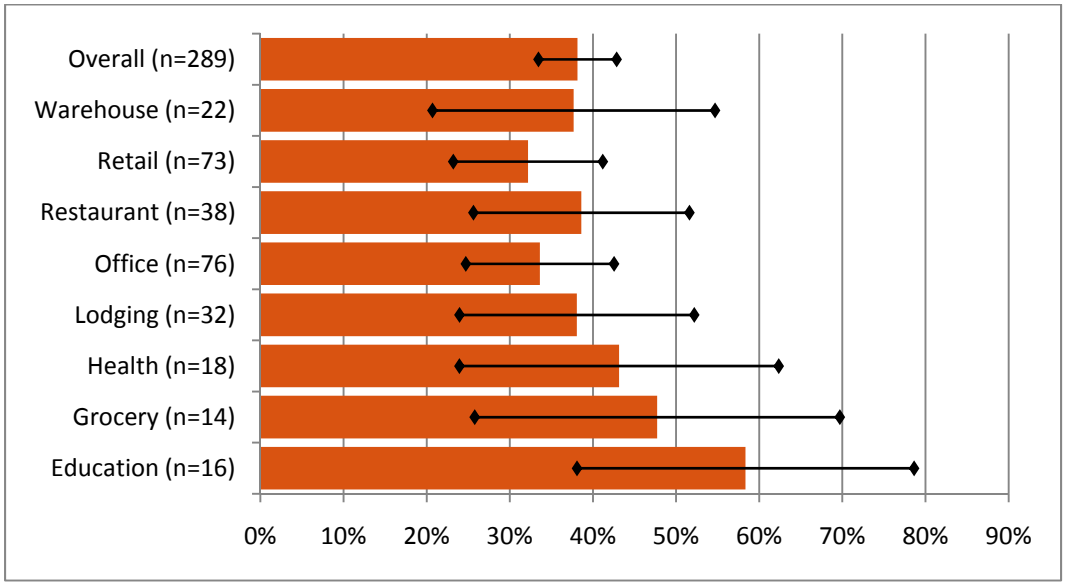
These distributions of interior bulb types are not uniform across business types. As seen in Table 14, health facilities account for the vast majority of T-5s (44 percent). Warehouses and offices have nearly twice the saturation of T-12s compared of other business types, with nearly two-thirds of their lighting composed of these bulbs. Schools have much higher saturations of T-8s than T-12s, compared to other business types.

Table 14. Interior Lighting Saturations by Business Type

Business Type	CFL	Incandescent	T-12	T-8	T-8 Plus	T-5	Other
Education (n=16)	3%	2%	23%	71%	0%	0%	1%
Grocery (n=14)	4%	3%	35%	49%	0%	6%	3%
Health (n=18)	2%	2%	34%	2%	14%	44%	1%
Lodging (n=32)	28%	40%	24%	5%	0%	1%	2%
Office (n=76)	5%	8%	61%	24%	0%	0%	2%
Restaurant (n=37)	19%	24%	30%	25%	0%	0%	2%
Retail (n=73)	6%	11%	62%	18%	0%	1%	2%
Warehouse (n=22)	4%	6%	61%	25%	0%	1%	3%
Overall (n=288)	5%	6%	42%	14%	7%	24%	1%

Though CFL saturations may seem low compared to residential data, this largely results from relatively low saturations of screw-based sockets in commercial buildings. As shown in Figure 23, when limiting lighting data only to bulbs in screw-based sockets, relatively high CFL saturations results across building types, with nearly 40 percent saturations across the commercial sector.

Figure 23. CFL Saturation of Screw-Based Sockets (with 90% Confidence Intervals)



Interior Lighting Controls

Specific controls used for a given lighting type can greatly impact overall consumption. Table 15 shows the vast majority of sites do not use automated controls.

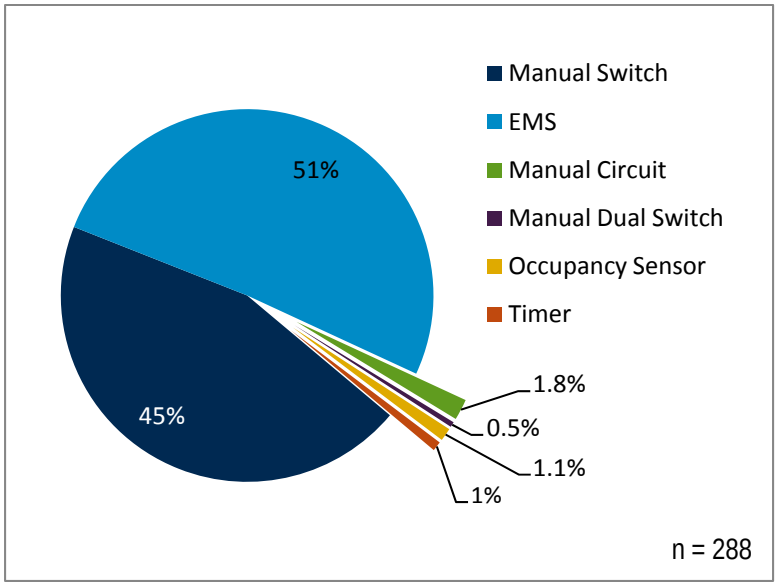
Table 15. Interior Lighting Control Penetrations

Business Type	Dimmer Switch	EMS*	Manual Circuit	Manual Dual Switch	Manual Switch	Occupancy Sensor	Timer
Education (n=16)	6%	0%	13%	6%	94%	13%	13%
Grocery (n=14)	0%	0%	36%	0%	86%	7%	7%
Health (n=18)	0%	6%	0%	0%	94%	6%	0%
Lodging (n=32)	0%	0%	3%	3%	100%	3%	0%
Office (n=76)	1%	0%	30%	1%	96%	5%	0%
Restaurant (n=37)	5%	0%	11%	0%	95%	8%	3%
Retail (n=73)	0%	0%	3%	0%	96%	4%	1%
Warehouse (n=22)	0%	0%	23%	0%	95%	5%	0%
Overall (n=288)	1%	0%	15%	1%	98%	6%	2%

* Energy Management System (EMS)

Despite lower penetrations of automated lighting controls, sites with higher bulb counts are more likely to use automated controls. This is particularly true for sites with linear fluorescents. As seen in Figure 24, 51 percent of linear fluorescents in the commercial sector are controlled using energy management systems (EMS).

Figure 24. Linear Fluorescent Control Type Saturation



Exit Signs

As exit signs must remain on at all times, they present special challenges in achieving energy efficiency. LED exit signs consume the least energy; incandescent exit signs consume the most. Table 16 provides penetrations of exit sign lighting by business type.

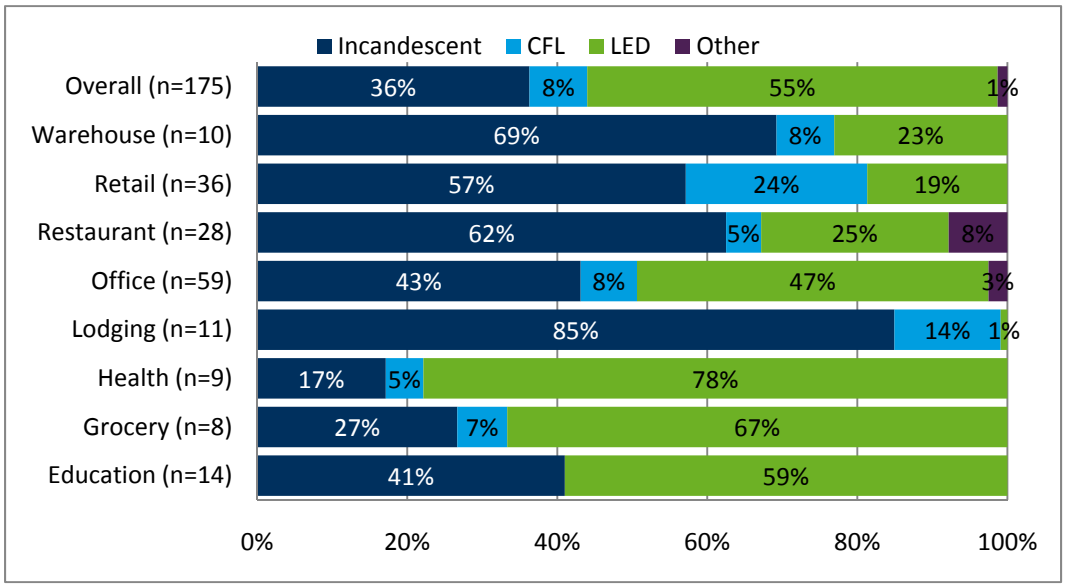
Table 16. Exit Sign Penetration by Business Type*

Business Type	All	Incandescent	CFL	LED	Other
Education (n=14)	88%	63%	0%	31%	0%
Grocery (n=8)	57%	14%	7%	36%	0%
Health (n=9)	50%	22%	11%	11%	0%
Lodging (n=11)	34%	28%	6%	3%	0%
Office (n=59)	78%	32%	7%	37%	3%
Restaurant (n=28)	74%	39%	3%	18%	5%
Retail (n=36)	49%	32%	10%	5%	0%
Warehouse (n=10)	45%	27%	5%	14%	0%
Overall (n=175)	63%	31%	7%	21%	2%

* Total exit sign penetration is slightly higher than the sum of individual bulb type penetrations due to the inaccessibility of some exit signs to site auditors, meaning auditors could not determine specific bulb types for these signs.

Though LED exit signs have low penetrations across the commercial sector, some business types seem to experience particularly high saturations. As shown in Figure 25, this is particularly true for health and grocery facilities. On the other hand, lodging sites appear to have higher saturations of exit signs with incandescent bulbs.

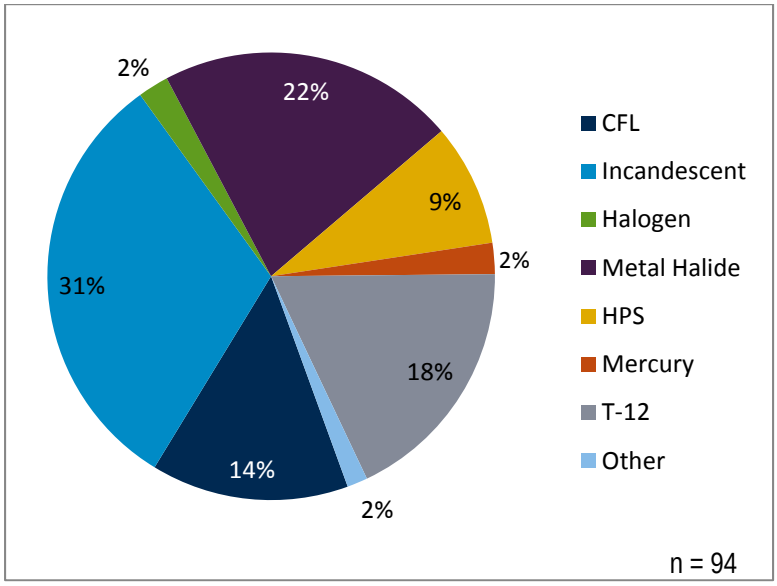
Figure 25. Exit Sign Saturations by Business Type



Exterior Lighting

Exterior lighting has a much more diverse distribution of bulb types than interior lighting. As shown in Figure 26, metal halide, high-pressure sodium, and mercury vapor bulbs are much more common in exterior lighting (with combined numbers representing just over one-third) than in interior lighting; and linear fluorescents are much less common.

Figure 26. Distribution of Exterior Bulb Types



As exterior bulbs show a great diversity in type across the commercial sector, their relative distribution across business types also is quite diverse. As seen in Table 17, education and health facilities, which typically have larger outdoor areas, show high saturations of metal halide and high-pressure sodium bulbs. High incandescent saturations among lodging and office facilities also prove particularly striking.

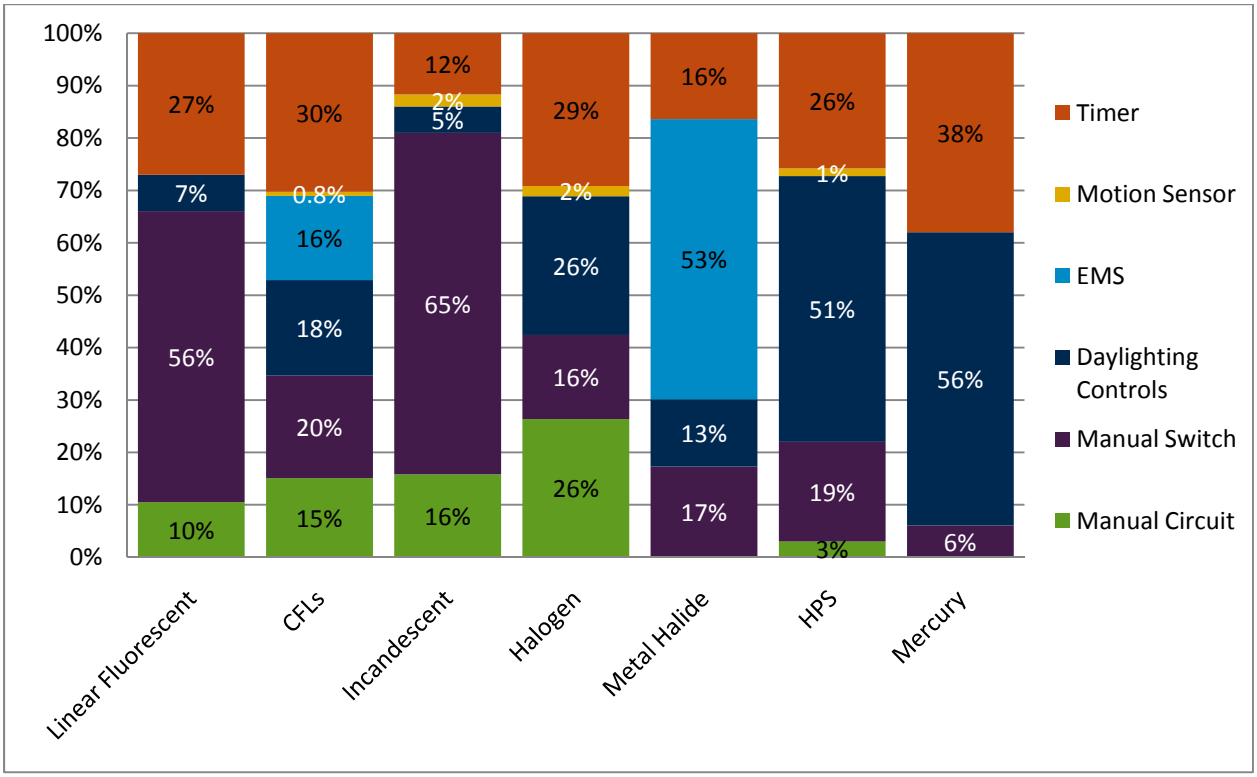
Table 17. Exterior Bulb Type Saturations by Business Type

Business Type	CFL	Incandescent	Halogen	Metal Halide	HPS	Mercury	T-12	Other
Education (n=16)	5%	14%	1%	64%	15%	2%	0%	0%
Grocery (n=14)	13%	28%	0%	20%	17%	2%	20%	3%
Health (n=18)	19%	13%	1%	54%	6%	3%	4%	0%
Lodging (n=32)	22%	67%	0%	0%	7%	2%	2%	0%
Office (n=76)	19%	42%	3%	10%	7%	1%	17%	0%
Restaurant (n=37)	6%	35%	3%	11%	8%	0%	36%	1%
Retail (n=73)	13%	24%	3%	4%	16%	5%	25%	10%
Warehouse (n=22)	3%	39%	2%	31%	13%	13%	0%	0%
Overall (n=288)	12%	26%	2%	18%	7%	2%	15%	1%

Exterior Lighting Controls

Exterior lighting controls also differ a great deal between bulb types. As shown in Figure 27, though the audits indicate EMS only controls high-pressure sodium and incandescent bulbs, the majority of exterior bulbs use some sort of automated control.

Figure 27. Exterior Control Type Saturations by Bulb Type



HVAC

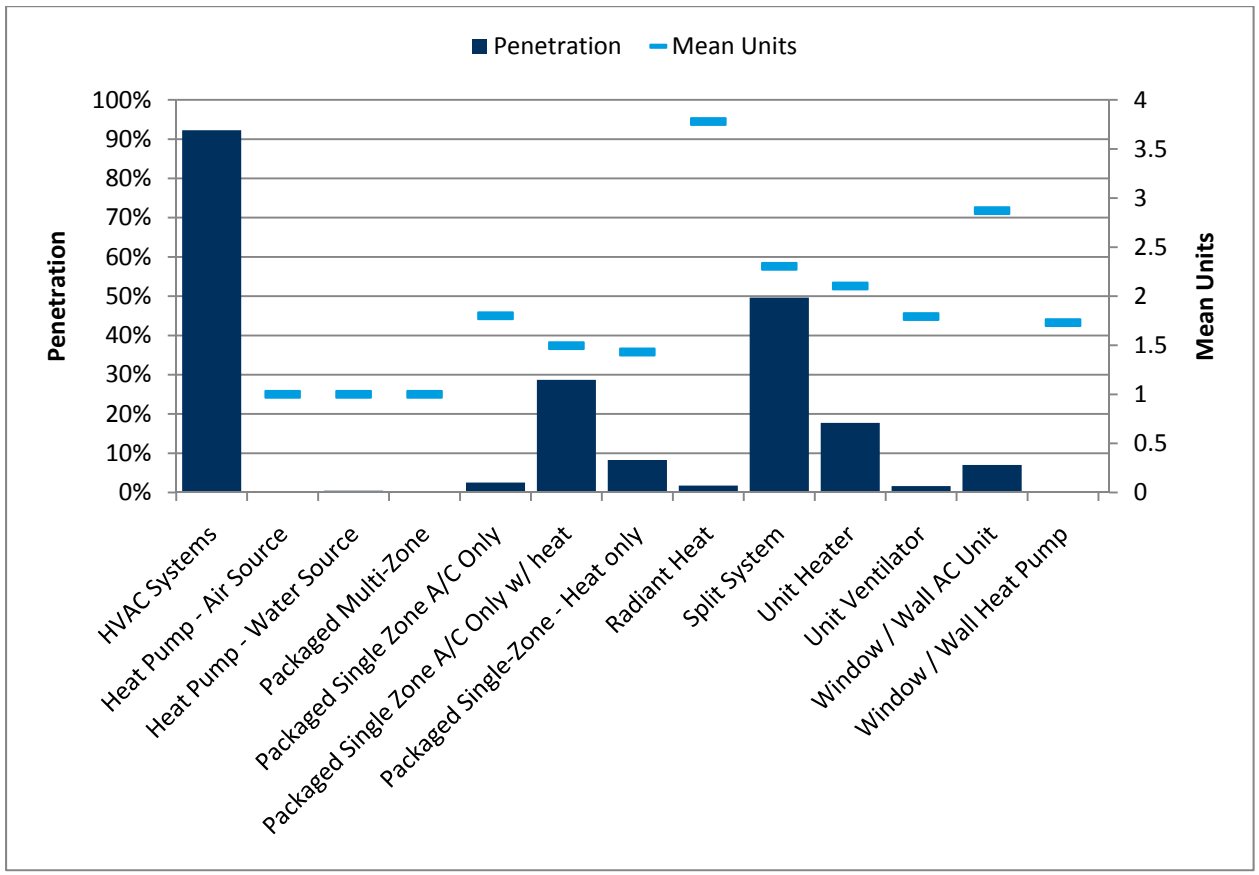
HVAC can play a large role in overall building energy consumption, particular in terms of natural gas. Overall, unitary HVAC systems[4] compose the majority of systems, with 92 percent of all sites having at least one unit. Roughly, 13 percent of all commercial facilities have boilers, and only 2 percent have chillers.

Unitary HVAC Systems

As shown in Figure 28, split systems make up the dominant unitary HVAC type, used by half of all commercial facilities. Most facilities without split or packaged units have multiple radiant heaters and/or window ACs. Heating fuel types split evenly between electric and natural gas, with 46 and 42 percent of units, respectively, using each.

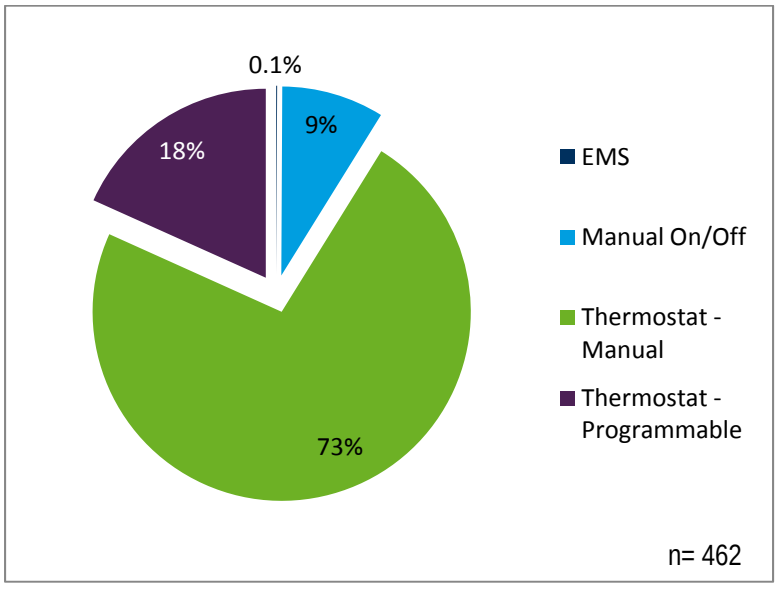
[4] The term "unitary HVAC" refers to packaged units (such as rooftop units), split systems, and other autonomous units, such as window air conditioners or space heaters.

Figure 28. Unitary HVAC System Penetrations and Mean Units



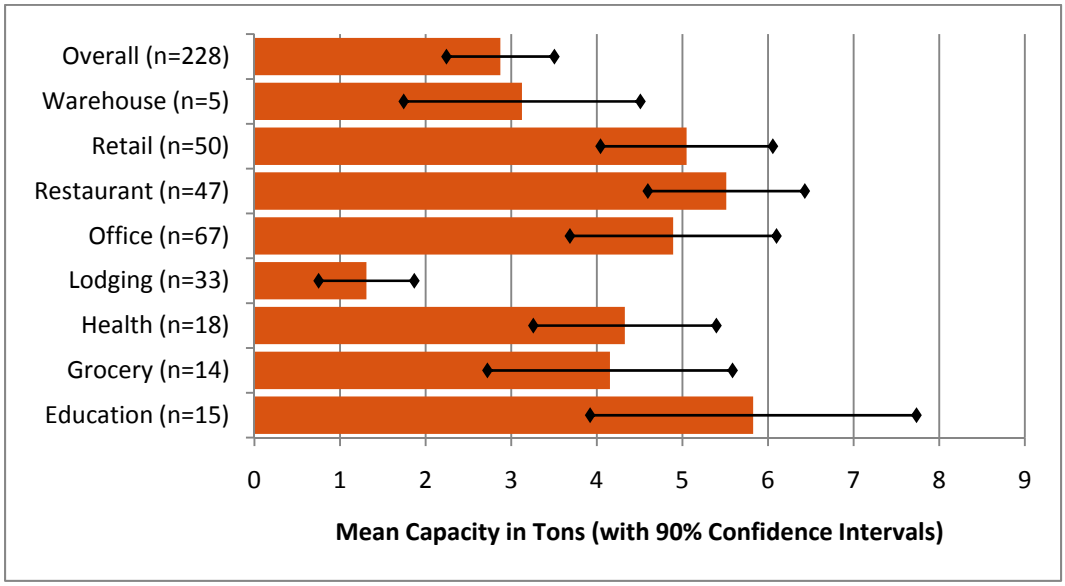
Very few unitary systems are automatically controlled. As shown in Figure 29, only 18 percent of unitary HVAC systems have some sort of automated controls.

Figure 29. Unitary HVAC Temperature Controls



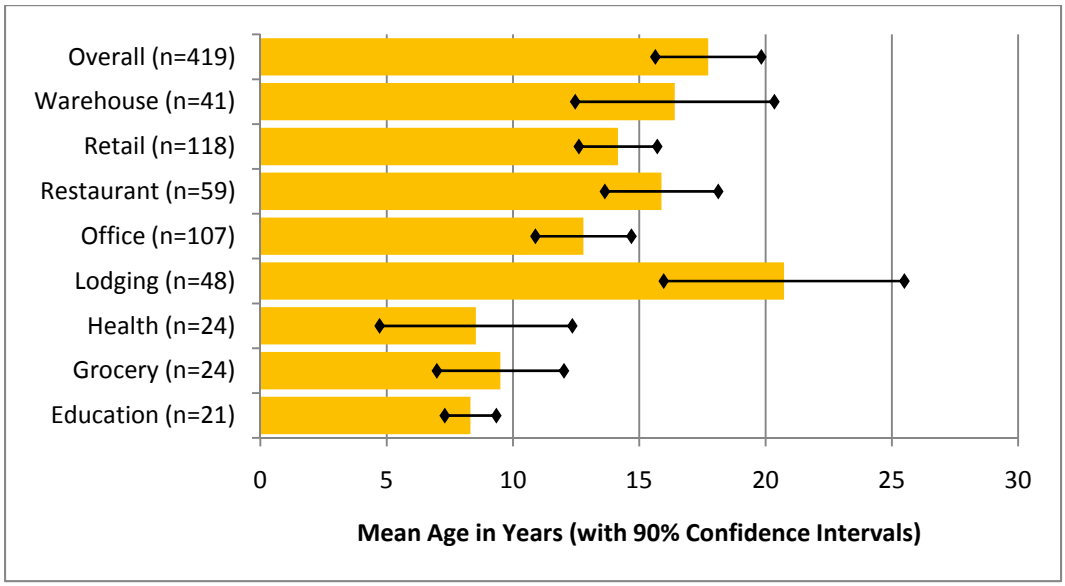
As shown in Figure 30, HVAC system sizes vary considerably. Unsurprisingly, given their relative size, education facilities have the largest cooling systems, averaging 5.8 tons. Of note, however, cooling systems in the restaurant segment average nearly 5.5 tons, even though restaurant sites average smaller sizes than other business types (as shown in Table 8).

