Ontario Residential End-Use Survey

FINAL REPORT

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CADMUS

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Introduction

As the first survey of home energy use undertaken by the Independent Electricity System Operator (IESO), the Residential End Use Survey (REUS) provides valuable information about the building characteristics, equipment, appliances and behaviours that drive residential energy use in Ontario. This report—and an associated Microsoft Excel dynamic reporting tool—provide an important information source for the IESO, local distribution companies (LDCs), gas utilities and other stakeholders to support three primary objectives:

- (1) Develop end-use saturations & fuel shares to support the <u>2019 achievable potential study</u>;
- (2) Provide data on residential building characteristics, equipment penetration and demographics to support program design, evaluation and marketing; and
- (3) Provide relevant household equipment data to support electricity load forecasting.

Through a competitive procurement process, the IESO selected The Cadmus Group (Cadmus), a strategic and technical consultancy to conduct the REUS in January 2018. Cadmus partnered with Logit Group, a Toronto-based market data collection firm, to recruit survey participants from an Ontario panel group of 64,000 households. In June and July 2018, the REUS was issued to Ontario households using an online survey platform. In total, 3,159 households participated in the survey.

This summary report organizes its findings for single-family and multifamily dwellings by 15 energy-use topic areas, including building envelope, lighting, space heating and domestic hot water, among others. All findings in the report are presented at the provincial-level, by building type—single-family vs. multifamily households.

Cadmus also developed a dynamic reporting tool to allow interested stakeholders to cross-tabulate the data by eight demographic metrics including income status and education levels, among others. This dynamic reporting tool allows users to query the data by IESO transmission zones.

This report includes the following sections:

- Methodology
- Study Findings
- Future Study Recommendations
- Appendices: Online Survey Questionnaire, Outreach Materials

To review detailed survey results (e.g. by IESO zone, by income level, etc.) the REUS Dynamic Reporting Tool is available on the IESO website at: <u>www.ieso.ca/homeenergysurvey</u>



Methodology

The REUS is a self-report, online survey. Survey participants were recruited via an online panel group composed of more than 64,000 households located in Ontario. Cadmus designed a stratified, random sample frame to produce survey results that are representative of all households in Ontario.

Sampling Approach

The aim of Cadmus' sample frame was to achieve statistical significance with 90% confidence and a $\pm 10\%$ precision level (i.e. nine out of 10 times, the survey would result in confidence intervals that include the true values). Cadmus stratified the sample frame by building types and geographic regions.

- **Building Types**. Cadmus stratified the survey sample by single-family vs. multifamily households. Single-family dwellings include single-family-detached houses, row houses, and mobile homes. Multifamily dwellings include low and high rise multi-unit residential buildings such as apartments and condominiums.
- **Geographic Regions**. Cadmus stratified the survey sample by the IESO's ten transmission zones depicted below.



Figure 1. Ontario IESO transmission zone map

Sample Frame and Sampling Modes

Cadmus partnered with Logit Group, a Toronto-based market data collection firm, to recruit survey participants from their online panel group of 64,000 households located in Ontario. Among the largest panel groups in Ontario, Logit Group ensures its panel is representative of the population by ensuring key demographic variables such as age, education, income level and number of people per household aligns with census data collected by Statistics Canada. Logit Group's is a paid panel that provides a small monetary incentive for completed surveys.

The online consumer panel included postal codes for mapping prospective survey participants to IESO zones as well as an indicator of building types, allowing Cadmus to recruit from within these strata.

Logit Group provided Cadmus with estimates of survey numbers they expected to complete for each building type and region. As the online survey progressed, Logit Group exceeded the targeted number of respondents in some regions, though it came up short in others. While Cadmus planned on completing 3,274 online surveys across Ontario, the team was able to recruit 3,159 households into the REUS.

Table 1 summarizes the completed single-family and multifamily online surveys, organized by IESO zone. To provide additional resolution for some census division regions, the sample frame includes an oversample of single family households.¹ The REUS aimed to reach a minimum of 70 households per IESO zone within each sector. Due to the lower than expected survey response rate in some areas, 90/10 confidence/precision was not achieved for the multifamily building type in some IESO zones (i.e., Essa, Niagara, and Northwest).

	Completed Online Surveys			
	Single-family	Multifamily		
East	479	73		
Essa	172	41		
Niagara	85	50		
Northeast	269	73		
Northwest	102	23		
Ottawa	109	71		
Southwest/Bruce	611	77		
Toronto	245	294		
West	309	76		
Provincial	2,381	778		

Table 1. REUS Online Sample Frame

Survey Design

Cadmus used an online survey methodology. This project task was completed in three steps:

- Develop list of survey questions
- Program final survey instrument into Qualtrics

¹ Study findings for the single-family sector for some census division regions is available upon request to IESO.



Develop List of Survey Questions

Cadmus began by developing a comprehensive list of survey questions with input from IESO's planning and energy efficiency staff that addressed all building end uses and characteristics in both single-family and multifamily households. The survey covered all major building characteristics, equipment, appliances and behaviours that drive residential energy use and collected details on all major end uses, including building envelope, HVAC, lighting and appliances.

As both the single-family and multifamily surveys were designed for residents and did not target multifamily building managers, the multifamily survey only collected information about the energy use characteristics of the dwelling unit. As such, information about equipment that services the entire building (e.g. rooftop cooling units) is not within the scope of this survey or report.

The survey was designed so that it was easy to understand for residents with minimal knowledge of household energy-use equipment. The Cadmus team used the following best practices to maximize data validity and minimize respondent bias:

- Avoid questions that are leading, ambiguous, or contain more than one topic
- Employ randomization of list-based survey items to reduce order effects
- Kept survey length to between 20 and 30 minutes for the average respondent to reduce survey fatigue and abandonment
- Provided visual images of different types of energy-using equipment (e.g. CFL vs. LED light bulbs) to aid in accurate identification by respondents
- Utilized skip logic so participants only answered relevant questions

Program Surveys

After the survey instrument was designed, reviewed and approved by the IESO, Cadmus programed the survey into Qualtrics, an online survey platform that enables users to develop and host surveys quickly, with an unlimited number of concurrent participants.² Cadmus used the Qualtrics Research Suite to create, administer and manage the online survey. Qualtrics also enables users to adapt surveys to mobile platforms including smart phones or tablets, which were used by approximately 32% of respondents to complete the survey.

Survey Implementation

Cadmus completed the following steps to implement the surveys:

- Survey Pretest
- Survey Participant Recruitment
- Tracking

² More information is available at the Qualtrics website. Available online: https://www.qualtrics.com



Survey Pretest

Cadmus conducted two pretests. The first was issued to a small number of IESO staff and staff family members to evaluate the clarity and length of the online survey instrument.

The second pretest was deployed to a 300-household subset of the online panel group, which produced 41 survey responses. The intent of the second pretest was to identify inconsistencies in the responses and to identify possible data analysis issues. Cadmus used these findings from both pretests to recommend changes to the survey instrument to improve clarity and post-survey analysis.

Survey Participant Recruitment

Starting in June 2018, Logit Group began sending recruitment emails to the households that were selected randomly from the stratified sample frame of their online panel group. Recruitment emails were sent in waves that targeted regions where quotas had not yet been achieved.

For households that did not respond to the initial recruitment email, and resided in regions in which quotas had not been met, Logit Group sent a reminder emails after three, six, and nine days. As participation was lower than anticipated in a few of the targeted regions, Logit Group deployed a secondary recruitment effort in July 2018 to expand the size and reach of their online panel. Prescreening of potential survey participants was conducted to ensure only qualified participants were engaged as part of the study.

Figure 2illustrates each of the steps discussed above for the email recruitment and survey implementation approach.





Survey Tracking

Cadmus established quotas by region and by building type to achieve the targeted confidence/precision level. The Qualtrics survey platform tracked all the survey responses compared against the quota

targets and relayed information via an online reporting dashboard. Once a quota had been met within a certain region and building type, Logit Group would cease sending emails to households of this building type within the region – instead focusing recruitment efforts on regions with survey responses under the quota target. If a potential survey respondent clicked on the web link to complete the survey, but the quota was already reached for their respective building type and region, they were shown a message that thanked them for their interest and indicated we had reached our required survey responses.

Table 2 below shows the number of households that were contacted, the number of respondents that started, but didn't complete the survey and our response rate of completed surveys.

Table 2. REUS Response Rates

Invites Sent	Drop-out/Terminated Surveys	Quota Full	Completed Surveys	Response Rate (%) ^a
50,786	2,856	7,565	3,159	7.3%

^a Excluding "quota full" counts, as these respondents were not provided the opportunity to complete the survey after a building type/regional quota was fulfilled.

Sample Weights

Population sizes in Ontario's nine IESO zones greatly varied. As the number of completed surveys was not proportional to population sizes, Cadmus developed post-sample weights and applied these to results aggregated the provincial level. The weights corrected for over- and underrepresentation of IESO zones in the aggregated results.

For example, the number of single-family households in the East IESO zone was 10.3% of the number of single-family households in Ontario (approximately 390,000 of 3.8 million households), but the sample of single-family households in East IESO zone was 20.1% of the Ontario sample (481 out of 2,398 surveys). Without weighting, East IESO zone would have been overrepresented and, consequently, would have biased the results toward East-specific results.

To calculate the weights, we took the percentage of population that was sampled and set the weights to the inverse of that percentage. The result is that each sampled household represents a portion of the total number of households in the population. For example, in the East zone, each respondent represents 810 households in the East region.

Table 3 shows the population sizes, sample sizes, percentages of population sampled, and weights by IESO zone and building type.

	Single-family				Multifamily			
IESO zone	Dwelling Counts	Sample	% of Population sampled	Sample Weight	Dwelling Counts	Sample	% of Population sampled	Sample Weight
East	389,486	481	0.123%	810	75,843	71	0.094%	1,068
Essa	271,334	175	0.064%	1,550	35,132	38	0.108%	925
Niagara	163,113	85	0.052%	1,919	31,897	50	0.157%	638
Northeast	195,686	272	0.139%	719	43,466	70	0.161%	621
Northwest	81,808	102	0.125%	802	13,104	23	0.176%	570
Ottawa	299,888	109	0.036%	2,751	112,720	71	0.063%	1,588
Southwest / Bruce	791,091	615	0.078%	1,286	191,153	72	0.038%	2,655
Toronto	1,204,875	245	0.020%	4,918	826,075	294	0.036%	2,810
West	386,338	314	0.081%	1,230	99,815	70	0.070%	1,426

Table 3. Sample Weights by IESO zone by Building Type

Data Review

Cadmus took a series of steps to prepare the survey data for analysis:

- 1. Exported survey data
- 2. Data preparation
- 3. Quality assurance/quality control measures

Step 1. Export Survey Data

In compliance with privacy legislation, personal identifiable information (PII) collected as part of the REUS was stored on Canadian servers. Measures were taken to minimize access to any PII including anonymizing the survey data before transferring it from Logit Group to Cadmus. Cadmus also stored this anonymized data and all working project files on Canadian servers to further protect customer privacy.

Step 2. Data Preparation

To prepare the data for quality assurance and control review, Cadmus had to first format and merge the data to produce a clean dataset. As part of this data preparation process, staff also classified each response by geographic area (urban vs. rural) as well as income status (low income vs. non-low income). Cadmus classified "rural" customers based on the survey participant's postal code - postal codes with the number "0" in the second digit of the postal code (i.e., LOK XXX) were coded as "rural," all other survey participants were coded as "urban" customers. Low-income respondents were classified based on the criteria that are used to establish low-income conservation program eligibility (Table 4).

Number of People Living in Home	Gross Annual Household Income
1 person	\$32,843
2 persons	\$40,886
3 persons	\$50,266
4 persons	\$61,028
5 persons	\$69,217
6 persons	\$78,065

Table 4. IESO Criteria for Low Income Status

Step 3. Quality Assurance/Control Measures

Validating Surveys and Completed Survey Definition

As an initial screen to remove any 'gaming' from the survey responses (i.e., respondents that have clicked through the survey to receive their incentive without fully reviewing and thoughtfully responding to the questions) Cadmus only considered a survey complete and counted it towards the sample quota if it met the following requirements:

- 1. It took the survey respondent more than 7 minutes to complete the survey³; and
- 2. Survey respondent answers more than 35% of forced-response questions with response other than "I don't know".
- 3. Survey respondent answers the two "simple math" screening questions correctly⁴

Survey Response Cleansing

Once incomplete responses were removed, Cadmus conducted a manual review of the survey responses to further ensure data quality. Cadmus invested heavily in the design of the survey to minimize uncertainty around the interpretation of customer responses. This was accomplished by:

- Only allowing "close-ended" response options on almost all questions
- Programing response rules into the Qualtrics survey platform (e.g., forced-response questions that require the respondents to provide an answer in order to continue with the survey)
- Indicating whether a question allows for multiple responses, or only a single response.
- Applying skip-logic to reduce survey length for respondents, and to reduce the possibility of response errors (e.g. if a respondent indicated they don't have space cooling equipment in their home, they were not asked a question about space cooling equipment age)

³ If a respondent finished the survey in less than seven minutes, Qualtrics did not allow them to submit the survey and the survey did not count towards the quota, as it was assumed the respondent didn't provide meaningful and thoughtful answers.

