KANSAS CITY POWER & LIGHT 2016 DSM POTENTIAL STUDY

VOLUME 2: MARKET RESEARCH

FINAL REPORT

Prepared for:
Kansas City Power and Light

April 19, 2017

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AEG would also like to acknowledge the valuable contributions of

The Brattle Group
The Blackstone Group
Washington University in St. Louis

INTRODUCTION

Kansas City Power and Light Company (KCP&L) engaged the Applied Energy Group (AEG) Team to conduct this Demand Side Management (DSM) Market Potential Study. It evaluates various categories of electricity DSM resources in the residential, commercial, and industrial sectors of KCP&L's service territory in Kansas and Missouri for the years 2019-2037. The resource categories investigated are: Energy Efficiency, Demand Response, Demand-Side Rates, and Combined Heat & Power.

The key objectives of the study are to:

- Perform a comprehensive analysis that complies with the respective statutory requirements of the Missouri Public Service Commission and the Kansas Corporation Commission
- Develop annual electricity energy and peak demand potential estimates for the DSM resource categories by customer class for each KCP&L jurisdiction for the time period of 2019 to 2037
- Develop baseline projections of annual electricity use and peak demand for each KCP&L jurisdiction, accounting for future codes and standards, naturally occurring energy efficiency, opt-out customers, smart connected devices, and combined heat and power
- Identify a subset of economic and program potential that is applicable to low-income customers
- Conduct a reliable, accurate and useful residential appliance saturation survey and C&I end-use saturation survey
- Quantify potential program savings from the DSM initiatives at various levels of cost
- Support KCP&L's effort to offer programs to all customer market segments while achieving the ultimate goal of all cost-effective demand-side savings

The study assesses various tiers of potential including technical, economic, maximum achievable, and realistic achievable potential. The study developed updated baseline estimates with the latest information on federal, state, and local codes and standards for improving energy efficiency.

As part of the study, the AEG Team conducted primary market research to collect data for the KCP&L service territory, including: end-use equipment saturation data and customer demographics and firmographics. All models and assumptions include the results from these primary market research efforts.

KCP&L will use the results of this study in its DSM and IRP planning process to optimally implement programs across its four service territories: Kansas City Power & Light Missouri (KCP&L-MO), Kansas City Power & Light Kansas (KCP&L-KS), Greater Missouri Operations Missouri Public Service (GMO-MPS), and Greater Missouri Operations St. Joseph Light & Power (GMO-SJLP).

REPORT ORGANIZATION

This report is presented in five volumes:

- Volume 1, Executive Summary
- Volume 2, Market Research Report
- Volume 3, Potential Analysis
- Volume 4, Program Potential
- Volume 5, Appendices

This document is Volume 2: Market Research.

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PRIMARY MARKET RESEARCH METHODOLOGY

The goal of the primary market research was to develop information that could be used to drive estimates of DSM potential within the KCP&L service territory. The results of this research are the primary basis for the sector market profiles and equipment and measure baselines in the subsequent potential analysis when integrated with other data from KCP&L, AEG, and third-party sources.

In this chapter, we begin by describing the methodology and research approach that was implemented. This is followed by a chapter of findings and results for residential customers, and finally a chapter of findings and results for non-residential customers.

RESIDENTIAL MARKET RESEARCH METHODOLOGY

The residential market research was structured to represent all households served by KCP&L, with a household defined as a single energy-using customer at a unique, contiguous location. Households were assumed to include single-family homes, manufactured homes, or units in multi-family dwellings, as long as those units are billed directly for some unique electricity use.

The research design involved using mailed survey packages to solicit the completion of questionnaires by a representative sample of customers. The package of information mailed to each sampled customer included:

- A cover letter which outlined the goals of the research.
- A paper version of the survey, along with a pre-paid return envelope.
- Information about how to complete the survey online, rather than on paper, should the respondent choose this alternative.
- Information about how to receive the incentive of $10, which was offered to the first 3,200 customers that completed the survey.
    - With the exception that 1,000 respondents in the first wave of mailings were not offered an incentive (to test the impact of the incentive on response rates).

RESIDENTIAL QUESTIONNAIRE DESIGN

The questionnaires made available to respondents (paper or online) had the following sections:

- End uses for which the household is billed for energy use
- Fuel used by each end use
- Cooling / heating system characteristics
- Thermostat characteristics and usage
- Water heater characteristics
- Lighting counts by type and location
- Presence and counts for other appliances and electronics
- EE-related actions taken currently and in the last five years
- Windows by type

- Overall home characteristics
- Demographics

Paper surveys were seven pages in length, while online surveys navigated through the same questions on multiple screens and took an average of sixteen minutes to complete.

RESIDENTIAL SAMPLE DESIGN

In order to design and draw the sample of customers that would be invited to complete a survey, the Team prepared the sample universe, then developed a sample design, and finally, drew an appropriate sample.

RESIDENTIAL SAMPLE PREPARATION

The first step of this process – preparing the sample universe – meant working with an initial list of all residential customer accounts drawn from KCP&L billings records, and then cleaning that file to generate a list of all premises (households) eligible to participate in the survey.

KCP&L generated a list of all residential customer accounts with at least nine months of usage in the prior twelve months. As indicated in Table 1-1 below, this list included just over 956,000 accounts that used 8,396 GWh of electricity in the prior twelve month period. Preparing this initial list of all customer accounts to create a valid sample universe for the survey included the following steps:

- Remove accounts that could be identified as non-residential or were specifically identified as being of an "unknown" type.
- Remove accounts that had premise / mailing addresses with only numeric content (since these would not be valid mailing addresses).
- Merge separate account listings that had identical addresses and customer names.
- Remove premises with annual kWh below the cutoff established by the Team (1,000).

Table 1-1 outlines the outcome of each of these steps. In total, 17.6% of the original accounts were eliminated or merged, although the accounts that were eliminated consume only 4.6% of the total electricity used by all of the accounts. Note that accounts removed as non-residential were those which had customer names that were clearly business names, or the names of churches, as well as those which were labelled as house meters, grain bins, feed lots, sheds, wells, or other non-residential structures.

Table 1-1 Residential Sample Universe Conditioning

Segment	Households	% of Original Accounts	Annual GWh	% of Original GWh
Original file provided by KCP&L	956,505	100.0%	8,396	100.0%
Accounts removed as non-residential or identified specifically as unknown*	24,679	2.5%	276	3.3%
Accounts removed due to no letters in address	4,689	0.5%	57	0.6%
Merged accounts with identical addresses and customer names	9,893	1.0%	n/a	n/a
Removed accounts with annual kWh below cutoff (1,000 kWh annual)	129,279	13.5%	45	0.5%
Total	**787,965**	**82.4%**	**8,017**	**95.4%**

The outcome of these sample conditioning steps was the creation of a sample universe which included all of the premises that were eligible for inclusion in the survey (the sample frame) and defined the universe of customers which the survey results would represent.

Residential Sample Design

The residential household sample universe defined above was segmented by housing type (single-family and multi-family) and operating company based on information provided in the sample records. Table 1-2 below outlines the distribution of premises for each of the defined sample cells (housing type by operating company) by total premises and by energy usage.

The Team defined a single sample design, deciding to target 800 completed surveys within each operating company, for a total of 3,200 surveys. The reason for the choice of sample size was (1) partly to reflect prior research conducted by KCP&L, and (2) partly to ensure that overall precision targets were met (800 completed surveys within each operating company should yield 95% confidence intervals of no more than +/- 3.5%). Within each service territory, the total of 800 interviews was allocated to single- and multi-family premises based on the distribution of single- to multi-family premises within each operating company. More specifically, sample sizes were allocated by housing type using a Neyman distribution, which prioritizes segments based on the variance in their energy use. This means the total of 800 completed interviews assigned to each operating company were assigned proportionally to the two housing types based on the population share in each of the two housing types multiplied by the standard deviation of kWh usage within that cell.

Table 1-2 Residential Sample Design

Territory	Segment	Annual Electricity Usage (GWh)	% Total GWh	Total Premises (N)	Target Sample	Total Premises (N)
GMO-MPS	Single-family	2,399	30%	200,497	736	23%
	Multi-family	225	3%	35,930	64	2%
	Total	**2,624**	**33%**	**236,427**	**800**	**25%**
GMO-SJLP	Single-family	579	7%	48,086	659	21%
	Multi-family	115	1%	12,637	141	4%
	Total	**694**	**9%**	**60,723**	**800**	**25%**
KCP&L-KS	Single-family	2,103	26%	169,569	675	21%
	Multi-family	381	5%	64,211	125	4%
	Total	**2,484**	**31%**	**233,780**	**800**	**25%**
KCP&L-MO	Single-family	1,754	22%	172,495	593	19%
	Multi-family	460	6%	84,540	207	6%
	Total	**2,215**	**28%**	**257,035**	**800**	**25%**
TOTAL	Single-family	6,836	85%	590,647	2,663	83%
	Multi-family	1,181	15%	197,318	537	17%
	GRAND TOTAL	**8,017**	**100%**	**787,965**	**3,200**	**100%**

Residential Survey Fielding

Given the fact that the sample universe had already been assigned to the appropriate cells of the sample matrix, the Team selected a sample for the survey mailings. Based on prior KCP&L experience, but recognizing that the planned survey was longer than surveys used by the company in the past, the Team drew a random sample of 32,000 premises. The working assumption was that overall survey response rates would be at least 10% (yielding at least 3,200 responses from 32,000 invitation packages mailed). The total number of 32,000 premises selected were sampled at a ratio of ten times the targeted numbers of survey completes within each of the cells of the sample design.

The 32,000 premises (ten per targeted completed interview per cell) was then split into two mailing waves.

- The first mailing wave included 20,000 premises (6.3 sample points per targeted completed interview per cell).

- A second wave of 12,000 premises (3.7 sample points per targeted completed interview per cell) was prepared, with the recognition that a second mailing might not be necessary, at least not for all of the sample cells.
- In fact, based on Wave 1 responses, just over 3,000 Wave 2 invitations were sent to households in the sample cells that were not filled from the Wave 1 mailing.
- Wave 1 survey invitations were mailed during the last week of March 2016, with Wave 2 survey invitations mailed during the last week of April. Data collection was closed mid-May 2016.
- The reason for parsing the total sample draw into two waves was (1) to minimize mailing costs, since the Wave 2 mailing could be implemented only as necessary, and (2) to minimize the number of returned surveys that might not be eligible for an incentive (because they were over-quota), thereby reducing possible negative customer feedback on these grounds.
- Note that survey invitation packages were sent to the mailing address included in the KCP&L customer file that was associated with sampled premises, even if this was different from the service address. However, survey invitation cover letters (and the survey itself) referenced the service address and survey respondents were specifically asked to respond for the service (premise) address.

Note that, in addition, a random selection of 1,000 of the Wave 1 mailings received a cover letter that did not mention the incentive. The goal of this action was to test the impact of the $10 incentive on response rates.

Table 1-3 below indicates the total mailings and responses received by sample design cell. Note that, given robust response rates to the Wave 1 mailings in several sample design cells, Wave 2 mailings were only necessary in some of the sample cells (most notably, the multi-family cells).

Table 1-3 Residential Sample Design, Survey Fielding

Territory	Segment	Target Sample Size	Wave 1 Survey Invitations Mailed	Responses to Wave 1 Invitations	Wave 2 Survey Invitations Mailed	Responses to Wave 2 Invitations
GMO-MPS	Single-family	736	4,600	937	0	0
	Multi-family	64	400	57	240	30
	Total	**800**	**5,000**	**994**	**240**	**30**
	Single-family	659	4,119	848	0	0
GMO-SJLP	Multi-family	141	881	140	529	4
	Total	**800**	**5,000**	**948**	**529**	**4**
KCP&L-KS	Single-family	675	4,219	904	0	0
	Multi-family	125	781	78	469	37
	Total	**800**	**5,000**	**982**	**469**	**37**
	Single-family	593	3,706	562	1,112	100
KCP&L-MO	Multi-family	207	1,294	156	776	44
	Total	**800**	**5,000**	**818**	**3,000**	**144**
Total	Single-family	2,663	16,644	3,251	1,112	100
	Multi-family	537	3,356	431	2,014	115
	GRAND TOTAL	**3,200**	**20,000**	**3,682**	**3,126**	**215**

Of the total of 3,897 questionnaires that were completed, 21.1% were filled out online, while 78.9% were filled out on paper and returned by mail. Only 807 invitation packages (4.1%) were returned as undeliverable.