Figure 30. Unitary HVAC Cooling Capacity by Business Type



As shown in Figure 31, most unitary systems are less than 20 years old, with the overall mean age at 17.7 years old. Lodging facilities are the only business types with mean ages above 20 years (at 20.7 years old).

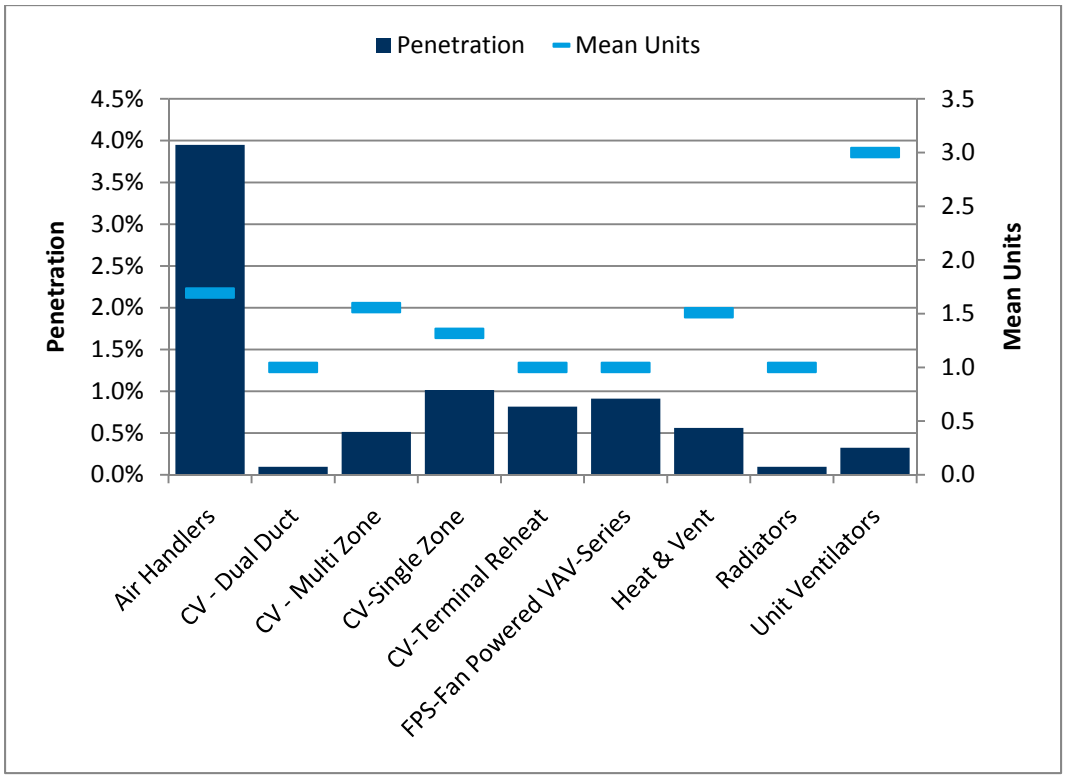
Figure 31. Unitary HVAC Unit Age by Business Type



Air Handlers

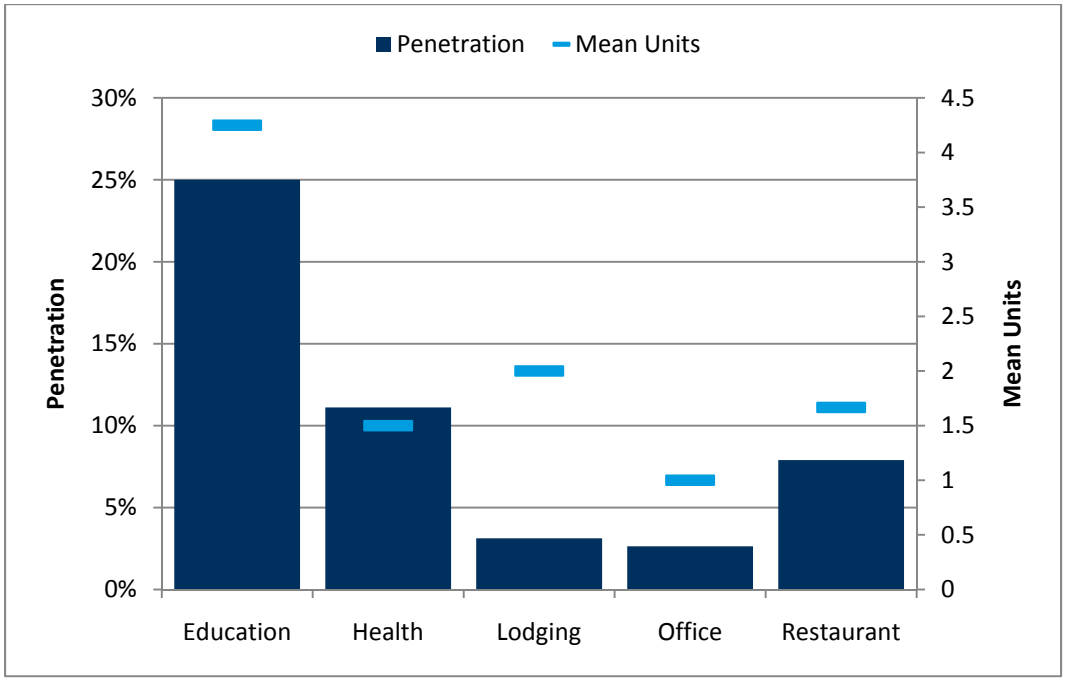
As shown in Figure 32, 4 percent of commercial buildings use air handlers. Most of these are constant volume (CV) units, with less than 1 percent of all sites with variable air volume (VAV) units.

Figure 32. Air Handler Penetrations and Mean Units



As shown in Figure 33, only five business types have air handlers of any sort, with education facilities most commonly using at least one air handler (one in four).

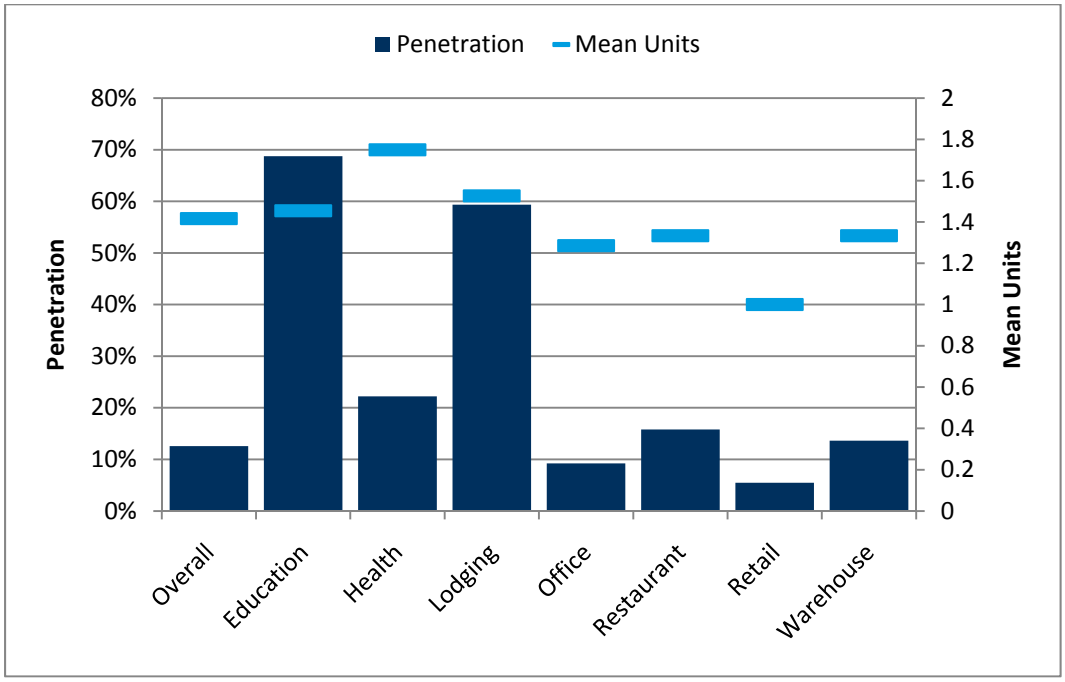
Figure 33. Air Handler Penetrations and Mean Units by Business Type



Boilers

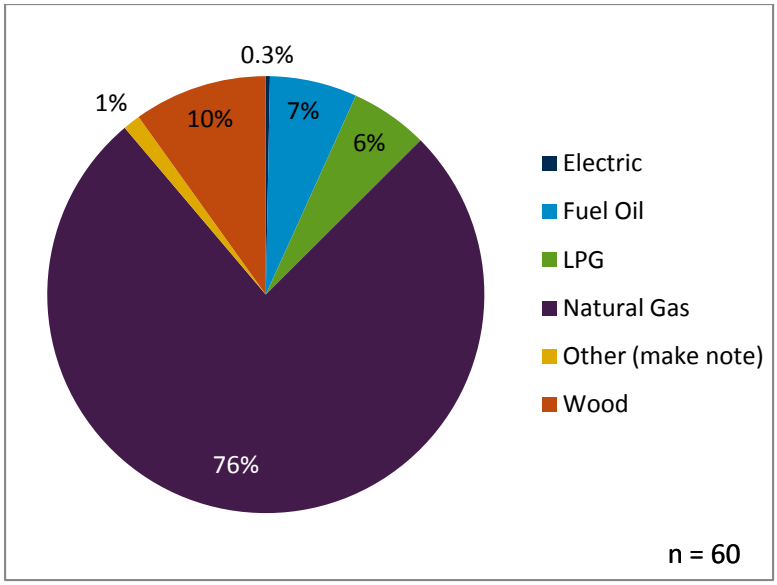
As shown in Figure 34, boilers are most frequently present in education facilities, with nearly 70 percent of buildings having at least one boiler. The majority of businesses with boilers only have a single unit, with the mean number of units ranging between 1 and 1.5.

Figure 34. Boiler Penetration and Mean Units by Business Type



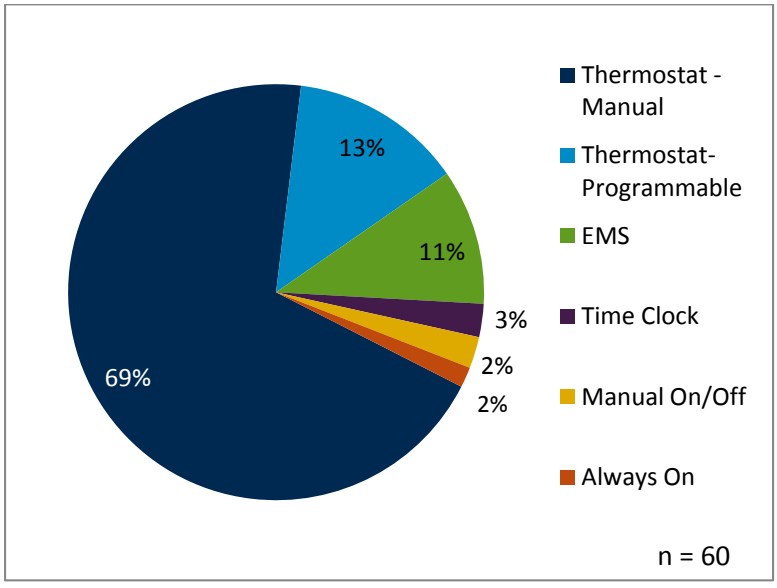
As shown in Figure 35, boilers predominantly use natural gas. Wood is the second most frequently used source, accounting for one in 10 commercial segment boilers. All sites with non-gas fuelled boilers are in the Northern portion of the state.

Figure 35. Boiler Fuel Type Distribution



As shown in Figure 36, thermostats control the majority of boilers in Michigan. EMS controls the majority of those not using thermostats. All boilers that were found to be always on were in lodging facilities.

Figure 36. Boiler Temperature Control Type

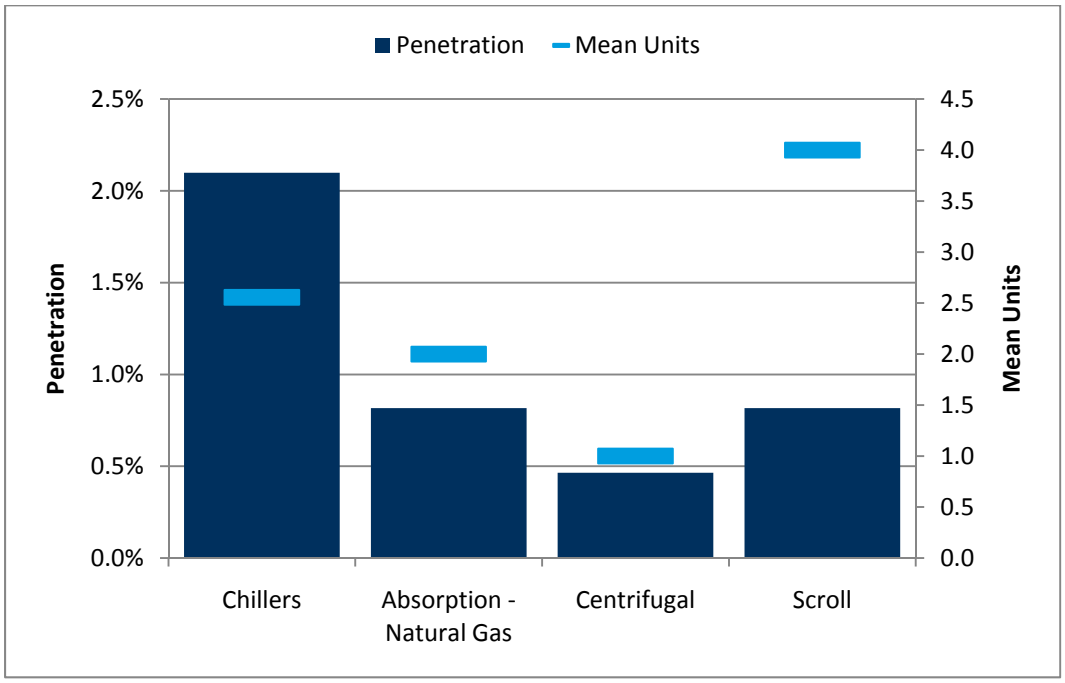


Though some vary considerably, boilers average less than 20 years old, with a mean boiler age of 17 years and a standard deviation of around 12 years. Site visits found, on average, health facilities have the oldest boilers, ranging from 22 to 32 years old. The oldest operating unit identified at any site was 50 years old.

Chillers

As shown in Figure 37, less than 3 percent of commercial sites have at least one chiller (found only in large offices and health facilities). Sites with chillers divide somewhat evenly between absorption, centrifugal, and scroll chillers.

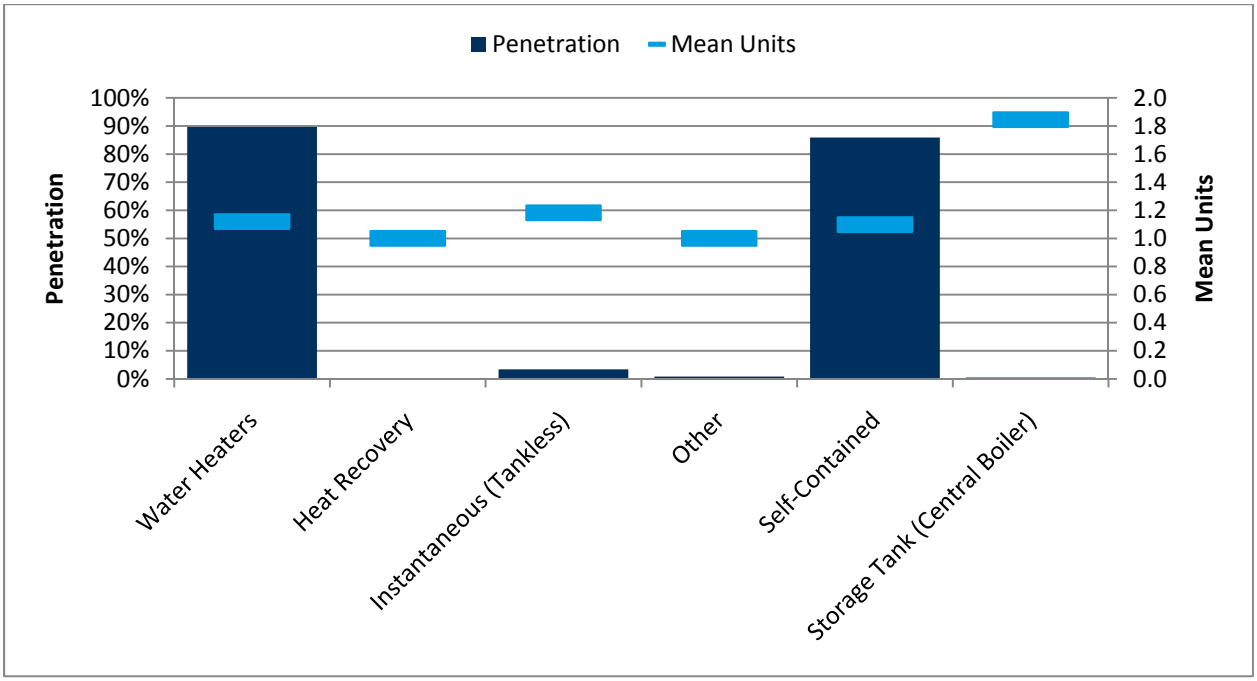
Figure 37. Chiller Penetrations and Mean Units



Water Heating

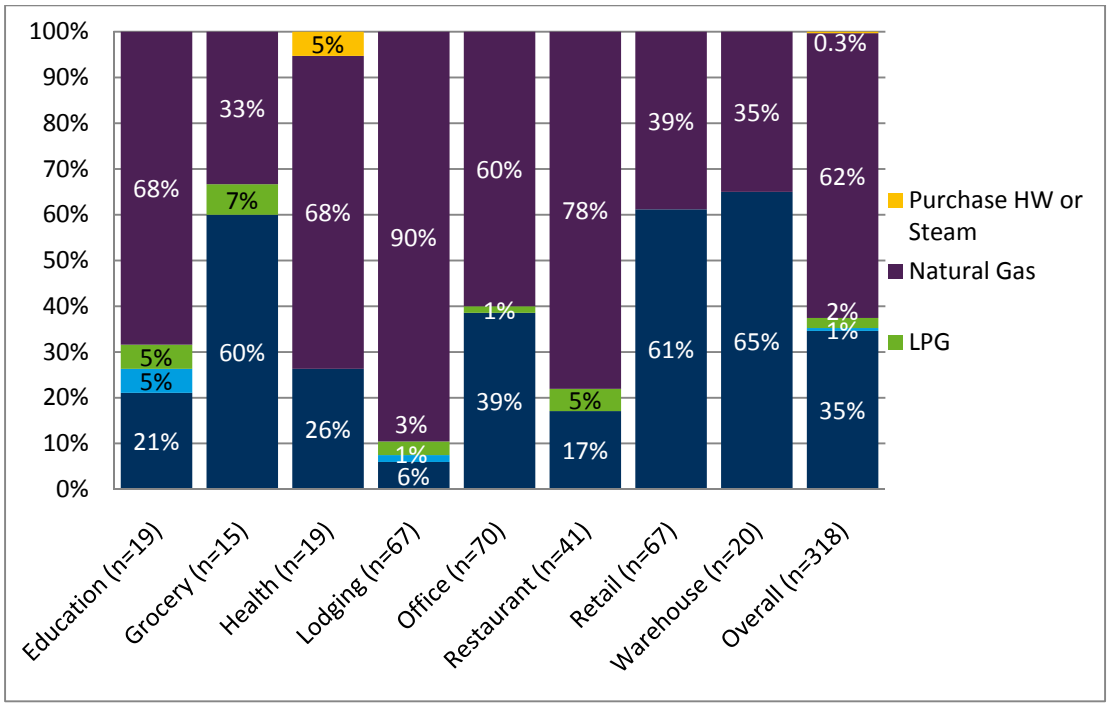
Nine in 10 commercial sites use some sort of water heating. Figure 38 presents penetrations and mean units of different water heating types observed. Virtually all the commercial segment uses self-contained tanked water heaters.

Figure 38. Water Heating Penetrations and Mean Units



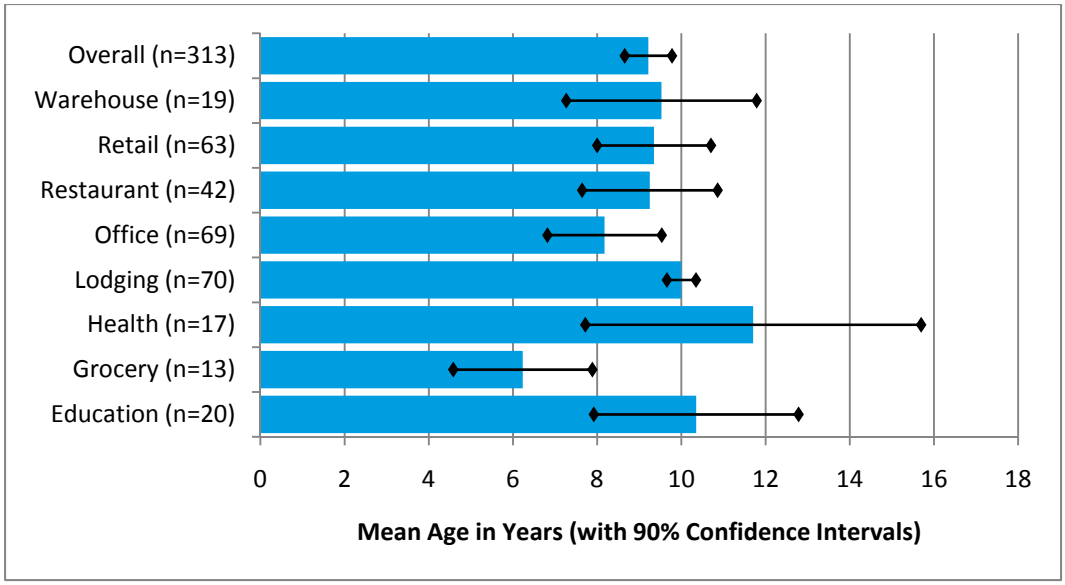
As shown in Figure 39, the majority of commercial water heaters use natural gas, with only a small portion (less than 5 percent) using a fuel other than gas or electricity. Retail, grocery, and warehouse facilities are most likely to have electric water heat; site visits found purchased steam only in the health segment. Liquid propane gas (LPG) water heating is relatively uncommon.

Figure 39. Water Heating Fuel Type Distributions by Business Type



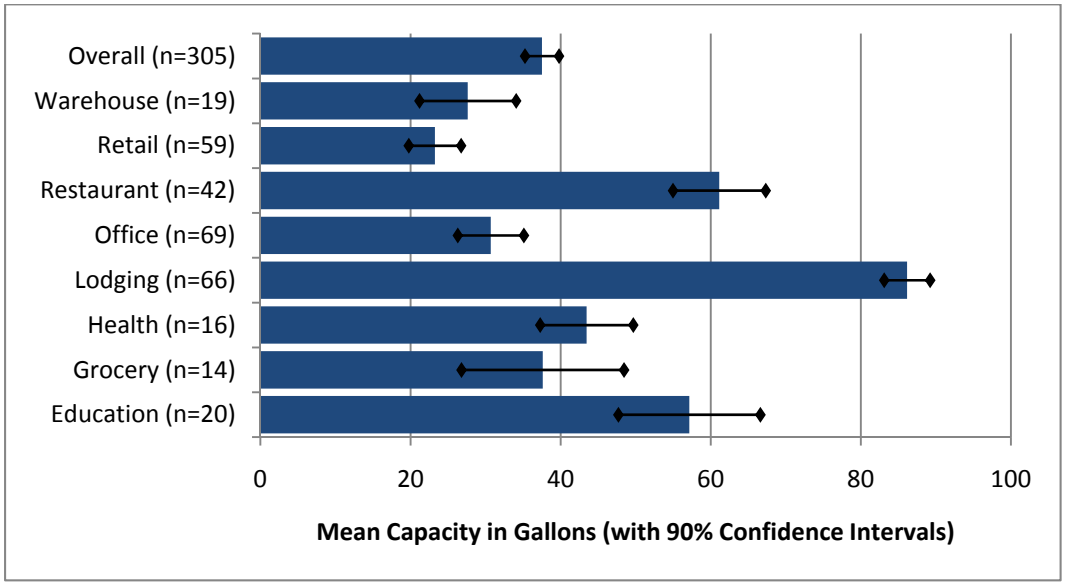
As shown in Figure 40, most business types use water heaters averaging less than 10 years old. Health facilities have the oldest units on average, whereas education facilities show the greatest range. In site visits to education facilities, units ranged from one to 60 years old.