⁴ If response is incorrect, it was flagged and a Cadmus staff member determined if the response was incorrect in good faith (we accepted survey) or if the response is attributable to a respondent that didn't provide meaningful and thoughtful answers (we rejected the survey).

While Qualtrics enabled the study to ensure responses were provided in a consistent, legible, and accurate manner, opportunities remained for respondents to provide responses that could lead to inaccurate reporting—usually due to self-reporting errors. For example, a respondent may have indicated they used an ENERGY STAR boiler, while also indicating that boiler was 30 years old (i.e., manufactured prior the establishment of ENERGY STAR certification). To reduce these inaccuracies and inconsistencies, Cadmus developed a survey question QC table that was used by the data analysts to screen each survey response. Responses that did not pass the screening logic were automatically flagged for a Cadmus staff member to manually review. The Cadmus staff member then determined whether the responses in question should be removed from the analysis, if adjustments to the dataset were required, or if respondent's intent is clear and reasonable. Table 5 summarizes the types of automated logic flags programmed into the data cleansing process, along with the rationale for each flag.

Flag Type	Review Completed
Heating/Cooling Equipment Count	Ensure the equipment count was reasonable, given household conditioned
heating/cooming Equipment count	floor space.
ENERGY STAR	Ensure the respondent did not falsely label old equipment ENERGY STAR if it was
	manufactured before the program's deployment.
Thermostat Set Doint	Confirm consistency in temperature preferences across all periods and
	winter/summer.
Eucl Sharo	Review for consistency in fuel shares across relevant equipment (e.g., space
	heating, water heating).
Equipment Usage	Check that equipment usage aligned with the household size and number of
Luphent Usage	residents (e.g., number of showers, clothes washer/dryer/dishwasher usage).
Bulb Counts	Check for reasonableness in lightbulb counts, based on a household's size.
Refrigerator/Freezer Counts	Check for reasonableness for multiple units, based on a household's size.
Window Glass Construction Distribution	Ensure that the distribution among window types sums to 100%.
Consumer Electronics Counts	Check for reasonableness regarding multiple units, based on the household's size
	and the resident counts.
Resident Counts	Check for reasonableness based on household size.

Table 5. Summary of Data Cleansing Flags

Data Analysis – Dynamic Reporting Tool

Cadmus developed a REUS dynamic reporting tool in Microsoft Excel to analyze all of the survey data. The tool was also built to allow users to cross tabulate the survey results using various demographic attribute categories, as shown in Table 6.

Demographic Attribute Categories	Demographic Attribute Iterations
Age of Respondent	Under 25
	25 to 44
	45 to 64
	65 or older
Education Level	High School
	College/University

Table 6. Demographic Attribute Categories and Iterations

Demographic Attribute Categories	Demographic Attribute Iterations		
	Post-graduate		
	Employed Full Time		
Employment Status	Not in Workforce (retired, student, etc.)		
	Other (part time, unemployed, etc.)		
Income Status	Low Income		
	Non-Low Income		
	Under \$25,000		
	\$25,000 to under \$50,000		
Income Level	\$50,000 to under \$100,000		
	Over \$100,000		
Coographic Area	Rural		
Geographic Area	Urban		
	Status Quo		
IFEO Cognostation	Day by Day		
reso segmentation	Cool Tech		
	Home Centric		
	1,000 sq. ft. (91 sq. meters) or less		
	1,001–1,500 sq. ft. (91–140 sq. meters)		
Desidence Cize	1,501–2,000 sq. ft. (141–185 sq. meters)		
Residence size	2,001–2,500 sq. ft. (186–230 sq. meters)		
	2,501–3,000 sq. ft. (231–280 sq. meters)		
	3,001 sq. ft. (280 sq. meters) or more		

For example, a user interested in seeing survey results broken down by household income status (low income vs. non-low income) can select the "By Building Type, By Income Status" crosstab attribute from the dynamic workbook's Dashboard. Survey findings, such as space heating fuel share as shown in Figure 3, will then summarize the reported findings accordingly.

Figure 3. Home Ownership Distribution by Building Type by Income Status

Primary Space Heating Equipment Fuel Share Distribution by Building Type, by Income Status						
	Single Family	Single Family Multifamily		Multifamily		
	Low Income	Non-Low Income	Low Income	Non-Low Income		
Natural Gas	68.6%	83.6%	24.5%	37.9%		
Electricity	17.3%	9.3%	74.4%	61.6%		
Bottled gas	3.3%	2.5%	0.0%	0.4%		
Heating oil	4.2%	2.2%	0.8%	0.0%		
Wood	4.9%	1.9%	0.0%	0.0%		
None	1.7%	0.4%	0.2%	0.1%		
n-value	434	1,681	109	163		
Count of "I don't know" responses	26	29	19	26		

* Multifamily responses reflect fuel share distribution of equipment in dwelling units (not equipment that services entire building).

The "Dashboard" tab also contains an Excel pivot table slicer, which can be applied to select specific IESO zones, which then updates the reporting tables to show only a subset of REUS data. For example, users can opt to review the same space heating fuel share findings presented in Figure 3 just for the East IESO zone, record the findings and then select the Essa IESO zone as a point of comparison.

To assist the user in only employing data where a sufficient sample exists, a minimum number of responses are required to show data to the user. If the response counts for a particular table fall below 67, calculated values revert to "ID" (i.e., insufficient data), and the cell is highlighted in red.

To help provide context regarding respondents' ability to answer particular questions, the count of "I don't know" responses or (in some cases) the "Prefer not to answer" responses appear in the row below the count of responses (n-value).

You can find the dynamic reporting tool on the IESO's home <u>energy survey webpage</u>. For further information regarding use of the IESO REUS dynamic reporting tool, see the "Read Me" tab in the file.



Study Findings

This section presents findings drawn from the REUS for the province of Ontario. As discussed above, sample weights were applied to results in each region to calculate provincial findings that control for differences in the number of households across regions. This approach provided greater weight to data from regions with larger populations.

Provincial results are based on a total of 2,400 surveys completed by occupants of single-family dwellings and 759 surveys from multifamily dwellings. In many cases, the number of responses to an individual question is fewer than the total number of completed surveys as not all households have the piece of equipment, appliance, etc. that is being asked about or respondents do not know the answer to the question. For each table, the number of observations included in the analysis is represented as an "n-value" count, with n-values over 385

To review detailed survey results (e.g. by IESO zone, by income level, etc.) the REUS Dynamic Reporting Tool is available on the IESO website at: www.ieso.ca/homeenergysurvey

have at least 95% confidence with 5% precision in the findings; n-values over 68 had at least 90% confidence with 10% precision in the findings.

The reader should be mindful that as a self-report survey, some results may reflect respondent bias respondents self-reporting more efficient equipment than they actually use, and/or they confuse equipment types (e.g., differences between CFLs and LEDs). We have noted where instances of selfreport bias may have occurred throughout the report. Cadmus' findings are summarized below, organized by end use/topic area, with data generally presented for the metrics shown in Table 7.

Metric	Definition	Sample Calculation	
Depatration	Share of responding households with at least one unit of	Penetration % = count of households with one	
Penetration	energy end-use equipment present.	or more freezers / total count of households	
Saturation	Average count of equipment per household for households	Saturation = total count of freezers / total	
Saturation	with at least one equipment unit present.	count of households with at least one freezer	
Equipment	Allocation of total againment counts on a parcentage basis	Distribution %s = total count of freezers type A	
Distribution	Anocation of total equipment counts on a percentage basis.	/ Count of all freezers	
Darameters	Various equipment/household characteristics: age,	Varias	
raiameters	efficiency, usage, behaviors, set points.	varies	

Table 7. Reporting Metrics Definitions

Home Characteristics

Table 8 summarizes the distribution of home ownership in Ontario, with 83% of single-family respondents reporting to own their residences, while 69% of multifamily respondents reporting that they rent. Figure 4 illustrates the distribution of home construction vintages in Ontario. The average single-family home is reported to be 37 years old and the average multifamily building is reported at 35 years old.

Building Type	Own	Rent	Occupy Without Rent	Count
Single-Family	83.2%	13.9%	2.9%	2,355
Multifamily	31.0%	68.6%	0.4%	771



Table 8. Home Ownership Distribution

The survey also asked respondents to report the floor area conditioned by their space heating systems (i.e., not including unconditioned rooms, such as garages). Table 9 summarizes response distributions, with an average, single-family household reporting 1,936 square feet of conditioned floor space and the average, multifamily unit reporting 940 square feet of conditioned floor space.

1984 -

1995

■ Single Family ■ Multifamily

1996 -

2000

2001 -

2005

2006 -

2011

2012 - 2017 or

later

2016

1978 -

1983

Table 9. Conditioned Area of Home

Building Type	Avg. Area (sq. ft)	1,000 sq. ft or Less	1,001 – 1,500 sq. ft	1,501 – 2,000 sq. ft	2,001 – 2,500 sq. ft	2,501 – 3,000 sq. ft	3,001 sq. ft or More	n- value
Single-Family	1,936	9.5%	26.3%	25.0%	16.4%	10.6%	12.1%	2,063
Multifamily	940	65.5%	25.7%	6.4%	1.4%	0.7%	0.3%	643

Space Heating

5.0%

0.0%

1946 -

1960

1961 -

1977

Before

1946

Table 10 exhibits the penetration of heating equipment in residential Ontario dwellings as well as the distribution of heating fuels used for primary heating equipment. Just over 81% of single-family households report using natural gas as their primary heating source, and almost 11% report using electricity as their primary heating fuel.

We have not reported findings from the multifamily sector on space heating equipment that could service the entire building (e.g. hot water boiler). These relevant tables have the "NR", or a not reported notation in the relevant fields.

	% of Homes with		Primar	y Equipment	Fuel Share Di	stribution	
Building Type	Space Heating Equipment	Natural Gas	Electricity	Bottled Gas	Heating Oil	Wood	None
Single-Family	99.8%	81.1%	10.6%	2.6%	2.5%	2.4%	0.6%
Multifamily ^a	NR ^a						NR ^a
n-value (SF)	2,372						2,115

Table 10. Space Heating Equipment Penetration and Fuel Share Distribution

^a NR = Not reported

Table 11 and Figure 5 summarize the fuel share distribution for primary heating equipment in singlefamily households by IESO zone. The Toronto and Ottawa IESO zones have the highest reported natural gas fuel share at 87% and 88% respectively; while the highest reported electric fuel share was noted in West (14%), Northeast (13%) and East (13%).

Table 11. Single-Family Heating Equipment Fuel Share Distribution by IESO zone

Fuel Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest / Bruce	Toronto	West
Natural Gas	60.5%	71.4%	84.2%	70.2%	70.7%	87.7%	84.8%	87.2%	82.5%
Electricity	13.1%	9.9%	7.9%	13.1%	9.6%	5.9%	9.4%	10.9%	14.6%
Bottled gas	8.5%	9.9%	1.8%	5.0%	4.7%	3.6%	1.1%	0.0%	0.9%
Heating oil	7.4%	5.2%	1.4%	5.9%	5.3%	2.2%	1.8%	0.9%	0.8%
Wood	10.0%	3.6%	3.1%	5.4%	9.7%	0.6%	2.5%	0.0%	0.0%
None	0.5%	0.0%	1.5%	0.4%	0.0%	0.0%	0.4%	0.9%	1.2%
n-value	428	155	72	240	83	99	543	214	281





Table 12 exhibits the distribution of primary heating equipment reported for single-family households. Central furnaces dominate the single-family market as primary heating equipment (78%) split between gas central furnaces (73%) and electric central furnaces (5%).

Building Type	Gas Central Furnace	Gas Boiler	Gas Wall/Floor Heater	Gas Fireplace	Elec. Central Furnace	Central Heat Pump	Ductless Heat Pump	Elec. Baseboard	Wood Fireplace	Other	n- value
Single Family	73.4%	4.8%	2.7%	0.8%	4.9%	2.2%	0.1%	3.2%	2.4%	5.4%	2,097
Multi- family										NR	

Table 12. Primary Heating Equipment Type Distribution

Table 13 summarizes some key parameters for primary space heating equipment in Ontario households, Table 14 shows reported saturation levels for notable space heating equipment, and Table 15 summarizes the penetration of supplemental heating equipment in households. For households with ductless heat pumps, single-family homes reported to have an average of 1.3 ductless heat pumps, while multifamily homes reported to have an average of 1.4. Approximately one-half (46%) of singlefamily homes reported to use a natural gas fireplace for supplemental heat.

	Average	% Floorspace	%	Prima	Primary Equipment Efficiency		
Building Type	Age (years)	Heated by Primary Equipment	ENERGY STAR	% High Efficiency	% Moderate Efficiency	% Low Efficiency	
Single-Family	9.5	91.7%	80.0%	52.6%	44.3%	3.1%	
Multifamily	NR	NR	NR			NR	
n-value (SF)	1,830	2,084	1,570			2,179	

Table 13. Primary Space Heating Equipment Parameters

Table 14. Space Heating Equipment Saturation

Building Type	Gas Fireplace	Electric Resistance	Ductless Heat Pump	Portable Elec. Heaters	Wood/Pellet Stove or Fireplace
Single-Family	1.2	2.3	1.3	1.3	1.2
Multifamily	١D ^a	2.0	1.4	1.3	ID ^a
n-value (SF/MF)	474/12	202/153	19/17	129/72	165/0

^a ID = Insufficient Data

Table	15. Suppl	emental	Heating	Equipment	Penetration

Building Type	Gas Fireplace	Electric Resistance	Ductless Heat Pump	Portable Elec. Heaters	Wood/Pellet Stove or Fireplace	n-value
Single-Family	45.6%	9.8%	1.5%	14.0%	9.9%	1,032
Multifamily	NR	NR	NR	NR	NR	

Table 16 summarizes key parameters that the survey collected on space heating thermostats, with 13% of single-family homes and 4.2% of multifamily homes reporting to have smart/wi-fi thermostats installed.