The net survey response rate for the total sample was 16.9%. The response rate was substantially higher for invitations sent to households in single-family homes (19.0%) than it was for those sent to

households in multi-family homes (10.7%). The response rate for households that were not offered an incentive was 14.1%.

Since more responses were received in some cells than were required to meet the precision estimates that were built into the sample design, the Team did not process all of the returned surveys. Ultimately, in order not to incur the costs associated with processing unnecessary surveys, the Team chose to process all of the returned multi-family surveys but only to process returns from single-family households up to the total target sample size. Final sample sizes and their associated 95% confidence intervals are reported in Table 1-4 below.

Table 1-4 Residential Final Fielded Sample for Analysis

Territory	Segment	Target Sample Size	Surveys Processed (Final Sample Size)	95% Confidence Interval
GMO-MPS	Single-family	736	736	+ / - 3.6%
	Multi-family	64	87	+ / - 10.5%
	Total	**800**	**823**	**+ / - 3.4%**
	Single-family	659	659	+ / - 3.8%
GMO-SJLP	Multi-family	141	144	+ / - 8.2%
	Total	**800**	**803**	**+ / - 3.5%**
KCP&L-KS	Single-family	675	675	+ / - 3.8%
	Multi-family	125	115	+ / - 9.1%
	Total	**800**	**790**	**+ / - 3.5%**
	Single-family	593	593	+ / - 4.0%
KCP&L-MO	Multi-family	207	200	+ / - 6.9%
	Total	**800**	**793**	**+ / - 3.5%**
Total	Single-family	2,663	2,663	+ / - 1.9%
	Multi-family	537	546	+ / - 4.2%
	GRAND TOTAL	**3,200**	**3,209**	**+ / - 1.7%**

RESIDENTIAL SAMPLE WEIGHTING

Since the sample design was intentionally structured to be disproportionate by segment, it was necessary to weight the file of survey respondents once the fielding was complete. To clarify, the sample was disproportionate in the sense that the total sample for each operating company was approximately equal, even though the total number of households in each operating company varies substantially (for example, there are approximately 236,000 households in the GMO-MPS territory compared to only approximately 61,000 households in the GMO-SJLP territory). This was done in order to ensure that each operating company and housing type had adequate sample sizes to support independent, segment-specific, analyses. In order to account for the disproportionate sample design, the total survey sample was weighted on the basis of housing type and operating company so that the final total sample characteristics on these characteristics are representative of the underlying population on these attributes. These weights are applied in the survey results presented in the remainder of this volume and in the data utilized in the potential analysis in subsequent volumes.

NON-RESIDENTIAL MARKET RESEARCH METHODOLOGY

The non-residential primary market research was structured to represent all of the business establishments served by one of the KCP&L operating companies. For the purposes of this research a "business establishment" was defined as including all of the energy used by a given business at a single contiguous location. By this definition, a single business enterprise could have multiple separate business establishments represented in the survey (e.g., when a given retail enterprise operates multiple stores as separate locations). Alternatively, a single business establishment could include

multiple buildings (as long as they are located in a contiguous property) and be served by multiple electric and / or gas meters.

The research design chosen for this sector involved the use of both onsite interviews and telephone surveys to complete questionnaires by a representative sample of non-residential customers. Potential survey respondents were first screened by telephone to determine eligibility (and the eligibility of the sampled premise) for the survey, and if qualified to respond, were asked to complete the survey, either immediately, or at their earliest convenience. Respondents to the telephone survey were asked to respond for the sampled business establishment, even if this was not their current, or regular, location. Respondents were also offered a 'thank you' payment of $10 for completing the survey.

NON-RESIDENTIAL QUESTIONNAIRE DESIGN

The questionnaires that were used in the survey had the following sections:

- Screening questions that qualified business establishments for the survey as having enclosed space (not an outdoor structure or operation, such as a billboard, parking lot, communications tower, etc.)
- Screening questions that qualified respondents to complete the survey as being knowledgeable about energy operations at the sample business establishment
- Type of business activity conducted at the facility
- Own / lease status
- Number of employees present
- End uses included in electric bill
- Square footage occupied
- Days and hours of operation
- Characteristics of windows and roof
- Characteristics of heating and cooling systems
- Characteristics of temperature control systems
- Characteristics of water heating systems
- Characteristics of facility lighting systems and controls
- Characteristics of office equipment
- Characteristics of kitchen equipment
- Characteristics of warehouse facilities
- Characteristics of laundry equipment
- Characteristics of pools / spas
- Characteristics of motors present
- Characteristics of EV charging stations
- Characteristics of on-site generation units
- Information on energy efficiency measures taken in the last three years

The telephone surveys took an average of 21 minutes to complete, while onsite surveys took an average of approximately an hour to complete.

NON-RESIDENTIAL SAMPLE DESIGN

In order to design and draw the sample of customers that would be interviewed for the survey, the Team prepared the sample universe, then developed a sample design, and finally, drew an appropriate sample.

NON-RESIDENTIAL SAMPLE PREPARATION

The first step of this process -- preparing the sample universe -- meant working with an initial list of all non-residential customer accounts drawn from KCP&L billings records, and then cleaning that file to generate a list of all establishments eligible to participate in the survey.

As is indicated in Table 1-5 below, the original file of just over 93,000 customer accounts ultimately yielded just over 33,000 eligible premises that could be used for the survey. Just over 18,000 accounts were eliminated because they were likely to be outdoor structures (railroad crossing, signs, cell towers, etc.), or were residential accounts. Another 8,300 accounts were merged into contiguous accounts to create premises (because they shared identical or adjacent addresses). Finally, almost 34,000 premises were eliminated because they had either less than nine months of usage data during the last twelve months or had usage below the minimum annual usage cutoff. It is worth noting that even with these exclusions, the in-scope premises account for almost 97% of the annual usage for all premises.

Table 1-5 Non-Residential Sample Universe Conditioning

Segment	Number of Accounts / Premises	% of Accounts / Premises	Annual GWh	% of Original GWh
Original file provided by KCP&L	93,260	100.0%	13,886	100.0%
Excluded Accounts				
Telecom / utility	11,447	12.3%	1,531	11.0%
Construction	2,989	3.2%	142	1.0%
Residential	2,823	2.7%	75	0.5%
Railroad	359	0.4%	13	0.1%
Signs / Advertising	610	0.7%	4	<0.1%
Total Excluded Accounts	18,228	19.5%	1,765	12.6%
Total in-scope accounts after exclusions (% as a proportion of accounts)	***75,032***	***80.5%***	***12,121***	***87.3%***
Accounts merged to create aggregated premises	8,297	8.9%	n/a	n/a
In-scope customer premises	***66,735***	***100%***	***12,121***	***100%***
Premises removed for having less than 9 months of billing data	6,005	9.0%	286	2.4%
Premises removed for having less than 12 MWh use per year	27,612	41.4%	118	1.0%
Final Total of Eligible In-Scope Sample Premises (% as proportion of premises)	**33,118**	**49.6%**	**11,713**	**96.6%**

NON-RESIDENTIAL SAMPLE DESIGN

For non-residential customers, the sample design process started by reviewing the electricity use indicated in KCP&L customer records by premise and mapping each premise to a business segment using KCP&L-assigned SIC codes. SIC codes for the 500 largest accounts overall and the top 20 accounts in each segment were reviewed manually and adjusted as appropriate. After isolating KCP&L's largest customers, the remaining premises were combined into a manageable number of business segments for sample design purposes:

- Commercial segments

  - Office
  - Retail
  - Restaurant
  - Grocery
  - College
  - Schools
  - Health
  - Lodging
  - Warehouse
  - Miscellaneous
- Industrial segments
  - Energy-intensive manufacturing
  - Non-energy-intensive manufacturing
  - Other industrial
- Unknown

Energy use totals for each of the defined business segments are outlined in Table 1-6 below, which also describes the number of premises assigned to each segment. Note that the values in this table represent all non-residential customer premises across the four KCP&L operating companies. Because of the total size of the customer universe involved, the Team chose to conduct the analysis for KCP&L in total, rather than individually for each of the four operating companies.

Table 1-6 Initial Energy Use Characteristics by Non-Residential Segment

Sector	Segment	Annual GWh	% of GWh	N of Premises
Commercial	Office	2,569	22%	8,577
	Retail	1,001	9%	5,658
	Restaurant	344	3%	1,856
	Grocery	450	4%	845
	College	152	1%	103
	Schools	584	5%	857
	Health	787	7%	911
	Lodging	227	2%	323
	Warehouse	271	2%	1,021
	Miscellaneous	707	6%	2,744
Industrial	Energy-intensive manufacturing	837	7%	358
	Non-energy-intensive manufacturing	710	6%	227
	Other industrial	2,197	19%	2,107
Unknown	Unknown	877	7%	7,521
TOTAL		**11,713**	**100%**	**33,118**

Within each segment, the largest premises were identified and set aside as the sample for the onsite surveys. For the remaining universe of customer premises, three-to-four size strata were defined for each segment. Breakpoints for the size strata within each segment were determined using the Dalenius-Hodges approach, which ensures that strata breakpoints minimize the variance within strata.

The Team chose a total target sample size of 800 respondents because this seemed to best balance needs for precision (offering a 95% confidence interval of no more than + / - 3.5%) and cost for the total KCP&L service territory. KCP&L also wanted to conduct onsite interviews with the largest customers, partly for customer service reasons and partly in recognition of the fact that these customers are more likely to participate in an onsite interview than to participate in a traditional telephone survey. Ultimately, the Team chose to allocate 40 of the total of 800 interviews to onsite interviews with KCP&L's largest customers, with the remaining 760 interviews assigned to the telephone sample design.

A total of 62 premises were selected to provide the sample for the 40 onsite interviews. The remaining 33,056 eligible premises comprised the sample universe for the 760 telephone surveys. This target sample of 760 completed surveys was allocated across strata using a Neyman allocation in a similar manner as applied during the residential sample design. Table 1-7 below shows the final sample segmentation by size. It also shows the target sample size ultimately assigned to each segment, along with the total number of premises in each segment and the number of premises selected for the survey. The premises selected for the telephone survey included all of the premises in the cell up to a ratio of 25:1 for each targeted survey to be completed (so if there were five interviews targeted for completion in a given cell, all of the premises in the cell were selected if there were up to 125 premises in the cell - if there were more than 125 premises in the cell, then 125 premises were randomly selected from that group).

Table 1-7 Non-Residential Sample Design by Premise Size and Segment

Sector	Segment	Size	Total N of Premises	Sample Selected	Target N of Completions
Commercial	Office	Smaller	7,572	5,325	73
		Medium	859	859	76
		Larger	141	141	104
	Retail	Smaller	4,107	325	13
		Medium 1	1,140	793	15
		Medium 2	325	325	16
		Larger	82	82	17
	Restaurant	Smaller	1,068	125	5
		Medium	549	150	6
		Larger	237	150	6
	Grocery	Smaller	652	434	8
		Medium	123	123	10
		Larger	68	68	7
	College	Smaller	63	63	2
		Medium	22	22	2
		Larger	11	11	2
	Schools	Smaller	568	568	14
		Medium	228	228	12
		Larger	60	60	12
	Health	Smaller	771	771	23
		Medium	114	114	16
		Larger	23	23	23
	Lodging	Smaller	249	249	6
		Medium	68	68	6
		Larger	16	16	6
	Warehouse	Smaller	846	354	6
		Medium	144	144	7
		Larger	27	27	8
	Miscellaneous	Smaller	2,056	218	8
		Medium 1	495	495	9
		Medium 2	151	151	9
		Larger	36	36	10
Industrial	Energy Intensive Mfg.	Smaller	306	306	14
		Medium	30	30	11
		Larger	17	17	11
	Non-Intensive Mfg.	Smaller	161	161	4
		Medium	45	45	4
		Larger	12	12	4
	Other Industrial	Smaller	1,907	1,907	46
		Medium	151	151	41
		Larger	38	38	38
Unknown	Unknown	Smaller	5,117	275	11
		Medium 1	1,734	308	12
		Medium 2	533	533	13
		Larger	134	134	14

NON-RESIDENTIAL SURVEY FIELDING

Customer premises selected for the telephone survey were communicated to Team partner The Blackstone Group (BGG), which was responsible for completing this group of interviews. Where telephone numbers for a given premise were not available in the customer record, BGG conducted telephone number look-ups. For some larger customers, enhanced contact information from KCP&L's Energy Consultants (KCP&L ECs) was available and was used to facilitate finding and reaching appropriate respondents.