Figure 40. Water Heater Age by Business Type



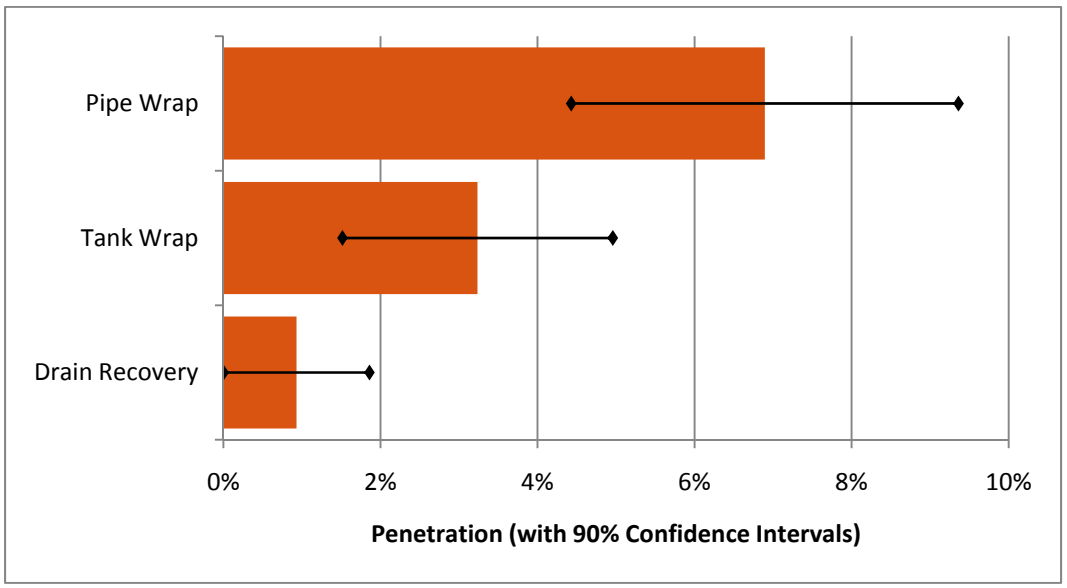
Lodging facilities use the largest water heaters, with a mean size of approximately 86 gallons, largely because one in eight has a storage tank(s) attached to a central boiler(s). As seen in Figure 41, most water heaters have a tank capacity between 30 and 40 gallons.

Figure 41. Water Heater Tank Capacity by Business Type



Few water heaters are equipped with energy-efficiency measures. As shown in Figure 42, fewer than 7 percent of commercial sites have pipe wrap, and less than 1 percent have drain heat recovery.

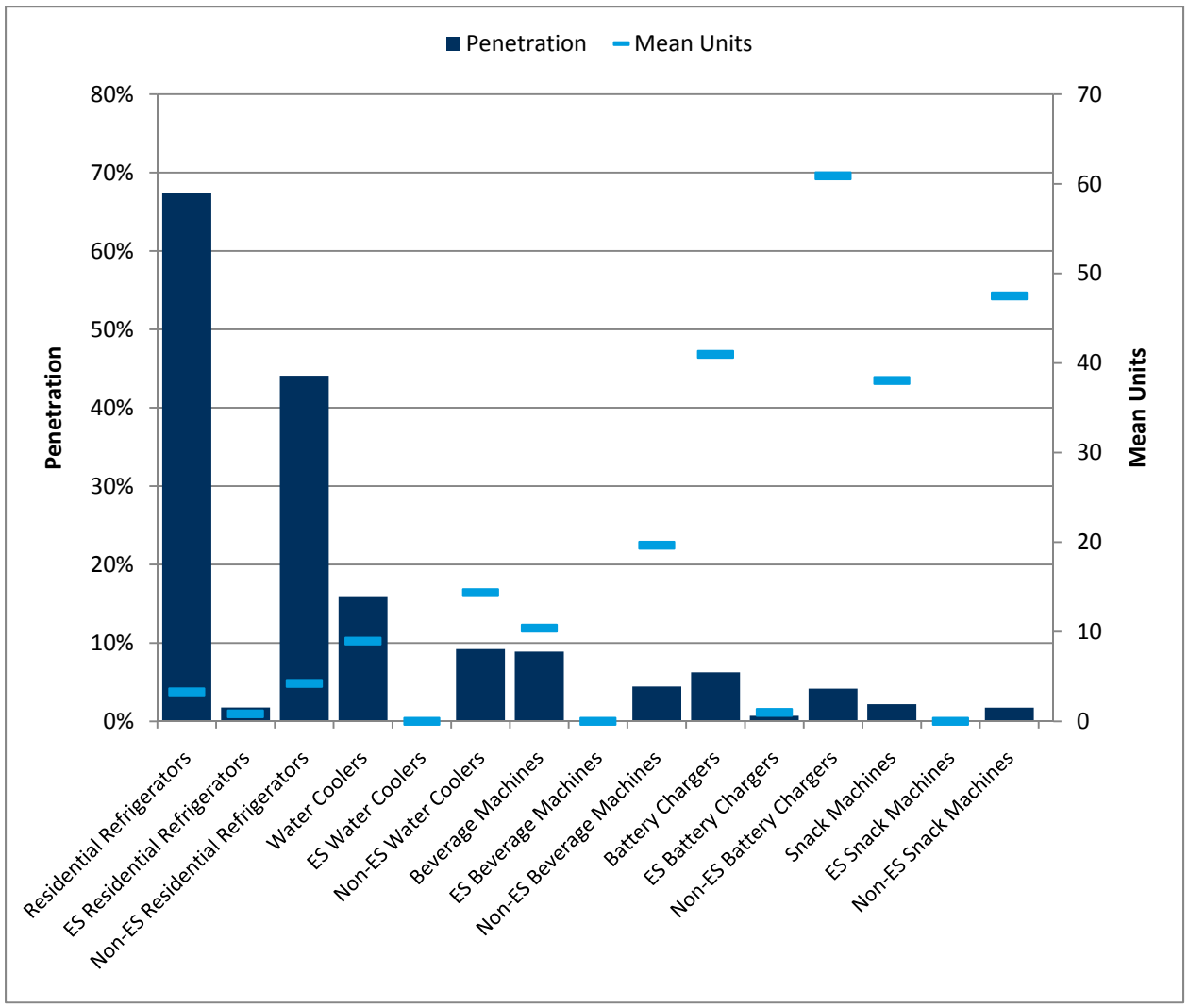
Figure 42. Water Heating Energy-Efficiency Measure Penetrations



Appliances

Most commercial sites (73 percent) use appliances, the most common of which are residential-style refrigerators (present in roughly two-thirds of commercial buildings). Other appliances, such as snack and beverage machines, have low penetrations. Where present, however, they can be significant, particularly in larger buildings such as health and offices facilities. In addition to standard appliances, Figure 43 compares penetrations and mean units between appliances with and without ENERGY STAR® ratings.

Figure 43. Appliance Penetrations and Mean Units*

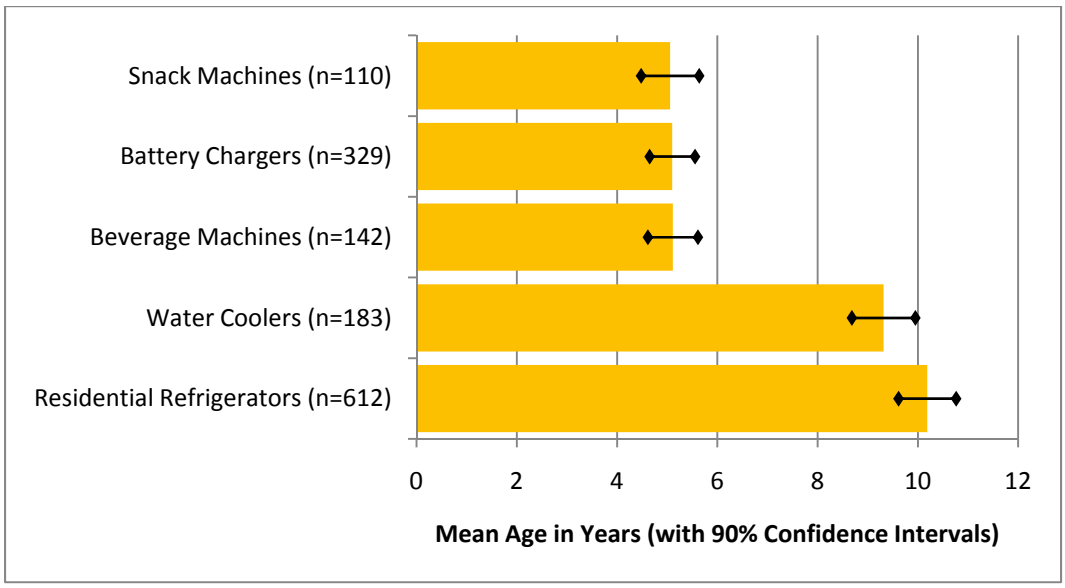


* "ES" and "Non-ES" in figures indicate ENERGY STAR rating of equipment.

In the commercial segment, ENERGY STAR appliances are rare. Some of this may be due to age, though, as shown in Figure 44, residential refrigerators average 10.2 years old, meaning most commercial sector refrigerators have been manufactured on or around the most recent NAECA[5] amendments, which took place in 2001.

[5] The National Appliance Energy Conservation Act of 1987. The most recent round of revisions reduced maximum refrigerator consumption by roughly 30 percent.

Figure 44. Appliance Age

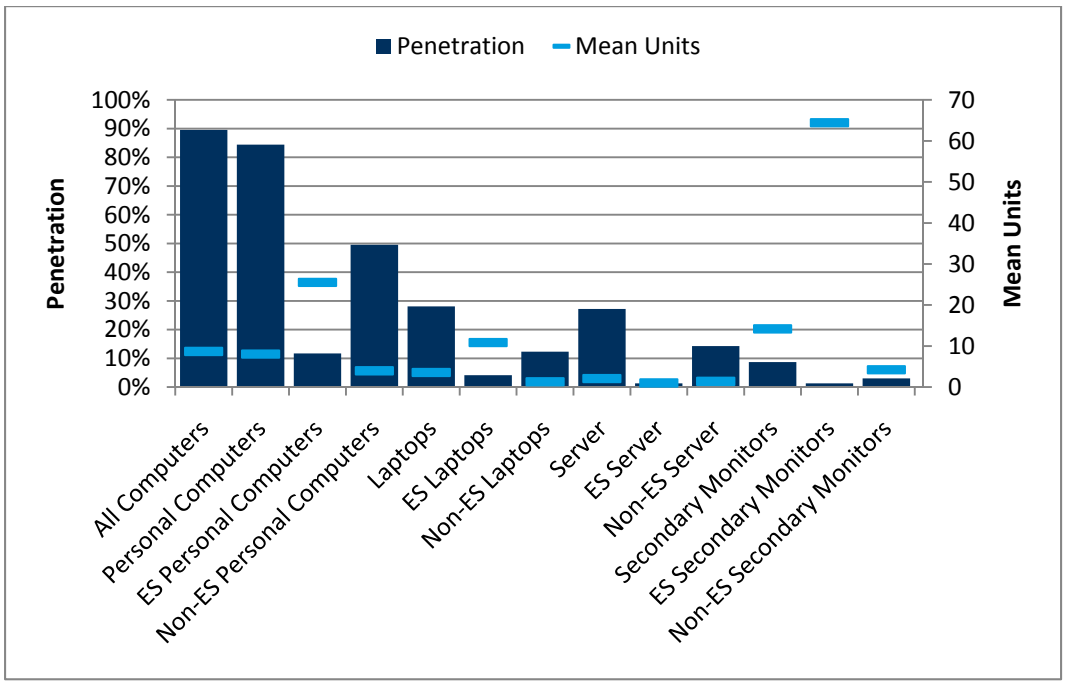


Office Equipment

Computers

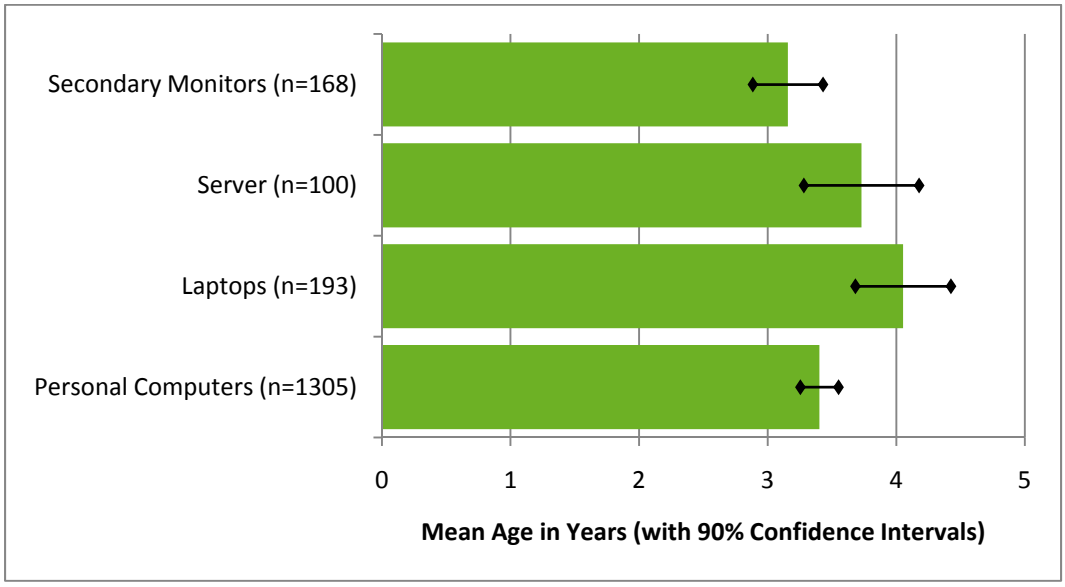
Nine in 10 commercial sites have at least one computer. The majority of these are desktops, present in 83 percent of commercial buildings. Though the minority of sites have ENERGY STAR computers or monitors, these penetrations are higher than those for appliances (with 11.7 percent of commercial sites having an ENERGY STAR desktop computer and 4.2 percent having an ENERGY STAR laptop). Figure 45 provides penetrations and mean units of computers and computing accessories for standard and ENERGY STAR units.

Figure 45. Computer Penetrations and Mean Units



As shown in Figure 46, computers and accessory components tend to be younger than other plug loads, with computing equipment typically less than five years old. [6]

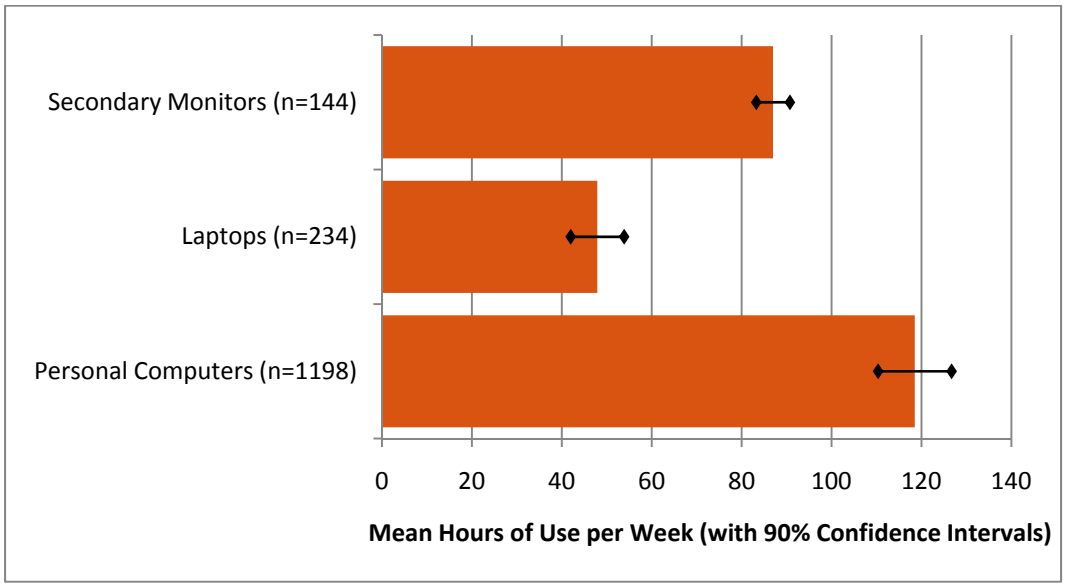
Figure 46. Computer Age



[6] Equipment age and hour-of-use estimate findings should be viewed as qualitative information only. Auditors asked the building owner/manager what they understood to be the average hours per week equipment was running and the approximate age.

Computer efficiency plays a particularly important role in energy savings, given their frequent use. Though laptops may not be used as extensively, desktops remain in use nearly 24 hours a day in businesses such as hospitals or hotels. Figure 47 provides overall average hours of weekly use for computing equipment.

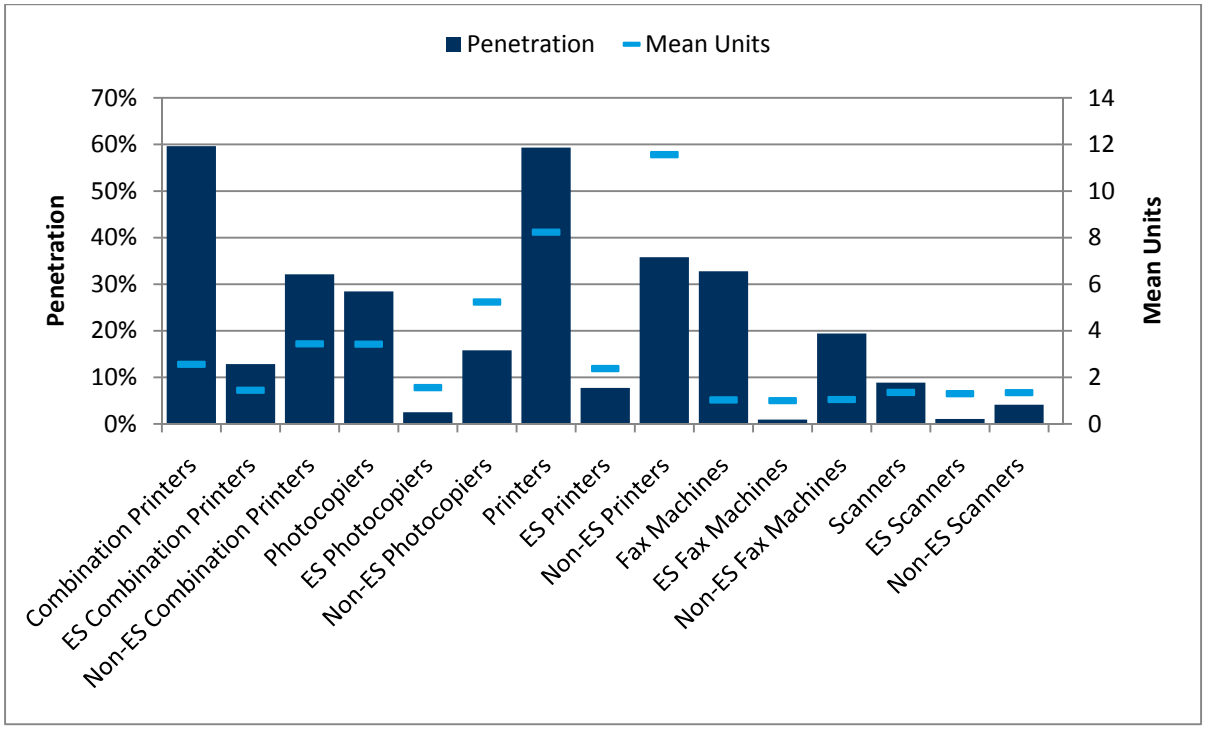
Figure 47. Computer Hours of Use per Week



Printers, Scanners, and Fax Machines

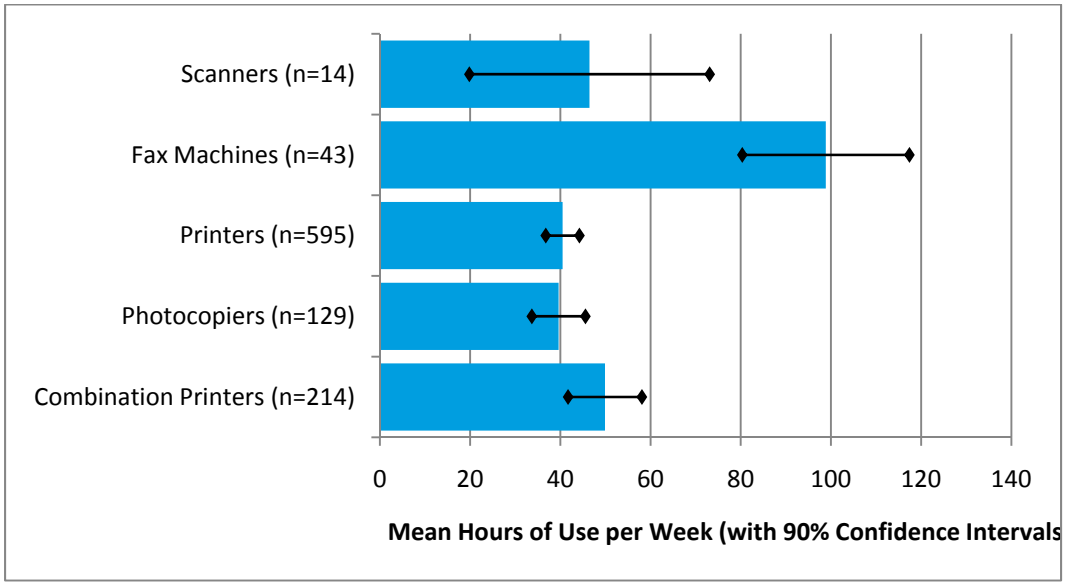
Distributions of other office equipment largely mirror that of computers: printers and combination units are present in most commercial buildings. ENERGY STAR units are uncommon, particular in sites with many units (note the difference Figure 48 shows in mean units between ENERGY STAR and non-ENERGY STAR printers).

Figure 48. Miscellaneous Office Equipment Penetrations and Mean Units



As shown in Figure 49, office equipment is used less steadily than computers, excepting fax machines, which operate nearly 100 hours a week, on average. This most likely results from their use in lodging and health facilities.

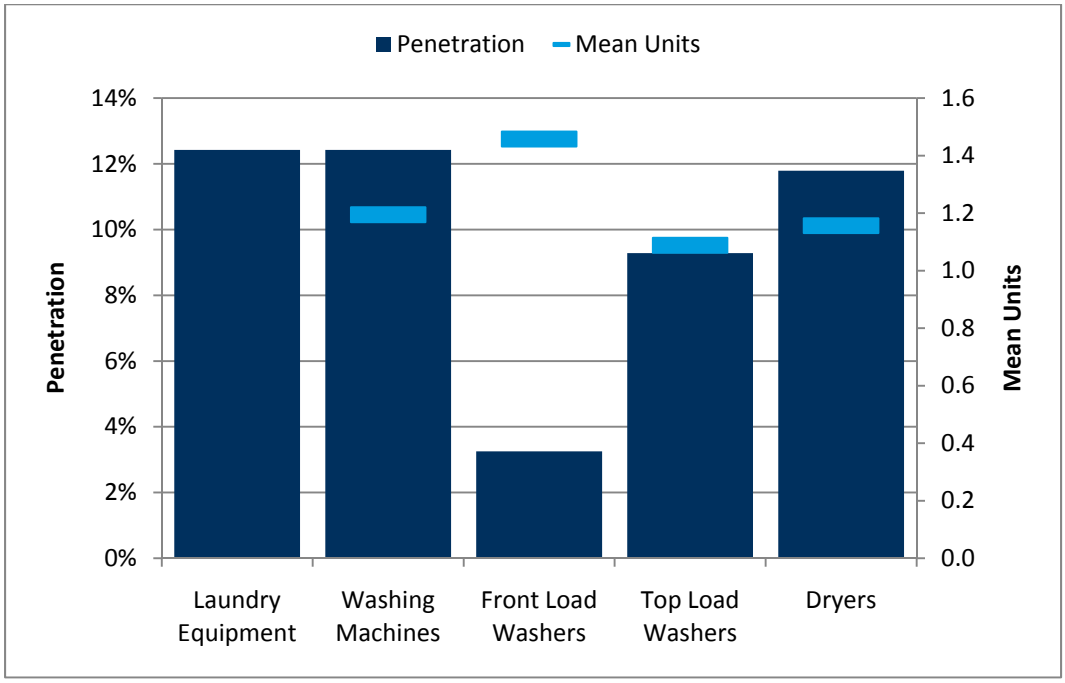
Figure 49. Miscellaneous Office Equipment Hours of Use per Week



Laundry

As shown in Figure 50, less than 15 percent of commercial buildings have laundry equipment, with most units confined to the lodging and health segments (78 percent and 50 percent penetrations, respectively). Top-load washers are the dominant configuration.