Building Type % Programmable Thermostat		% Smart/Wi-Fi	Average Set Points (Degrees Celsius)				
		Thermostat	Occupant Home	Occupant Away	Occupant Asleep		
Single-Family	61.5%	13.0%	20.8	18.7	19.3		
Multifamily	27.8%	4.2%	21.1	18.8	20.0		
n-value (SF/MF)	2,108/212	2,108/212	2,092/				

Table 16. Space Heating Thermostat Parameters

Space Cooling

As noted above, we have not reported findings from the multifamily sector on space cooling equipment that could service the entire building (e.g., central AC). These relevant tables have the "NR", or a not reported notation in the relevant fields.

Table 17 exhibits the penetration of cooling equipment in Ontario residential dwellings. Approximately 93% of single-family households reported having space cooling equipment.

Building Type	% of Homes with Space Cooling Equipment	n-value
Single-Family	92.8%	2,213
Multifamily	NR	
NR = Not repor	ted	

Table 17. Penetration of Space Cooling Equipment

Table 18 exhibit the reported distribution of primary cooling equipment by building type. Central air conditioners dominated the single-family market of primary cooling equipment (77%), while heat pumps are reported to account for almost 5% of the single-family cooling market.

Table 18	. Primary	Cooling	Equipment	Туре	Distribution
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Building Type	Central AC	Central Heat Pump	Ductless Heat Pump	Evaporative Cooler	Fans (Room, Ceiling)	Window/ Room AC	Other	n-value
Single-Family	76.8%	3.8%	0.8%	0.4%	8.6%	9.6%	0.0%	2,015
Multifamily							NR	
NR = Not reporte	ed							

Table 19 and Figure 6 exhibit the variances in the distribution of space cooling equipment in singlefamily households across IESO zones. Northwest and Northeast IESO zones showed the lowest central air conditioner market share at 50% and 39% respectively but had the highest reported market share of fans and window/room air conditioners. Both Essa and East IESO zones reported the largest market share of heat pumps at roughly 5.5%.

Table 19. Single-Family Primary Cooling Equipment Distribution by IESO zon	Table 19	. Single-Family	/ Primary Co	oling Equipment	t Distribution	by IESO zon
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Equipment Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest /Bruce	Toronto	West
Central AC	59.3%	61.2%	78.1%	39.2%	49.7%	87.6%	79.6%	85.5%	83.7%

Equipment Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest /Bruce	Toronto	West
Central Heat Pump	4.1%	4.3%	0.0%	2.9%	1.5%	4.3%	2.6%	5.3%	2.5%
Ductless Heat Pump	1.4%	1.5%	1.6%	1.2%	2.7%	0.3%	0.5%	0.7%	0.2%
Evaporative Cooler	0.3%	0.0%	3.2%	2.4%	0.0%	0.0%	0.5%	0.0%	0.2%
Fans (Room, Ceiling)	18.6%	14.7%	4.0%	32.4%	25.7%	2.9%	8.2%	3.8%	3.7%
Window/Room AC	16.3%	18.3%	13.2%	21.8%	19.2%	4.9%	8.5%	4.8%	9.7%
Other	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.1%	0.0%	0.0%
n-value	415	144	70	196	70	97	536	208	279





Table 20 summarizes selected key parameters for primary space cooling equipment in Ontario households, Table 21 shows the saturation of some notable space cooling equipment, and Table 22 summarizes the penetration of supplemental cooling equipment in households. For households with window/room air conditioners, single-family homes reported an average of 1.6 room air conditioners per household while multifamily homes reported an average of 1.3 room air conditioners.

			Equipment Efficiency					
Building Type	Average Age (years)	% ENERGY STAR	% High Efficiency	% Moderate Efficiency	% Low Efficiency			
Single-Family	9.8	72.4%	42.8%	49.4%	7.8%			
Multifamily	NR	NR			NR			
n-value (SF)	1,634	1,429			1,907			
NR = Not reported								

Table 20. Primary Space Cooling Equipment Parameters

Building Type	Central Heat Pump	Ductless Heat Pump	Window/ Room AC	Fans (Room/Ceiling)	Evaporative Cooler	
Single-Family	1.3	1.3	1.6	2.8	1.1	
Multifamily	NR	1.4	1.3	1.9	NR	
n-value (SF/MF)	98/ -	44/24	383/183	960/138	36/ -	
NR = Not reported						

Table 21. Cooling Equipment Saturation

Table 22. Supplemental Cooling Equipment Penetration

Building Type	Central Heat Pump	Ductless Heat Pump	Window/ Room AC	Fans (Room/Ceiling)	Evaporative Cooler	n-value				
Single-Family	4.7%	2.9%	10.0%	71.5%	2.0%	1,054				
Multifamily	NR	NR	NR	NR	NR					
NR = Not reported										

Table 23 summarizes key parameters collected during the survey regarding space cooling thermostats. Notably, 15% of single-family homes and more than 3% of multifamily homes reported to have smart/wi-fi thermostats installed.

Table 23. Space Cooling Thermostat Parameters

			Average Set Points (degrees Celsius)				
Building Type	% Programmable Thermostat	% Smart/Wi-fi Thermostat	Occupant Home	Occupant Away	Occupant Asleep		
Single-Family	65.3%	15.2%	22.6	23.5	22.4		
Multifamily	36.6%	3.3%	21.6	22.6	21.9		
n-value (SF/MF)	1,490/172	1,490/172			1,474/169		

Domestic Hot Water

As noted above, we have not reported findings from the multifamily sector on water heating equipment that could service the entire building. These relevant tables have the "NR", or a not reported notation in the relevant fields.

As shown in Table 24, natural gas is reported to fuel the majority of the water heating units in single-family households (73%). Table 25 and Figure 7 show the distribution of water heating equipment in single-family households. While standard tank units were reportedly most prevalent, tankless water heaters made up 7.5% of the single-family market.

Table 24. Water Heating Penetration and Fuel Share Distribution

	% of Homes with	Fuel Share						
Building Type	Water Heating Equipment	Natural Gas	Electricity	Bottled Gas (Propane, Butane, LP)	Other			
Single-Family ^a	92.8%	72.7%	24.4%	1.9%	1.1%			
Multifamily	NR ^b				NR ^b			
n-value (SF)	2,321				2,038			

^a Single-family respondents reflect the share of households with equipment in home (i.e. not in the home's exterior).

^b NR = Not reported

Building Type	Standard Tank— Electric	Standard Tank— Gas	High Eff. Condensing— Gas	Tankless— Electric	Tankless— Gas	Heat Pump— Electric	Other	n-value
Single-Family	21.2%	64.1%	4.7%	0.8%	6.7%	1.8%	0.8%	1,785
Multifamily							NR	

Table 25. Water Heating Equipment Type Distribution





As shown in Table 26 and Figure 8, Northwest and East IESO zones reported the highest market share of water heater equipment fueled by electricity at 41% and 46% respectively. West and Niagara IESO zones reported the highest market share of water heater equipment fueled by natural gas at 83% and 84% respectively. The survey also found that tankless water heaters were most prevalent in the Essa IESO Zone with a market share of approximately 11%.

Equipment/Fuel Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest / Bruce	Toronto	West
Gas High Efficiency Condensing	4.9%	1.7%	2.1%	2.8%	1.3%	3.3%	4.2%	5.5%	5.5%
Gas Whole House Tankless System	4.1%	10.0%	5.7%	5.2%	4.0%	7.0%	5.0%	7.6%	8.8%
Gas Standard Tank	42.1%	51.3%	75.7%	51.7%	50.1%	64.7%	68.7%	70.4%	68.4%
Electric Heat Pump	1.9%	4.0%	1.8%	0.4%	5.3%	0.0%	1.0%	1.1%	5.1%
Electric Whole House Tankless System	0.7%	1.1%	0.0%	0.4%	0.0%	0.0%	0.4%	1.6%	0.1%
Electric Standard Tank	43.5%	29.0%	14.7%	36.7%	35.3%	24.2%	20.1%	13.1%	11.4%

Table 26. Single-Family Water Heating Equipment Distribution by IESO zone

Equipment/Fuel Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest / Bruce	Toronto	West
Bottled Gas High Efficiency Condensing	0.8%	2.5%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.7%
Other	1.9%	0.6%	0.0%	2.8%	4.0%	0.7%	0.4%	0.7%	0.0%





Table 27 summarizes key water heater parameters, including average age, shower behavior, ENERGY STAR penetration, Internet-enabled unit penetration and share of water heaters rented in single-family households. The majority of respondents reported having ENERGY STAR-certified equipment,⁵ and the multifamily sector shows a relatively high penetration of Internet-enabled water heaters (12%).

	Table 27. Water fleating Equipment Parameters									
Туре	Average Age	Avg. # of Household	% Rented ^a	% ENERGY STAR						
	(rears)	Showers Per								

11.3

8.5

Week

7.1

NR

Table 27. Water Heating Equipment Parameters

60.5%

NR

^a Responses from rented households only

Building

Single-Family

Multifamily

6 Internet

Enabled

2.6%

NR

83.1%

NR

⁵ Possible self-report bias.



Lighting

Table 28 and Figure 9 exhibit the inventory's results, with CFLs and LEDs combined holding the majority market share at 60% and 49% of all sockets for single-family and multifamily households, respectively. Single-family households reported that almost 42% of all light bulbs in their homes were LEDs. This market share remains higher than that observed elsewhere in North America. For example, a 2017 onsite study⁶ in the Pacific Northwest⁷ of the U.S. found that LEDs comprised 20% of the single-family market, while a 2015 onsite study for New York state⁸ in the U.S. found that CFL and LEDs combined made up 30% of the single-family market. Statistics Canada⁹ reported 32% of Ontario households having at least one LED present in 2015, which was an increase from 12% in 2013 and 9% in 2011.

This market is currently undergoing rapid transformation and this has been accelerated in Ontario by the saveONenergy consumer program, which has provided incentives for over 47 million LEDs since 2015. The results of the REUS survey are in agreement with this rapid market transformation and the significant program participation in recent years. However, as previously mentioned, self-report surveys can result in some respondent bias—that is respondents self-reporting more efficient equipment than they actually use and/or they confuse equipment types (e.g., differences between CFLs and LEDs), and therefore the results should be considered with some caution.

⁶ Data collected by trained field technicians, visiting a sample of homes in-person.

⁷ *Residential Building Stock Assessment – Single Family Report*. Northwest Energy Efficiency Alliance. 2017

⁸ Residential Statewide Baseline Study – Single Family Report. New York State Energy Research and Development Authority (NYSERDA). 2015

Accessed from Statistics Canada website: <u>https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810004801&pickMembers%5B0%5D=1.7</u>. November 2018



Figure 9. Lighting Bulb Type Distribution



Building Type	Incandescent/Halogen	CFL	LED	Linear Fluorescent	Other	n-value
Single-Family	29.6%	17.8%	41.8%	6.2%	4.5%	2,294
Multifamily	36.9%	17.2%	32.0%	9.7%	4.1%	752

Table 29 and Figure 10 exhibit the distribution of light bulbs across IESO zones as reported in singlefamily households. There were no major differences in the distribution of efficient light bulbs across IESO zones for the single-family sector – CFL/LED light bulbs market share reportedly ranged from 56% in Northwest to 62% in Southwest/Bruce. LED market share in single-family households reportedly ranged from 37% in Ottawa to 45% in Southwest/Bruce. Table 30 and Figure 11 show the distribution of light bulbs across IESO zones as reported in multifamily households. The multifamily sector showed more variation in the distribution of light bulbs, with CFL/LED market share reportedly ranging from 39% in East to 59% in Northeast. LED market share in multifamily households reportedly ranges from 24% in West to 38% in Northwest, Northeast and Ottawa.