Within each cell, sample points were randomly selected for calling and multiple attempts (up to seven) were made to contact the company and find an eligible respondent. Note that the Team recognized that, given the sample available in many cells, that it would not be possible to meet the targeted sample size in many sample cells (e.g., in the "Larger" cell of the "Other Industrial" segment, the sample design called for completing 38 interviews from only 38 sample points available). As a result, the plan was to work the sample from top-to-bottom, that is, focusing first - and longest - on the larger size sample cells, and getting as many completed interviews as possible from those cells. Once the available sample in the larger and medium-sized cells was exhausted, interviewers were allowed to move to the smaller-sized cells, and to complete additional interviews within those cells as these were available in order to get as close as possible to the total target sample size.

Customer premises selected for the onsite surveys were communicated to Mr. Ray Ehrhard from the staff of Washington University in St. Louis who was responsible for completing those interviews. Mr. Ehrhard's team contacted appropriate respondents at each facility (using information provided by the KCP&L ECs) and attempted to schedule an onsite interview, using the same questionnaire that was completed in the telephone surveys.

All 752 of the valid interviews ultimately completed in the non-residential sector, as shown in Table 1-8 below, were completed during April and May 2016.

Table 1-8 Non-Residential Final Fielded Sample for Analysis by Premise Size and Segment

Sector	Segment	Size	Sample Provided	Target N of Completions	N of Surveys Completed
Commercial	Office	Smaller	5,325	73	194
		Medium	859	76	29
		Larger	141	104	9
	Retail	Smaller	325	13	28
		Medium 1	793	15	34
		Medium 2	325	16	6
		Larger	82	17	1
	Restaurant	Smaller	125	5	5
		Medium	150	6	3
		Larger	150	6	4
	Grocery	Smaller	434	8	18
		Medium	123	10	4
		Larger	68	7	3
	College	Smaller	63	2	3
		Medium	22	2	1
		Larger	11	2	6
	Schools	Smaller	568	14	28
		Medium	228	12	2
		Larger	60	12	2
	Health	Smaller	771	23	53
		Medium	114	16	7
		Larger	23	23	5
	Lodging	Smaller	249	6	10
		Medium	68	6	3
		Larger	16	6	1
	Warehouse	Smaller	354	6	18
		Medium	144	7	14
		Larger	27	8	4
	Miscellaneous	Smaller	218	8	13
		Medium 1	495	9	22
		Medium 2	151	9	7
		Larger	36	10	7
Industrial	Energy Intensive Mfg.	Smaller	306	14	26
		Medium	30	11	2
		Larger	17	11	3
	Non-Intensive Mfg.	Smaller	161	4	11
		Medium	45	4	1
		Larger	12	4	7
	Other Industrial	Smaller	1,907	46	96
		Medium	151	41	4
		Larger	38	38	12
Unknown	Unknown	Smaller	275	11	15
		Medium 1	308	12	14
		Medium 2	533	13	11
		Larger	134	14	6

NON-RESIDENTIAL SAMPLE WEIGHTING

The non-residential sample design was also intentionally disproportionate. In this case, the sample was disproportionate in the sense that sample points were assigned to larger energy use business segments at a higher rate than they were assigned to segments with lower energy usage. In order to account for the disproportionate sample design, the final set of survey respondents was weighted on the basis of sample design segment so that the final total sample is representative of the underlying population, accounting for segment. Two sets of weights were calculated for use in the data analysis: (1) population (or establishment) weights were used to weight the sample population to the number and proportion of total establishments in the underlying universe, while (2) energy weights were used to weight the sample population to the amount of energy used by each sample design cell. The first of these weighting regimes – establishment weights – is applied in the survey results presented in the remainder of this volume so results are easier to interpret on a "per customer" basis. The data utilized in the potential analysis utilizes the energy weights since this is the desired metric from a modeling perspective.

Note also that because the number of completed interviews in some of the sample design cells was small, it was necessary to combine some sample cells before calculating appropriate weighting values for the aggregated cells. These sample cell aggregations were ultimately completed for specific groups of cells (typically, aggregating together the larger size cells with fewer available customers) in the following sectors: retail, grocery, college, schools, lodging, warehouse, miscellaneous, energy-intensive manufacturing, and non-energy-intensive manufacturing.

2

RESIDENTIAL SATURATION SURVEY RESULTS

This chapter summarizes key findings and results from the residential saturation survey. Note also that the results of this research are the primary basis for the detailed market profiles and baseline characterizations presented in Volume 3, Potential Analysis and Volume 5, Appendices. This chapter is organized into the following sections:

- Household equipment and characteristics covered
- Household demographics
- Primary energy using systems
- Thermostats
- Home appliances
- Lighting
- Home improvement measures
- Differences by service territory
- Differences by survey response modality (mail vs internet)

HOUSEHOLD EQUIPMENT AND CHARACTERISTICS COVERED

The residential customer survey captured information about a wide range of features of customer homes, including the following household characteristics and energy-using equipment:

- Household demographics
  - Own / Rent
  - Type of home
  - Size of home
  - Age of home
  - Education / income
- Type of windows
- Heating / Cooling equipment
  - Equipment present
  - Fuel type
  - Recent replacements
  - Controls
- Water heating
  - Number and type
  - Fuel type
  - Tank size

- Lighting
  - Number by type and location
- Other end uses
  - Number by type
- Energy efficiency measures
  - Measures taken by type

Note that all of the survey results reported here have been weighted by operating company and housing type to ensure that they are representative of the underlying universe of KCP&L residential customers.

HOUSEHOLD DEMOGRAPHICS

As shown in Figure 2-1, the survey results indicate that a total of 79% of households are single-family properties (71% detached and 8% attached), while 12% are multi-family households in buildings with 2-4 units, and 6% are multi-family households in buildings with five or more units. Consistent with these proportions, just under three-quarters of households (72%) say they own their own properties.

On average homes are older, with a median age of 40 years (just 26% have been constructed since 1990) with, most commonly, three bedrooms and an average size of just under 1,800 square feet.

More than half of all households (57%) have a member that has graduated from a four-year college. The median income for the population as a whole is just under $52,000, with 30% earning $75,000 or more.

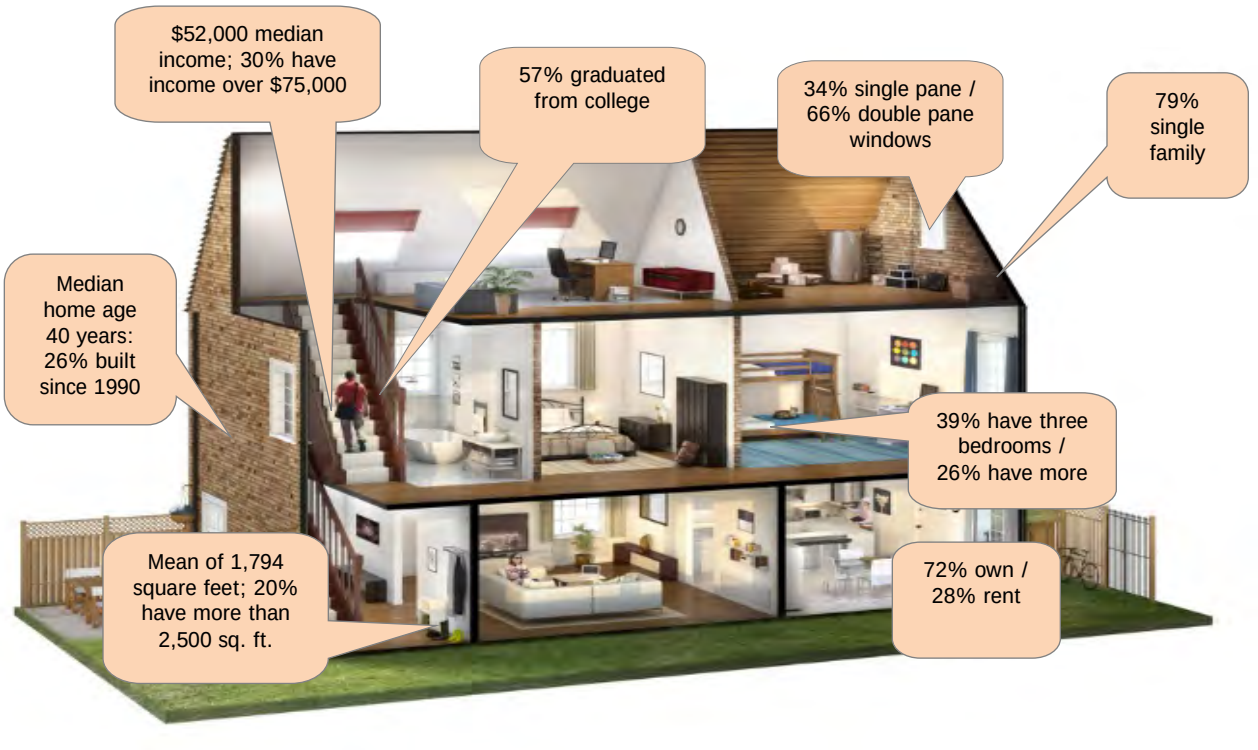


Figure 2-1 Summary of Demographic and Household Characteristics

PRIMARY ENERGY USING SYSTEMS

Natural gas is present in approximately 60% of all homes in the KCP&L service territory, though note that only 21% of all households report using natural gas for cooking, and only 10% report using natural gas for clothes drying. Central air conditioner systems are the predominant form of cooling equipment.

Heating / Water Heating Systems

59% of heating systems and 60% of water heaters are fueled by gas.

- 52% of those who pay for home heating use a warm air gas furnace
- 26% use an electric furnace, while 6% use a heat pump (either air source or geothermal)

Cooling Systems

96% say they pay for cooling (another 2% say someone else (such as a landlord) pays for cooling.

Of those who say they pay for home cooling:

- 60% use central AC systems
- 5% use a heat pump (air source or geothermal)
- 4% use room air conditioners
- Only 2% use fans
- 29% are not sure of their system

Figure 2-2 Summary of Primary Heating and Cooling System Characteristics

THERMOSTATS

Half of all households report having a programmable thermostat, but in only about half of these households is this programmable capability actually used consistently. Just 14% of these programmable thermostats are internet-enabled, but only 9% of households with a programmable thermostat actually use this capability.

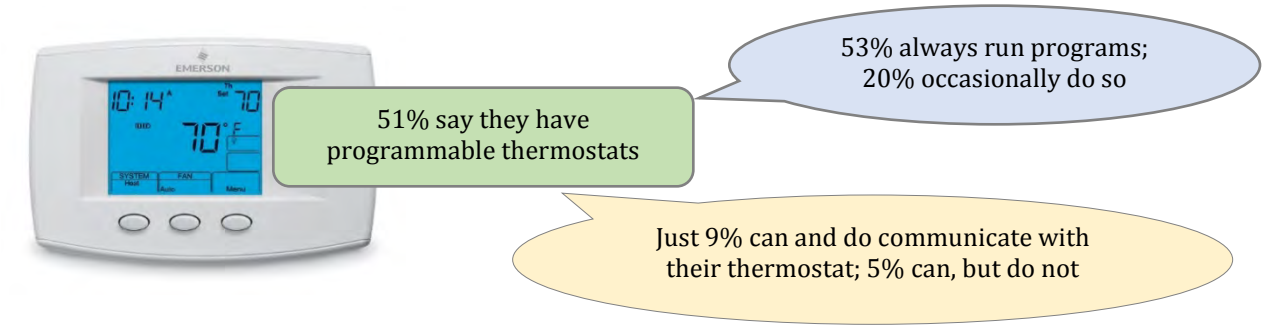


Figure 2-3 Characteristics of Household Thermostats

HOME APPLIANCES

KCP&L households report an average of just over one refrigerator per household and almost one microwave and one oven per household. Other major appliances are less common, particularly the natural gas-fueled versions.