Figure 50. Laundry Penetrations and Mean Units*



* The category "laundry equipment" refers to any kind of laundry equipment, whether a washer or dryer.

Twelve percent of top-load washers are ENERGY STAR-rated, while 25.7 percent of front-load units are. Thirteen percent of front-load washers have ozonating cycles,[7] and approximately 63.1 percent of dryers use natural gas, with the remainder using electricity.

Cooking Equipment

Fifteen percent of commercial sites use some type of commercial cooking equipment, with restaurants accounting for the largest share. Table 18 provides penetrations of cooking equipment across commercial business types.

[7] Ozonating cycles use ozone in cooled water to clean, therefore requiring less hot water.

Table 18. Commercial Cooking Equipment Penetrations by Business Type

Business Type	All Commercial Cooking Equipment	Standard Ovens	Griddles	Ranges	Steam Cookers	Fryers	Hot Food Holding Cabinets	Convection Ovens	Conveyor Ovens
Education	50%	31%	19%	38%	0%	0%	13%	19%	0%
Grocery	31%	21%	0%	14%	7%	7%	0%	14%	7%
Health	6%	6%	6%	0%	6%	0%	6%	0%	0%
Lodging	3%	3%	0%	0%	0%	0%	0%	0%	0%
Office	3%	1%	1%	1%	0%	0%	0%	1%	0%
Restaurant	89%	55%	63%	61%	21%	66%	34%	37%	24%
Retail	3%	0%	1%	0%	0%	3%	1%	0%	1%

As shown in Figure 51, the most common types of cooking equipment are griddles, with 9.6 percent of commercial buildings having at least one unit. Fryers, standard ovens, and ranges, however, are also relatively common, with about one in 11 sites having one or more units.

Figure 51. Cooking Equipment Penetrations and Mean Units

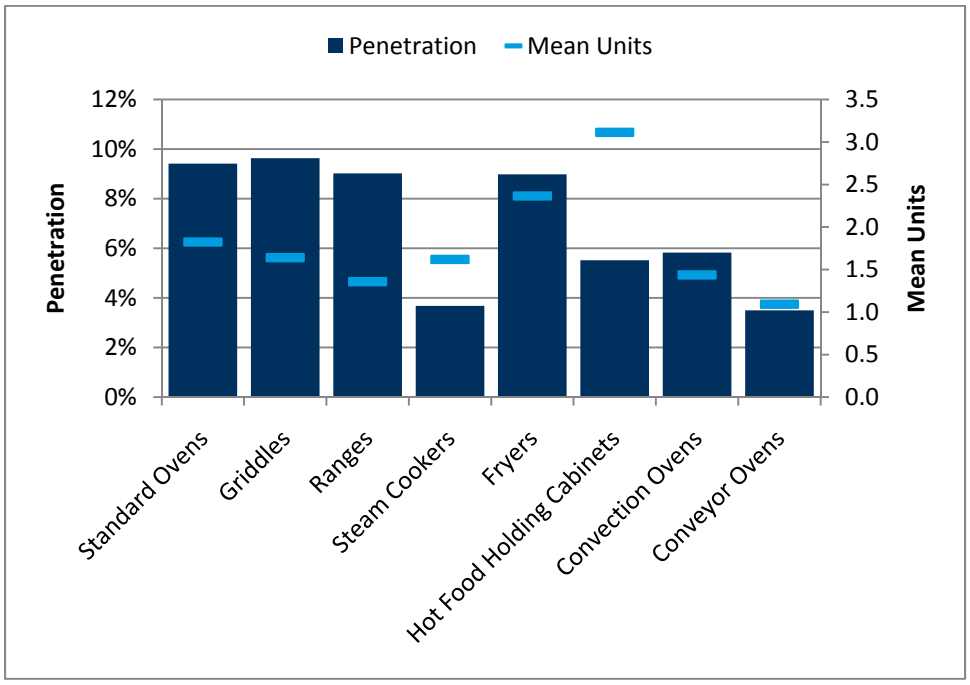
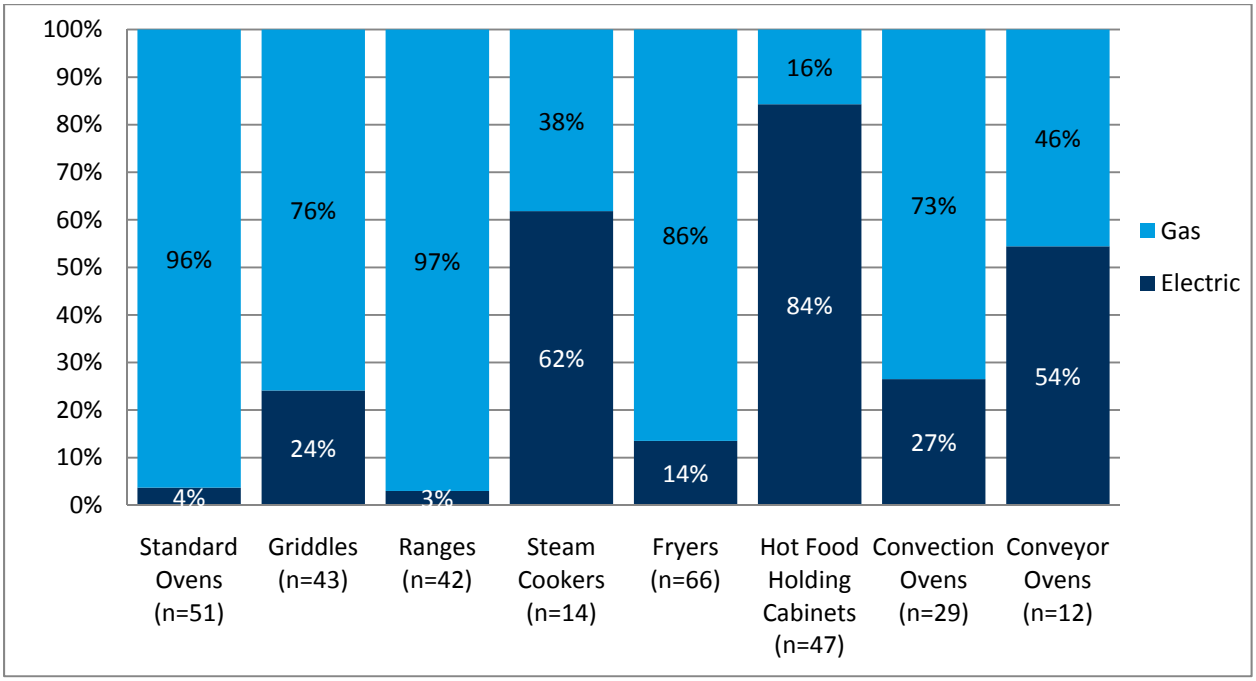


Figure 52 shows most commercial cooking equipment is gas-fired, particularly for standard ovens, where 96 percent of units use gas. Neither wood nor propane-fired equipment were observed during our site visits.

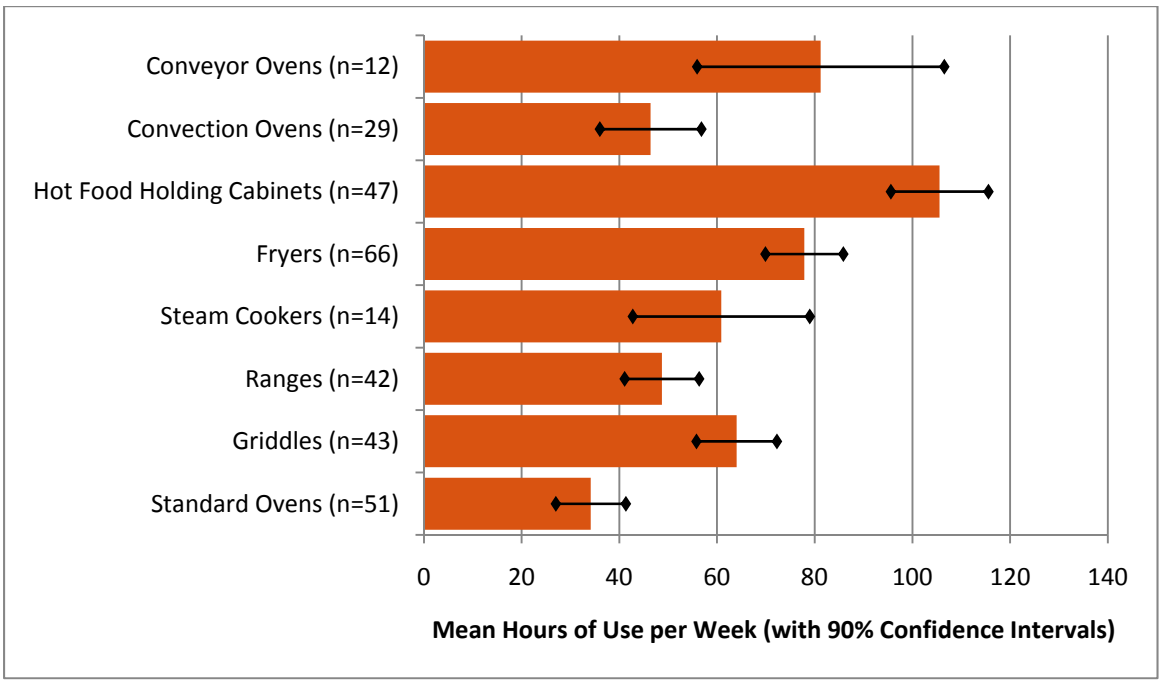
Figure 52. Fuel Share for Cooking Equipment



On average, hot food holding cabinets operate the greatest portion of the week (105 hours per week). As shown in Figure 53, ovens, ranges, and griddles typically average 35 to 65 hours usage per week.[8]

[8] Hour-of-use estimate findings should be viewed as qualitative information only. Auditors asked the building owner/manager what they understood to be the average hours per week equipment was operated.

Figure 53. Cooking Equipment Hours of Use



Refrigeration

Approximately 31 percent of buildings use commercial refrigeration equipment. As shown in Table 19, grocery and restaurant experience the highest penetrations.

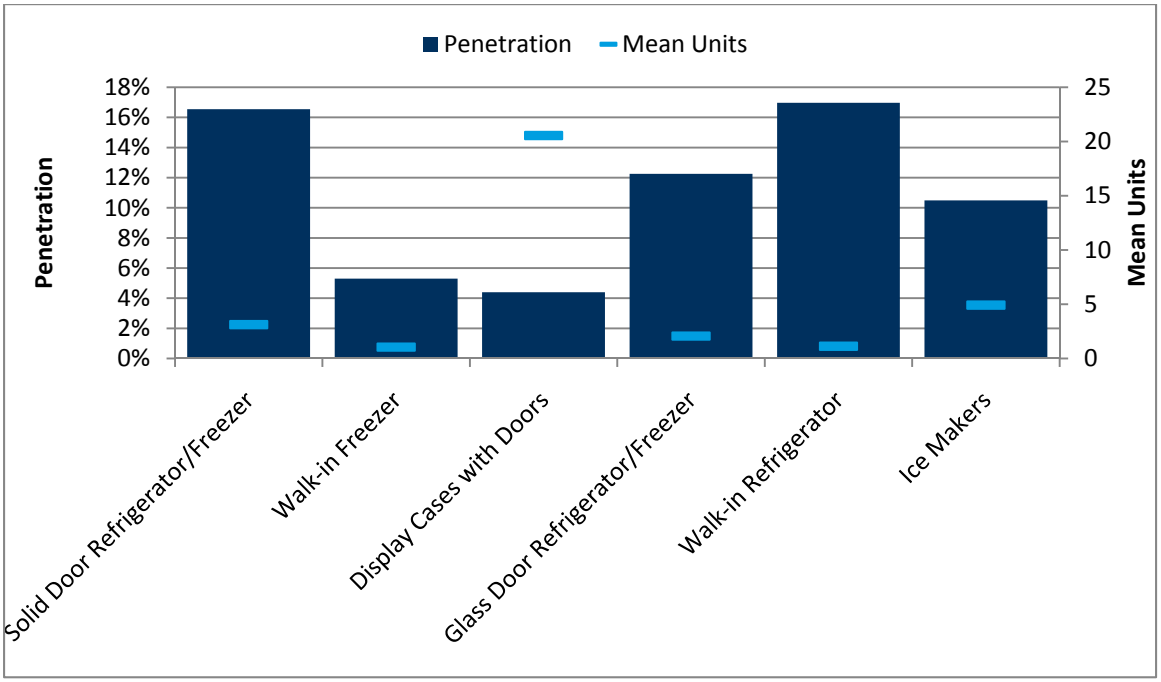
Table 19. Commercial Refrigeration Penetrations by Business Type

Business Type	Penetration
Education	50%
Grocery	100%
Health	12%
Lodging	6%
Office	1%
Restaurant*	97%
Retail	20%
Warehouse	0%
Overall	31%

* Those restaurants without commercial refrigeration equipment still had at least one residential refrigerator on site.

As shown in Figure 54, solid refrigerators and/or freezers and walk-in refrigerators are the most common equipment types, with both present in over 16 percent of buildings.

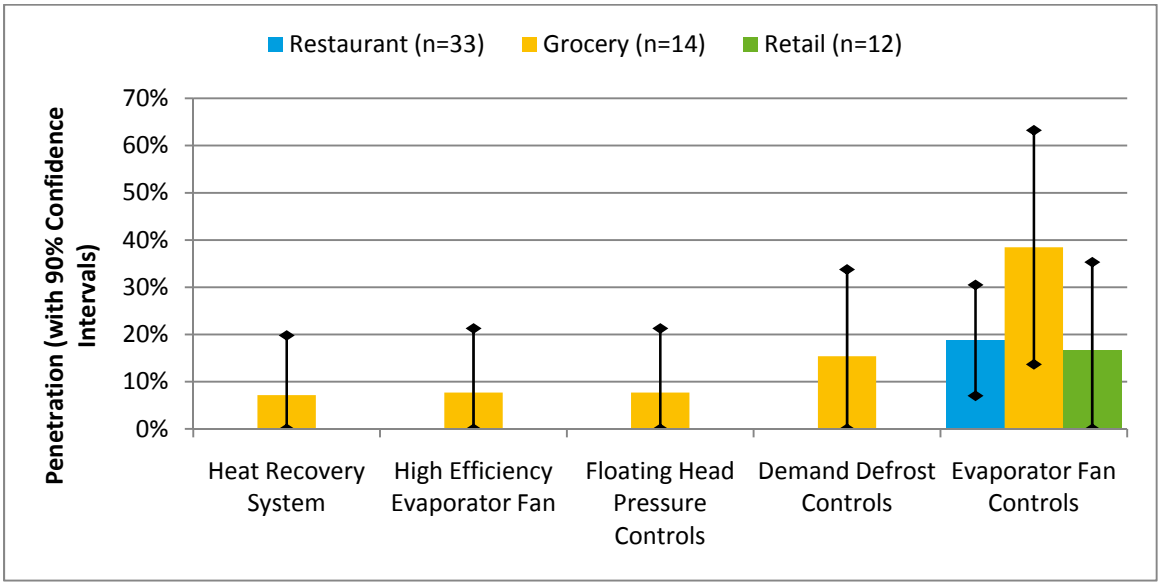
Figure 54. Commercial Refrigeration Equipment Penetrations and Mean Units*



* Display case quantities are expressed in terms of the number of doors. Where only linear feet were collected, we used an assumption of one door per 2.5 linear feet.

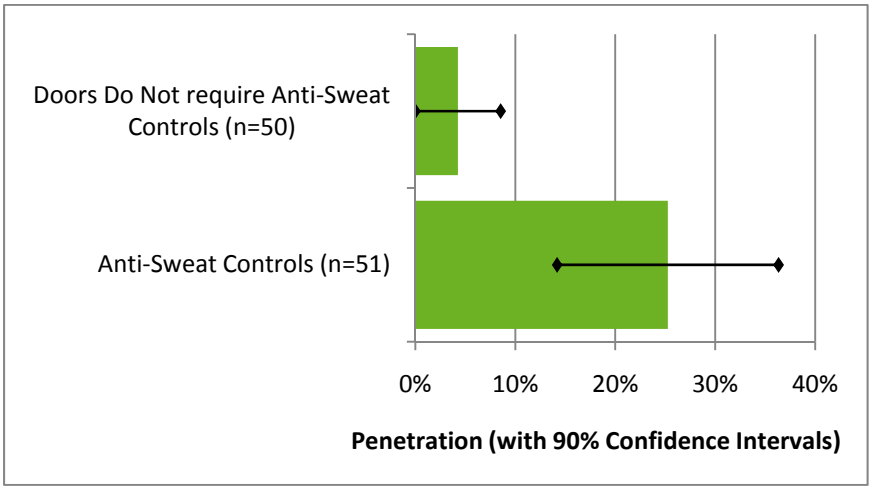
One in five sites with display cases use evaporator fan controls. As shown in Figure 55, this was the most common energy-efficient feature found on commercial refrigeration equipment. Other features, such as heat recovery systems, are found in less than 5 percent of sites with commercial refrigeration equipment.

Figure 55. Penetrations of Refrigeration Features by Business Type



Anti-sweat heater controls or special doors not requiring anti-sweat controls can significantly reduce refrigeration loads for display cases. As shown in Figure 56, with approximately 25 percent sites with display cases having controls and 5 percent having special doors.

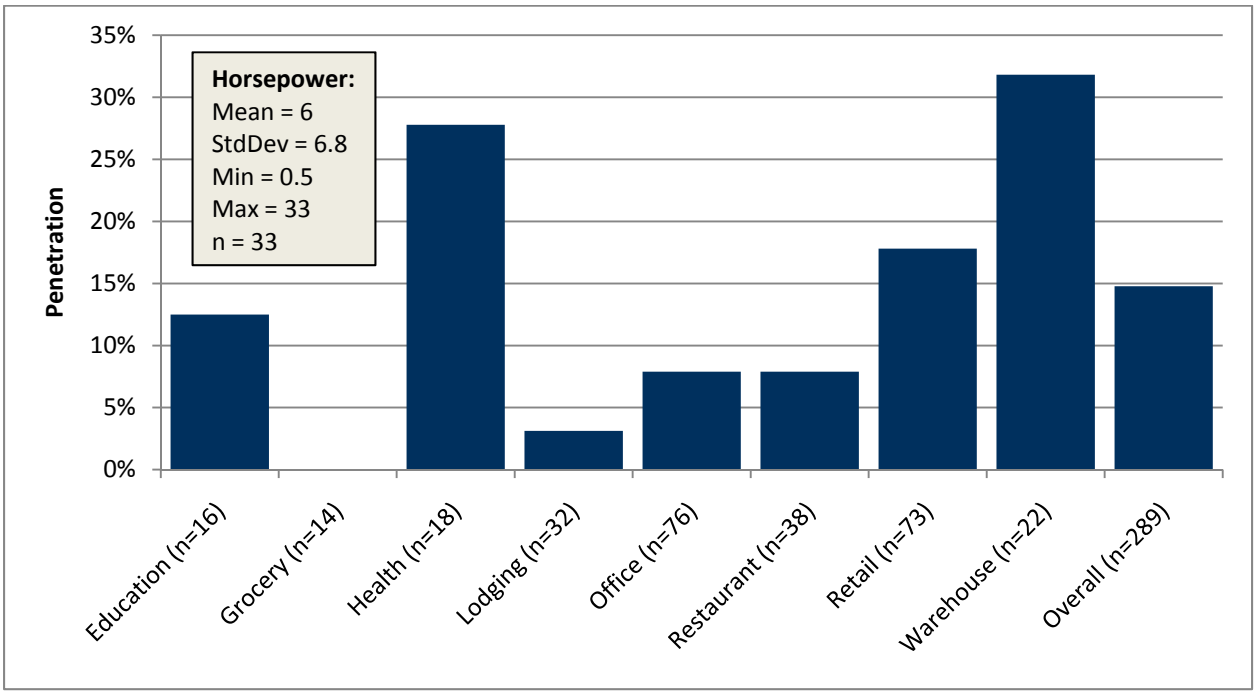
Figure 56. Penetration of Anti-Sweat Measures



Compressed Air Systems

As shown in Figure 57, 15 percent of commercial sites have compressed air systems. Site visits found these systems in all business types, except grocery facilities. These systems spanned a wide range of sizes, with a 6 horsepower mean.

Figure 57. Compressed Air Penetration by Business Type and Horsepower



Telephone Survey

Sector-Wide Analysis

This section examines the ways Michigan commercial customers think about energy usage and energy efficiency. The section provides a baseline assessment of respondents' energy-related attitudes, perceptions, and behaviors across Michigan's commercial sector. Key topics include:

- Energy-efficiency knowledge;
- Energy efficiency's importance;
- Recent energy-efficient installations (and installation barriers);
- Plans for future energy-efficient equipment installations; and
- Barriers to becoming more energy efficient.

Commercial Decision Making

Profile of Survey Respondents

The telephone survey targeted individuals with the most knowledge about their facilities' energy use, equipment-selection processes, and maintenance decision processes. Table 20 provides a breakdown of respondents' job titles per segment.

Table 20. Respondent Titles

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
President/Owner	52%	26%	68%	28%	61%	50%	49%	66%	69%	43%
Property Manager	12%	7%	9%	13%	13%	18%	6%	15%	10%	17%
Facility Engineer/Manager	13%	19%	6%	22%	9%	23%	11%	3%	5%	10%
Other Senior Executive	8%	14%	4%	10%	4%	2%	11%	5%	8%	12%

Most often, we spoke with business presidents or owners, especially for the following segments: retail (69 percent); grocery (68 percent); restaurants (66 percent), and lodging (61 percent). Facility managers played an important role in following segments: miscellaneous (23 percent); health care (22 percent); and education (19 percent). We also spoke with many property managers in the following segments: miscellaneous (18 percent) and warehouse (17 percent).

During discussions, we asked for the positions of other individuals involved in making decisions regarding equipment additions and replacements. Table 21 provides percentages of individuals in each of the three positions most often cited.

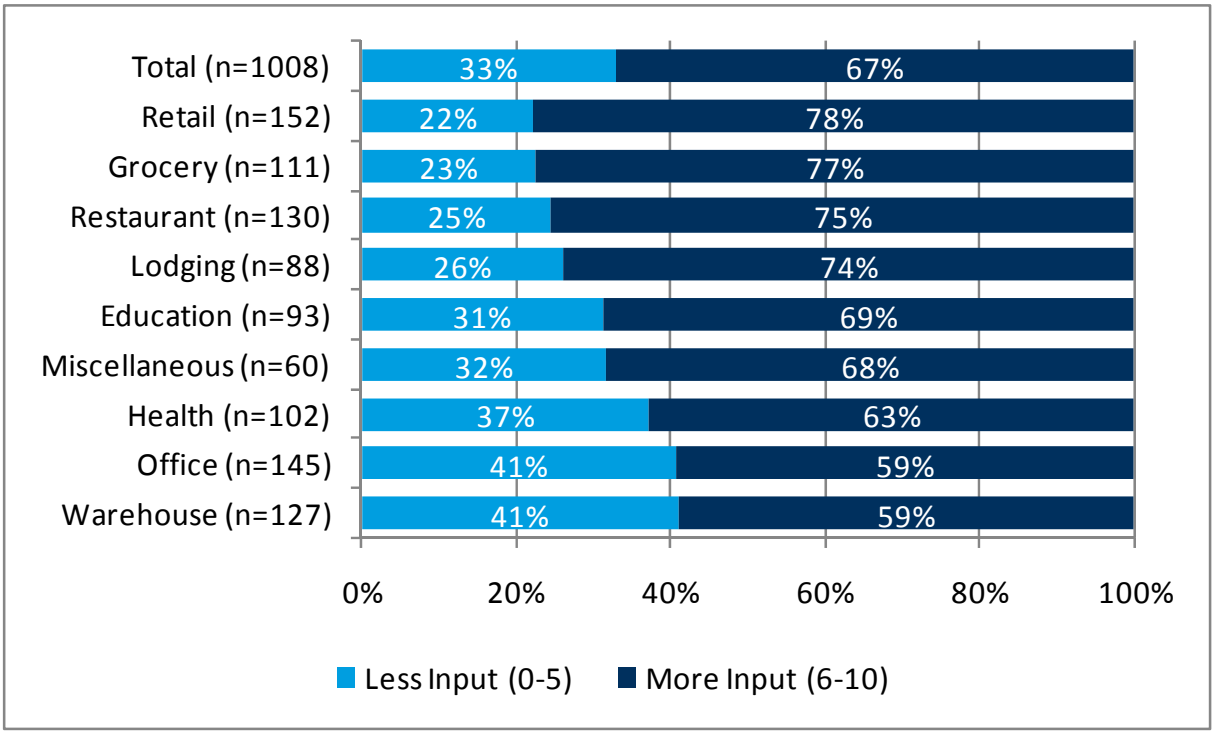
Table 21. Titles of Others Involved in Decisions about Equipment Changes

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
President/Owner	49%	31%	46%	45%	51%	60%	45%	44%	48%	54%
Property Manager	7%	3%	2%	5%	0%	5%	10%	7%	6%	4%
Other Senior Executive	5%	14%	1%	11%	8%	2%	5%	5%	3%	9%

As shown in Table 21, respondents in all segments cited presidents and owners as those most often involved in involved in making decisions regarding equipment additions or replacements.