Bulb Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest / Bruce	Toronto	West
Incandescent /Halogen	29.6%	28.5%	32.0%	27.9%	31.5%	31.6%	28.3%	30.6%	26.7%
CFL	18.6%	16.1%	20.7%	23.1%	17.0%	21.8%	16.7%	15.8%	22.0%
LED	42.0%	44.1%	38.1%	35.4%	39.4%	37.6%	45.3%	41.7%	41.6%
Linear Fluorescent	5.7%	7.2%	4.8%	8.7%	6.7%	6.5%	5.0%	6.4%	7.1%
Other	4.1%	4.0%	4.5%	4.9%	5.4%	2.4%	4.8%	5.5%	2.6%
n-value	467	164	80	261	100	104	593	229	296

Table 29. Single-Family Lighting Bulb Type Distribution by IESO zone



Figure 10. Single-Family Lighting Bulb Type Distribution by IESO zone

Table 30. Multifamily	/ Lighting Bulk	Type Distribution	by IESO zone
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Bulb Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest / Bruce	Toronto	West
Incandescent /Halogen	42.7%	22.0%	28.7%	25.2%	37.4%	40.0%	31.5%	39.0%	35.0%
CFL	9.8%	18.3%	25.7%	20.7%	19.3%	10.4%	21.3%	15.6%	29.5%
LED	28.8%	35.6%	28.2%	38.4%	38.2%	37.9%	33.1%	32.0%	24.1%
Linear Fluorescent	9.9%	16.6%	10.8%	11.3%	4.6%	8.2%	8.7%	9.9%	8.1%
Other	8.7%	7.5%	6.5%	4.5%	0.6%	3.5%	5.5%	3.5%	3.2%
n-value	69	40	50	70	23	68	74	284	74



Figure 11. Multifamily Lighting Bulb Type Distribution by IESO zone

Table 31 summarizes additional lighting equipment parameters. The average number of lamps per household was reported at 42 for SFDs and 21 lamps for multifamily units.¹⁰ Multifamily units again showed a higher propensity towards Internet-enabled devices, with 16% of all LEDs Internet-enabled.

Building Type	Avg. # of Lamps per Household	Avg. # of Lamps in Storage	% LEDs Internet Enabled
Single-Family	42.2	12.9	5%
Multifamily	20.8	7.4	16%
n-value (SF/MF)	2,294/752	2,018/569	1,495/352

Table 31. Home Lighting Equipment Parameters

Table 32 details respondents' preferences for incandescent lamps—roughly one-third of respondents indicated expense as the most important factor.

Table 32. Distribution of Customer Preferences for Incandescent Lamps

Building Type	Brighter	Better Quality Light	Less Expensive	Turn on Instantly	Already Installed/Original Equipment	Replacements Not Available	Other	n-value
Single-Family	18.2%	24.0%	36.1%	9.3%	3.4%	3.4%	5.5%	1,283
Multifamily	19.8%	28.9%	34.9%	6.9%	0.8%	2.2%	6.5%	406

Clothes Washer/Dryer and Dishwasher

Table 33 exhibits the penetration of clothes washers, clothes dryers and dishwashers in single-family and multifamily homes. While almost all surveyed single-family homes reported to have a clothes washer and dryer present, just less than one-half of surveyed multifamily dwellings reported to have such equipment within their unit.

Table 33. Penetration of Clothes Washer, Clothes Dryer and Dishwasher

Building Type	% of Homes with Clothes Washer	% of Homes with Clothes Dryer	% of Homes with Dishwasher
Single-Family	96.4%	94.2%	73.7%
Multifamily	44.9%	42.7%	45.0%
n-value (SF/MF)	2,372/771	2,369/772	2,375/774

Table 34 details the fuel share distributions for clothes dryers, with 88% and 94% of clothes dryers electrically fueled for single-family and multifamily dwellings, respectively.

Table 34. Clothes Dryer Fuel Share Distribution

Building Type	Natural Gas	Electricity	Bottled Gas (propane, butane, LP)	Other	n-value
Single-Family	11.2%	88.1%	0.5%	0.1%	2,179

¹⁰ These findings generally align with data published by Statistics Canada in 2011 that found an average of 27 lamps per residential home in Ontario (single-family and multifamily combined). Statistics Canada website: https://www150.statcan.gc.ca/n1/pub/11-526-s/2013002/t012-eng.htm. Accessed November 2018.

Multifamily

0.1% 0.0% 278

Table 35, Table 36, and Table 37 summarize various equipment parameters, including usage behaviors, equipment age, ENERGY STAR market share and internet-enabled equipment for clothes washers, dryers and dishwashers. Survey respondents reported that almost 40% of all clothes dryer loads were offset with hang-drying during the summer. Single-family households also showed a greater propensity to wash clothes with cold water cycles (9%) when compared with multifamily households (4%). As with other end uses, multifamily households reported a higher penetration of Internet-enabled equipment compared with single-family households, with just fewer than 2% of Internet-enabled dishwashers reported in multifamily dwellings.

Table 35. Clothes Washer Equipment Parameters

Building Type	Avg. # of Loads per Household per Week	% of Loads as Cold Water Cycles	Avg. Age (years)	% ENERGY STAR	% Internet Enabled
Single-Family	4.1	9.0%	7.3	83.8%	2.9%
Multifamily	3.3	4.0%	6.2	82.0%	2.5%
n-value (SF/MF)	2,259/305	2,209/300	1,926/233	1,893/236	2,219/295

Table 36. Clothes Dryer Equipment Parameters

Building Type	Avg. # of Loads per Household per Week	% Loads Hang Dry—Winter	% Loads Hang Dry—Summer	Avg. Age (Years)	% ENERGY STAR	% Internet Enabled
Single-Family	3.2	20.7%	39.7%	8.0	77.7%	2.1%
Multifamily	2.6	23.0%	34.4%	6.7	81.2%	2.5%
n-value (SF/MF)	2,149/275	989/76	964/70	1,800/211	1,770/212	2,120/259

Table 37. Dishwasher Equipment Parameters

Building Type	Avg. # of Loads per Household per Week	Avg. Age (Years)	% ENERGY STAR	% Internet Enabled	n-value
Single-Family	3.5	7.2	78.9%	0.8%	3.5
Multifamily	2.9	6.5	77.8%	1.8%	2.9
n-value (SF/MF)	1,651/303	1,396/226	1,319/211	1,625/291	1,651/303

Cooking

Table 38 through Table 40 detail survey findings for cooktop/stove/range cooking equipment in singlefamily and multifamily households. More than 97% of households reported having a cooktop, stove or range present. Of the single-family households that have a cooktop/stove/range present, they reported a saturation of 1.2 units per household. While convection appliances were reported to be more common in single-family households (28%), induction appliances were more common in multifamily dwellings (6.3%). The majority of ranges use electricity as a fuel, and 4% of ranges were reported to be Internetenabled in the multifamily sector.

Ruilding Type	Penetration	Saturation	Cooktop/Stovetop/Range Equipment Type Distribution					
Building Type	Felletration	Saturation	Conventional	Convection	Induction	Other		
Single-Family	97.1%	1.2	66.3%	28.0%	3.9%	1.8%		
Multifamily	97.5%	1.3	80.3%	11.5%	6.3%	1.9%		
n-value (SF/MF)	2,367/774	2,298/747				2,231/706		

Table 38. Cooktop/Stove/Range Penetration, Saturation and Equipment Type Distribution

Table 39. Cooktop/Stove/Range Fuel Share Distribution

Building Type	Electric + Natural Gas	Natural Gas	Electricity	Bottled Gas (Propane, Butane, LP)	Other	n-value
Single-Family	2.7%	18.8%	77.1%	0.8%	0.7%	2,208
Multifamily	1.7%	4.9%	93.4%	0.0%	0.0%	686

Table 40. Cooktop/Stove/Range Equipment Parameters

Building Type	Avg. Usage per Household per Week	Avg. Age (years)	% Internet Enabled	n-value (Usage / Age / Internet)
Single-Family	11.7	8.8	2.1%	2,210 / 1,792 / 2,164
Multifamily	11.5	8.7	4.0%	696 / 435 / 663

Table 41 and Figure 12 exhibit the fuel share distribution for cooktop/stove/range equipment in singlefamily households. Northwest and Northeast IESO zones reported the highest electric fuel shares at 91% and 90% respectively, while West and Niagara reported the highest natural gas fuel shares at 33% and 24% respectively. The East and Essa IESO zones reported higher fuel shares for bottled gas equipment at 4% and 3% respectively.

Table 41. Single-Family Cooktop/Stove/Range Fuel Share Distribution by IESO zone

Fuel Type	East	Essa	Niagara	Northeast	Northwest	Ottawa	Southwest/ Bruce	Toronto	West
Electric + Gas	1.1%	0.2%	4.4%	1.0%	0.0%	1.6%	1.0%	5.6%	2.0%
Natural Gas	12.1%	12.5%	24.2%	5.1%	7.7%	13.7%	22.4%	19.1%	32.8%
Electricity	81.2%	83.8%	69.7%	89.9%	91.3%	84.7%	75.6%	75.2%	64.7%
Bottled Gas	3.8%	3.3%	0.3%	1.5%	1.0%	0.0%	0.1%	0.0%	0.0%
Other	1.8%	0.3%	1.5%	2.5%	0.0%	0.0%	0.9%	0.0%	0.6%
n-value	455	160	77	251	93	104	564	218	286



Figure 12. Single-Family Cooktop/Stove/Range Fuel Share Distribution by IESO zone

Table 42, Table 43, and Table 44 detail the survey findings for standalone wall oven equipment in singlefamily and multifamily households, which reported—respectively—9.4% and 7.9% having separate wallovens, with an even distribution of equipment between conventional and convection ovens. Almost all ovens (95%+) were reported to be fueled by electricity.

Table 42. Stand	lalone Wall Ov	en Penetratio	n, Sa	turat	ion and E	quipme	nt Typ	e Distri	bution

Building Type	Denetration	Saturation	Standalone Wall Oven Equipment Type Distribution				
building type	renetration	Saturation	Conventional	Convection	Other		
Single-Family	9.4%	1.2	55.5%	39.3%	5.3%		
Multifamily	7.9%	1.2	57.1%	40.3%	2.6%		
n-value (SF/MF)	2,353/761	204/50			197/47		

Building Type	Electric + Natural Gas	Natural Gas	Electricity	Bottled Gas (Propane, Butane, LP)	Other	n-value
Single-Family	1.0%	3.3%	95.3%	0.2%	0.2%	188
Multifamily	0.0%	3.0%	97.0%	0.0%	0.0%	43

Table 43. Standalone Wall Oven Fuel Share Distribution

Table 44. Standalone Wall Oven Equipment Parameters

Building Type	Avg. Usage per Household per Week	Avg. Age (Years)	% Internet Enabled	n-value (Usage/Age/Internet)
Single-Family	6.9	9.5	7.4%	187/157/181
Multifamily	7.8	9.0	ID	43/31/41



Refrigerator/Freezer

As shown in Table 45, 98% of single-family and multifamily households reported having at least one fullsize refrigerator, with an average of 1.3 full-size refrigerators per home in the single-family sector. Table 46 shows standalone freezers were reportedly much more prevalent in single-family households (61% penetration), with manual defrost chest freezers the most common (38%). As shown in Table 47 and Figure 13, a minority of homes used compact/mini-fridges, with only 10% of multifamily dwellings reporting the equipment present.

			Full-size Refrigerator Equipment Type Distribution						
Building Type	Penetration	Saturation	Single	Тор	Bottom	Side-by-	Othor		
			Door	Freezer	Freezer	Side	Other		
Single-Family	97.9%	1.3	12.8%	36.8%	36.7%	12.6%	1.1%		
Multifamily	97.5%	1.0	15.2%	64.5%	15.9%	3.8%	0.5%		
n-value (SF/MF)	2,373/774	2,381/778				2	2,313/744		

Table 45. Full-size Refrigerator Penetration, Saturation and Equipment Type Distribution

Table 46. Standalone Freezer Penetration, Saturation and Equipment Type Distribution	Table 46.	Standalone	Freezer Pene	etration, Satu	uration and I	Equipment [·]	Type Distribution
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			Stand-alone Freezer Equipment Type Distribution					
Building Type	Penetration	Saturation	Upright, Frost-	Upright, Manual	Chest,	Chest, Manual		
			Free	Defrost	Frost-Free	Defrost		
Single-Family	61.1%	1.1	22.1%	19.8%	19.8%	38.3%		
Multifamily	26.9%	1.1	16.5%	25.7%	22.3%	35.4%		
n-value (SF/MF)	2,371/773	2,381/778				1,561/214		

Table 47. Compact/Mini-Fridge Penetration and Saturation

Building Type	Penetration	Saturation	
Single-Family	23.2%	1.2	
Multifamily	10.8%	1.2	
n-value (SF/MF)	2,372/774	2,381/778	



Figure 13. Refrigeration Equipment Penetration

Table 48 summarizes refrigeration equipment parameters. The majority of refrigeration equipment was reported as ENERGY STAR-certified,¹¹ while just under 2% of all full-size refrigerators were Internetenabled. On average, standalone freezers were more than 10 years old.

	Full-Size Refrigerator			Standalor	ne Freezer	Compact/Mini-Fridge	
Building Type	Average Age (years)	% ENERGY STAR	% Internet- Enabled	Average Age (years)	% ENERGY STAR	% ENERGY STAR	
Single-Family	7.8	77.3%	1.7%	11.6	62.0%	63.7%	
Multifamily	7.6	63.8%	1.8%	9.7	62.2%	76.6%	
n-value (SF/MF)	1,859/453	1,787/517	2,257/714	1,275/164	1,183/180	441/62	

Table 48. Refrigeration Equipment Parameters

Humidifier/Dehumidifier

Table 49 and Table 50 exhibit penetration and saturation levels for humidifiers and dehumidifiers. Roughly one-third of single-family households reported to have humidifiers and dehumidifiers. Reported saturation of humidifiers averaged 1.5 per single-family household and 1.3 per multifamily household.