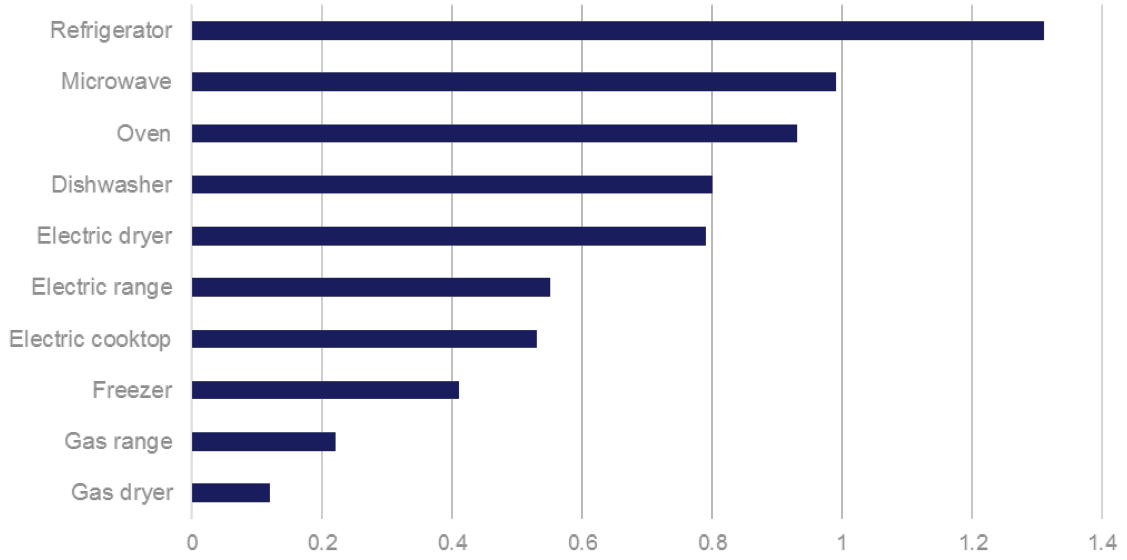


Figure 2-4 Average Number of Major Home Appliances per Household

Households in the KCP&L service territory report having an average of 2.4 total computers and a slightly larger number of televisions per household. The other electronic technologies that occur, on average, in at least every household are VCRs/DVDs (an average of 1.1 per household), and cable set-top boxes (an average of 1.26 per household both with and without embedded DVRs). Note that TIVOs occur in another 11% of households.

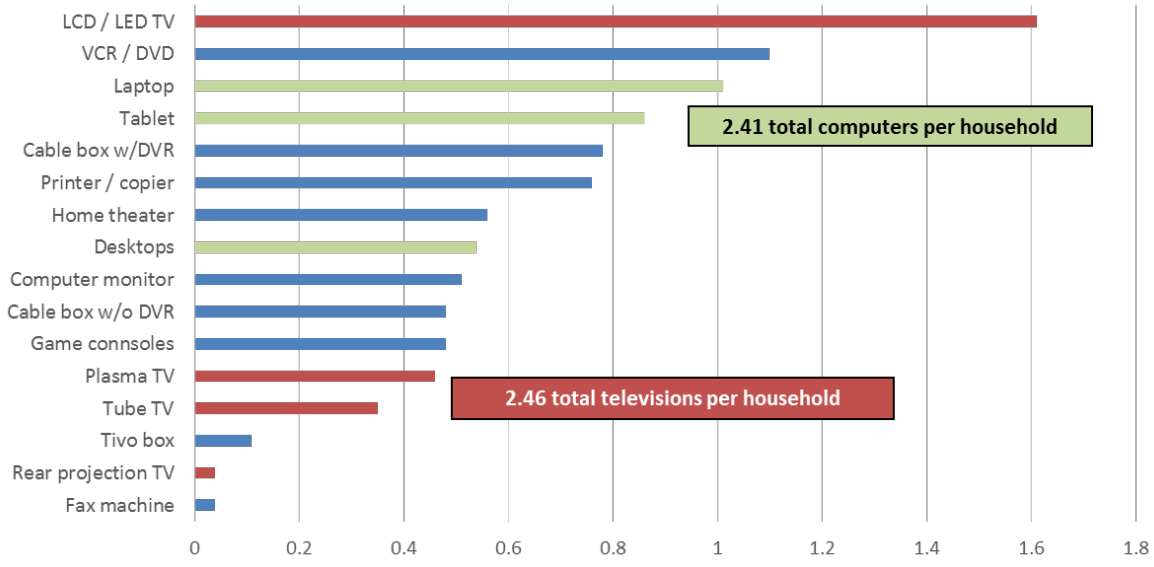


Figure 2-5 Average Number of Electronic Technology Items per Household

Note that emerging electric technologies are still not very common within this population. Fewer than three percent say they have some form of backup generation present, while none of the other technologies explored occur in even one percent of households.

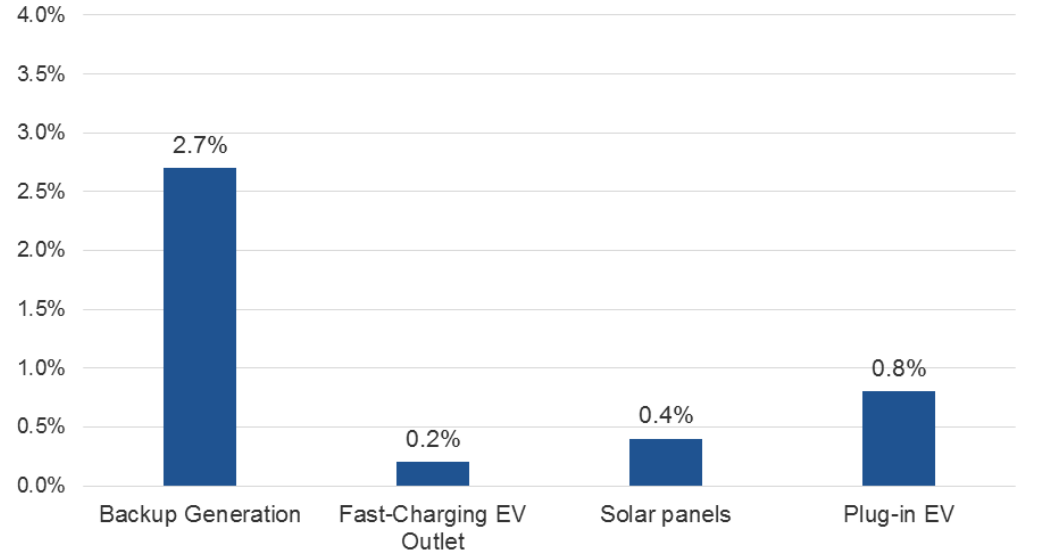


Figure 2-6 Frequency of Occurrence for New Electric Technologies

LIGHTING

As is depicted in the graphic below, incandescent bulbs account for an average of half of all the lightbulbs reported within each KCP&L household, with CFLs making up another quarter of all bulbs. Not pictured in the graphic are tubular fluorescents (accounting for 7.2% of all bulbs) and "other" bulbs (3.2%).

Figure 2-7 Frequency of Lightbulbs by Type per Household

HOME IMPROVEMENT MEASURES

Respondents living in single-family homes are obviously much more likely to report making any of a number of energy-related home improvements within the last five years. In total, almost 80% of single-family home owners reports having made at least one improvement, compared to just over 40% of multi-family residents. Adding weather stripping or caulking, or tuning up a heating or cooling system are the most common EE home improvements claimed.

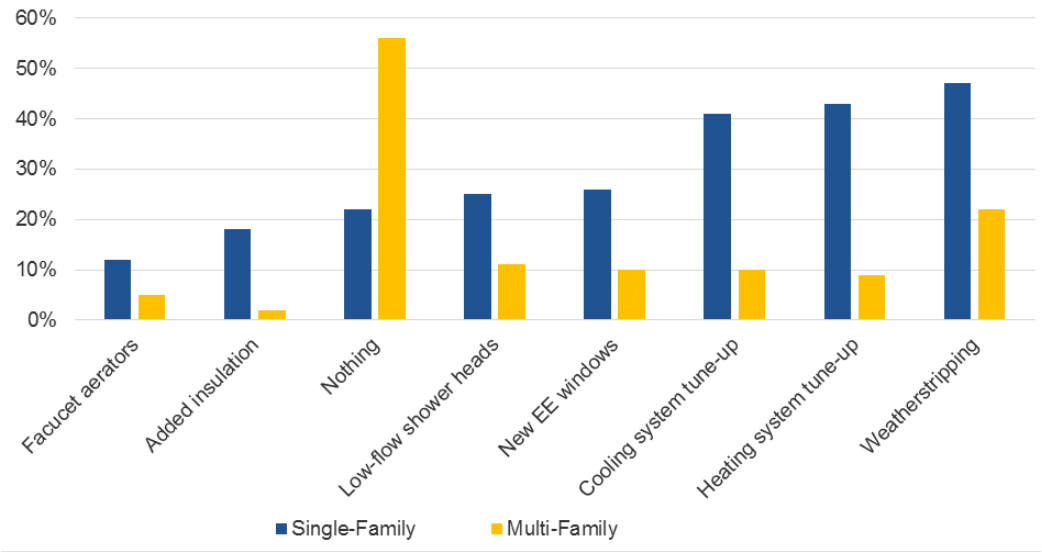


Figure 2-8 Frequency of Home Improvements

DIFFERENCES BY SERVICE TERRITORY

For most attributes, customer households are similar across the various KCP&L service territories. There are a few differences, however, that are noteworthy for each service territory (details are provided in Table 2-1 below).

- The **GMO-MPS** service territory is different from other geographies in that households tend to have the largest mean square footage values (especially higher than those in GMO-SJLP and KCP&L-MO) and have homes that were built more recently than any other geography.
- The **GMO-SJLP** service territory is different from other geographies in that households are:
  - More likely than any of the others to use electricity for heating or water heating
  - Less likely than any of the others to have central air conditioners
  - Less likely than any of the others to have a programmable thermostat
  - Less likely than any of the others to have had a heating or cooling system tune-up in the last five years
  - The most likely to have heads of household with lower levels of education and income
- The **KCP&L-KS** service territory is different from other geographies in that households are:
  - The most likely to have heads of household with higher levels of education and income
  - Less likely to live in single-family homes (compared, at least to those in GMO-MPS and GMO-SJLP)
  - More likely than those in any other geography to say they conduct annual HVAC maintenance
  - Report higher mean square footage values for their homes (especially compared to those in KCP&L-MO, and to a lesser extent, those in GMO-SJLP)
- The **KCP&L-MO** service territory is different from the other geographies in that households are:
  - The least likely to have electric water heaters (especially compared to those in GMO-SJLP)
  - The least likely to own their homes or to live in single-family homes
  - Tend to report having the smallest homes on average, the smallest proportion of newer properties, and the largest proportion of single-pane (vs. double-pane) windows

Table 2-1 Notable Differences in Building and Household Characteristics by Service Territory