Using a scale of 0 to 10, where 0 meant no input and 10 meant significant input, we asked respondents to rate their influence levels on potential facility decisions or improvements, such as new equipment installations. Figure 58 provides ratings overall and by segment.

Figure 58. Respondent Input into Potential Facility Improvements



Overall, 67 percent of respondents rate their influence level a 6 or higher. Looking at the responses by segment, 78 percent of retail respondents (most often presidents or owners), report having a high influence level regarding facility improvement decisions. In contrast, only 59 percent of office and warehouse respondents report having a high influence level.

Facility Ownership

Facility ownership often plays an important factor in an organization's ability to undertake energy-efficient actions. Table 22 shows ownership arrangements of respondents' businesses.

Table 22. Facility Ownership

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	997	93	112	101	84	59	143	130	152	123
My company owns and operates this facility.	60%	69%	73%	67%	83%	62%	52%	59%	63%	53%
My company rents this facility.	18%	12%	13%	12%	6%	20%	20%	13%	22%	20%
My company leases this facility.	18%	16%	12%	16%	2%	15%	23%	26%	10%	19%
My company owns this facility but it is rented to someone.	3%	1%	0%	5%	3%	2%	3%	2%	4%	6%

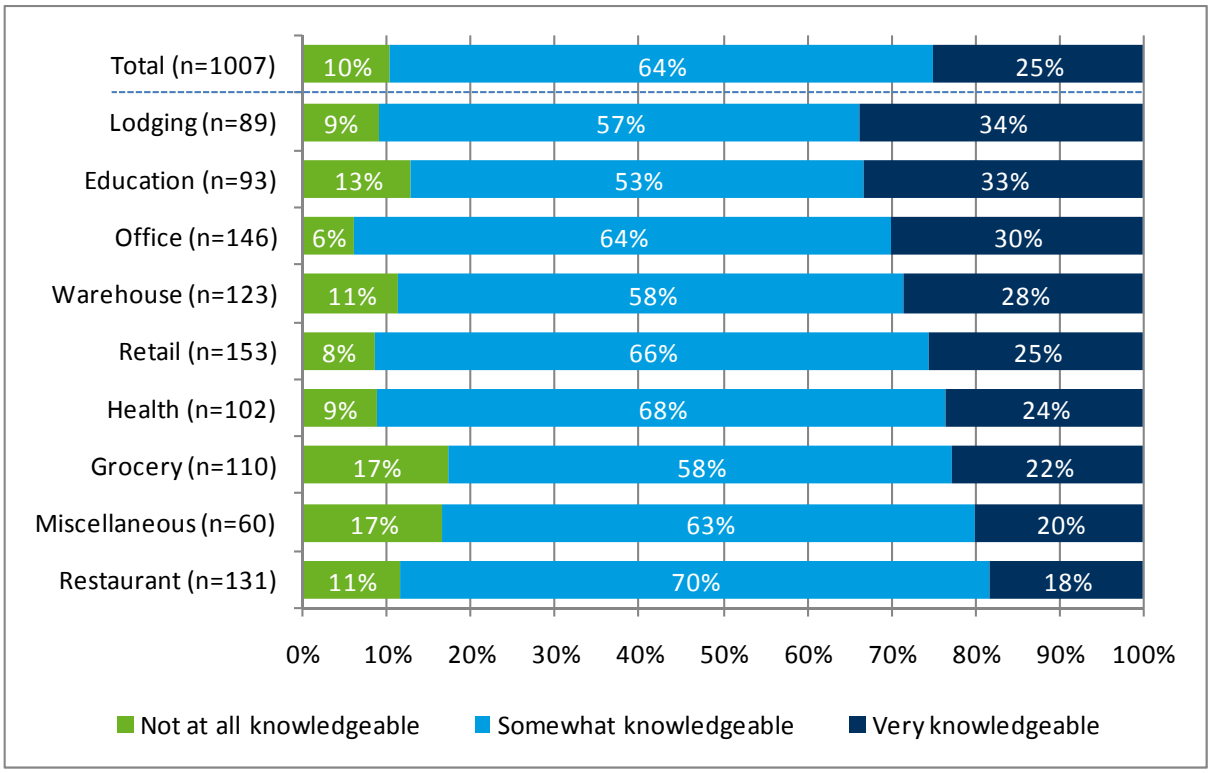
Overall, over half of respondents' companies own and occupy their facilities. Lodging facilities are most likely to own their facilities (83 percent), while warehouses (53 percent) and offices (52 percent) are least likely to own their facilities. Although renters and lessees may not be the primary decision makers regarding efficient equipment purchases and installations, such installations may potentially help them save energy and money as over 90 percent of businesses renting or leasing their facilities pay their own electric bills. Sample sizes are too small for comparison by segment.

Energy-Efficiency Knowledge

General Knowledge

We asked respondents to rate their knowledge about ways their companies can save money by using energy more efficiently. Figure 59 shows almost 90 percent of respondents report at least some knowledge of their options, and one-quarter of respondents say they are very knowledgeable.

Figure 59. Respondent Knowledge about Ways to Save Money by Using Energy More Efficiently

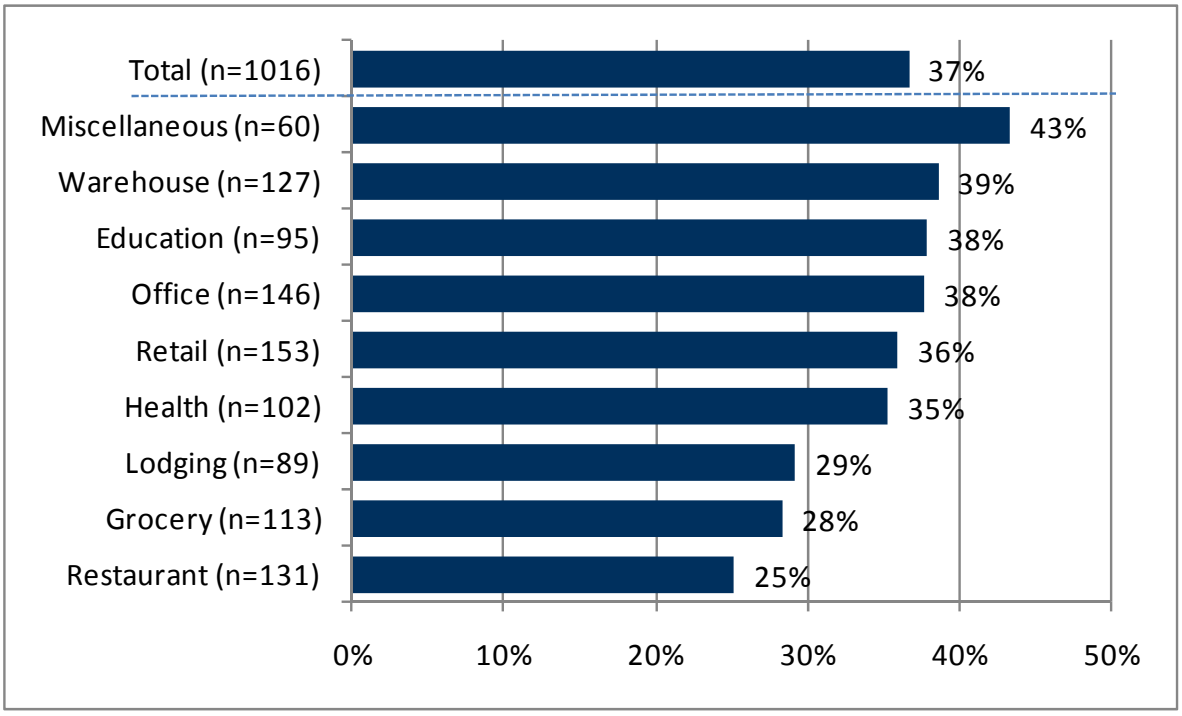


Lodging and education segment respondents are most likely to rate themselves as very knowledgeable (34 and 33 percent, respectively). In the restaurant segment, 18 percent of respondents report being very knowledgeable, while 70 percent report being somewhat knowledgeable. Respondents in the office segment are least likely to rate themselves as not at all knowledgeable: only 6 percent say they do not know about ways to save money by using energy more efficiently.

Awareness of Utility Energy-Efficiency Programs

As shown in Figure 60, overall, nearly 40 percent of respondents report awareness of energy-efficiency programs designed to help businesses save energy and offered by their local utilities.

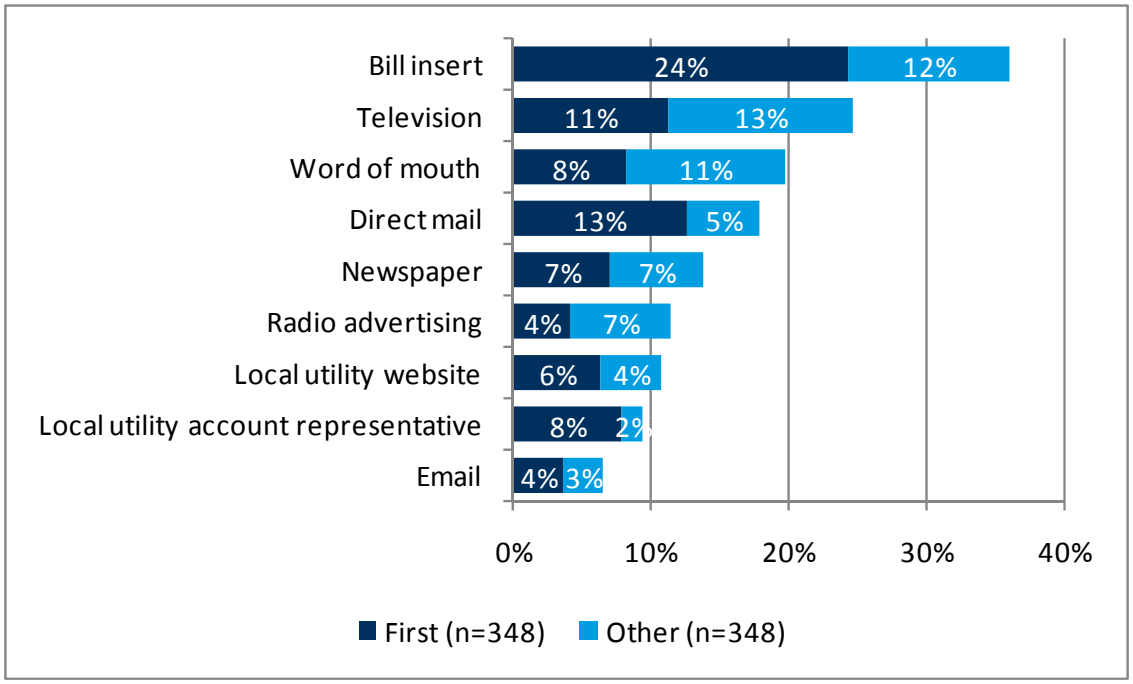
Figure 60. Percent of Respondents Who Knew of Utility Energy-Efficiency Programs



Respondents saying they are aware of utility energy-efficiency programs were asked to describe their familiarity level with the programs. Approximately one-third of these businesses report they are not at all familiar with the programs. Over half (61 percent) of these respondents say they are somewhat familiar with the programs, while only 8 percent of respondents say they are very familiar with the programs. Of those somewhat or very familiar with the programs, 18 percent report having participated in one or more of the programs. This 18 percent represents 3 percent of all respondents. Sample sizes are too small for comparison by segment.

As shown in Figure 61, respondents reporting familiarity with their local utility provider's energy-efficiency programs for businesses were asked how they heard of the programs.

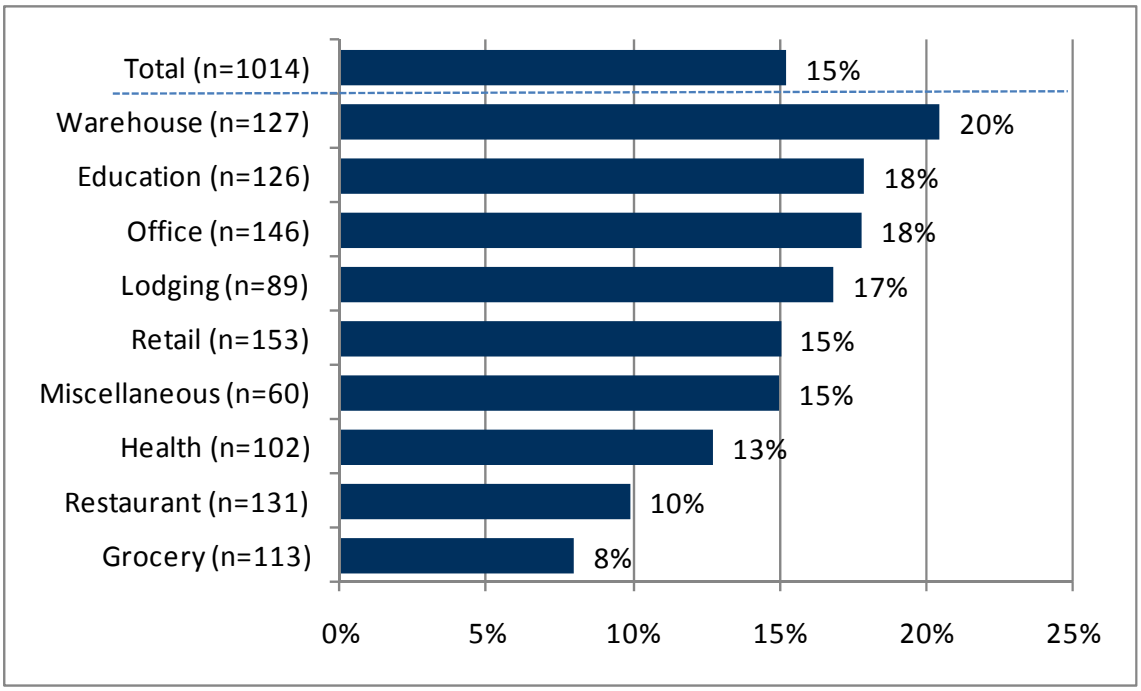
Figure 61. How Respondents Heard about Utility Energy-Efficiency Programs



Bill inserts appear to be the most effective way to inform commercial customers of utility energy-efficiency programs: 36 percent of respondents cite this channel as their source of program information, followed by television and word-of-mouth (24 percent and 19 percent, respectively). Respondents cite e-mail least often (7 percent).

As shown in Figure 62, 15 percent of respondents across the commercial sector say they have visited their local utility's Website to look for energy-efficiency information.

Figure 62. Percent Who Visited Utility Website in Past Six Months to Look for Energy-Efficiency Information

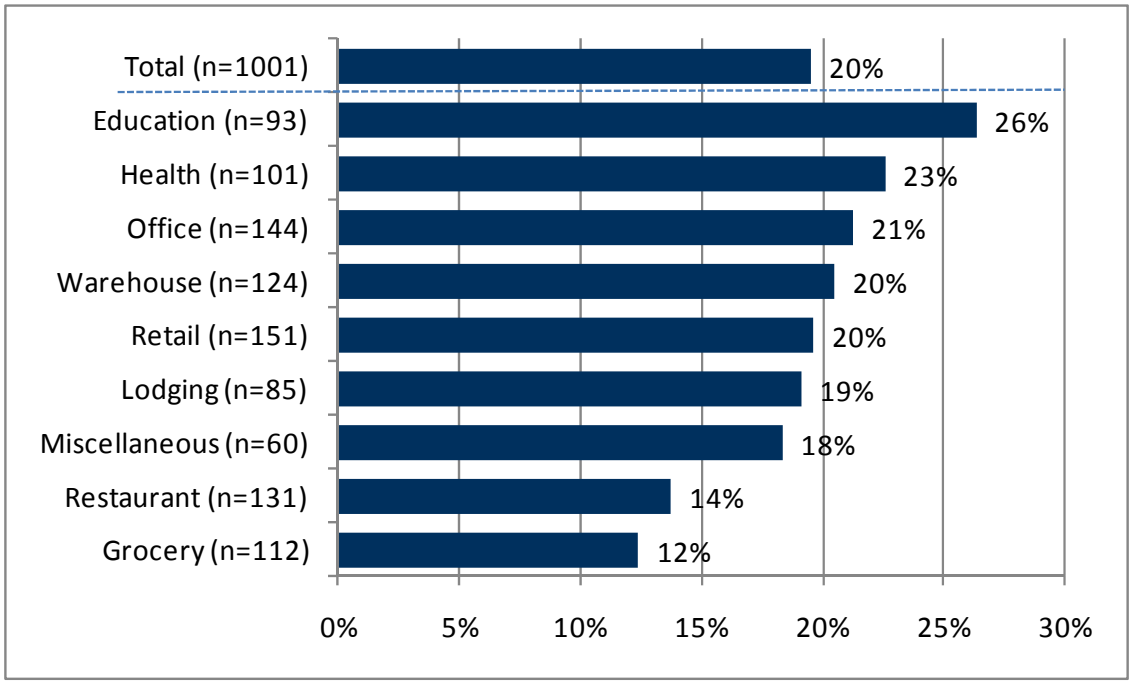


Warehouse and education segment respondents are most likely to report visiting their local utility's Website (20 and 18 percent, respectively), while restaurant and grocery segment respondents are least likely report visiting the Website (10 and 8 percent, respectively). More respondents reporting awareness of their local utility's energy-efficiency programs for businesses also report visiting their utility's Website (23 percent) than those unaware of the utility programs (9 percent). Percentages of respondents reporting visits to their utility's Website do not differ from those participating in their utility's energy-efficiency programs and those who do not.

Awareness of Other Energy-Efficiency Programs

Approximately one in five respondents report awareness of other programs providing energy-efficiency information. Figure 63 shows awareness for the overall commercial sector and by segment.

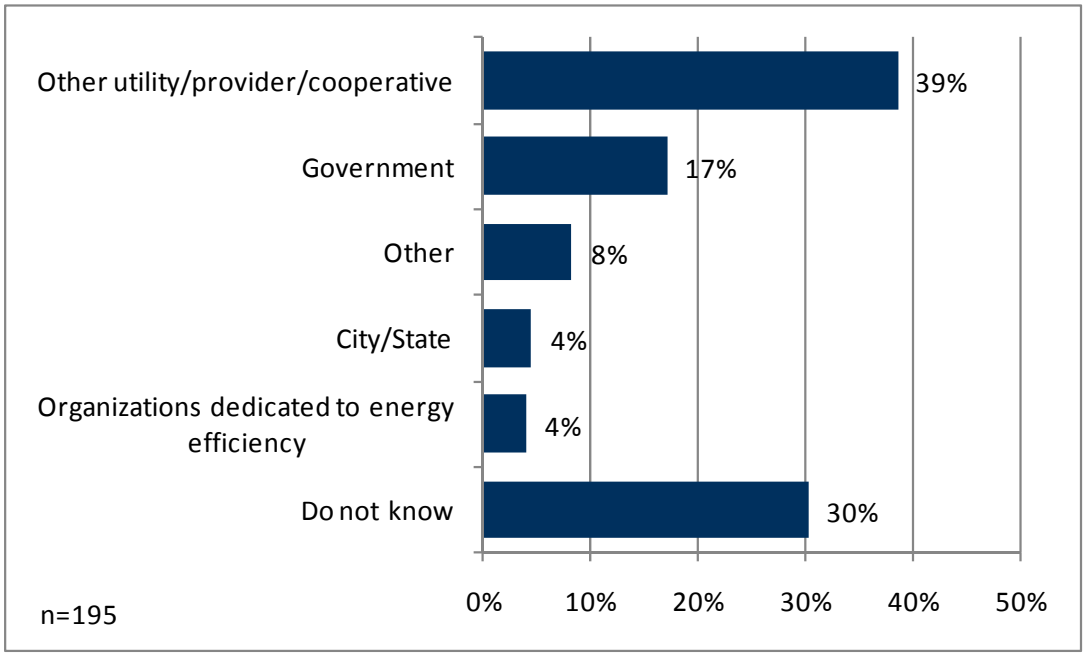
Figure 63. Awareness of Non-Utility Energy-Efficiency Programs



Across all business types, awareness of local utility programs and other utility programs is the highest for the education segment. Respondents in the restaurant and grocery segments report the lowest awareness levels for both program types.

As shown in Figure 64, approximately one-third (30 percent) of respondents aware of other programs do not know the names of the programs or groups offering them. Of those aware of other programs, nearly 40 percent mention the name of another utility, and 17 percent know of government programs.

Figure 64. Mentions of Other Non-Utility Programs



Energy-Efficiency Attitudes

Importance of Energy Efficiency

Using a scale of 1 to 10 (where 1 is not at all important and 10 is extremely important), we asked respondents to rate the importance of a number of factors in managing operations of their buildings. Table 23 provides ratings in aggregate and by segment.

Table 23. Importance of Factors in Managing Facilities' Energy Operations

Percent Important (6-10)	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
Reducing energy costs	89%	93%	92%	95%	96%	88%	85%	95%	90%	84%
Improving energy efficiency	85%	89%	87%	91%	89%	83%	79%	91%	91%	80%
Being "green"	68%	75%	57%	76%	83%	70%	64%	67%	71%	62%

For commercial customers in all segments, reducing energy costs and improving efficiency are both very important. Being "green" is comparatively less important to respondents in all segments. Fewer respondents in the warehouse segment report reducing energy costs, improving energy efficiency, or being green as important factors in managing their facilities' energy operations than do respondents in other segments.

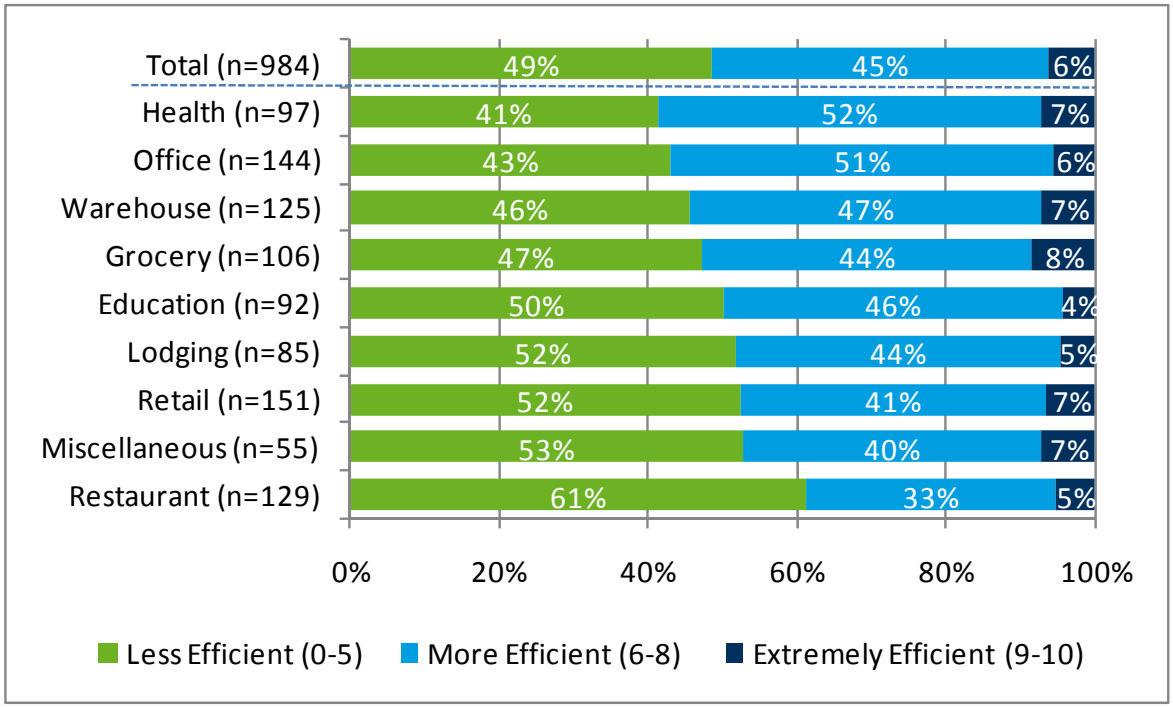
While over two-thirds of respondents rate being "green" important, only 17 percent of these respondents report having a corporate energy policy. Only 15 percent of those reporting reducing

energy costs as important have a corporate energy policy, and only 16 percent of those reporting improving energy efficiency as important have such a policy.

Reported Efficiency of Facility

We asked respondents to rate their buildings' energy efficiency, again using a scale of 0 to 10 (where 0 is not at all efficient and 10 is extremely efficient). Figure 65 summarizes building ratings in total and by segment.