Building Type	Humidifier	Dehumidifier
Single-family	31.5%	34.3%
Multifamily	18.4%	8.7%
n-value	40/13	2,331/756

Table 49. Humidifier/Dehumidifier Penetration

¹¹ Possible self-report bias.

Building Type	Humidifier	Dehumidifier
Single-family	1.5	1.1
Multifamily	1.3	1.2
n-value	271/112	769/54

Table 50. Humidifier/Dehumidifier Saturation

Building Envelope

Table 51 summarizes survey responses on the quality of household/dwelling insulation by building type. Almost 90% of single-family respondents indicated their homes were at least adequately insulated, but more than 20% of multifamily respondents indicated their units were not insulated or poorly insulated.

Table 51. Household Insulation Quality Distribution

Building Type	Not Insulated	Poorly Insulated	Adequately Insulated	Very Well Insulated	n-value
Single-Family	0.8%	10.2%	60.9%	28.1%	2,242
Multifamily	4.1%	17.6%	53.1%	25.1%	602

Figure 14 details the distribution of window glass construction by building type. Almost 82% of windows in single-family households reported to have double or triple-pane glass, with a smaller share of multifamily windows (60%) reported as using double or triple-pane glass. Table 52 shows almost 30% of windows in single-family households were low-e gas filled, while just over 10% of multifamily windows were low-e gas filled.



Figure 14. Window Glass Construction Type Distribution

Table 52. Window Parameters

Building Type	% Low-e Gas Filled	Avg. Age (years)
Single-Family	29.4%	13.6
Multifamily	10.7%	14.8
n-value (SF/MF)	2,300/735	1,773/432

Consumer Electronics

The trend towards internet-connected and smart electronic devices in households is evident in the study findings. As shown in Table 53, the television market has transitioned largely to Internet-enabled LED screens (50% of the single-family market share). Most televisions also were ENERGY STAR-certified, and the average number of televisions per household was 2.3 for single-family and 1.7 for multifamily. Due to a limitation in the data collection, equipment counts in this section are presented as average counts of equipment units over <u>all</u> households surveyed. This is different from the saturation figures reported above, which average equipment counts over only households that reported having that piece of equipment in their home. Therefore, the average equipment number per household could be lower than 1.0 (unlike saturation metrics, reported elsewhere in this report). See the recommendations section for additional information.

Building Type	Avg. # por Household	% ENERGY STAR	% Internet Enchled	Television Type Distribution			
building type	Avg. # per nousenoiu	70 ENERGI STAR	% internet chabled	Standard	LCD	LED	Other
Single-Family	2.3	70.6%	50.2%	12.3%	31.6%	49.8%	6.3%
Multifamily	1.7	68.8%	45.3%	16.0%	35.2%	43.5%	5.2%
n-value (SF/MF)	2,297/722	1,670/523	2,352/700	2,297/722			97/722

Table 53. Television Parameters and Equipment Type Distribution

Table 54 summarizes the average number of equipment units per household and ENERGY STAR penetration for laptops, desktop computers and monitors. The personal computer market also has transitioned, with roughly twice as many laptop computers reported per household (1.3 for multifamily) compared with desktop computers (0.6 for multifamily). ENERGY STAR equipment also was prevalent, with more than 50% penetration reported across single-family and multifamily dwellings.

	Laptop Co	omputer	Desktop Co	omputer	Desktop Monitors		
Building Type	Avg. # per Household	% ENERGY STAR	Avg. # per Household	% ENERGY STAR	Avg. # per Household	% ENERGY STAR	
Single-Family	1.5	69.5%	0.8	57.9%	1.1	70.4%	
Multifamily	1.3	66.9%	0.6	53.7%	0.8	63.8%	
n-value (SF/MF)	2,344/722	1,470/469	2,339/772	1,156/375	2,347/773	876/330	

Table 54. Computer Equipment Parameters

Survey respondents also provided information on the number of various types of consumer electronics in their home, as shown in Table 55. Smart speakers are beginning to penetrate the market, with an average number of 0.3 smart speakers per home for single-family and multifamily. Tablet computers also were throughout Ontario, with an average of 1.3 tablets per single-family household.
Building Type	Video Game Consoles	DVD, Blu- Ray, VCR	Stereo Systems Connected to Television	Standalone Stereo System	Smart Speaker	Tablet Computer	Printer	Smart Phone	Non- Smart Cell Phones	n- value
Single-Family	0.8	1.1	0.5	0.5	0.3	1.3	1.1	2.0	0.3	2,347
Multifamily	0.6	0.7	0.3	0.4	0.3	1.0	0.7	1.5	0.3	773

Table 55. Average Number of Consumer Electro	onics per Household
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Smart plug penetration was reported at about 12% for single-family and multifamily households, with an average saturation of 2.4 per single-family household, as shown in Table 56. The distribution of smart plugs by application remained fairly even across home offices, entertainment systems and other various devices.

Table 56.	Smart Plug	Penetration.	Saturation and	l Eaui	pment	Distribution
10510 30.	Sinareriag	i chettation,	Sucuration and	Lyui	pincinc	Distribution

Puilding Type	Donotration	Saturation	Smart Plug Equipment Distribution				
Building Type	Penetration	Saturation	Home Office	Entertainment System	Other Devices		
Single-Family	12.5%	2.4	40.4%	33.6%	26.0%		
Multifamily	11.4%	2.8	25.1%	34.8%	40.1%		
n-value (SF/MF)	2,284/745	250/75			250/75		

Pools/Hot Tub

Ontario exhibited fairly high pool ownership levels, with 10.7% of single-family households reporting a swimming pool on their property, as shown in Table 57. Almost one-half (44%) of swimming pools were reportedly not heated, while 34% of all pools were heated with natural gas as shown in Table 58. Almost all pools (95%) were reported to use a single-speed pool pump motor, with no respondents indicating use of a variable speed pool pump as shown in Table 59.

Table 57. Pool and Hot Tub Penetration

Building Type	Swimming Pool	Hot Tub
Single-Family	10.7%	7.3%
n-value	2,356	2,357

Table 58. Pool Heating Fuel Share Distribution

Building Type	Natural Gas	Electricity	Solar Heater	Bottled Gas	Other	None	n-value
Single-Family	34.1%	11.1%	9.4%	1.1%	0.2%	44.2%	269

Table 59. Pool Pump Equipment Type Distribution

Building Type	Single Speed	Variable Speed	No Pump	n-value
Single-Family	94.8%	0.0%	5.2%	191

Hot tub penetration in homes was reported to be 7.3% for single-family, as shown in Table 57, with the majority of hot tubs heated using electricity: 90% in single-family households as shown in Table 60.

Table 60. Hot Tub Heating Fuel Share Distribution

Building Type	Natural Gas	Electricity	Bottled Gas (Propane, Butane, LP)	n-value
Single-Family	9.9%	89.9%	0.2%	175

Vehicles

Survey respondents provided information on vehicle electricity consumption. Table 61 exhibits penetrations of engine vehicle block heaters in households: 10.6% of single-family and 4.1% of multifamily households reported this equipment's presence.

Building Type	% of Homes w/Block Heater	n-value
Single-Family	10.6%	2,311
Multifamily	4.1%	742

Table 61. Penetration of Vehicle Block Heaters

Figure 15 exhibits the penetration of electric vehicles in Ontario, with almost 2.4% of all single-family and just over 2.2% of multifamily households reporting they owned or leased an electric or plug-in hybrid vehicle. While electric vehicles have been incentivized in Ontario over the past several years, this market share remains higher than that what would be expected based on electric vehicle sales in Canada¹². This higher than expected reported finding may reflect respondent bias—respondents selfreporting more efficient equipment than they actually use and/or they confuse equipment types (e.g., differences between hybrid and plug-in electric vehicles). Table 62 and Table 63 summarize consumers' charging behaviors. Single-family households more likely charged overnight (58% of respondents), compared with multifamily respondents, who showed a higher propensity for charging during the day or evening hours. Level 2 charges were more prevalent in multifamily households; however, both housing types had relatively low percentages of consumers not charging at home (14% for single-family and 19% for multifamily).

¹² FleetCarma reported that the total cumulative number of plug-in electric vehicles on the road in Canada to be 47,800. With more than 33 million vehicles in total on the road in Canada according to Statistics Canada, this suggests that plug-in electric vehicles account for approximately 0.2% of all cars on the road.



Figure 15. Penetration of Electric Vehicles in Households



Building Type	Day (9am to 5pm)	Evening (5pm to 9pm)	Overnight (9pm to 9am)	n-value
Single-Family	7.1%	34.5%	58.4%	49
Multifamily	17.6%	40.4%	42.0%	17

Table 63. EV Home Charger Equipment Type Distribution

Building Type	Level 1 (110v)	Level 2 (240v)	Don't Charge at Home	n-value
Single-Family	48.3%	37.4%	14.4%	51
Multifamily	33.6%	47.6%	18.8%	19

Demographics of Survey Respondents

Table 64, Table 65, Table 66, Table 67, Table 68 and Table 69 summarize survey respondents' demographics, including distributions by age, household size, education level, employment status, household income, and housing type. The REUS respondent demographics summarized below generally align with the census demographics data reported by Statistics Canada.

		•	-		
Building Type	Under 25	25 to 44	45 to 64	65 or older	n-value
Single-Family	5.7%	26.2%	43.7%	24.4%	2,350
Multifamily	7.1%	33.8%	35.4%	23.7%	769

Table 64. Respondent Age Distribution

Table 65. Average Number of People per Household by Age Group

Building Type	Total	Under 18	18 to 34	35 to 54	55 to 64	65 or older	n-value
Single-Family	2.7	10.6%	17.4%	24.4%	22.3%	25.3%	2,326
Multifamily	2.0	8.1%	24.1%	23.5%	19.0%	25.2%	751

Table 66. Respondent Education Level Distribution

Building Type	High school	College/university	Post-graduate	n-value
Single-Family	14.7%	69.1%	16.2%	2,335
Multifamily	16.7%	63.3%	20.0%	764

Table 67. Respondent Employment Status Distribution

Building Type	Employed Full Time	Not in Workforce (retired, student, etc.)	Other (part time, unemployed, etc.)	n-value
Single-Family	45.6%	39.6%	14.8%	2,316
Multifamily	41.1%	39.3%	19.6%	757

Table 68. Respondent Household Income Level Distribution

Building Type	Under \$25,000	\$25,000 to under \$50,000	\$50,000 to under \$100,000	Over \$100,000	n-value
Single-Family	8.8%	18.6%	40.5%	32.0%	2,049
Multifamily	21.6%	25.8%	37.5%	15.1%	692

Table 69. Respondent Housing Type Distribution

Building Type	Single-Family Detached	Double/Row House	Mobile Home	MURB Low-Rise	MURB High-Rise	n-value
Single-Family	77.9%	20.9%	1.3%	0.0%	0.0%	2,381
Multifamily	0.0%	0.0%	0.0%	37.9%	62.1%	778

Future Study Recommendations

As the first study of its kind for IESO, the REUS charted new ground in collecting valuable, Ontariospecific home energy use data for various stakeholders. To continue to advance and improve about this research instrument, Cadmus has identified several observations and recommendations that could be considered to improve future end-use surveys and/or enrich the current study's findings:

Sampling and Logistics

- The panel group used for the online survey approach had a greater share of households in urban areas in the southern Ontario. For future studies, consider fielding a paper-based survey to reach a broader range of households in Ontario, especially in the northern regions such as the Northwest IESO zone.
- Consider developing a sample frame by IESO zone, building type, and one or two important stratification variables (e.g., income status, urban vs. rural); so all cross tabulations have the necessary confidence/precision (e.g., 90/10 by Toronto IESO zone, single family dwellings, and low-income households).
- Deploy the survey in spring or fall when homeowners are less likely to be on vacation.

Data Quality & Supplementary Research

- Focus self-report surveys on end-use/equipment saturations and fuel shares as well as on household characteristics and behaviors.
 - Consider targeted on-site surveys to collect more robust equipment efficiency data (e.g., ENERGY STAR equipment penetration).
- Implement phone survey verification follow-ups to confirm unexpected findings (e.g. on electric vehicle penetration and internet-enabled penetration findings).
- Future residential end use studies should closely monitor the following household equipment and building characteristics that are undergoing the most rapid transformation:
 - Lighting equipment type distribution
 - Heat pump space heating and water heating equipment
 - Smart/wi-fi thermostat penetration
 - Internet-enabled equipment, appliance and consumer electronic penetration
 - Home envelope characteristics such as insulation levels and window construction (e.g., # of panes and penetration of low-e gas filled windows)
 - Plug-in electric vehicle penetration
- Future studies should be conducted every three years to capture changes to rapidly transforming markets, as outlined above, and to provide timely and relevant inputs to future achievable potential studies.

Survey & Questionnaire Design

As this uses a self-report survey, it is important to ensure all survey questions are as straightforward and clear as possible. These surveys can be improved by adopting the following recommendations:

- Instruct respondents not to include seasonal lights such as Christmas or Halloween lights in the lighting inventory questions.¹³
- Make it clear that single-family households should include water heaters in garages or outside their home so long as it serves their home. This will improve the domestic hot water end-use penetration estimates.
- A separate survey of multifamily building owners and/or facility managers would be helpful to inform characteristics of space heating, space cooling and water heating equipment that services the entire building (since individual unit dwellers are not familiar with these central systems).
- Ask respondents if they have a piece of equipment in their home before asking about the equipment type (e.g., for cooking, refrigeration and consumer electronics). This will allow the average equipment count across all respondents to be presented as well the penetrations (i.e., share of respondents that reported having at least one equipment unit) and saturations (i.e., average equipment count across only those respondents who reported having at least one equipment unit).