	GMO-MPS	GMO-SJLP	KCP&L-KS	KCP&L-MO
Natural gas used for heating	57.5%	43.9%	59.9%	64.2%
Central air conditioner(s) present	56.9%	44.0%	63.0%	62.6%
Room AC(s) present	5.2%	8.6%	1.4%	5.4%
Heat pump (air source or geothermal) present	8.5%	12.9%	5.1%	2.3%
Have a programmable thermostat	51.5%	31.8%	56.8%	50.2%
If programmable thermostat - always run programs	50.5%	43.8%	57.4%	51.6%
If programmable thermostat - communicate wireless	14.7%	15.2%	11.7%	16.1%
Natural gas standard water heater tank present	59.1%	37.4%	59.7%	61.4%
Electric standard water heater tank present	25.7%	48.3%	23.9%	17.3%
TV set-top boxes (with or without DVR)	1.4	1.0	1.3	1.1
Sump pump	0.3	0.1	0.4	0.1
Dishwasher	08	0.6	0.9	0.7
% of windows that are single pane	32.1%	30.0%	29.7%	39.4%
Lighting (proportion of primary lighting categories):				
Incandescent	58%	58%	64%	53%
CFLs	29%	34%	24%	34%
LEDs	13%	8%	12%	13%
EE actions taken in last 5 years				
Added weather stripping / caulking	41.4%	43.2%	40.8%	41.9%
Added insulation	13.5%	17.0%	15.2%	14.8%
Installed new EE windows	18.8%	25.1%	27.5%	20.3%
Had heating system tune-up	34.8%	24.8%	39.8%	35.2%
Had cooling system tune-up	33.5%	23.5%	39.3%	33.5%
Did none of the above	29.6%	29.2%	27.1%	29.5%
EE actions being taken today				
Conduct annual HVAC maintenance	45.8%	40.1%	54.7%	43.2%
Adjust thermostat settings when away	79.5%	74.4%	84.3%	78.0%
None of the above	6.7%	9.7%	6.9%	8.7%
Demographics				
% who own their home	77.0%	79.4%	72.0%	64.8%
Total % single family homes (including manufactured)	87.5%	87.6%	77.9%	73.0%
Mean square footage of home	1,896	1,766	1,872	1,635
Proportion of homes built since 1989	39.8%	22.0%	30.4%	17.3%
Education at least college degree	46.4%	37.7%	67.3%	53.2%
Mean Income	$65,990	$53,750	$78,460	$62,660

*Indicates geography with higher than average values

**Indicates geography with lower than average values

DIFFERENCES BY SURVEY RESPONSE MODALITY (MAIL VS INTERNET)

As was noted in the Residential Methodology section, respondents had the option to respond to the survey either by completing and returning a paper version of the questionnaire, or to provide the same survey content by filling out the survey online. One of the questions that KCP&L had about this methodology was whether the responses provided online were different from those provided by people who completed the survey on paper.

As indicated in Table 2-2 below, there are, in fact, a consistent set of differences between the two groups. Those respondents who completed the survey online (compared to those who completed the survey on paper) reported:

- Having more central air conditioners and more warm air gas furnaces, as well as having, using, and communicating wirelessly with programmable thermostats
- Having more "high tech" devices (LCD / LED TVs, VCRs/DVDs/Blu-ray players, video game consoles, cable set-top boxes, home theaters, laptops, tablets, and monitors)
- Living in larger and newer homes, and having higher levels of education and income

In summary, those who respond online tend, not surprisingly, to be "techier" in terms of their appliance and equipment use and to be more upscale in their demographics. It is worth noting, however, that the two groups do not differ meaningfully in terms of their reported energy efficiency-related behavior.

It should be noted that AEG does not believe that any differences in responses by survey modality are indicative of a bias being introduced into the results by offering both options. It is likely, AEG believes for example, that the higher tech, higher income and education respondents who were more likely to respond online would have responded on paper if that had been the only option available to them. It was just that, given the option, they preferred to respond online.

Table 2-2 Comparisons in Reported Building and Household Characteristics by Survey Response Modality

Characteristic	Online Questionnaire Response	Paper Questionnaire Response
Primary Energy Using Systems		
Natural gas used for space heating	63.8%	57.7%
Natural gas used for water heating	65.4%	58.1%
CAC used for cooling	85.3%	50.0%
Natural gas warm air furnace used for heating	59.2%	49.7%
Use a programmable thermostat	60.8%	47.5%
If programmable thermostat - always use programmed settings	61.9%	48.4%
If programmable thermostat - can and do communicate	15.1%	5.8%
Appliances		
Tube-type televisions present	0.25	0.39
Plasma flat screen televisions present	0.37	0.49
LCD / LED televisions present	1.96	1.48
VCR / DVD / Blu-Ray players present	1.32	1.01
Video game consoles present	0.78	0.38
Cable set-top boxes (with or without DVR) present	1.58	1.14
Home theaters present	0.77	0.49
Desktop computers present	0.63	0.51
Laptop computers present	1.43	0.86
Tablet computers present	1.24	0.71
Monitors present	0.78	0.41
Printers / copiers / scanners present	0.95	0.70
EE actions taken in last 5 years		
Added weather stripping / caulking	42.4%	41.2%
Added insulation	14.7%	14.7%
Had heating system tune-up	36.1%	35.5%
Installed 1+ "smart" power strips	6.1%	6.7%
None of the above	29.8%	28.5%
EE actions being taken today		
Perform annual HVAC maintenance	49.3%	46.4%
Turn down heating / cooling when away	85.8%	77.9%
None of the above	5.1%	8.6%
Overall Household Characteristics and Demographics		
Mean square footage	1,923	1,743
Home built since 1989	37.0%	25.2%
Head of household is college graduate or more	70.8%	47.7%
Mean income of head of household	$83,200	$61,600

*Indicates meaningful differences between responses from alternative survey modalities

3

NON-RESIDENTIAL SATURATION SURVEY RESULTS

This chapter summarizes key findings and results from the non-residential saturation survey. Note also that the results of this research are the primary basis for the detailed market profiles and baseline characterizations presented in Volume 3, Potential Analysis and Volume 5, Appendices. This chapter is organized into the following sections:

- Content covered in the saturation survey
- Business / building characteristics
- Heating and cooling systems
- Water heating
- Lighting
- Electronic equipment
- Other end uses
- Energy efficiency-related improvements

CONTENT COVERED IN THE SATURATION SURVEY

The non-residential customer surveys captured information about a wide range of features of customer business facilities, including the following:

- Business characteristics
  - Business type
  - Own / lease property status
  - Number of employees
  - Days of operation
- Building characteristics
  - Square footage
  - Roof color
  - Type of windows
- Heating / Cooling equipment
  - % of space heated / cooled
  - Primary / secondary equipment present
  - Fuel type
  - Maintenance practices
  - Controls
- Water heating
  - Type

  - Fuel
  - Size
- Lighting
  - Number by type
  - Controls
  - Operating hours
- Other end uses present
  - Electronics
  - Kitchens
  - Warehouse space
  - Laundry
  - Pool / spa
  - Motors
  - Onsite electric generation equipment
- Energy efficiency measures

Note that all of the survey results reported here have been weighted by establishment size and type to ensure that the results are representative of the underlying universe of KCP&L non-residential customers.

BUSINESS / BUILDING CHARACTERISTICS

The survey results indicate that just over three-quarters of those establishments (79%) have no more than 19 full-time employees present at any one time. As would be expected, the mean reported facility size (in square footage) is much higher - at just over 50,000 sq. ft. - than the median size (at almost 4,900 sq. ft.).

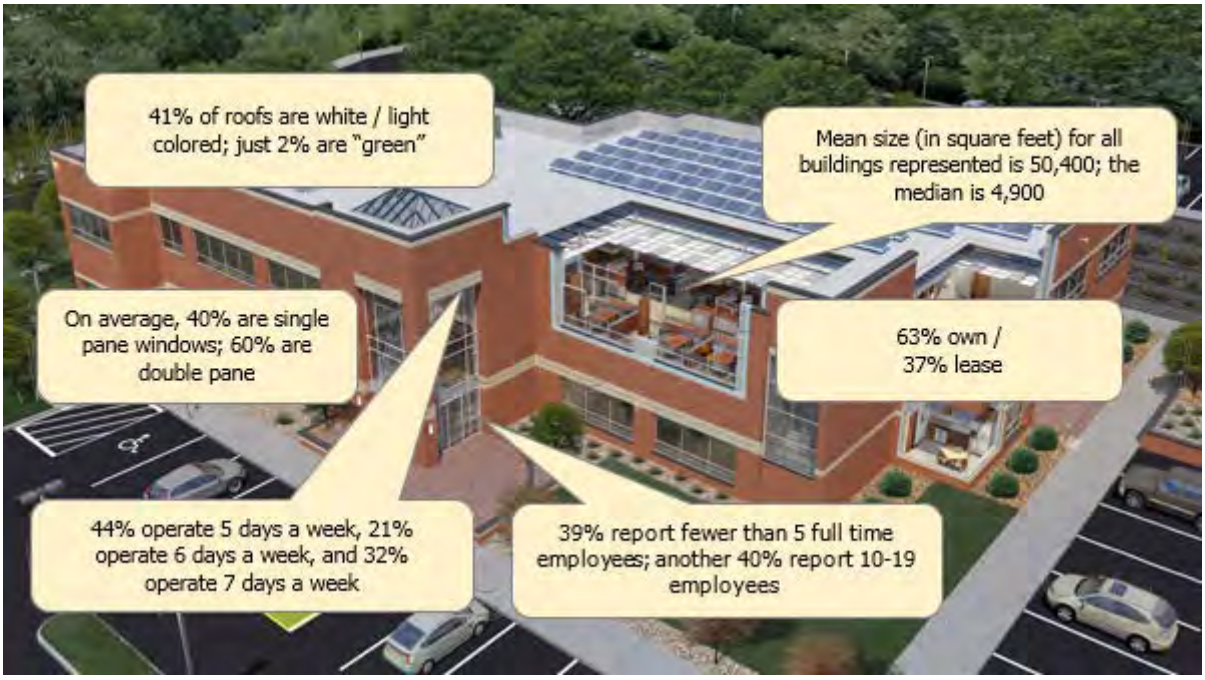


Figure 3-1 Summary of Business and Building Characteristics (N=752 All Respondents)

The building types most likely to report larger numbers of employees are restaurants (with 58% reporting at least 20 employees) and educational facilities (74% with at least 20 employees). Retail facilities (5%) are least likely to say they have at least 20 full-time employees.

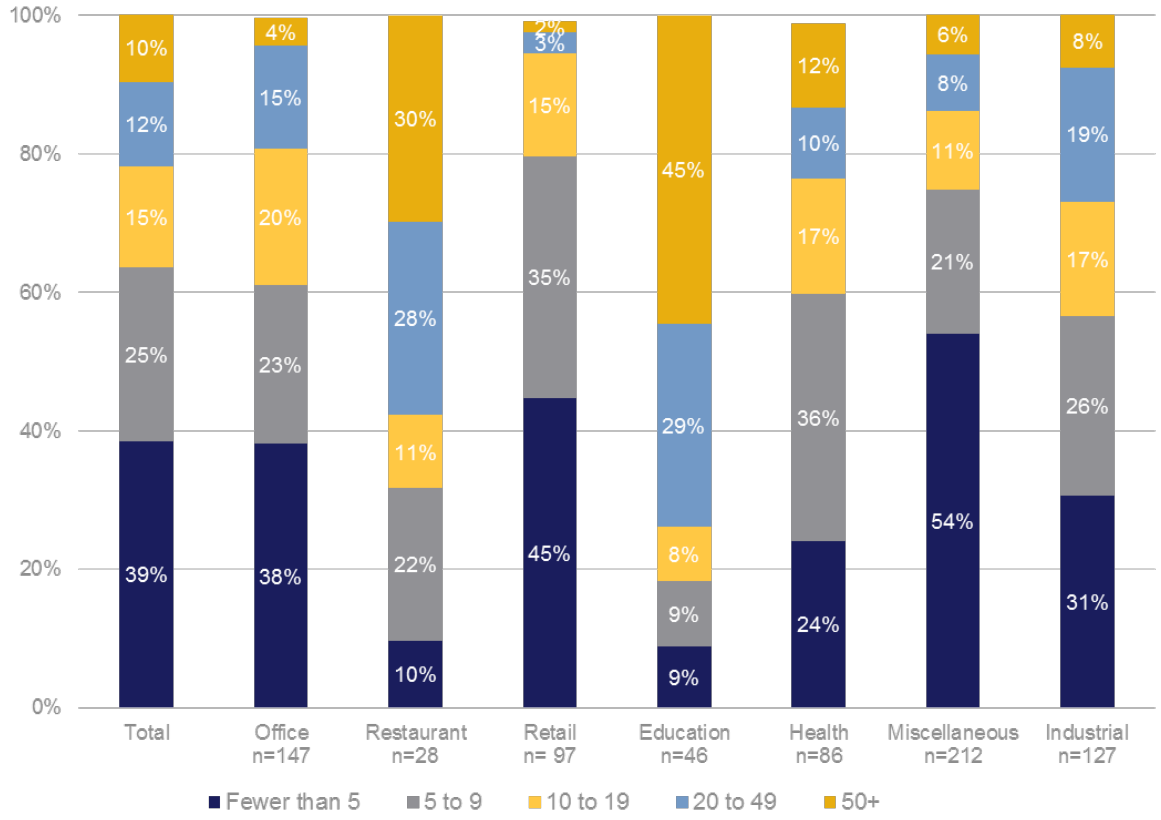


Figure 3-2 Number of Employees by Building Type[1]

The largest facilities in terms of average square footage are colleges, data centers, and large offices; all at over 90,000 mean square feet. See Figure 3-3 below.