Figure 65. Reported Efficiency of Facility



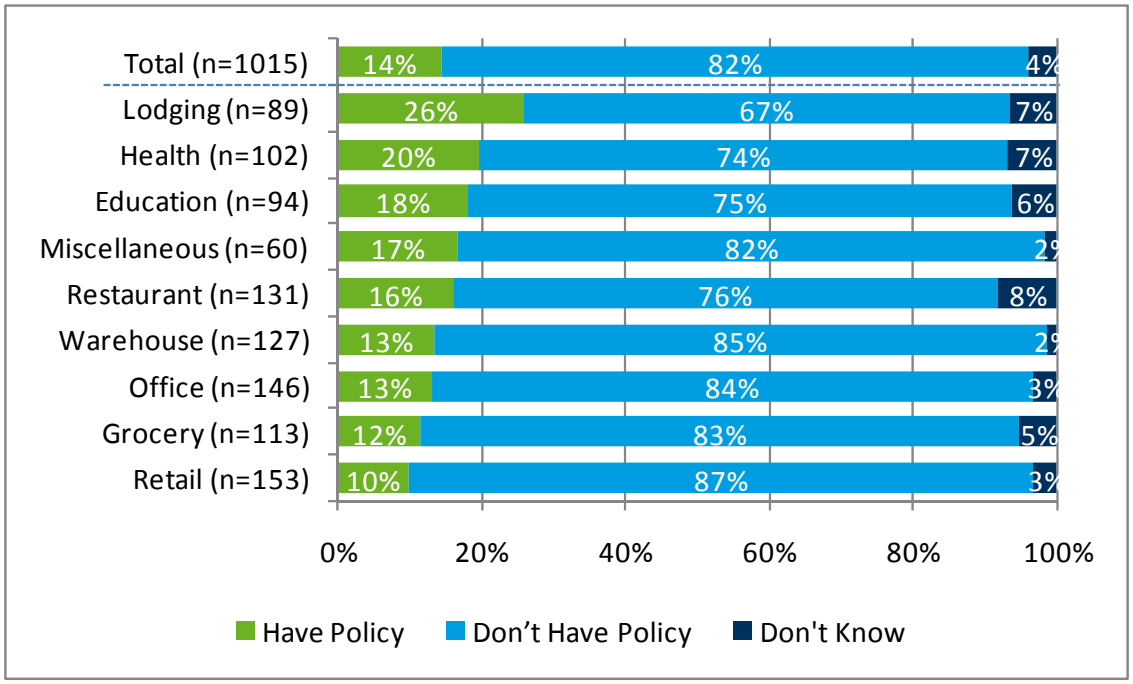
Overall, slightly more than half of respondents rate their buildings' efficiency a six or higher, but only 6 percent rate their buildings as extremely efficient (a 9 or 10). Restaurants rate their facilities as less efficient than other segments, with 61 percent of restaurant respondents rating their facilities as less efficient (a rating of 5 or lower). However, restaurants respondents report some of the lowest percentages of ownership and highest percentage of leased facilities.

Energy-Efficiency Behaviors

Energy-Efficient Corporate Policies and Budgets

The presence of corporate energy policies may indicate companies more likely to invest in energy efficiency. Figure 66 shows percentages of respondents with corporate energy policies.

Figure 66. Facilities with a Corporate Energy Policy

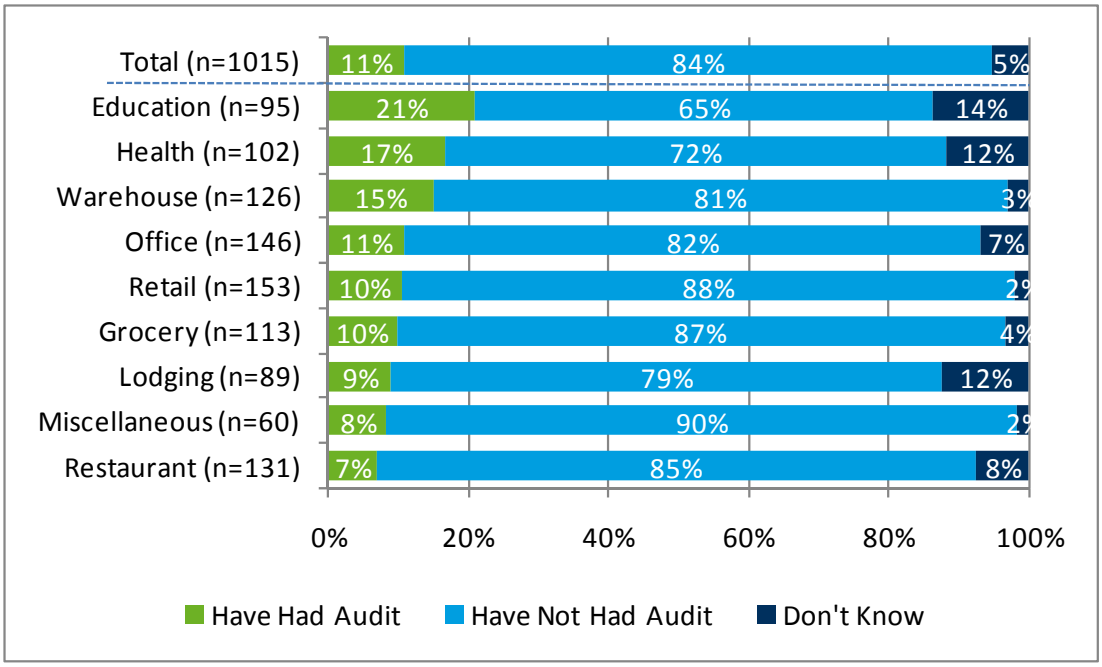


Overall, only 14 percent of respondents report having a corporate energy policy, with most energy policies reported by lodging respondents. The retail segment reports the fewest corporate energy policies.

A corporate budget committed to energy-efficiency improvements increases an organization's ability to install efficient equipment and undertake other energy-efficiency actions. However, only 3 percent of respondents (43 of 1,016) reported their companies having an annual budget for implementing energy-efficiency improvements to their facilities. Education facilities represent approximately one-quarter of respondents (10 of 43) with annual energy-efficiency budgets. Further, over half of these respondents (27 of 43) say such budgets are included as part of their overall capital investment budgets, rather than as a separate budgetary item; 25 of 43 respondents with energy-efficiency budgets could not estimate the budget as a percentage of annual revenue.

An energy audit or consultation conducted at a commercial facility can help identify potential ways to save energy. Respondents were asked if their companies had energy audits or consultations to assess their facilities' energy efficiency during the last two years; Figure 67 shows their responses.

Figure 67. Facilities and Energy Audits

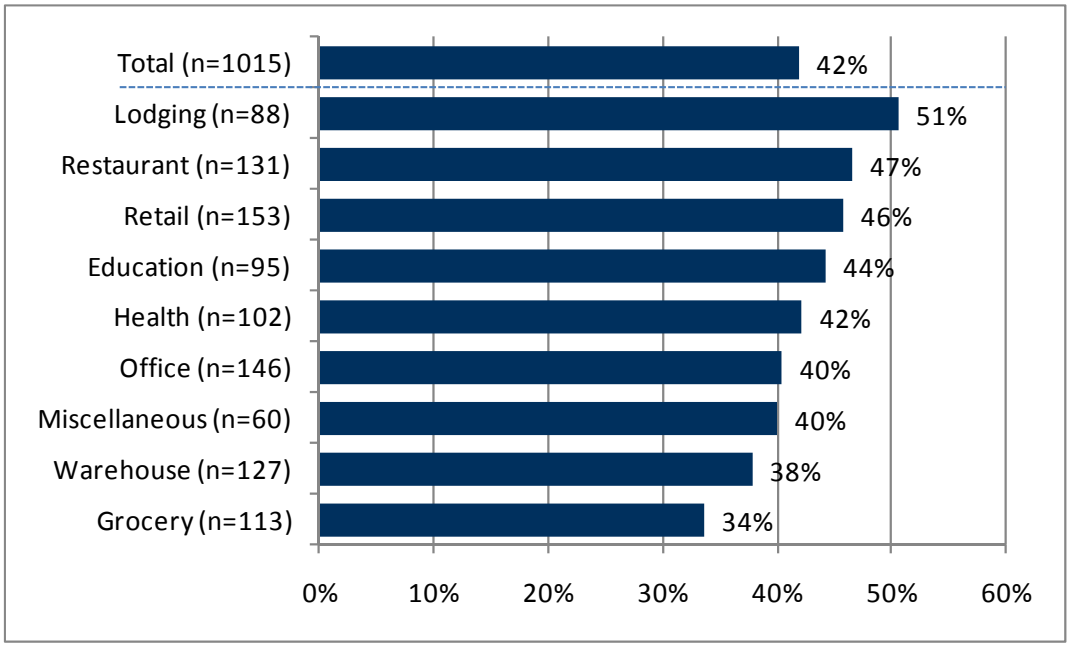


Overall, 11 percent of respondents had an energy audit or consultation during the past two years. Education facilities report the highest number of energy audits (21 percent), and restaurants report the smallest number of energy audits (7 percent).

Recent Energy-Efficient Equipment Installations

Respondents were asked if they installed energy-efficient equipment in the past two years. As shown in Figure 68, overall, a little over 40 percent of respondents (430) report installing energy-efficient equipment at their facilities over the past two years.

Figure 68. Past Installation of Energy-Efficient Equipment



Over half of lodging facilities report installing energy-efficient equipment in the past two years, while only 34 percent of groceries report installing such equipment. Surprisingly, restaurants reported higher levels of recent energy-efficiency equipment installations (47 percent), even though they typically lease their facility. Other respondents installing energy-efficient equipment are more likely to own or operate their facility than those not making such installations. Companies reporting awareness of their local utility's energy-efficiency programs are no more likely to have installed equipment during the past two years than those not aware of the programs.

Respondents reporting installing energy-efficient equipment over the past two years were asked to describe types of equipment installed. Table 24 summarizes their responses.

Table 24. Types of Energy-Efficient Equipment Installed in Past Two Years (Base = All Respondents)

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
Lighting	57%	62%	50%	49%	62%	63%	47%	56%	66%	69%
HVAC	30%	29%	34%	49%	33%	29%	25%	31%	23%	29%
Water Heating	10%	12%	13%	12%	9%	0%	8%	15%	10%	8%
Refrigeration equipment	7%	2%	16%	14%	0%	0%	0%	20%	7%	4%
Motors	6%	5%	8%	0%	7%	4%	3%	8%	6%	6%
Other	5%	10%	0%	7%	11%	8%	8%	5%	3%	0%
Window/Doors	5%	5%	0%	5%	7%	4%	8%	0%	4%	2%
Appliances/electronics	3%	0%	0%	0%	4%	0%	10%	2%	0%	0%
Food service	2%	0%	0%	0%	0%	0%	2%	13%	0%	0%

Of those installing efficient equipment, over half say they installed efficient lighting measures, and approximately one-third say they installed efficient heating or air conditioning equipment. More retail and warehouse respondents report installing lighting measures than respondents in other segments. Respondents in the restaurant, grocery, and health segments report the greatest percentages of efficient refrigeration equipment installations. Unsurprisingly, respondents in the office segment report the greatest percentages of efficient appliance and electronics installations, and respondents in the restaurant segment report the greatest percentage of efficient food service installations.

Respondents installing efficient equipment in the past two years were asked their primary and ancillary reasons for installing energy-efficient equipment rather than standard efficiency equipment. Respondents most often cite as their primary reason: “to reduce energy consumption / save energy” (45 percent) and “to maximize bill savings / save money” (27 percent). The most often cited secondary reason was “to maximize bill savings / save money” (68 percent of the 158 respondents providing a secondary reason). Some cite wanting to improve equipment performance as an additional reason. Only 7 percent of respondents (29 of 430) cite being a “green-conscience” company as a primary or secondary reason.

Despite small sample sizes by segment, respondents most often cite “to reduce energy consumption / save energy” as their primary reason for installing efficient equipment. In the retail segment, however, more respondents cited “to maximize bill savings / save money” as their primary reason for installing efficient equipment.

Only 10 percent of respondents installing efficient equipment receive tax credits for doing so. A higher percentage of respondents in the warehouse and office segments receive tax credits than respondents in other segments.

CFL Knowledge and Purchase

Respondents were asked questions about lighting in their facilities. Table 25 summarizes their responses.

Table 25. CFL Knowledge and Purchase

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
Have Heard of CFLs	80%	80%	73%	78%	85%	85%	79%	73%	84%	80%
Currently have screw-based CFLs installed	56%	51%	56%	56%	83%	45%	56%	71%	62%	44%
Have purchased screw-based CFLs for facility in past 3 months	46%	37%	44%	56%	67%	52%	38%	59%	47%	27%

Overall (and in almost every segment), eight in 10 respondents report having heard of CFLs, and over half report currently having screw-in CFLs installed at their facilities. CFL installation is most prevalent in the lodging, restaurant, and retail segments. Almost half of all respondents report purchasing CFLs for use in their facilities over the past three months, with respondents in the lodging and retail segments reporting highest purchase frequencies. Warehouse segment respondents report both the lowest percentage of CFL installations and the lowest percentage of recent CFL purchases, an unsurprising finding as warehouses typically use other lighting types (such as pin-based fixtures) for overhead lighting on warehouse floors. Similarly, facilities in the education and office segments typically use pin-based fixtures for overhead lighting in classrooms and office areas, which may explain comparatively low percentages of screw-based CFLs purchased in the last three months for those segments.

Future Energy-Efficient Behaviors

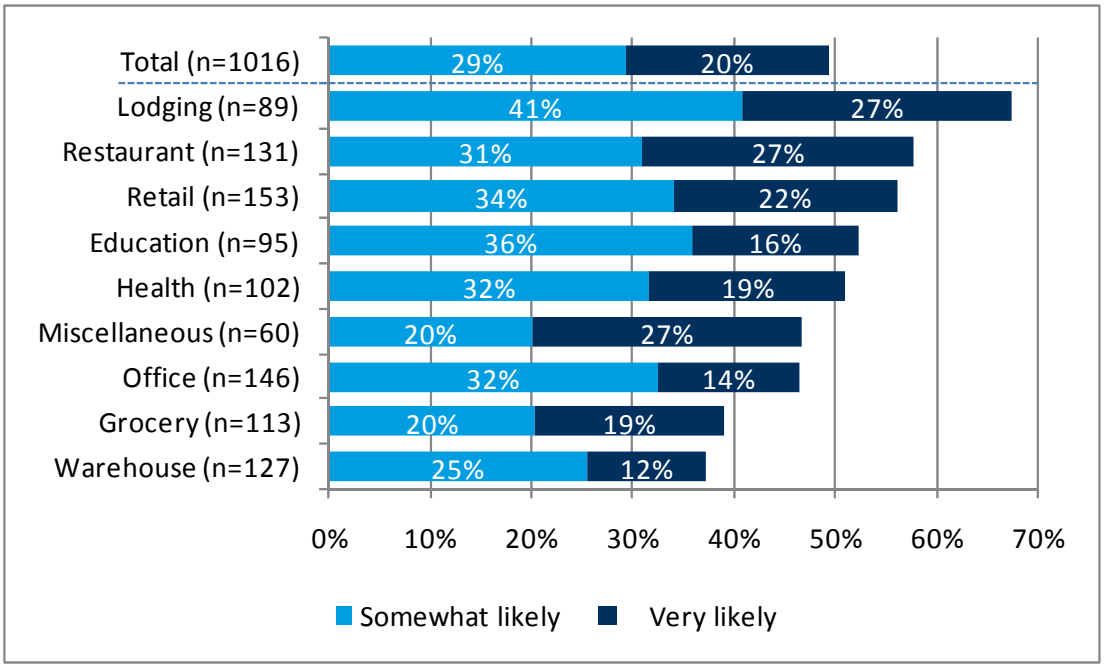
The survey asked respondents how likely they were to replace or upgrade any equipment at their locations in the next two years, rating the likelihood on a 1 to 5 scale, where 1 is very unlikely and 5 is very likely. Table 26, below, summarizes their responses. Slightly over half the respondents plan to replace or upgrade equipment, with lodging facilities and restaurants most likely replacing or upgrading lighting. Warehouses generally prove less likely than other facility types to replace any equipment, and VSDs are the least likely equipment types to be installed in all facility types.

Table 26. Likelihood to Replace or Upgrade Equipment Types

Percent (Very/Somewhat Likely)	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
Likely to replace/upgrade	53%	54%	52%	53%	71%	57%	49%	65%	52%	42%
Specific Equipment										
Lighting	32%	29%	29%	34%	52%	38%	23%	42%	35%	25%
Water Heating	19%	25%	16%	17%	33%	25%	18%	23%	16%	8%
AC/HVAC	18%	19%	15%	23%	22%	19%	19%	21%	12%	12%
Refrigeration	16%	14%	32%	21%	32%	5%	17%	34%	12%	10%
Motors	13%	17%	18%	23%	10%	16%	11%	19%	8%	7%
EMS	11%	10%	10%	14%	16%	13%	12%	14%	8%	4%
Process Measures	11%	6%	10%	17%	9%	14%	7%	12%	8%	12%
Food service	10%	16%	20%	16%	11%	4%	5%	38%	3%	3%
VSDs	7%	14%	6%	10%	7%	5%	7%	6%	5%	3%

We asked respondents other steps they would likely to take to reduce energy usage at their facilities over the next two years. In addition to replacing or upgrading equipment, approximately half of respondents say they are somewhat or very likely to take other steps to improve energy efficiency, as shown in Figure 69.

Figure 69. Likelihood to Take Other Steps to Reduce Energy Usage

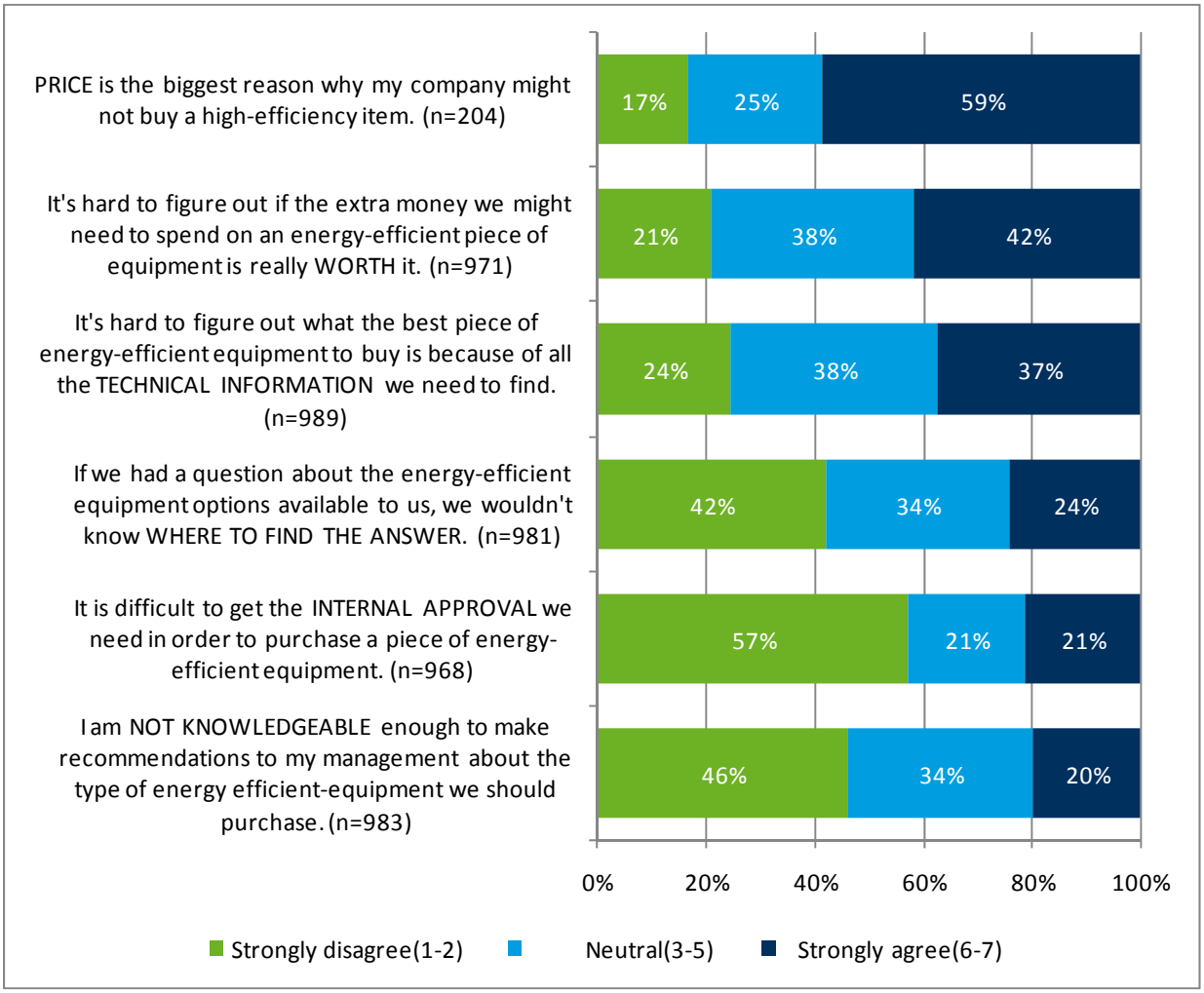


More lodging respondents report they are somewhat or very likely to take other steps to reduce energy use than respondents in other segments, while warehouse respondents are least likely to take other steps. Of those likely to take other steps, the most common steps cited include two non-capital-intensive, behavioral steps: shutting off lights and equipment when not in use (49 percent); and seasonally adjusting thermostat settings (32 percent).

Barriers to Becoming More Efficient

Although respondents express some interest in making energy-efficient equipment purchases, possible purchase barriers include: lack of staff knowledge or expertise; internal politics; and costs. Respondents were asked to state their agreement level with a series of statements describing common barriers to becoming more efficient. Figure 70 summarizes their responses.

Figure 70. Barriers to Energy Efficiency



Price proves to be the largest barrier for approximately 60 percent of respondents as well as the factor identified as the biggest barrier in each segment.

After price, respondents most often cite informational barriers. Forty-two percent of respondents strongly agree it is difficult to determine whether efficient equipment is worth its cost, and

37 percent report is difficult to find the necessary technical information. Groceries (43 percent strongly agree) most likely see technical information as a barrier, while retail facilities (63 percent strongly disagree), miscellaneous (62 percent strongly disagree) and grocery (60 percent strongly disagree) facilities see internal approval as the least likely barrier.

When asked other barriers to their companies purchasing energy-efficient equipment, 33 percent of respondents cite price. Seven percent of respondents cite financing availability, the only other barrier mentioned by more than 5 percent of respondents.

As shown in Table 27, the recent economic downturn also presents a barrier affecting investment decisions. Overall, nearly 70 percent of respondents say the economic downturn has adversely affected their investment decisions regarding new equipment purchases.

Table 27. Effect of Economic Downturn

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
Percent whose investment decisions with respect to purchasing NEW EQUIPMENT have been affected a great deal by the economic downturn (% 4-5)	69%	68%	67%	70%	68%	72%	64%	79%	72%	70%
Percent whose investment decisions with respect to ENERGY EFFICIENT MEASURES have been affected by the economic downturn (% Yes)	74%	76%	73%	79%	70%	81%	65%	72%	81%	73%
Percent whose COMPANY RESOURCES available for energy efficiency investments has been affected (% 6-10)	72%	82%	71%	64%	59%	77%	71%	69%	75%	69%
Percent whose PAYBACK PERIOD for energy efficiency investments has been affected (% 6-10)	70%	84%	67%	67%	68%	72%	61%	77%	72%	80%
Percent whose ACCESS TO FINANCING for energy efficiency investments has been affected (% 6-10)	68%	81%	72%	69%	67%	69%	61%	71%	74%	69%

Up to 15 percent of respondents per segment answering specific economic downturn questions do not know the effects on payback periods, with the education (15 percent), restaurant (14 percent), and healthcare (13 percent) segments most likely not to know. Twelve percent of healthcare respondents do not know the current economic environment's effect on their company's available resources for energy-efficiency investments, and 14 percent of restaurant respondents answering specific economic downturn questions do not know the current economic environment's effect on their company's access to financing for energy-efficiency investments.

Commercial Segment Summaries

This section summarizes findings from the telephone survey of Michigan's nine commercial market segments, describing each segment's attitudes about and awareness of energy-efficiency, personnel involved in energy-related decision making, and corporate energy policies. In addition,

the section describes barriers the state of Michigan may experience in marketing energy-efficiency programs to its commercial establishments. These segment-specific summaries draw on data presented in the above sector-wide analysis.