Data Analysis

When designing survey questions, it is also important to bear in mind post-data collection analysis. Future survey analysis can benefit from the following recommendations:

- Limit non-responses to "I don't know", "Prefer not to answer", and "Not applicable", ensuring that respondents choose at least one pre-defined response category for every question. This simplifies survey analysis and avoids ambiguity in non-responses.
- Design all questions with numeric categories such that each category contains an unambiguous mid-point (e.g. "1 to 3 bulbs" instead of "1 to 2 bulbs").
- When possible, avoid asking respondents to provide text responses (with "Other, please specify" being used sparingly).
- For space heating questions, ask questions pertaining to primary equipment (its fuel and equipment type) separate from secondary equipment.

¹³ Cadmus removed any responses suspected of including seasonal light bulb counts in the inventory (based on abnormally high bulb counts/square foot) as part of the data review process.

Appendix A. REUS Online Survey Instrument

Welcome to the IESO Home Energy Survey!

YOUR FEEDBACK MATTERS.

The Independent Electricity System Operator (IESO) is seeking your input to make a difference in future energy planning in Ontario. Your response to our Home Energy Survey will help identify opportunities for improving energy efficiency programs and assist in planning for future energy needs in Ontario.

To start the survey, click the right arrow button below.

This survey asks questions about energy-using equipment in your home (e.g., lights, refrigerators, ovens, etc.) – therefore, we suggest that you take this survey while at home. This survey can be completed at your convenience. If you would like to begin now and return to it later, simply close your browser and your progress will be automatically saved. When you are ready to finish, use the original link provided in the email from Logit Group with the same browser and you will return to the place you ended.

If you have questions or would like to learn more about this research study or the IESO, please visit www.ieso.ca/homeenergysurvey, email us at homeenergysurvey@ieso.ca or call us at 416-957-3555.

To check out the "**Frequently Asked Questions**" page for answers to questions about the study, copy this link (http://ieso.ca/-/media/files/ieso/survey/home-energy-survey-faq.pdf) into another tab on your internet browser.

End of Block: Welcome

Start of Block: Screening

ID Please enter the 5-digit Survey ID (found above your name on the mailing label):

C2 What type of home do you live in?

O Mobile home

• A single-family detached home

O Double/row house (semi-detached, town house or a single-family home that has been converted to more units)

O Low-rise, multi-unit residential building (condo or apartment with fewer than 5 stories)

O High-rise multi-unit apartment building (condo or apartment with 5 or more stories)

O Other ______

🔘 I don't know

O Prefer not to answer

End of Block: Screening

Start of Block: C. Home and lifestyle

C2a How many units are in the building your unit occupies? *Excludes row houses*.

O 3 to 6 units

🔘 7 to 10 units

11 to 15 units

16 to 20 units

21 to 30 units

31 to 50 units

○ 51 to 75 units
○ 76 to 125 units
O More than 125 units
○ I don't know
C3 Do you own or rent your home/apartment?
Own
○ Rent
Occupy without rent
◯ I don't know
Display This Question:
If Do you own or rent your home/apartment? = Rent
C3b Who pays the electricity bill for your home/apartment? Select one response.
C3b Who pays the electricity bill for your home/apartment? Select one response. O Myself or someone who lives at this home/apartment
C3b Who pays the electricity bill for your home/apartment? Select one response. Myself or someone who lives at this home/apartment A friend or family member who not does not live at this home/apartment
C3b Who pays the electricity bill for your home/apartment? Select one response. O Myself or someone who lives at this home/apartment A friend or family member who not does not live at this home/apartment Landlord or owner of this home/apartment
C3b Who pays the electricity bill for your home/apartment? Select one response. Myself or someone who lives at this home/apartment A friend or family member who not does not live at this home/apartment Landlord or owner of this home/apartment Someone else
C3b Who pays the electricity bill for your home/apartment? Select one response. Myself or someone who lives at this home/apartment A friend or family member who not does not live at this home/apartment Landlord or owner of this home/apartment Someone else

C4 In what year was this home/apartment originally built?

O Before 1946

O Between 1946 and 1960

O Between 1961 and 1977

O Between 1978 and 1983

O Between 1984 and 1995

O Between 1996 and 2000

O Between 2001 and 2005

O Between 2006 and 2011

O Between 2012 and 2016

2017 or later

🔘 I don't know

C5 How long have you lived at this address?

O Less than 2 yrs.

○ 3 to 5 yrs.

○ 6 to 10 yrs.

11 to 20 yrs.

○ 21 to 30 yrs.
Over 30 yrs.
○ I don't know
C6 Please indicate if any of the following has been updated in the past six years? Select all that apply.
Roof structure or surface
Caulking or weather-stripping around windows or doors
Exterior doors
Exterior wall siding
Insulation of basement or crawl spaces
Insulation in the garage
Insulation in roof or attic floor
Insulation in exterior (outside) walls
The foundation
Other

Display This Question:

If HousingType = home

C7 What is the heated area of your home?

- O 600 sq. ft. (55 m2) or less
- 601 1,000 sq. ft. (56 90 m2)
- 1,001 1,500 sq. ft. (91 140 m2)
- 1,501 2,000 sq. ft. (141 185 m2)
- 2,001 2,500 sq. ft. (186 230 m2)
- 2,501 3,000 sq. ft. (231 280 m2)
- 3,001 3,500 sq. ft. (281 325 m2)
- 3,501 4,000 sq. ft. (326 370 m2)
- 4,001 4,500 sq. ft. (371 420 m2)
- 4,501 5,000 sq. ft. (421 465 m2)
- 5,001 sq. ft. (466 m2) or more
- 🔘 I don't know
- O Prefer not to answer

Display This Question:

If HousingType = apartment/unit

C8 What is the heated area of your apartment/unit?

- 500 sq. ft. (46 sq. meters) or less
- 501 750 sq. ft. (47 69 sq. meters)
- 751 1,000 sq. ft. (70 92 sq. meters)
- 1,001 1,250 sq. ft. (93 116 sq. meters)
- 1,251 1,500 sq. ft. (117 139 sq. meters)
- 1,501 1,750 sq. ft. (140 162 sq. meters)
- 1,751 2,000 sq. ft. (163 185 sq. meters)
- 2,001 2,250 sq. ft. (186 209 sq. meters)
- 2,251 -2,500 sq. ft. (210 232 sq. meters)
- 2,501 2,750 sq. ft. (233 255 sq. meters)
- 2,751 3,000 sq ft. (256 279 sq. meters)
- 3,001 sq. ft. (280 sq. meters) or more
- 🔘 I don't know
- O Prefer not to answer

C9 Are you a natural gas customer? *If you use natural gas to heat your home/apartment or to heat your water, select "Yes."*

○ No
○ Yes
○ I don't know
O Prefer not to answer
Display This Question:
If HousingType = apartment/unit
D1a Do you have space heating equipment in your apartment or unit? Do not include space heating equipment that are not in your apartment or unit or those that serve multiple units.
O No space heating equipment in my apartment or unit
○ Yes
◯ I don't know

O Prefer not to answer

D2 This question is about the fuel you use to heat your home/apartment. Indicate which types of fuel you use to heat your home/apartment. *Select all that apply.*

I don't know what heating fuels I use
None
Natural gas
Electricity
Bottled gas
Heating oil
Wood or wood pellets
Other
Prefer not to answer
End of Block: C. Home and lifestyle

Start of Block: D. Space Heating

D3 Indicate the primary heating equipment (heats the majority of your home/apartment, most often used) and the equipment you use to supplement your primary heating, and the number of units.

Click the blue equipment text to see an image of the equipment type.

	Primary Unit	Supplemental Unit	Count of units (Select if more than 1)
	(select one)	(select all that apply)	
I don't know what heating equipment I use			▼ 2 4 or more

None		▼ 2 4 or more
Natural gas central forced-air furnace (hot air vents)		▼ 2 4 or more
Natural gas		▼ 2 4 or more
Natural gas boiler (hot water radiator)		▼ 2 4 or more
Natural gas		▼ 2 4 or more
Other gas equipment		▼ 2 4 or more
Electric resistance (baseboard/ceiling/floor/wall)		▼ 2 4 or more
Electric central forced-air furnace (hot air vents)		▼ 2 4 or more
Electric		▼ 2 4 or more
Electric ductless heat pump; mini-split (heats and cools)		▼ 2 4 or more
Electric portable heaters		▼ 2 4 or more
Other electric equipment		▼ 2 4 or more

Bottled gas central forced-air furnace (hot air vents)		▼ 2 4 or more
Bottled gas		▼ 2 4 or more
Bottled gas boiler (hot water radiator)		▼ 2 4 or more
Other bottled gas equipment		▼ 2 4 or more
Heating oil central forced-air furnace (hot air vents)		▼ 2 4 or more
Heating oil		▼ 2 4 or more
Heating oil boiler (hot water radiator)		▼ 2 4 or more
Other heating oil equipment		▼ 2 4 or more
Wood-burning		▼ 2 4 or more
Other equipment type / fuel 1		▼ 2 4 or more
Other equipment type / fuel 2		▼ 2 4 or more
Prefer not to answer		▼ 2 4 or more

D4 Thinking about your *primary heating equipment*, what is the age of this equipment? *Best estimate*.

O Enter number of years _____

🔘 I don't know

D5 Is your *primary heating equipment* ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

No
 Yes
 I don't know

D6 What portion of the heated floor space in your home/apartment is heated with your *primary heating equipment*? *Best estimate.*

Less than 50%
50% to 60%
61% to 70%
71% to 80%
81% to 90%
91% or more
I don't know

D7 How would you rate the efficiency of the *primary heating system equipment*? *Provide your best estimate.*

⊖ High
O Medium
C Low
○ I don't know
D8 Do you use a thermostat to control the <i>primary heating equipment</i> ?
○ No
○ Yes
○ I don't know
O Prefer not to answer
D8a Indicate the type of thermostat you use to control the primary heating equipment.
○ Simple on/off control

O Programmable thermostat (can be set to automatically adjust the temperature at certain times of the day)

Smart/WiFi enabled (can be programmed to automatically adjust the temperature at certain times based on motion sensors or learned behavior, or using an app on your Smart phone or tablet)

Standard thermostat (allows you to set the temperature and manually turn heat on/off. You cannot set the on/off times.)

O Other ______



🔘 I don't know

O Prefer not to answer

D8b During the **winter**, what is the typical temperature you set your thermostat to heat your home... *Best estimate*.

When someone is home during the day? When someone is NOT home during the day? Inside your home/apartment at night?

- ▼ Below 13°C (55°F) ... I don't know
- ▼ Below 13°C (55°F) ... I don't know
- ▼ Below 13°C (55°F) ... I don't know

End of Block: D. Space Heating

Start of Block: E. Space Cooling

Display This Question:

If HousingType = apartment/unit

E1a Do you have space cooling equipment in your apartment or unit? *Do not include space cooling equipment that are not in your apartment or unit or those that serve multiple units.*

No space cooling equipment in my apartment or unit

🔘 Yes

🔘 I don't know

Prefer not to answer

E1 Please indicate the equipment you use to cool your home/apartment. Indicate the primary cooling equipment (cools the majority of your home/apartment, most often used) and the equipment you use to supplement your primary cooling equipment.

	Primary Unit	Supplemental Unit
	(select one)	(select all that apply)
I don't know what cooling equipment I use		
None		
Central air conditioner		
Ductless heat pump; mini-split (heats and cools)		
Window/room air conditioner		
Fans (room, window, ceiling, etc.)		
Swamp cooler or evaporative cooler		
Other equipment type / fuel 1		
Other equipment type / fuel 2		
Prefer not to answer		

Click the blue equipment text to see an image of the equipment type.

E2_primary How many *primary cooling units* does your home/apartment have?

	○ One
	Отwo
	○ Three
	O Four or more
	O I don't know
	O Refused to answer
E2_	_secondary How many <u>supplemental cooling units</u> does your home/apartment have?

Central air conditioner	▼ One Prefer not to answer
Central heat pump	▼ One Prefer not to answer
Ductless heat pump; mini-split	▼ One Prefer not to answer
Window/room air conditioner	▼ One Prefer not to answer
Fans (room, window, ceiling, etc.)	▼ One Prefer not to answer
Swamp cooler or evaporative cooler	▼ One Prefer not to answer
Other 1	▼ One Prefer not to answer
Other 2	▼ One Prefer not to answer
1	

E3 Thinking about your *primary cooling equipment*, what is the age of this equipment? *Best estimate*.

O Enter number of years ______

🔘 I don't know

E4 Is your *primary cooling equipment* ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.

○ Yes	
○ I don't know	
E5 How would you rate the efficiency of your primary cooling system equipment ? Best estimate.	
○ High	
O Medium	
C Low	
○ I don't know	
E6 Do your use a thermostat to control the <i>primary cooling system equipment</i> ?	
○ No	
○ Yes	
○ I don't know	
O Prefer not to answer	

E6a Indicate the type of thermostat you use to control the *primary cooling system equipment*.