[1] Totals do not always add to 100% due to "Not sure" responses.

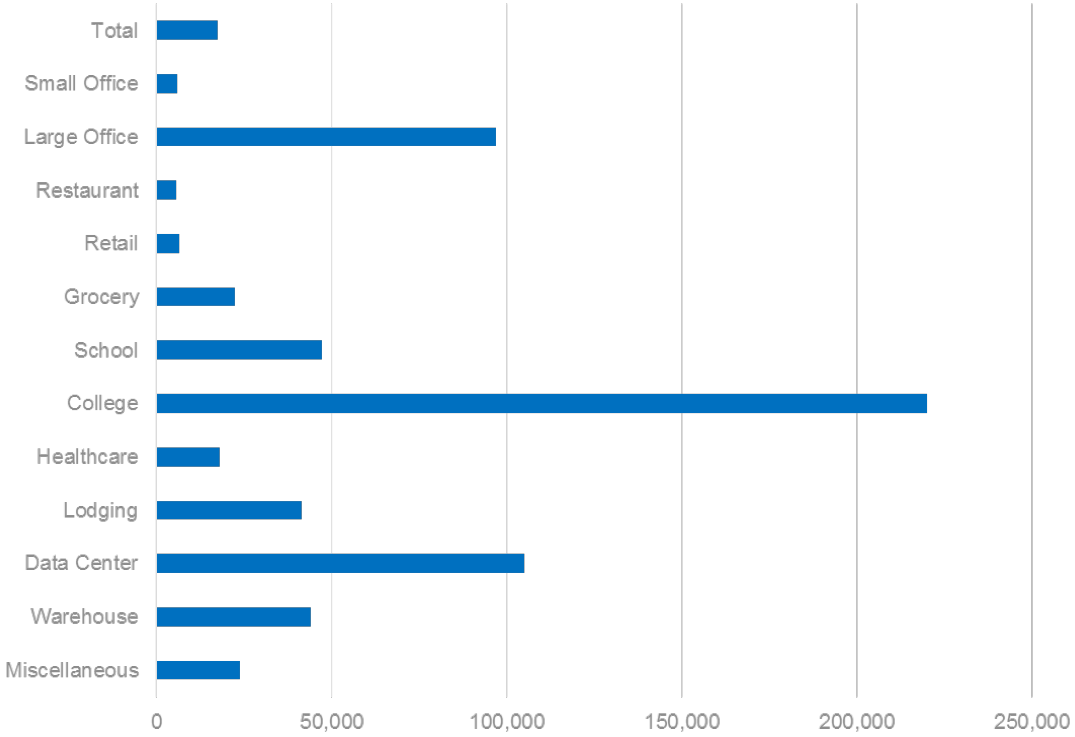


Figure 3-3 Facility Square Footage by Building Type

HEATING AND COOLING SYSTEMS

Warm air gas furnaces and warm air electric furnaces are the two most common primary heating systems, at 37.8% and 34.0% of all non-residential establishments respectively. Heat pumps, including both air-cooled and geothermal, are next most common at 9.9%.

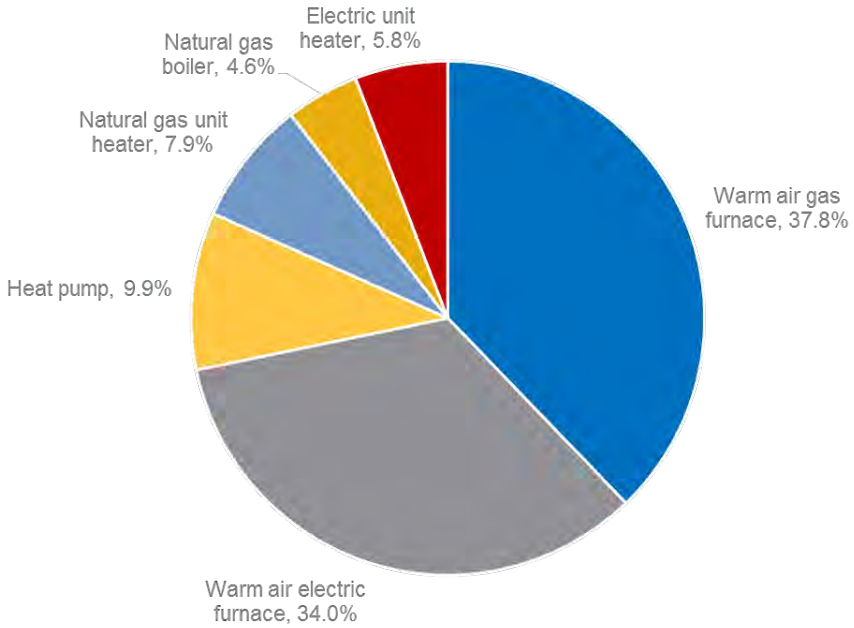


Figure 3-4 Type of Primary Heating System (N=570, those who are billed for heating some or all of their space)

Packaged air conditioners, at 69.3% of C&I establishments, are by far the most common type of primary cooling system used in these facilities, with air-cooled and water-cooled chillers accounting for another 24.1% of these systems.

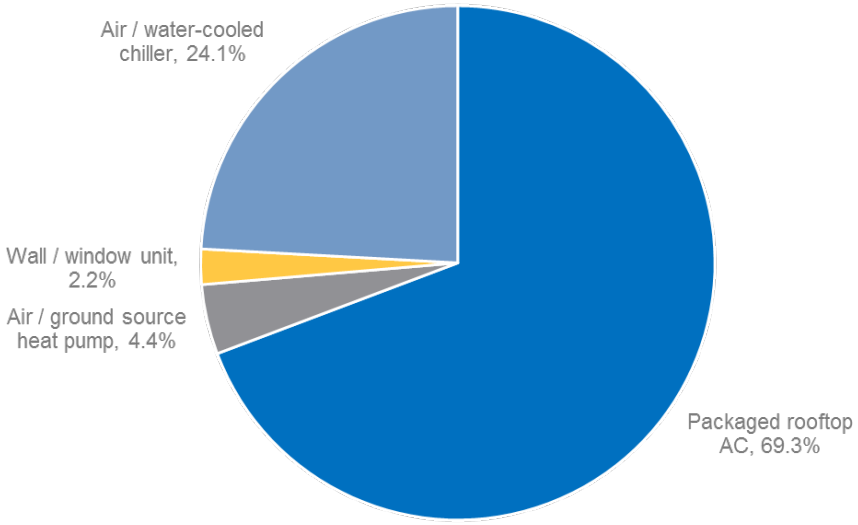


Figure 3-5 Type of Primary Cooling System (N = 713, those who are billed for cooling some or all of their space)

The most common reported approach to maintaining HVAC systems within the overall population is to do this maintenance seasonally (46%), though only doing this maintenance "as needed" is next most common (at 31%). Restaurants are most likely to say they conduct maintenance either monthly or seasonally (a total of 93%). Retail facilities are the least likely to report conducting maintenance this regularly (at just 45%).

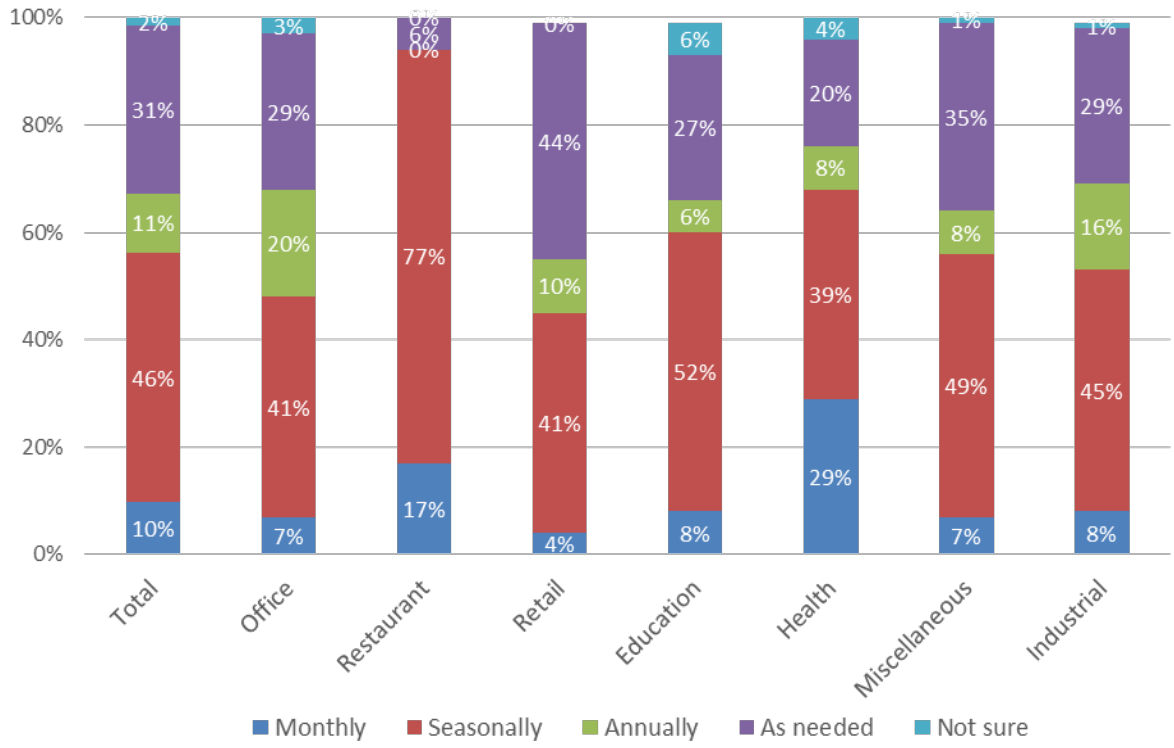


Figure 3-6 Primary Cooling System Maintenance Practices by Building Type (N=713, those who are billed for cooling some or all of their space)[2]

[2] Office =137, Restaurant = 28, Retail =92, Education=45, Health= 84, Miscellaneous=200, Industrial = 117. Totals do not always add to 100% due to "Not sure" responses.

Programmable thermostats are the most common form of HVAC system control reported (with 62% of total facilities reporting this type of control present), followed by manual thermostats (28%). Restaurants (at 81%) are most likely to report having programmable thermostats, while educational facilities are most likely to report having EMSs (30%).