Table 28. Summary of Key Responses by Market Segment

	Total	Education	Grocery	Health	Lodging	Miscellaneous	Office	Restaurant	Retail	Warehouse
n	1,016	95	113	102	89	60	146	131	153	127
Attitudes										
Value reducing energy costs (% 6-10, valid)	89%	93%	92%	95%	96%	88%	85%	95%	90%	84%
Value improving energy efficiency (% 6-10, valid)	85%	89%	87%	91%	89%	83%	79%	91%	91%	80%
Value being "green" (% 6-10, valid)	68%	75%	57%	76%	83%	70%	64%	67%	71%	62%
Awareness of Programs										
Have heard of utility programs (% yes, total)	37%	38%	28%	35%	29%	43%	38%	25%	36%	39%
Are familiar with other energy-efficiency programs (% yes, total)	20%	26%	12%	23%	19%	18%	21%	14%	20%	20%
Decision-Making and Policies										
Have more input into facility Improvements (% 6-10, valid)	67%	69%	77%	63%	74%	68%	59%	75%	78%	59%
Have a corporate energy policy (% yes, total)	14%	12%	12%	20%	20%	26%	13%	16%	10%	13%

Education (n=95)

Approximately 69 percent of education segment respondents own their own facilities, meaning these customers will achieve the benefits of lower energy bills for any capital investment in energy-efficiency they make. This segment's buildings are predominantly older, with 73 percent of respondents reporting buildings older than 20 years. Building sizes vary across segments, with about 40 percent under 20,000 square feet, and approximately one-quarter between 20,000 and 250,000 square feet. Number of employees per building also varies, with 40 percent reporting fewer than 10 employees, 38 percent reporting 10 to 49 employees, and 20 percent reporting 50 or more employees. Eighty-three percent of education facilities report being open six to 16 hours per day (83 percent) during weekdays. During weekends, 57 percent report their facility not open at all, and 39 percent report their facility open 10 hours or less.

Education facilities prove very receptive to energy efficiency. Almost all education respondents (93 percent) report reducing energy costs as very important to them when managing building operations. Respondents also cite improving energy efficiency (89 percent) as very important, and 75 percent cite being "green" as important when managing their buildings,

A relatively high portion of education facilities (38 percent) report familiarity with local utility-sponsored, energy-efficiency programs, and education facilities report the highest awareness of non-utility sponsored programs (26 percent), such as those sponsored by other utilities, cooperatives, or government agencies. These facilities, however, are also among the least likely to have a corporate energy policy (18 percent).

Forty-four percent of education facilities have installed energy-efficient equipment during the last two years, and 52 percent report they are somewhat or very likely to take other steps to reduce energy usage at their facilities over the next two years.

Grocery (n=113)

Grocery respondents are among those most likely to own and operate their own facilities (73 percent, compared to an average 60 percent across all segments). While groceries tend to have relatively small facilities (42 percent under 5,000 square feet), a single location (90 percent), and fewer employees than most other segments (76 percent with fewer than 10 employees), 76 percent of these facilities are greater than 20 years old, and have high energy-use per square footage relative to other segments.[9]

Grocery respondents find reducing energy costs (92 percent) and improving energy efficiency (87 percent) very important. However, only 34 percent of groceries have installed energy-efficient equipment in the past two years. Grocery respondents report greater input into facility improvements (77 percent) than almost all other segments (a 67 percent average for all segments). Combined, these factors indicate good potential for energy-saving opportunities.

Grocery respondents find being "green" less important in managing their facilities operations (57 percent) than other segments. Grocery respondents report some of the lowest awareness of utility energy-efficiency programs designed for businesses (28 percent) as well as programs offered by other entities (12 percent). More than any other segment, grocery respondents cite not knowing where to find answers to their questions regarding energy-efficiency equipment options as a barrier (34 percent). Only 8 percent have visited their utility's Website in the past six months seeking information about energy efficiency, and only ten 10 percent report having had an energy audit of their building in the past two years.

Healthcare (n=102)

Healthcare facilities are among those most likely to have several locations (34 percent), and be open 24 hours, both on weekdays (33 percent) and on weekends (30 percent). In addition, healthcare facilities are among the most likely to have been affected by the economic downturn in terms of energy efficiency (79 percent).

Healthcare facilities prove very receptive to energy efficiency, with respondents highly valuing reductions in energy costs (95 percent) and improving energy efficiency (91 percent) in managing their facilities. Further, the healthcare segment is among those most highly value being "green" (76 percent). Seventeen percent of healthcare facilities have had energy audits in the past two years, and 42 percent installed energy-efficient equipment during the same time. Forty-nine

[9] U.S. Energy Information Administration Independent Statistics and Analysis. U.S. Commercial Buildings Energy Intensity, Total Midwest, Table 6b. http://www.eia.gov/emeu/efficiency/cbecstrends/cbi_html/cbecs_trends_6b.html

percent have installed HVAC measures, and healthcare facilities are those most likely to upgrade to energy-efficient lighting (34 percent), motors (23 percent), refrigeration (21 percent), and process measures (17 percent).

Lodging (n=89)

Lodging facilities tend to have larger facilities (43 percent with more than 5,000 square feet) and multiple locations (26 percent). More than many other segments, lodging respondents are more likely to value reducing energy costs (96 percent), being "green" (83 percent), and having a corporate energy policy (20 percent). Fewer lodging respondents (70 percent) than the average (74 percent) report their organization's investment in energy efficiency being affected by the economic downturn.

Respondents in this segment currently report buildings with the highest percentage of screw-based CFLs installed (83 percent, compared to a sector-level average of 56 percent) and CFLs purchased during the last three months (67 percent, compared to a sector- level average of 46 percent). Respondents also report the highest intent to upgrade additional lighting (52 percent), and to take additional steps to reduce energy use (68 percent), such as turning off lights when not in use, seasonally adjusting thermostat settings, and installing occupancy sensors.

Office (n=146)

Office segment businesses tend to be smaller and have fewer than 10 employees (75 percent). Generally, office buildings are newer facilities than in other segments, with 32 percent under 20 years old and under 20,000 square feet (72 percent). The office segment more likely rents or leases their facilities than other segments (43 percent, compared to an average of 36 percent), and less likely owns and occupies their own facility (52 percent, compared to an average of 60 percent). However, approximately 95 percent of renters/lessees pay their own electric bills.

Although 64 percent of office segment respondents value being "green," and 85 percent value reducing energy costs in managing the building operations, both values are among the lowest of all segments queried. The office segment has a roughly average percentage of facilities with energy-efficient equipment installations over the past two years (40 percent, with the sector-level average at 42 percent).

Restaurant (n=131)

Restaurants are more likely to lease their facilities (26 percent) than other segments, and are more likely to have multiple locations. Generally, restaurants are mid-sized businesses, with 50 or fewer employees in a mix of older and newer buildings, typically under 5,000 square feet and open between six and 16 hours per day, both weekdays and weekends.

When managing business operations, 95 percent of restaurant segment respondents highly value reducing energy costs, and 91 percent highly value improving energy efficiency. As in the other segments, most restaurant respondents describe their level of energy-efficiency knowledge as somewhat or very knowledgeable (88 percent), though restaurant respondents report some of the lowest awareness levels of both local utility energy-efficiency programs for business customers (25 percent) and similar programs sponsored by other agencies (e.g., cities, the state, or other utilities) (14 percent). Only 7 percent of restaurant facilities have had energy audits during the past two years (the lowest percentage of all segments), although 17 percent plan to have an audit.

During the past two years, 47 percent of restaurant respondents have installed energy-efficient equipment, such as efficient lighting (56 percent), HVAC equipment (31 percent), refrigeration equipment (20 percent), and water heating equipment (15 percent). Restaurants report some of the highest adoption rates for efficient lighting, with 71 percent of respondents currently reporting use of screw-based CFLs in their facilities. In addition, restaurants report that over half (55 percent) of the available sockets in their facilities are filled with CFLs (versus 61 percent on average across all segments). Restaurants are highly likely to install more efficient lighting (42 percent) and are likely to take additional steps to improve energy efficiency, such as: shutting off lights and equipment when not in use (34 percent), having an energy audit (17 percent); and replacing equipment, such as lighting and appliances (10 percent).

Unfortunately, financing such energy-efficiency upgrades may not prove easy: 72 percent of respondents in the restaurant segment have had investment decisions for purchases of new equipment affected by the economic downturn, and 77 percent report payback periods for energy-efficiency investments being affected.

Retail (n=153)

Retail segment respondents tend to have small businesses with fewer than 10 employees (80 percent), in facilities predominantly under 20,000 square feet (70 percent). A greater percentage of this segment (91 percent) values improving energy efficiency than most other segments (85 percent, on average), although retail businesses are less likely than other segments to have corporate energy policies (10 percent).

Retail has been among the segments most negatively impacted by the economic downturn, regarding investments in energy-efficient measures (81 percent, with the sector- level average at 74 percent) and access to financing for energy-efficient equipment (74 percent, with the sector-level average at 68 percent). Still, retail is among the segments installing the highest percentage of lighting measures over the past two years (66 percent, with the sector- level average at 57 percent). Sixty-two percent of retail establishments report use of screw-based CFLs in their fixtures, with 63 percent of available sockets filled with CFLs. Fifty-six percent of retail respondents plan to take additional energy saving actions, such as building envelope improvements (26 percent), shutting off lights and equipment when not in use (23 percent), and adjusting thermostats and replacing lighting and appliances (12 percent).

Warehouse (n=127)

Warehouses predominantly have older buildings (72 percent older than 20 years), with 46 percent between 5,000 and 50,000 square feet. Approximately 70 percent of respondents in the warehouse segment have fewer than 10 employees, while nearly one-quarter have 10 to 50 employees. The majority of warehouse facilities remain open six to 10 hours per day on weekdays, with fewer hours on weekends. More respondents own and operate their buildings (53 percent) rather than rent or lease (39 percent).

Warehouse respondents do not value reducing energy costs (84 percent), improving energy efficiency (80 percent), or being “green” (62 percent) as much as most of the other segments. However, warehouse respondents report some of the highest awareness levels of utility energy-efficiency programs for businesses (39 percent), and 20 percent report awareness of other programs sponsored by other agencies, such as cities, the state, or other utilities.

Only 13 percent have a corporate energy policy, and respondents report the least amount of influence on potential facility improvements of any segment (59 percent).

Warehouses have been impacted by the economic downturn, with 80 percent of respondents reporting payback periods for energy-efficiency investments affected. Slightly more warehouse respondents than average rate their building as extremely or more efficient (54 percent, compared to the sector- level average of 51 percent), and somewhat more than average report having an energy audit in the past two years (15 percent, compared to the sector-level average of 11 percent). However, only 38 percent of warehouse respondents report installation of energy-efficient equipment over the last two years, in contrast to the sector- level average of 42 percent. Lighting measures made up over half of this equipment, though warehouses report the lowest percentage of screw-based CFLs installed (44 percent, with the average at 56 percent) and CFL purchases in the past three months (27 percent, with the average at 46 percent). This may be due to use of other types of fluorescent lighting on warehouse floors, such as pin-based fixtures. Warehouses report 50 percent of available sockets contain CFLs, a rate lower than the sector-level average of 61 percent, likely due to their requiring different types of lighting technologies. Finally, warehouses report the lowest likelihood (37 percent) of all segments to take other steps to reduce energy use in the future (the average is 49 percent).

Miscellaneous (n=60)

The miscellaneous category represents a mixture of owned (62 percent) and rented/leased (35 percent) facilities, which typically are a company's only location (87 percent). Seventy percent of facilities in the miscellaneous segment are older than 20 years, and are evenly split between those under 5,000 square feet and those 5,000 to 50,000 square feet. Approximately 70 percent are small, with fewer than 10 employees, while nearly one-quarter have between 10 and 50 employees. Typically, these businesses are open six to 10 hours on weekdays (68 percent), and not at all or under five hours on weekends (53 percent).

When managing their facilities' energy operations, 88 percent of respondents value reducing energy costs; 83 percent value improving energy efficiency; and 70 percent value being "green." These businesses report the highest level of awareness of utility-sponsored energy efficiency business programs (43 percent). However, 53 percent report their building as less efficient (rating of 5 or lower on a scale of 0 to 10; across all segments, 49 percent of respondents report their facilities are less efficient). Only 8 percent of businesses in the miscellaneous category have had an energy audit during the past two years (compared to the sector- level average of 11 percent), and only 40 percent have installed any energy-efficient equipment in the past two years. The energy-efficient equipment installed predominantly has been lighting (63 percent) and HVAC measures (29 percent). Of all segments, miscellaneous segment facilities have the lowest percentage of screw-based sockets filled with CFLs (44 percent, with the average at 61 percent). These businesses report investments in energy efficiency affected by the economic downturn (81 percent), among the highest rate reported by all segments (retail also reports 81 percent, with the average at 74 percent). The miscellaneous segment also has been among those most affected by the downturn in terms of company resources available for energy-efficiency investments (77 percent, compared to a sector- level average of 72 percent).

Appendix A. Firmographics

Table 29. Respondent Firmographics

Firmagraphics of Respondents	Commercial Phone Survey (Weighted)
Location	n=(1,016)
My company's only location	75%
One of several locations owned by my company	18%
The headquarter location of a company with several locations	6%
Don't know	1%
Refused	0%
Age of Facility	n=(1,016)
Less than 1 year	0%
1-5 years	4%
6-10 years	7%
11-15 years	9%
16-20 years	6%
More than 20 years	69%
Don't know	6%
Refused	0%
Approximate Square Footage	n=(1,016)
1- 4,999 square feet	40%
5,000-19,999 square feet	25%
20,000-49,999 square feet	10%
50,000-249,999 square feet	5%
250,000 -499,999 square feet	1%
500,000+ square feet	1%
Don't know	17%
Refused	0%
Number of employees	n=(1,016)
Fewer than 10	69%
10-49	25%
50-99	3%
100-249	1%
250-499	0%
500 or more	0%
Don't know	1%
Refused	0%
Weekday operating hours	n=(1,016)
Not at all	0%
1-5 hours	2%
6-10 hours	63%
11-16 hours	21%
17-23 hours	3%
24 hours	9%
Don't know	1%
Refused	1%

Firmagraphics of Respondents	Commercial Phone Survey (Weighted)
Weekend operating hours	n=(1,016)
Not at all	35%
1-5 hours	13%
6-10 hours	27%
11-16 hours	13%
17-23 hours	2%
24 hours	8%
Don't know	2%
Refused	1%
Type of primary cooling system	n=(1,016)
DX air conditioning	69%
Cooling Chiller	3%
Individual window unit(s)	1%
Fans	1%
Other	1%
No cooling	17%
Don't know	8%
Refused	1%
Type of primary heating system	n=(1,016)
Gas Furnace	53%
Electric resistance heating	16%
Gas Boiler	9%
Heat Pump	3%
Other	5%
Wood	2%
Oil	1%
Propane	1%
Hot water/steam	1%
No heating	2%
Don't know	6%
Refused	1%
Hot water heating fuel	n=(1,016)
Gas	54%
Electric	28%
Propane	1%
Wood	1%
Other	1%
Gas and electric	0%
No hot water	3%
Don't know	10%
Refused	1%

Appendix B. Telephone Survey Instruments

State of MI Baseline Study
Commercial Customer Telephone Survey

FINAL

Introduction

Hello, my name is [INTERVIEWER NAME] and I'm calling from Opinion Dynamics on behalf Michigan Public Service Commission and your local electric and gas provider. We are calling to get your opinion about energy efficiency and also to learn about energy efficiency investments you may have made at your facility located at [LOCATION] in [CITY]. Your participation is important in helping your utility improve their energy efficiency programs for businesses. This survey should take about 15 minutes.

Screener

S1. Are you the person that is most knowledgeable about the energy consumption and equipment decisions made at this site?

1. Yes
2. No (ASK TO SPEAK WITH RIGHT PERSON AND REPEAT INTRO. IF PERSON IS NOT AVAILABLE, LOG CONTACT NAME AND PHONE NUMBER AND CALL BACK)
8. (Don't Know) (THANK AND TERMINATE)
9. (Refused) (THANK AND TERMINATE)

S2. Which power company provides electric power to your business?

1. DTE Energy/Detroit Edison
2. Consumers Energy
3. (Other, specify)
8. (Don't know)
9. (Refused)

S3. Which company supplies natural gas services to your business?

1. DTE Energy/Mich Con/Michigan Consolidated
2. Consumers Energy
3. (Other, specify)

4. (No natural gas at my business)
8. (Don't know)
9. (Refused)

[Terminate if S2=1,2,8,9 and S3=1,2,8,9]

Facility Characteristics

F1. According to our records, the type of business located at [LOCATION] is best characterized as [SEGMENT]. Is this correct? [IF NO SEGMENT IN PURCHASED SAMPLE, SKIP TO F2]

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

[SKIP IF F1=1]

F2. How would you characterize this facility?

1. (Education (K-12)
2. (Grocery)
3. (Health)
4. (Office)
5. (Lodging)
6. (Restaurant)
7. (Retail)
8. (Warehouse)
9. (Miscellaneous/Other) (THANK AND TERMINATE)
98. (Don't know) (THANK AND TERMINATE)
99. (Refused) (THANK AND TERMINATE)

F3. Which of the following best describes the ownership of the facility located at [LOCATION]?

1. My company owns and occupies this facility
2. My company owns this facility but it is rented to someone else
3. My company rents this facility
4. My company leases this facility
8. (Don't know)
9. (Refused)

[SKIP IF F3=1]

F4. Is your company responsible for paying the electric bill?

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

Energy Efficiency Attitudes

I am first going to ask you some questions about energy efficiency.

A1. How would you rate your knowledge of the different ways your company can save money by using energy more efficiently? Would you say that you are…

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

A2. On a scale of 0 to 10, where 0 is "Not at all Efficient," and 10 is "Extremely Efficient," how energy efficient would you rate your building?

Not At All Efficient	Extremely Efficient	DK	Ref.
0	10	98	99

A3. On a scale of 0 to 10, where 0 is "Not at all Important," and 10 is "Extremely Important," how important are the following when managing the operations of your building? How important is… [ROTATE]

Not At All Important	Extremely Important	DK	Ref.
0	10	98	99

A3a. Reducing your energy costs
A3b. Improving energy efficiency
A3c. Being "green"

[ASK IF A3a<4]

A4a. Why do you rate "reducing your energy costs" as being less important to the operations of your building?

00. (Open End)
98. (Don't know)
99. (Refused)

[ASK IF A3b<4]
A4b. Why do you rate "improving energy efficiency" as being less important to the operations of your building?

00. (Open End)
98. (Don't know)
99. (Refused)

[ASK IF A3c<4]
A4c. Why do you rate being "green" as being less important to the operations of your building?

00. (Open End)
98. (Don't know)
99. (Refused)

A5. Has your company had an energy audit/consultation to assess this location's energy efficiency in the last 2 years?

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

A6. Does your organization have a corporate energy policy to reduce environmental emissions or energy use? An example would be to use more efficient equipment.

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

Program Awareness

P1. Are you aware of any energy efficiency programs offered by your local utility that are designed to help business customers save energy?

1. Yes
2. No [skip to P6]
98. (Don't know) [skip to P6]
99. (Refused) [skip to P6]

[ASK IF P1=1]
P1a. What energy efficiency programs are you aware of? [OPEN RESPONSE]

[SKIP TO P6 IF P1 <> 1]

P2. How did you FIRST hear about these programs offered by your local utility provider?

1. (Local utility website)
2. (Radio advertising)
3. (Newspaper)
4. (Television)
5. (Bill insert)
6. (Contractor)
7. (Billboard)
8. (Email)
9. (Word of mouth)
10. (Local utility account representative)
11. (Vendor)
12. (Direct mail)
00. (Other, specify)
98. (Don't know)
99. (Refused)

P3.What other ways have you heard about it? [MULTIPLE RESPONSE; UP TO 3]

1. (Local utility website)
2. (Radio advertising)
3. (Newspaper)
4. (Television)
5. (Bill insert)
6. (Contractor)
7. (Billboard)
8. (Email)
9. (Word of mouth)
10. (Local utility account representative)
11. (Vendor)
12. (Direct mail)
00. (Other, specify)
96. (No other way)
998. (Don't know)
999. (Refused)

P4. How familiar would you say you are with the energy efficiency programs offered by your local utility provider?

Would you say you are…

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

[SKIP TO P6 IF P4 = 1, 8, 9]

P5. Has your business located at [[LOCATION] participated in any energy efficiency programs sponsored by your local utility?

1. Yes
2. No
998. (Don’t know)
999. (Refused)

[SKIP IF P5<>1]

P5a. Which energy efficiency programs has your business participated in? [OPEN END]

1. (New construction program)
2. (Prescriptive program)
3. (Custom program)
4. (Multifamily program)
00. (Other, specify)
98. (Don’t know)
99. (Refused)

P6. Outside of programs sponsored by your local utility provider, are you familiar with any other programs that provide information about energy efficiency and reducing the cost to buy energy efficient equipment for your business?

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

[SKIP IF P6 <> 1]

P7. Can you tell me the name of the programs or the group offering it?

2. (Other utility/provider/cooperative)
3. (Government)
4. (City/State)
00 (Other, specify)
998. (Don’t Know)
999. (Refused)

P8. Have you visited your local utility providers' website in the past 6 months to look for energy efficiency information?

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

Barriers

B1.How much input do you have into potential facility improvements, specifically the installation of new equipment? Please use a scale from 0 to 10 where 0 is "no input" and 10 is "significant input".

0	10	98	99
No input	Significant input	DK	Ref

B2. We are interested in understanding how companies like yours make decisions about purchasing energy efficient equipment. I am going to read a list of statements that may or may not apply to your company at this time, but please answer them to the best of your ability. Using a scale from 1 to 7 where 1 is 'Strongly Disagree' and 7 is 'Strongly Agree,' please indicate your level of agreement with the following statements:

1	2	3	4	5	6	7	98	99
Strongly disagree						Strongly agree	DK	Ref

[Randomize List]

a. It's hard to figure out if the extra money we might need to spend on an energy efficient piece of equipment is really worth it.
b. It's hard to figure out what the best piece of energy efficient equipment to buy is because of all the technical information we need to find.
c. Price is the biggest reason why my company might not buy a high efficiency item.
d. If we had a question about the energy efficient equipment options available to us, we wouldn't know where to find the answer.
e. It is difficult to get the internal approval we need in order to purchase a piece of energy efficient equipment.
f. I am knowledgeable enough to make recommendations to my management about the type of energy efficient equipment we should purchase.

B3. Other than the things I just asked you about, can you think of anything else that could get in the way of your company purchasing energy efficient equipment? [MULTIPLE RESPONSE] [UP TO THREE RESPONSES]

1. (Price/cost)
2. (Availability/lack of technology)
3. (Payback period)

4. (Lack of technical knowledge/understanding)
5. (Corporate approval)
6. (Procurement process)
7. (Financing availability)
8. (Lack of time)
9. (Lack of quality vendors)
96. (None)
00. (Other, specify)
98. (Don't know)
99. (Refused)

B4. Based on a 5 point scale where 1 is "not at all" and 5 is "a great deal", to what extent has the current economic downturn adversely affected your investment decisions with respect to purchasing new equipment?

1. Not at all
2.
3.
4.
5. A great deal
998. (Don't know)
999. (Refused)

[SKIP TO C1 IF B4 =1]
B5. Has the current economic downturn adversely affected your investment decisions with respect to installing energy efficient measures?

1. Yes
2. No
98. (Don't know)
99. (Refused)

B6. On a scale of 0 to 10, where 0 is "not at all" and 10 is "a lot", how much has the current economic environment affected your firm in the following areas? [998=DK, 999=Ref]

a. The payback period required for energy efficiency investments
b. Company resources available for energy efficiency investments
c. Access to financing for energy efficiency investments

Recent Energy Efficiency Behaviors

C1. Within the past 2 years, has your company installed any energy efficient equipment at this location?

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

[SKIP TO T1 IF C1 <>1]

C2. If you were to group this equipment into large end uses such as lighting, HVAC, motors, etc, how would the energy efficient equipment you installed be grouped? [MULTIPLE RESPONSES-ALLOW 5 RESPONSES]

1. (Lighting)
2. (AC/HVAC system)
3. (Motors)
4. (Variable Speed Drives/VSDs)
5. (Refrigeration equipment)
6. (Energy Management System (EMS))
7. (Food service)
8. (Process Measures) (IF NEEDED: This includes pumps and compressed air nozzles))
9. (Water Heating)
00. (Other, specify)
98. (Don't know)
99. (Refused)

C3a. Did your company receive a tax credit for installing this equipment?

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

[SKIP TO C4 IF C3a<>1]

C3b. Who did you receive the tax credit from?

1. (The federal government)
2. (The State of Michigan)
3. (My city or town/township)
4. (Other, specify)
8. (Don't know)
9. (Refused)

C3c. What percentage of the incremental cost of the equipment did the tax credit cover?