O Simple on/off control

O Programmable thermostat (can be set to automatically adjust the temperature at certain times of the day)

Smart/WiFi enabled (can be programmed to automatically adjust the temperature at certain times based on motion sensors or learned behavior, or using an app on your Smart phone or tablet)

Standard thermostat (allows you to set the temperature and manually turn heat on/off. You cannot set the on/off times.)

O Other ______

🔘 I don't know

O Prefer not to answer

E6b During the SUMMER, what is the typical temperature you set your thermostat to cool your home/apartment... *Best estimate*.

When someone is home during the day?	▼ Off I don't know
When someone is NOT home during the day?	▼ Off I don't know
Inside your home/apartment at night?	▼ Off I don't know

End of Block: E. Space Cooling

Start of Block: F. Water Heating

F1 Do you have a water heater in your home/apartment? Do not include water heaters that are not in your home/apartment

🔿 No

○ Yes

🔘 I don't know

Prefer not to answer

Display This Question: If Do you own or rent your home/apartment? = Rent And HousingType = home

F2 Do you own or rent your water heater?

🔿 Own

O Rent

🔘 I don't know

F3 Indicate which type of fuel your water heater uses.

O I don't know what fuel my water heater uses

Natural gas

Electricity

O Bottled gas

O Other _____

O Prefer not to answer

F4 Please indicate the type of water heating system you have in your home/apartment. *Click the equipment text to see an image of the equipment type.*

	Primary Equipment
	(select one)
I don't know what water heat equipment I use	
Natural gas standard tank	
Natural gas whole house tankless system (instantaneous water heater)	
Natural gas high-efficiency condensing	
Natural gas - don't know type	
Electric standard tank	
Electric heat pump	
Electric whole house tankless system (instantaneous water heater)	
Electric point-of-use tankless system	
Electric - don't know type	

Bottled gas standard tank		
Bottled gas whole house tankless system (instantaneous water heater)		
Bottled gas high-efficiency condensing (with plastic vent pipe)		
Bottled gas - don't know type		
Type of water heater and fuel type		
Prefer not to answer		
F5 What is the age of your water heating equipment? <i>Best estimate.</i>		
O Enter number of years		
🔿 I don't know		
F6 Is your water heating equipment ENERGY STAR qualified? <i>Best estimate.</i> ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.		
◯ No		
○ Yes		
🔿 I don't know		

F7 Is your water heating equipment internet-enabled?

◯ No		
○ Yes		
O I don't know		

F8 In total, how many showers and baths are taken by all residents in your home/apartment in a **typical week**? *Best estimate.*

Fewer than 2
2 to 4
5 to 7
8 to 10
11 to 15
16 to 20
More than 20
I don't know

End of Block: F. Water Heating

Start of Block: G. Lighting

G1 Please indicate the types of rooms you have in your home/apartment. Select all that apply.

Kitchen	
Separate dining room	
Living, and/or family room(s)	
Finished basement recreation room	
Bathroom(s)	
Bedroom(s)	
Office and/or den	
Hallways and/or entryways	
Garage	
Other	
Prefer not to answer	

G2_kitchen Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your **kitchen**.

▼ None/Not applicable Prefer not to answer
▼ None/Not applicable Prefer not to answer
▼ None/Not applicable Prefer not to answer
▼ None/Not applicable Prefer not to answer
▼ None/Not applicable Prefer not to answer

G2_Dining Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your **separate dining room**.

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer

G2_Living Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your **living** and/or family room.

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer

G2_Recreation Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your **recreation room**.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer
	1

G2_Bath Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in all of your **bathrooms**.

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer
	1

G2_Bedrooms Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in all of your **bedrooms**.

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer

G2_Office Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your **office and/or den**.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer
	I

G2_hall Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your **hallways and/or entryways**.

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer

G2_Garage Indicate how many of each type of bulb is used in the ceiling fixtures and lamps in your garage.

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer
	1

G2_Exterior Indicate how many of each type of bulb is used in the ceiling fixtures and lamps **outside** of your home/apartment.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer

G2_Other Indicate how many of each type of bulb is used in the ceiling fixtures and lamps on the **other**

area you specified

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None/Not applicable Prefer not to answer
CFLs	▼ None/Not applicable Prefer not to answer
Linear fluorescents/flourescent tubes	▼ None/Not applicable Prefer not to answer
LEDs	▼ None/Not applicable Prefer not to answer
Other	▼ None/Not applicable Prefer not to answer

G3 What do you like most about using incandescent light bulbs compared to CFLs or LEDs?

🔘 I don't know

G4 How many of the LEDs you have installed in your home/apartment are **internet-enabled LED or** "**smart**" light bulbs? A smart bulb is an internet-capable LED light bulbs that allows lighting to be customized, scheduled, and controlled remotely

None
1 to 2
3 to 5
6 to 8
9 to 10
11 or more
I don't know

G5 How many of the interior and exterior lights are controlled by timers, dimmer switches, and occupancy sensors?

Interior lights on timers	▼ All I don't know
Interior lights on dimmers	▼ All I don't know
Interior lights on occupancy sensors	▼ All I don't know
Exterior (outside) lights on timers	▼ All I don't know
Exterior (outside) lights on dimmers	▼ All I don't know
Exterior (outside) lights on motion sensors	▼ All I don't know
Exterior (outside) photocell sensors	▼ All I don't know

G6 A boy had 4 light bulbs, but lost one. How many light bulbs does he have now?

○ None	
🔿 1 bulb	
O 2 bulbs	
O 3 bulbs	
O 4 bulbs	
O 5 or more bulbs	
🔿 I don't know	

G7 How many bulbs of each type does your home/apartment currently have in storage (i.e. not screwed into a fixture or lamp)?

Click the bulb type text to see an image of the bulb type.

Incandescents/halogens	▼ None I don't know
CFLs	▼ None I don't know
Linear fluorescents/Flourescent tubes	▼ None I don't know
LEDs	▼ None I don't know
Other	▼ None I don't know

End of Block: G. Lighting

Start of Block: H. Humidifiers/Dehumidifiers/HRV

H1 Does your home/apartment regularly use a humidifier?

O No

○ Yes

○ I don't know
H1a What type of humidifier does your home/apartment use most?
O Whole house humidifying system (connected to HVAC system)
O Individual Humidifier(s)
Other
○ I don't know
H1b Is your whole house humidifying system ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.
○ No
○ Yes
○ I don't know
H1c Is your whole house humidifying system internet-enabled?
◯ No
○ Yes
○ I don't know
H1d

1110

O 1	
○ 2	
O 3	
<u> </u>	
○ 5 or more	
◯ I don't know	

H1e Indicate the share of individual humidifiers that are ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.

○ Most
○ Some
○ None
O I don't know
H2 Does your home/apartment regularly use a <u>de</u> humidifier?
○ No
○ Yes
○ I don't know

H2a What type of <u>dehumidifier does your home/apartment use most?</u> Whole house dehumidifying system (connected to HVAC system) Individual dehumidifier(s) O Other I don't know H2b Is your whole-house dehumidifying system ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo. O No O Yes O I don't know H2c Is your whole house dehumidifying system internet-enabled? O No O Yes I don't know H2d How many individual dehumidifiers do you use in your home/apartment? \bigcirc 1

O 3	
○ 4	
O 5 or more	
🔿 I don't know	

H2e Indicate the share of individual dehumidifiers that are ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

(
	○ Most
	○ Some
	○ None
	🔾 I don't know

H3 Does your home/apartment have a Heat Recovery Ventilator (air exchanger)? *This is a whole house system that circulates air in and out of your home.*

○ No		
○ Yes		
◯ I don't know		

H3a Is your heat recovery ventilator ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

🔿 No



○ Yes
○ I don't know
H3b Is your heat recovery ventilator internet-enabled?
◯ No
○ Yes
○ I don't know
End of Block: H. Humidifiers/Dehumidifiers/HRV
Start of Block: I. Clothes Washing
I1 Do you have a clothes washer in your home/apartment?
\bigcirc No, I do not have a clothes washer in my home/apartment
O Yes, I have a clothes washer in my home/apartment
O I don't know
O Prefer not to respond
I2 What type of clothes washer do you have?
○ Top loading washer
O Front loading washer
○ I don't know
O Prefer not to respond

13 what is the age of your clothes washer? Best estimate.
O Enter number of years
O I don't know
14 Is your clothes washer ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.
○ No
○ Yes
O I don't know
I5 Is your clothes washer internet-enabled?
○ No
○ Yes
O I don't know
I6 About how many loads do you wash during a typical week using your clothes washer? <i>Provide your</i> best estimate.
○ Never
○ 1 or less
O 2 to 3

🔿 4 to 7



O 8 to 10
○ 11 or more
◯ I don't know
I7 What percentage of the clothes washer loads use a cold water cycle in a typical week?
O None
O Less than 10 %
○ 11 to 25%
○ 26 to 50%
○ 51 to 75%
○ 75 to 90%
○ 90% or more
🔿 I don't know
End of Block: I. Clothes Washing
Start of Block: J. Clothes Drying
J1 Do you have a clothes dryer in your home/apartment?
O No, I do not have a clothes dryer in my home/apartment
O Yes, I have a clothes dryer in my home/apartment
🔿 I don't know
O Prefer not to answer

J2 What type of clothes dryer do you have in your home/apartment?
O Natural gas dryer
O Electric dryer
O Bottled gas (propane, butane, LP)
Other
O I don't know
O Prefer not to answer
J3 What is the age of your clothes dryer? <i>Best estimate.</i>
O Enter number of years
O I don't know
J4 Is your clothes dryer ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.
○ No
○ Yes
◯ I don't know
J5 Is your clothes dryer internet-enabled?
○ No
○ Yes

🔿 I don't know	
J6 In a typical week in winter, about how many lo estimate.	oads do you dry using your clothes dryer? <i>Best</i>
O 1 or less	
O 2 to 3 loads	
• 4 to 7 loads	
O 8 to 10 loads	
O More than 10 loads	
🔿 I don't know	
J7 Do you ever hang <u>all</u> your clothes to dry instea	d of using your clothes dryer?
◯ No	
○ Yes	
O I don't know	
J7a What percentage of loads in a typical week de each season? <i>Best estimate</i> .	o you hang to dry instead of using the clothes dryer in
Winter	▼ None I don't know
Summer	▼ None I don't know
End of Block: J. Clothes Drying	
Start of Block: K. Dishwashers	



K1 Do you have a dishwasher?		
○ No		
○ Yes		
◯ I don't know		
O Prefer not to answer		
K1a How many dishwasher loads are run in a typical week ? <i>Best estimate</i> .		
O 1 or less		
O 2 to 3 loads		
O 4 to 7 loads		
O 8 to 12 loads		
○ 13 or more loads		
O I don't know		
K1b What is the age of your dishwasher? Best estimate.		
O Enter number of years		
O I don't know		

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K1c Is your dishwasher ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.

○ No
○ Yes
○ I don't know
K1d Is your dishwasher internet-enabled?
Νο
○ Yes
🔿 I don't know
End of Block: K. Dishwashers
Start of Block: La. Food Preparation - Stoves part 1
LUa Do you have a cooktop, stove, or range-oven in your home/apartment?
○ No
○ Yes
○ I don't know
O Prefer not to answer

L1_StoveType Indicate the type of **cooktop**, **stove**, **or range-oven** you have in your home/apartment.

Primary	▼ None/not applicable Prefer not to answer
Secondary	▼ None/not applicable Prefer not to answer

End of Block: La. Food Preparation - Stoves part 1

Start of Block: Lb. Food Preparation - Stoves part 2

L1_Stove_Fuel Indicate the <u>fuel</u> type used by the **cooktop**, **stove**, **or range-oven** you have in your home/apartment.

cooktop, stove, or range #1	▼ Natural gas Prefer not to answer
cooktop, stove, or range #2	▼ Natural gas Prefer not to answer

L1_Stove_Use Indicate how frequently you use the **cooktop**, **stove**, **or range-oven** you have in your home/apartment.

Primary cooktop, stove, or range	▼ Three or more times a day Not applicable
Secondary cooktop, stove, or range	▼ Three or more times a day Not applicable

L2 What is the age of your primary cooktop, stovetop, or range-oven? *Best estimate*.

O Enter number of years ______

🔘 I don't know

L3 Is your primary cooktop, stovetop, or range-oven ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

○ No	
○ Yes	
🔿 I don't know	
L4_stove Is your primary cooktop, stovetop, or rang	e-oven internet-enabled?
◯ No	
○ Yes	
O I don't know	
End of Block: Lb. Food Preparation - Stoves part 2	
Start of Block: Lc. Food Preparation - Ovens part 1	
L0b Do you have a stand-alone wall oven, not conne home/apartment?	ected to a cooktop, stovetop or range in your
◯ No	
○ Yes	
◯ I don't know	
O Prefer not to answer	
L1_Oven_type Indicate the type of stand-alone wal connected to cooktop, stovetop or range).	I-oven you have in your home/apartment (not
Primary	▼ None/not applicable Prefer not to answer
Secondary	▼ None/not applicable Prefer not to answer

End of Block: Lc. Food Preparation - Ovens part 1

Start of Block: Ld. Food Preparation - Ovens part 2

L1_Oven_Fuel Indicate the fuel type used by the stand-alone wall oven(s) you have in your home/apartment.