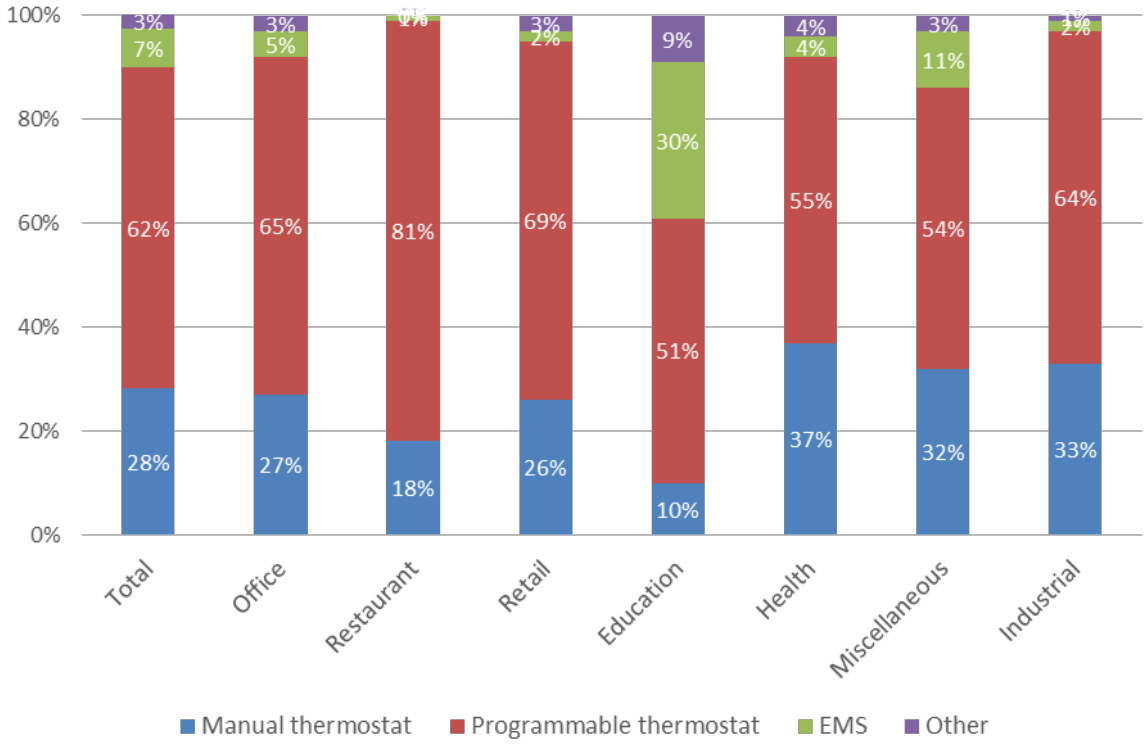


Figure 3-7 HVAC Controls by Building Type (N=713, those who are billed for cooling some or all of their space)[3]

WATER HEATING SYSTEMS

Stand-alone, storage tank water heaters are the most common form of water heating systems within this population (with 59% of total establishments reporting these present). This type of water heating system is most common in restaurants (at 75%), and least common in educational facilities (at 47%), offices (47%), and health facilities (48%). Central boilers are most common within educational facilities (at 17%), while domestic-type systems are most common in health facilities (23%), and office and industrial facilities (at 20%). Note, however, that almost one-in-five respondents (18%) are unsure of the type of water heating system they have.

Not shown in the graphic below, respondents in total say that 62% of all water heating systems are fueled by electricity, while 33% are fueled by gas.

[3] Office =137, Restaurant = 28, Retail =92, Education=45, Health= 84, Miscellaneous=200, Industrial = 117. Totals do not always add to 100% due to "Not sure" responses.

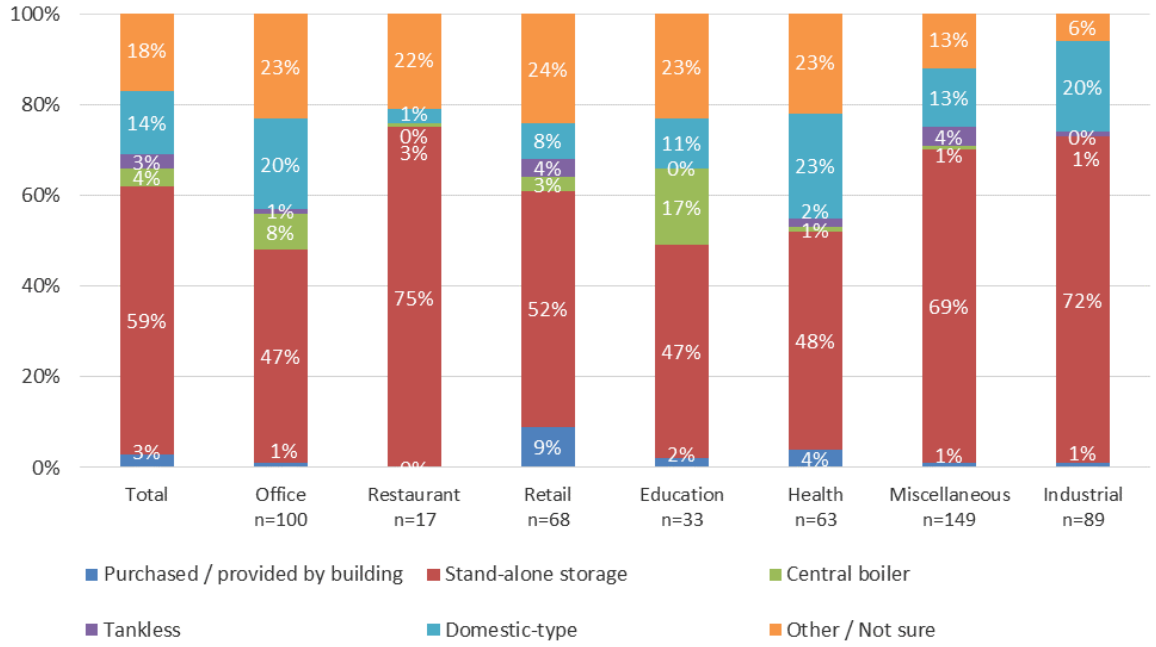


Figure 3-8 Type of Water Heating System by Building Type (N=523, those who are billed for water heating)

LIGHTING

Respondents say that traditional fluorescent bulbs or tubes account for almost one third of all of the light bulbs that are present in these facilities. Respondents were not sure or named other types of bulbs for almost one-quarter of the lightbulbs.

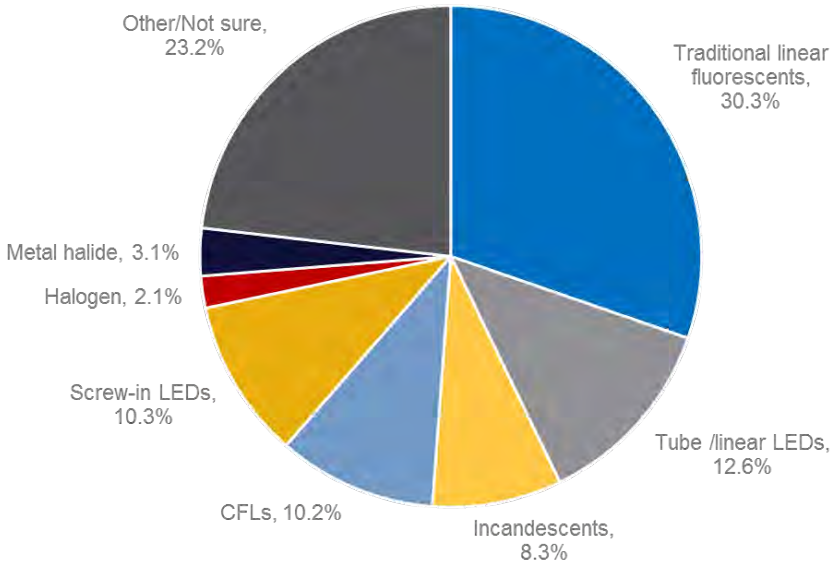


Figure 3-9 Distribution of Interior Light Bulbs / Tubes by Type (N=740, those who are billed for interior lighting)

Not shown in the Figure, 52% of all of the fluorescent bulbs or tubes respondents say are present in their facilities are described as T-12s, while 25% are described as T-8s; 3% are described as Super T-8s; and 7% are described as T-5s.

ELECTRONIC EQUIPMENT

With respect to electronics in commercial establishments, the most common types of equipment present are computer monitors (nearly 30 per establishment), desktop computers (nearly 25 per establishment), servers (just over 20 per establishment), and laptop computers (over 15 per establishment). There is, of course, variability in the number of some of these devices present by building type. The largest differences are in the number of POS terminals present, with a mean of almost 13 POS devices present in retail establishments, and a mean of just over 5 present in restaurants, compared to a mean of 1.5 across all establishments.

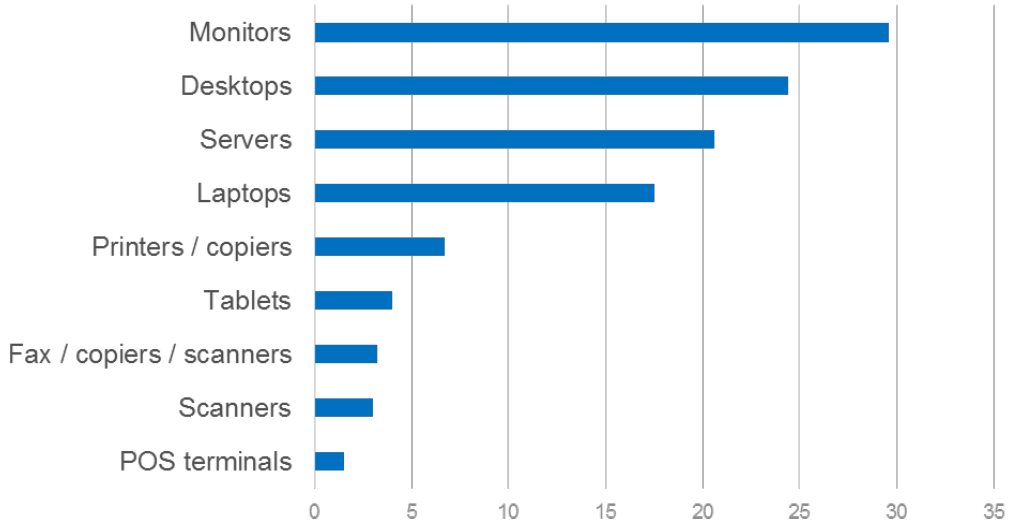


Figure 3-10 Average Number of Pieces of Electronic Equipment per Commercial Establishment (N=752 - All respondents)

OTHER END USES

Almost two-thirds of all non-residential customer establishments (62%) report having some form of kitchen present, though more than half (55% of those with kitchens) say they have only small kitchenettes. Just 16% of all facilities say they have laundry facilities, though only 2.2% report having commercial- or institutional-scale facilities. Nearly 39% of all non-residential customer establishments report having some warehousing facilities present, though only 3.6% of all establishments say they have refrigerated warehousing.

62% of customer business establishments report having a kitchen present (N=478)

- 55% of these are small kitchenettes
- 21% are residential-scale kitchens
- 20% are commercial-scale
- 3% are institutional-scale

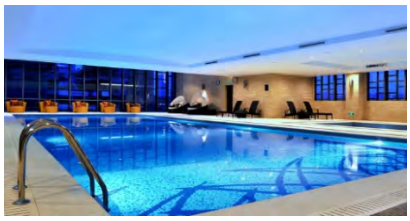
13.5% of all customer facilities report having limited laundry facilities

2.2% report having commercial- / institutional-scale laundry facilities

2.5% of all customer establishments report having both refrigerated and unrefrigerated warehouse space on-site

1.1% report having only refrigerated warehouse space

34.9% report having only unrefrigerated warehouse space



5.4% report having a pool on site

1.9% report having at least one spa on site

Figure 3-11 Other End Uses Present (N=752 All respondents)

For manufacturing facilities, motors are assumed to account for a substantial portion of energy use. More than one third of industrial establishments (35.7%) report that motors account for more than 50% of total energy use, while in another 23% of properties motors are described as accounting for 25-50% of total energy use.