00. [NUMERIC OPEN END; UP TO 100%]
98. (Don't know)
99. (Refused)

C4. What were the major reasons for installing energy efficient equipment as opposed to standard efficiency equipment? [MULTIPLE RESPONSES – ALLOW 4 RESPONSES]

1. (To reduce energy consumption/save energy)

2. (To maximize bill savings/save money)
3. (To improve equipment performance)
4. (To benefit from energy efficiency tax credits/incentives)
5. (To be a more green-conscience company)
00. (Other, specify)
98. (Don't know)
99. (Refused)

Intent to Take Action

T1. Thinking about improvements you might make at your facility within the next 2 years, how likely are you to replace or upgrade any of the following equipment at this location? Are you very unlikely, somewhat unlikely, neither unlikely nor likely, somewhat likely, or very likely? (Go through end uses below)

a. Lighting
b. AC/HVAC
c. Motors
d. Variable Speed Drives/VSDs
e. Refrigeration equipment
f. Energy Management Systems (EMS)
g. Food service
h. Process measures (IF NEEDED: This includes pumps and compressed air nozzles)
i. Water heating

1. Very unlikely
2. Somewhat unlikely
3. Neither likely nor unlikely
4. Somewhat likely
5. Very likely
98. (Don't know)
99. (Refused)

T2. In the next 2 years, how likely are you to take other steps to reduce energy usage at your facility?

1. Very unlikely
2. Somewhat unlikely
3. Neither likely nor unlikely
4. Somewhat likely
5. Very likely
98. (Don't know)
99. (Refused)

[SKIP IF T2 <> 4, 5]
T3. What steps might you take to reduce your facility's energy usage? (IF TOO MUCH DETAIL IS GIVEN, PROMPT FOR MAJOR END-USE CATEGORIES LISTED) [MULTIPLE RESPONSES-ALLOW 5 RESPONSES]

1. (Have an energy audit)
2. (Shut off lights and/or equipment when not in use)
3. (Research energy efficiency equipment options)
4. (Inquire about energy efficiency programs)
5. (Seasonally adjust thermostat settings)
6. (Install occupancy sensors)
7. (Building envelope improvements)
00. (Other, specify)
96. (None/nothing)
98. (Don't know)
99. (Refused)

[SKIP IF T1a-i <> 4, 5]
[REPEAT FOR EACH TYPE]

a. Lighting
b. AC/HVAC
c. Motors
d. Variable Speed Drives/VSDs
e. Refrigeration equipment
f. Energy Management Systems (EMS)
g. Food service/commercial cooking
h. Process measures (IF NEEDED: This includes pumps and compressed air nozzles)
i. Water heating

T4a-i. You mentioned you may replace [TYPE] in the next two years. **Without** a utility rebate, how likely would you be to install energy efficient [TYPE]?

[SKIP IF T4A-I = 4]
T5a-i. If <UTIL> provided a rebate that covered 50% of the difference in the incremental cost between efficient and standard equipment, how likely would you be to install the efficient equipment?

[SKIP IF T4a-i = 4 OR T5a-i= 4]
T6a-i. How about if the rebate covered 75% of the difference in the incremental cost?

1. Very unlikely
2. Somewhat unlikely
3. Somewhat likely
4. Highly likely
5. Not applicable

99. Refused
98. Don't know

CFL Module

Now I would like to ask you some questions about the lighting you have at your facility.

L1. Have you ever heard of compact fluorescent light bulbs, sometimes called CFLs?

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

[SKIP TO X1 IF L1 <> 1]

L2. Do you currently have any screw-based CFLs installed at your facility?

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

[SKIP IF L2 <>1]

L3. Approximately, what percent of screw-based sockets currently have CFLs? Your best estimate is fine.

00. [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

L4. Approximately, in what percentage of screw-based sockets at your facility could CFLs be installed? Your best estimate is fine.

00. [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

L5. Have you purchased screw-in CFLs for use in your facility in the last 3 months?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[SKIP to X1 IF L5 <>1]

L6. Approximately, how many screw based CFLs have been purchased for use in your facility in the last 3 months? Your best estimate is fine.

00. [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

Firmographics

We're almost finished. I just have a few questions about your business to make sure we're getting a representative sample of utility customers.

X1. Which of the following best describes this facility? This facility is…

1. My company's only location
2. One of several locations owned by my company
3. The headquarter location of a company with several locations
8. (Don't know)
9. (Refused)

X2. How old is this facility?

1. (<1 year)
2. (1-5 years)
3. (6-10 years)
4. (11-15 years)
5. (16-20 years)
6. (> 20 years)
8. (Don't know)
9. (Refused)

X3. What is the approximate square footage of this facility?

1. (1- 4,999 sq. ft)
2. (5,000-19,999 sq. ft)
3. (20,000-49,999 sq. ft)
4. (50,000-249,999 sq. ft)
5. (250,000 -499,999 sq. ft)
6. (500,000+ sq. ft)
8. (Don't know)
9. (Refused)

X4. Approximately, how many employees work at this facility? (PROMPT, IF NECESSARY)

1. (Fewer than 10)
2. (10-49)
3. (50-99)
4. (100-249)
5. (250-499)
6. (500 or more)
8. (Don't know)
9. (Refused)

X5. How many hours a day is this facility generally open on weekdays?

1. (1-5 hours)
2. (6-10 hours)
3. (11-16 hours)
4. (17-23 hours)
5. (24 hours)
6. (Not at all)
8. (Don't know)
9. (Refused)

X6. How many hours a day is this facility generally open on weekends?

1. (1-5 hours)
2. (6-10 hours)
3. (11-16 hours)
4. (17-23 hours)
5. (24 hours)
6. (Not at all)
8. (Don't know)
9. (Refused)

X7. What type of primary cooling system is used for space cooling at this facility?

1. Direct expansion (DX) air conditioning (e.g. packaged roof-top units, split-AC units, heat pumps, through-the-wall AC units)
2. Cooling Chiller
3. (Other, Specify)
4. Building does not have cooling
8. (Don't know)
9. (Refused)

X8. What type of primary heating system is used for space heat at your facility?

1. Electric resistance heating (e.g. electric furnace, baseboard heating, unit heaters)
2. Heat Pump
3. Gas Furnace
4. Gas Boiler
5. Other, specify
6. Building does not have heating
8. (Don't Know)
9. (Refused)

X9. What type of fuel does your hot water heater system have at your building?

1. Electric
2. Gas
3. Other, specify
4. Building does not have water heating
8. (Don't Know)
9. (Refused)

[SKIP IF F4 <> 1]

X10. Approximately, what is the average monthly electric bill at this location?

1. ($100-$999)
2. ($1,000-$2,999)
3. ($3000-$4999)
4. ($5,000-$9,999)
5. ($10,000-$14,999)
6. ($15,000+)
8. (Don't know)
9. (Refused)

X11. Does your company have an annual budget for implementing energy efficiency improvements in your facility?

1. Yes
2. No
998. (Don't know)
999. (Refused)

[SKIP TO X14 IF X11 <> 1]

X12. Is the budget for energy efficiency improvements included as part of your company's overall budget for capital investments, or is it a separate budgetary item?

1. Included as part of overall capital investment budget
2. Separate budgetary item
998. (Don't know)
999. (Refused)

X13. What is your estimated annual budget for implementing energy efficiency improvements in your facility, as a percent of your annual revenue? PROMPT: "Your best guess is fine"

00. (NUMERIC OPEN END)
01. (None; we don't have one)
99999998. (Don't know)
99999999. (Refused)

X14. What is your title?

1. (President/Owner)
2. (Property Manager)
3. (Other senior executive)
4. (Facility engineer/manager)

5. (Consultant)
00. (Other, specify)
98. (Don't Know)
99. (Refused)

X15. Who else is involved in making decisions about equipment additions or replacements? [MULTIPLE RESPONSE; UP TO 3]

1. (President/Owner)
2. (Property Manager)
2. (Other senior executive)
3. (Facility engineer/manager)
4. (Consultant recommends)
00. (Other, specify)
98. (Don't Know)
99. (Refused)

X16. Thank you again for your participation. Your responses will remain confidential, but may I get your name and title in case I need to call you back?

00. [RECORD NAME]
99. (Refused)

Thank you for your time. Those are all my questions.

Appendix C. Site Survey Data Collection Instrument

Commercial Onsite Survey

Michigan State

General Info (Complete before visit if possible, and finish on-site):

Company name: _____

Contact Information:

Name: _____

Title: _____

Phone number: _____

Email address: _____

Mailing address: _____

Gas account #: _____

Annual therm usage: _____

Engineer name: _____

Date: _____

Gas meter numbers:

_____

_____

_____

_____

Gift Card

Received Card (Signature): _____ Date Received: _____

Record Card Number: _____

1. Is this building occupied all year? Y / N / DK

   a. If No, then circle months:

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

2. What is the weekly occupancy schedule of this building?

Day	Business Hours (Business is Open)	Occupied Hours (when people are onsite)	Closed All Day?	Open 24 Hours?
Sunday	From: ____ To: ____	From: ____ To: ____	□	□
Monday	From: ____ To: ____	From: ____ To: ____	□	□
Tuesday	From: ____ To: ____	From: ____ To: ____	□	□
Wednesday	From: ____ To: ____	From: ____ To: ____	□	□
Thursday	From: ____ To: ____	From: ____ To: ____	□	□
Friday	From: ____ To: ____	From: ____ To: ____	□	□
Saturday	From: ____ To: ____	From: ____ To: ____	□	□

3. How many people, on average, occupy this building? _____

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

Education	Grocery	Health	Lodging	Office	Restaurant	Retail	Warehouse	Other

5. If Other: Please describe: _____

6. If Lodging:

   a. How many rooms does this building have? _____

   b. What is the average annual occupancy? _____

Building Information

7. What year was primary construction completed on the building? _____

8. What is the main entrance orientation? (N,S,E,W) _____

9. How large is this **business** in square feet? _____ ft^2

10. How large is the total **building** (excluding garage) in square feet? _____ ft^2

    a. What percent of the total building square footage from Question 10 is unconditioned?

    __ _____ %

11. If the building has an unconditioned parking garage, how large is it? _____ ft^2

12. A) How many floors is this **business:** B) **This building:**

    Above ground? _____ _____

    Below ground? _____ _____

13. What was the most recent year this building was commissioned?

    _____ N/A DK

14. LEED Building? Please indicate certification level. _____ N/A DK

Envelope

15. Answer all questions for all parts of the business/building associated with the **gas and electric meter numbers** recorded**.**

Building Envelope		
Walls		
Framing Type	*1= Metal 3=Concrete* *2=Wood 4=Masonry*	
Insulation Type	*1= Batt /Blown 2=Rigid* *3= None 4=Unknown*	
Estimated R-Value	DK if unknown	
Windows		
% of Total Wall Area (i.e. window to wall ratio)	*(Average % per wall)*	
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*	
Roofs		
Total Roof Area	(Ft^2, DK if unknown)	
Roof Type	*1=Flat 2=Pitched*	
Surface Material	*1= Built - up 2=Cool Roof* *3=Membrane 4=Metal* *5=Shingles/Flat 6=Green Roof* DK if unknown	
Estimated R-Value	DK if unknown	
Floors		
Floor Type	*1= Basement (conditioned)* *2=Basement (unconditioned)* *3=Crawl* *4= Slab (unconditioned)* DK if unknown	
Estimated R-Value	DK if unknown	

HVAC System

16. Does this business have packaged HVAC units?
    Y / N / DK

    a. If yes, how many total units does this business have?
    _____

17. Does this business have a central air handler?
    Y / N / DK

    b. If yes, how many total air handlers does this business have?

    _____

18. Does this business have a boiler?
    Y / N / DK

    a. If yes, how many total boilers does this business have?

    _____

19. Does this business have a chiller? Y / N / DK

    b. If yes, how many total chillers does this business have?

    _____

20. Does this business have condenser water pumps? Y / N / DK

    c. If yes, how many total condenser water pumps does this business have?

    _____

21. Does this business have chilled water pumps? Y / N / DK

    d. If yes, how many total chilled water pumps does this business have?

    _____

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

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

Packaged HVAC System				
		System 1	System 2	System 3
HVAC System Type	*(see Table Below)*			
Number of Units				
Regular Maintenance?	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Percent of **Business**	*(%)* DK if unknown			
Age	*(Years; estimate to within 5 years if not on nameplate)*			
Temperature Control Type	*(See Table Below)*			
Manufacturer				
Model name	*DK if unknown*			
Model number	*DK if unknown*			
Rated Cooling Capacity	*(Tons, DK if unknown)*			
Rated Heating INPUT Capacity	*(Btu/hr, DK if unknown)*			
Rated Heating OUTPUT Capacity	*(Btu/hr, DK if unknown)*			
Performance Rating	*(Circle One)*	EER / SEER / COP / DK	EER / SEER / COP / DK	EER / SEER / COP / DK
Performance Rating Value	DK if unknown			
Primary Heat:				
Fuel Type	(*see Table Below*)			
Efficiency	(%, DK if unknown)			
Supplemental Heat:				
Fuel Type	*(see Table Below)*			
Efficiency	(% DK if unknown)			
Terminal Reheat Type	*(see Table Below)*			
Insulated Duct	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK

Air-to-Air Heat Recovery	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Economizer	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK

Packaged HVAC System Types			
Packaged single zone AC only	Packaged heat pump, air source	Unit ventilator	Packaged VAV
Packaged single zone – AC w/heat	Packaged HP, ground source	Window/wall AC unit	Evaporative cooler
Packaged single Zone - heat only	Packaged HP, water source	Window/wall heat pump	Split system HP
Packaged multi-zone	Radiant heat	Split system AC	Unit heater

Fuel Types	
Natural gas	Purchase HW or steam
Electric	Wood
Fuel oil	Other (note type)
LPG	

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

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

Ventilation

24. Is an indoor parking garage with ventilation present? Y / N

25. If yes, is the garage ventilation system controlled with CO sensors? Y / N / DK

26. For interior spaces, is any demand-controlled ventilation system employed? Y / N / DK

			Total Number of Hoods
27.	Are ventilation hoods used?	Y/N/DK	
28.	Demand based controls (DCV Controls)?	Y/N/DK	
29.	Variable Volume?	Y/N/DK	
30.	Is make up air provided direct to ventilation hood?	Y/N/DK	

Domestic Hot Water

31. Does this business have domestic hot water? Y / N / DK

    a. If yes, how many total hot water heaters does this business have?

    _____

32. Faucets < 2.2 gpm (low flow) _____ Faucets > 2.2 gpm: _____

    Showerheads < 2.5 gpm (low flow) _____ Showerheads > 2.5 gpm _____

Domestic Hot Water				
		System 1	System 2	System 3
Water Heat type	*(see Table Below)*			
Fuel Type	*(see Table Below)*			
Age	*(Years)*			
Location	*(Conditioned or Unconditioned*			
Manufacturer				
Model Name/ Number	DK if unknown			
Tank Capacity	(Gal, DK if unknown)			
Input Capacity	(kW or Btu/hr, DK if unknown)			
Output Capacity	(only for gas, Btu/hr, DK if unknown)			
Recovery rate	(Gal/hr, DK if unknown)			
Efficiency	*(EF*, DK if unknown*)*			
Tank Wrap	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Pipe Wrap	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Circulation Pump	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Continuously Circulating	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Set-Point	*(^0F, DK if unknown)*			
Is a Setback Used	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Is Drain Water heat Recovery Used	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK

Water Heater Types
1=Heat Pump
2=Heat Recovery
3=Instantaneous (Tankless)
4=Self-Contained
5=Storage Tank (Central Boiler)
6=Self-Contained Storage
7=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	

Lighting

33. Fill in Lighting Spreadsheet (separate page) fully, for both interior and exterior lighting.

34. Are there skylights in the building? Y / N

    a. Are skylights used as a light source in the building? Y / N

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

36. What type of exit signs does this building have – see table below?_____

Type	Count
Incandescent	
Compact fluorescent	
LED	
Other (note type)_	
Don't Know	

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

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

	Total Number of Units	Age (years) DK if don't know	Frequency of Use (hrs/wk) DK if don't know	EnergyStar? (Total number of units)
1. Personal Computers				
2. Laptops				
3. Secondary Monitors				
4. Servers				
5. Combination printer/scanner/ copier/fax				
6. Printers				
7. Scanners				
8. Photocopiers				
9. Fax Machine				
10. Water coolers				
11. Battery Chargers				
12. Snack Machines				
13. Beverage Machines				
14. Residential Style Refrigerators				

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

Are power supplies 80% efficiency (80 Plus)? _____%

Are any vending machine controllers used? Y / N / DK

If either a residential or commercial clothes washer and/or dryer is present, please complete the table below:

	Washers		Dryer
	Front Load	Top Load	
Number of Units			
Ozonating Cycle?	Y / N / DK		--
Age (years) (DK if don't know)			
Loads per week (DK if don't know)			
Total number EnergyStar?			
Dryer fuel type (1=electric, 2=natural gas, 3=propane)	--	--	
Efficiency (MEF) DK if don't know			--

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

	Type 1	Type 2	Type 3
Number of Units			
Age (years) DK if don't know			
Manufacturer DK if don't know			
Model Name/Number DK if don't know			
Loads per week DK if don't know			
Energy Star?	Y / N		
Efficiency (EF) DK if don't know			

Are commercial dishwashers used? Y / N

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

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

    e. If yes, what is the fuel of the booster heater? Electric / Gas

Cooking

42. Does this building have any commercial kitchen equipment? Y / N / DK

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 of units	Age (years) DK if unknown	Frequency of Use (hrs/wk) DK if unknown	EnergyStar ?
1. Standard Oven	E / G				Y / N / DK
2. Convection Oven	E / G				Y / N / DK
3. Range	E / G				Y / N / DK
4. Fryer	E / G				Y / N / DK
5. Hot food holding cabinet	E / G				Y / N / DK
6. Steam Cooker	E / G				Y / N / DK
7. Griddle	E / G				Y / N / DK
8. Conveyor Oven	E / G				Y / N / DK

43. **Refrigeration**

44. Does this building have any commercial refrigeration equipment? Y / N

45. (Non-residential-style refrigerators)

46. Total Refrigeration System capacity:_____Tons / DK

47. Refrigeration equipment details for stand alone :

	Total Size (ft^3)	Qty	Stand alone ?	Age (years)	Energy-Star?
1. Solid door refrigerator/freezer					Y / N / DK
2. Glass door refrigerator/ freezer					Y / N / DK

48. Refrigeration equipment details:

(Types: 3=Open Medium Temp Display Case, 4=Open Low Temp Display Case, 5=Display case with doors)

	Total linear ft
3. Open medium temp display case	
4. Open low temp display case	
5. Display case with doors	

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

	Type	Size (ft^2)	Age (years) DK if unknown	Lighting (Fluorescent, LED, None)	Compressor (hp) DK if unknown
System 1					
System 2					
System 3					
System 4					
System 5					
System 6					
System 7					

49. Are there multiplex compressor systems used? Y / N / DK
50. Are anti-sweat heater controls used on display case doors? Y / N / DK
51. What type of lights do display cases have? _____
52. (1=fluorescent, 2=LED)
53. Are VFDs used on compressors? Y / N / DK
54. Are demand defrost controls used? Y / N / DK
55. Are floating head pressure controllers used? Y / N / DK
56. Are high-efficiency evaporator fans used? Y / N / DK
57. Are night covers used on open display cases? Y / N / DK
58. Are evaporator fan controls used? Y / N / DK

59. Has this refrigeration system been commissioned? Y / N / DK

60. Is a heat recovery system used? Y / N / DK

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

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

Ice maker details:

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

Central HVAC System -Air Handler				
		System 1	System 2	System 3
HVAC System Type	(*See table below, DK if unknown*)			
Temperature Control Type	(*See table below, DK if unknown*)			
Percent of total **business** sq.ft.	(% or DK)			
Does this system serve more than this **business**?	(Y/N/DK)			
Manufacturer	*DK if unknown*			
Model name	*DK if unknown*			
Model number	*DK if unknown*			
Cooling Coils	(*Circle One*)	Y / N / DK	Y / N / DK	Y / N / DK
Heating Coils	(*Circle One*)	Y / N / DK	Y / N / DK	Y / N / DK
Terminal Reheat Type	*(see Table above)*			
Supply Fans:				
Volume Control	VFD	Y / N	Y / N	Y / N
Quantity				
Total Motor HP				
Motor Efficiency	*(S, PE, DK if unknown)*			
Return Fans:				
Volume Control	VFD	Y / N	Y / N	Y / N
Quantity				
Total Motor HP				
Motor Efficiency	*(S, PE, DK if unknown)*			

HVAC System Type		
CV single zone	VAV cooling only	Hydronic heat pump
CV Multi-zone	VAV terminal reheat	Induction
CV dual duct	VAV dual duct	Radiant heat
CV terminal reheat	Fan coil	PTAC
FPS Fan powered VAV series	Baseboard	Unit ventilator
FPP Fan powered VAV parallel	Heat & vent	Radiator

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

Central HVAC System- Boiler				
		System 1	System 2	System 3
Fuel Type	*(see Table Below)*			
Regular Maintenance	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Percent of **business**	*(%, DK if unknown)*			
Does this system serve more than this business?		Y / N / DK	Y / N / DK	Y / N / DK
Age	*(Years, estimate to within 5 years if not on nameplate)*			
Temperature Control Type	*(See Table Below)*			
Manufacturer				
Model name/ Number	*DK if unknown*			
Input Capacity	*(Btu/h, DK if unknown)*			
Output Capacity	*(Btu/h, DK if unknown)*			
Number of Boilers				
Number of Units on Standby				
Hot Water Pumps				
Quantity				
Total Motor HP				
Motor Efficiency	*(S, PE)*			
Capacity Control Type	*One Speed* *Two Speed* *2=Variable Speed*			
Heating Pipes Insulated	*(Circle One)*	Y / N	Y / N	Y / N

38. Estimate of uninsulated pipe:_____ Linear Ft./meters ___ In./cm Diameter
39. Estimate of uninsulated fittings: _____ Quantity In./cm Diameter

Fuel Types	
Natural gas	Purchase HW or steam
Electric	Wood
Fuel oil	Other (note type)
LPG	

Central HVAC System- Chiller				
		System 1	System 2	System 3
Chiller Type	*(see Table Below)*			
Regular Maintenance	*(Circle One)*	Y / N / DK	Y / N / DK	Y / N / DK
Percent of **business**	*(%)*			
Does this system serve more than this business?	*(Y/N/DK)*			
Age	*(Years, estimate to within 5 years if not on nameplate)*			
Temperature Control Type	*(See Table Below)*			
Chiller Manufacturer				
Model name/ Number	*DK if unknown*			
Rated Cooling Capacity	*(Tons, DK if unknown)*			
Performance Rating	*(Circle One)*	EER - IPLV - kW/ton	EER - IPLV - kW/ton	EER - IPLV - kW/ton
Performance Rating Value	*DK if unknown*			
Compressor Design Full load KW	*DK if unknown*			
Number of Chillers				
Number of Units on Standby				
Heat Rejection System				
Condenser Type	*(See Table Below)*			
Capacity Control Type	*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)*			
Total Fan Horsepower	*(HP)*			

Chiller Types	
Centrifugal	Absorption, hot water
Reciprocating	Absorption, steam
Rotary	Absorption, natural gas
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

		System 1	System 2	System 3
Pump Use	*1= Primary* *2=Secondary* *DK if unknown*			
Quantity				
Total Motor Horsepower	*(HP) DK if unknown*			
Motor Efficiency	*(S, PE) DK if unknown*			
Capacity Control	*1= Constant Speed* *2=Variable Speed* *DK if unknown*			
Temperature Control Type	(See Table Below) *DK if unknown*			
Number of Units on Standby	*DK if unknown*			

Condenser Water Pumps

Quantity	*DK if unknown*			
Total Motor HP	*(HP) DK if unknown*			
Motor Efficiency	*(S, PE) DK if unknown*			
Capacity Control	*1= Constant Speed* *2=Variable Speed* *DK if unknown*			
Temperature Control Type	(See Table Below) *DK if unknown*			
Number of Units on Standby	*DK if unknown*			

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

Water

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

64. What type of fuel is used to heat the pool? [Check one]G / E / P / Other: _____

65. Size of pool in gallons _____

66. Indoor or outdoor? _____

67. Is a pool cover used? Y / N

68. What is the water temperature setting? _____

69. If indoor pool, what is the space heat temperature setting? _____

70. When is the pool used?

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

71. Pool pump details:

	Pump 1	Pump 2	Pump 3	Pump 4
Age (years) DK if unknown				
Manufacturer DK if unknown				
Model Number DK if unknown				
Size (hp) DK if unknown				
RPM DK if unknown				
Enclosure Type (1=ODP, 2=TEFC)				
Efficiency (%)DK if unknown				

72. How are the pool pumps controlled? DK if unknown

	Pump 1	Pump 2	Pump 3	Pump 4
Runs continuously				

Timer				
VSD				
Other				

Hot Tubs / Spas

1. Does this building have a hot tub/spa?..... Y / N
2. Indoor or Outdoor? ..... I / O
3. Is a cover used? ..... Y / N
4. What is the water temperature setting? ..... _____
5. If indoor, what is the space heating temperature setting?..... _____
6. What type of fuel is used to heat the hot tub? [Circle one].....G / E / P / Other
7. When is the hot tub used?

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

Other Process Loads

73. Does this building have a compressed air system_____Y / N
    a. If Yes, total HP of air compressor system: _ / DK

Renewable Energy

74. Does this building have any renewable energy systems? Y / N / DK
75. If so what type? (e.g. solar, wind) _____
76. What is the capacity of the system? (MWh, Annual kWh, max kW)_____ / DK