Primary stand-alone wall oven▼ Natural gas ... Prefer not to answerSecondary stand-alone wall oven▼ Natural gas ... Prefer not to answer

L1_Oven_Use Indicate how frequently you use the stand-alone wall-oven(s) you have in your home/apartment and the typical usage for the appliance(s).

Primary stand-alone wall oven	Three or more times a day Not applicable
Secondary stand-alone wall oven	▼ Three or more times a day Not applicable

L7 What is the age of your primary stand-alone wall oven? Best estimate.

O Enter number of years ______

🔘 I don't know

L8 Is your primary stand-alone wall oven ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

⊖ Ye	·S
\bigcirc L	on't know
L9 Is your	primary stand-alone wall oven internet-enabled?

🔿 No

○ Yes

O I don't know

End of Block: Ld. Food Preparation - Ovens part 2

Start of Block: M. Refrigerators

M1 How many wine chillers, compact or mini-refrigerators do you have plugged in and turned on in your home/apartment?

○ None	
O 1	
○ 2	
O 3 or more	
O I don't know	
O Prefer not to answer	
Are most of your wine chillers, compact, or mini refrigerators ENEPCY STAP qualified? ENEPCY	

M2 Are most of your wine chillers, compact, or mini-refrigerators ENERGY STAR qualified? *ENERGY* STAR products sometimes can be identified with the ENERGY STAR logo.

◯ No		
○ Yes		
🔿 I don't know		

M3 How many <u>full size refrigerators</u> do you have plugged in and turned on in your home/apartment? *Do not include compact or mini refrigerators and wine chillers.*

○ None	
○ 1	
○ 2	
O 3	
O 4 or more	
O I don't know	
O Prefer not to answer	
M4 Please indicate the type of <u>full size refrigera</u>	tor(s) you have in your home/apartment.
First refrigerator	▼ None/not applicable Prefer not to answer
Second refrigerator	▼ None/not applicable Prefer not to answer
Third refrigerator	▼ None/not applicable Prefer not to answer
Fourth refrigerator	▼ None/not applicable Prefer not to answer
M5 What is the age of your primary full-sized ref	rigerator? Best estimate.
O Enter number of years	
O I don't know	

M6 Is your primary full-sized refrigerator ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

Start of Block: N. Freezers N1 How many stand-alone freezers do you have plugged in and turned on? <i>Do not include freezers</i>	that
End of Block: M. Refrigerators	
○ I don't know	
○ Yes	
○ No	
M7 Is your primary full-sized refrigerator internet-enabled?	
O I don't know	
○ Yes	
○ No	

are part of your refrigerator.

○ None
O 1
○ 2
O 3 or more
○ I don't know
O Prefer not to answer

N2 Please indicate the type of <u>stand-alone</u> freezers you have in your home/apartment. Answer for the three most-used freezers.

First freezer	▼ Upright, frost free (auto defrost) Prefer not to answer	
Second freezer	▼ Upright, frost free (auto defrost) Prefer not to answer	
Third freezer	▼ Upright, frost free (auto defrost) Prefer not to answer	
N3 What is the age of your primary stand-alone freezer? <i>Best estimate.</i>		

Enter number of years ______
 I don't know

N4 Is your primary stand-alone freezer ENERGY STAR qualified? *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.*

🔘 No

○ Yes

🔘 I don't know

End of Block: N. Freezers

Start of Block: P. Insulation and Windows

P1_SFD Indicate whether the following areas of your home/apartment are insulated. Best estimate.

Attic walls	▼ Yes, all Not
Attic floor	▼ Yes, all Not
Exterior (outside) walls	▼ Yes, all Not
Basement	▼ Yes, all Not
Garage walls (attached garages)	▼ Yes, all Not
Garage door (attached garages)	▼ Yes, all Not

Applicable

Applicable Applicable Applicable

Applicable

Applicable

Display This Question:			
If HousingType = apartment/unit			
P1_MURB Are the exterior (outside) walls of your apart	ment or unit insulated?		
○ No			
○ Yes			
🗌 I don't know			
P2 Which best describes the insulation level of your hor	me/apartment? Best estimate.		
O Very well insulated			
O Adequately insulated			
O Poorly insulated			
O Not insulated			
P3 Indicate the percentage of each window glass constr home/apartment. Be sure to fill in a response for each r	ruction type installed in your row.		
Single-pane (layers) glass - standard	▼ None (0%) All (100%)		
Double-pane (layers) glass - standard	▼ None (0%) All (100%)		
Double-pane (layers) glass - low-e gas filled	▼ None (0%) All (100%)		
Triple-pane (layers) glass - <i>standard</i> ▼ None (0%) All (100%)			
Triple-pane (layers) glass - low-e gas filled	▼ None (0%) All (100%)		

P4 Are all, most, some or none of your windows ENERGY STAR qualified? *ENERGY STAR products* sometimes can be identified with the ENERGY STAR logo.

○ Most
○ Some
○ None
○ I don't know
P5 What is the age (in years) of most of your windows? Best estimate.
O Enter number of years
○ I don't know
End of Block: P. Insulation and Windows
Start of Block: Q. Pools
Display This Question:
If HousingType = home Q1 Does your home have a swimming pool? Do not include a community use or common area pool.
○ No
○ Yes
○ I don't know
O Prefer not to answer

Q1a What fuel do you use to heat the pool? Select all that apply.

Pool is not heated
Natural gas
Electricity
Solar heater
Bottled gas only (propane, butane, LP)
Other
I don't know
Q1b Indicate the type of pump.
O Do not use a pump
O Single speed pump
O Variable speed pump
○ I don't know

Q1c Is your pool pump ENERGY STAR qualified? ENERGY STAR products sometimes can be identified with the ENERGY STAR logo.

No
Yes
I don't know

Q1d Is your pool pump internet-enabled?
○ No
○ Yes
◯ I don't know
End of Block: Q. Pools
Start of Block: R. Hot Tubs
R1 Does your home/apartment have its own hot tub? Do not include a community use or common area hot tub.
○ No
○ Yes
O I don't know
O Prefer not to answer
R1a What fuel do you use to heat the hot tub?
Electricity
O Natural gas
O Bottled gas (propane, butane, LP)

Other_____

🔘 I don't know

Start of Block: S. Entertainment and Technology

S1 How many of the following electronic devices do you use in your home/apartment? Best estimate.

Standard television (Cathode Ray Tube/CRT/ big box TV)	▼ 0 Prefer not to answer
LCD television	▼ 0 Prefer not to answer
LED television	▼ 0 Prefer not to answer
Other type of television	▼ 0 Prefer not to answer
Cable or satellite box	▼ 0 Prefer not to answer
DVD players (Blue-ray, etc.) and/or VCRs	▼ 0 Prefer not to answer
Video game console (Xbox, Playstation, Wii, etc.)	▼ 0 Prefer not to answer
Separate sound or stereo system connected to TV	▼ 0 Prefer not to answer
Stand-alone stereo or docking stations	▼ 0 Prefer not to answer
Smart speakers (Amazon Echo, Google Home, Apple HomePod, etc.)	▼ 0 Prefer not to answer
Laptops	▼ 0 Prefer not to answer
Desktop computers (including monitor)	▼ 0 Prefer not to answer
Additional external computer monitors	▼ 0 Prefer not to answer
Tablets or e-readers	▼ 0 Prefer not to answer
Stand-alone printers	▼ 0 Prefer not to answer
"Smart" phones	▼ 0 Prefer not to answer
Other cell phones	▼ 0 Prefer not to answer

S2 A girl had 2 TV's, she bought another one. How many TVs does she have now?

O None

🔘 One

◯ Two

○ Three

O Four or more
◯ I don't know
S3 Does your home/apartment have high-speed internet access?
○ No
○ Yes
○ I don't know
O Prefer not to answer
S3a Is a wireless router used in your home/apartment for accessing the internet?
◯ No
○ Yes
○ I don't know
O Prefer not to answer
S4 Do you have any smart plugs or smart power strips in your home/apartment? A smart plug or smart power strip is programmed to automatically turn off electricity to the things plugged into it when you don't need to use it.
◯ No
○ Yes
◯ I don't know

S4a How many smart plugs or smart power strips do you use for... Best estimate.

Home office equipment Home entertainment system Other devices

▼ 0 … I don't know ▼ 0 … I don't know

▼ 0 ... I don't know

End of Block: S. Entertainment and Technology

Start of Block: T. ENERGY STAR

T1a Please indicate the share of each equipment type below that are **ENERGY STAR qualified**. *ENERGY STAR products sometimes can be identified with the ENERGY STAR logo*.

Laptop(s)	▼ All I don't know
Desktop computer(s)	▼ All I don't know
Additional desktop monitor(s)	▼ All I don't know
Television(s)	▼ All I don't know
Cable or satellite box	▼ All I don't know

T1b Please indicate which of the following equipment types in your home/apartment are **internet**-**enabled**. *Select all that apply*.

^J Television(s)

Cable or satellite box

None

End of Block: T. ENERGY STAR

Start of Block: U. Vehicles

U1 Do you or anyone in your home/apartment use a vehicle block heater? O No O Yes O I don't know U2 Do you or anyone in your home/apartment own or lease an electric vehicle? O No O Yes O I don't know O Prefer not to answer U2a When do you typically charge your vehicle? O During the day (9am to 5pm) \bigcirc In the evening (6pm to 9pm) Overnight (10pm to 8am) O I don't know U2b Do you charge it at your home/apartment using a... C Level 1 (110 volts) - Standard wall outlet C Level 2 (240 volts) - Similar to a clothes dryer outlet ○ I do not charge it at home I don't know

End of Block: U. Vehicles

Start of Block: V. Customer Segmentation

V1 Please indicate which of the following you have done in the past 12 months. Select all that apply.

Use more electricity during off peak times in the evening and at night

- $^{ar{J}}$ Installed any small energy efficient products like CFL or LED light bulbs or weather-stripping
- Washed your clothes in cold water
- Hung your clothes out to dry
- Adjusted your thermostat to use less heating
- Adjusted your thermostat to use less air conditioning
- igstarrow Unplugged any electronics like TVs or computers when they were not in use
- ^J Replaced old, working appliances with ENERGY STAR appliances
- ⁹ Purchased large quantities of incandescent bulbs (multiple boxes at once)
- [」] Improved/upgraded the insulation of your home
- Installed new energy efficient windows
- Purchased advanced/smart power bars
- □ I have not taken any actions to reduce my electricity usage

V2 Which energy- related home improvements would you be interested in implementing in your home/apartment in the next 12 months? *Please select all that apply.*

Installing an army officiant	lighting a gentual	n n a al cata
Installing energy-efficient i	lighting control	products
		0.00000

- Upgrading to smart thermostats
- ^J Replacing old appliances with energy-efficient models (e.g. washer, dryer, dishwasher, fridge)
- ^J Upgrading to a high-efficiency furnace
- $^{
 m J}$ Installing Air Source Heat Pumps to heat and cool your home
- Upgrading to high-efficiency central air conditioning system
- Replacing windows or doors to make home less drafty
- ^J Upgrading wall, floor or ceiling for improved home insulation
- Installing smart power bars with integrated timer, auto shut-off and occupancy sensors
- Installing home automation system (e.g. Automatic temperature and lighting control)
- Other (please specify)

None

」 I don't know

End of Block: V. Customer Segmentation

Start of Block: W. Home Type

W0 Please provide answers to the following questions. **Your responses are confidential** and no data will be linked to you or your home/apartment. The information is used to compare energy usage between various groups.

W1 What is your age?

O Under 18
O 18 to 24
O 25 to 34
O 35 to 44
O 45 to 54
O 54 to 64
O 65 or older

O Prefer not to answer

W2 Including yourself, how many people in your home/apartment are ...

Under the age of 18	▼ 0 Prefer not to answer
Between 18 and 34	▼ 0 Prefer not to answer
Between 35 and 54	▼ 0 Prefer not to answer
Between 55 and 64	▼ 0 Prefer not to answer
65 and older	▼ 0 Prefer not to answer
I	

W3 What is the highest level of education completed by any person in your home/apartment?

Less than high school
O Some high school
O Completed high school
O Some college/university
O College/university diploma
O Post-graduate
O Prefer not to answer
W4 How would you describe your employment status?
O Employed full time
O Employed part time
O Unemployed but looking for work
O Not in workforce (retired, student, not looking for work, etc.)
O Other
O Prefer not to answer

W5 In 2017, what was your annual household income before taxes?

O Under \$10,000

- \$10,000 to under \$15,000
- \$15,000 to under \$20,000
- \$20,000 to under \$25,000
- \$25,000 to under \$30,000
- \$30,000 to under \$35,000
- \$35,000 to under \$40,000
- \$40,000 to under \$45,000
- \$45,000 to under \$50,000
- \$50,000 to under \$60,000
- \$60,000 to under \$80,000
- \$80,000 to under \$100,000
- \$100,000 to under \$150,000
- \$150,000 to under \$200,000
- \$200,000 or more
- O Prefer not to answer

End of Block: W. Home Type



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