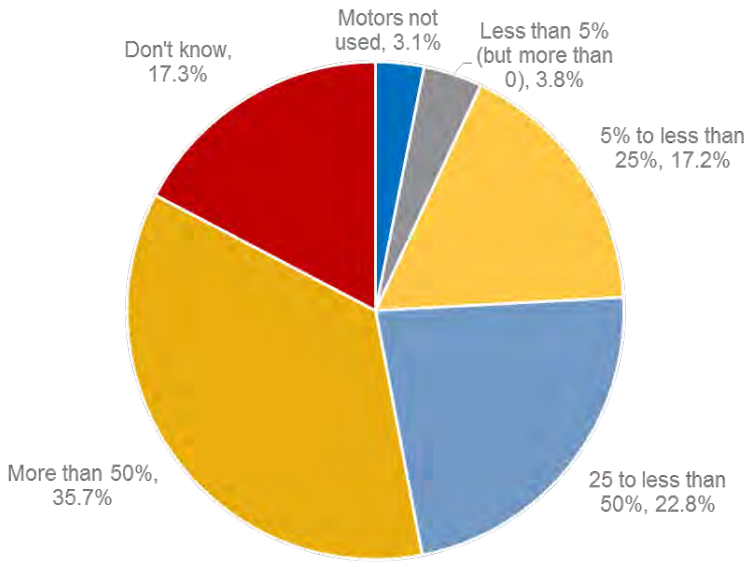


Figure 3-12 Proportion of Total Industrial Facility Energy Use Attributed to Motors (N=119, Manufacturing / Production / Processing selected as primary business)

Again specifically within the industrial or manufacturing sector, the largest proportion of motors (37%) are described as falling into "other" applications. This means most commonly that they are integrated as part of an industrial process, for example a motor that runs machinery such as mixers, grinders, mills, extruders, parts assembly, and other process related operations, rather than powering our other named categories: fans / blowers, compressed air systems, pumps, or conveyors.

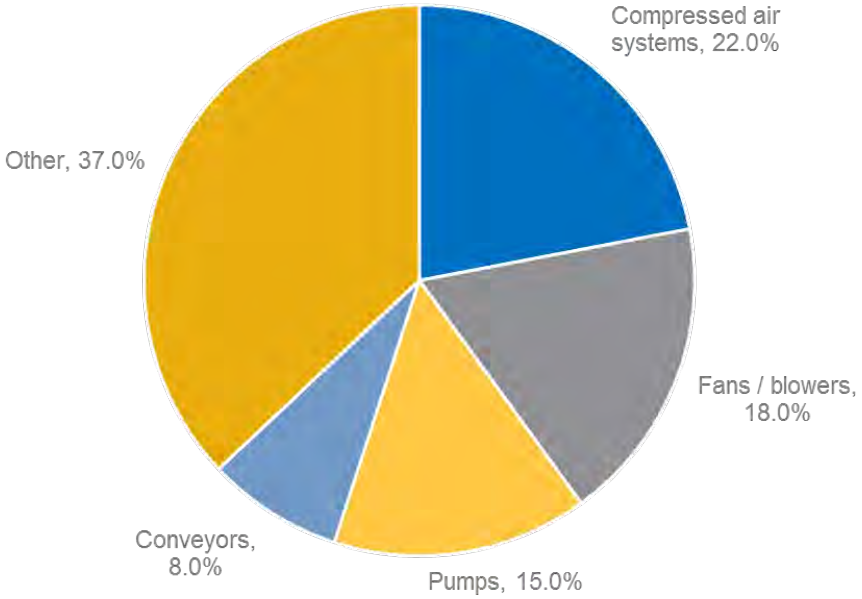


Figure 3-13 Distribution of Motors by Use (N=103, those who selected manufacturing / production / processing as their primary business activity, and reported that motors are responsible for at least some electricity use)

Relatively few facilities report having solar panels (3%), wind turbines (0.2%) or combined heat and power systems (0.8%), though almost 6% say they have some other form of electric generation, most likely in the form of backup generators.

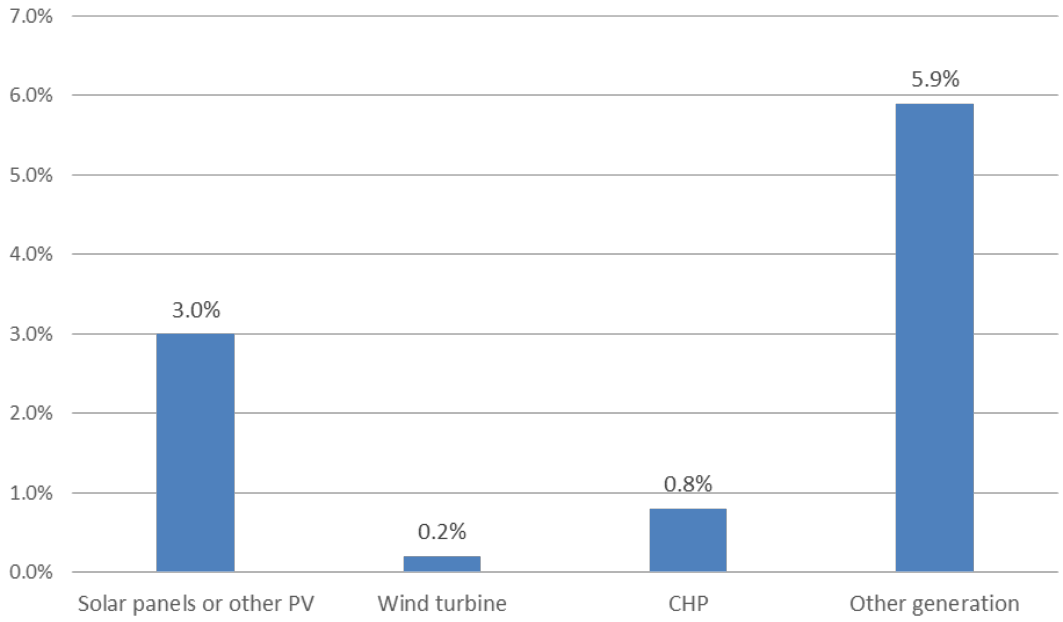


Figure 3-14 Electric Generation Resources Present (N=752 - All respondents)

ENERGY EFFICIENCY-RELATED IMPROVEMENTS

Nearly 70% of all business establishments report having made at least one lighting-related energy efficiency improvement within the last three years. Most common among these changes are the replacement of incandescent bulbs with LEDs or CFLs (46.5%) and / or upgrading fluorescent bulbs (44.1%). It is worth noting that customers in the GMO-SJLP service territory are least likely to report making EE improvements in lighting (45% say they have done nothing in this category within the last three years vs. 29% to 33% who said this in the other three service territories). Customers in the KCP&L-KS service territory are most likely to report upgrading their fluorescent lamps / bulbs (51% compared to 38% in GMO).

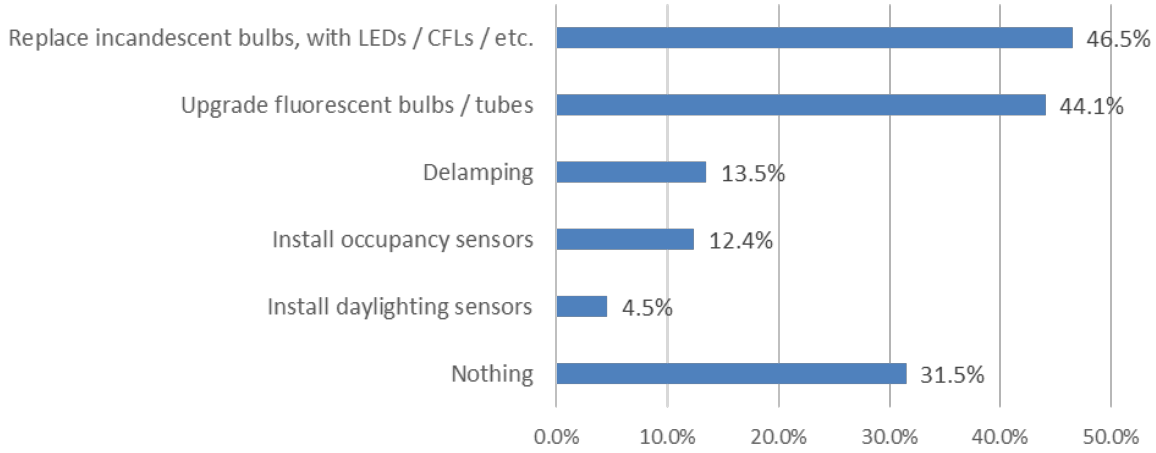


Figure 3-15 Lighting-Related Energy Efficiency Improvements Made in the Last 3 Years (N=752, All Respondents)

Energy efficiency improvements in HVAC systems are much less common than they are in lighting systems. While only 31.5% of non-residential establishments say they have made no energy efficiency improvements to their lighting systems within the last three years, 73% say they made no EE-related improvements to their HVAC systems in the same time period.

As we saw with lighting improvements, customers in the GMO-SJLP service territory are also least likely to report making EE improvements in HVAC systems (86% report making no improvements within the last three years, while only 65% of KCP&L-KS customers report this outcome).

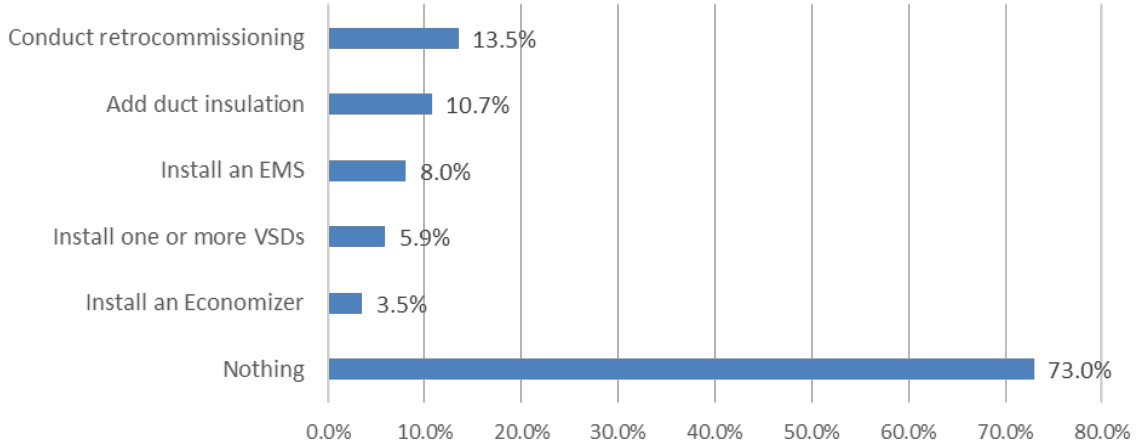


Figure 3-16 HVAC-Related Energy Efficiency Improvements Made in the Last 3 Years (N=752, All Respondents)

Investments in energy efficiency improvements related to water heating equipment are also not very common (68% say they have done nothing in this area within the last three years, similar to the 73% who said the same thing for HVAC systems, and much higher than the 32% who said they had done nothing related to energy efficiency for lighting systems).

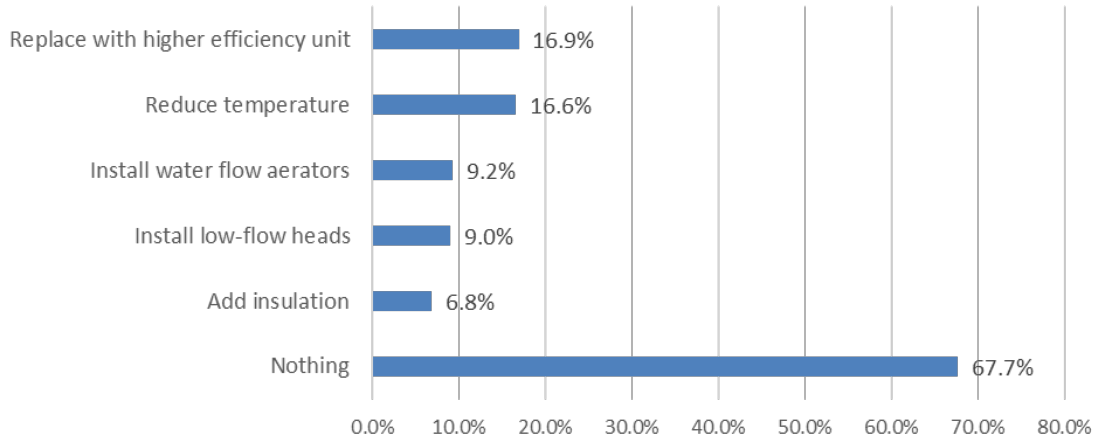


Figure 3-17 Water Heating-Related Energy Efficiency Improvements Made in the Last 3 Years (N=752, All Respondents)

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