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May 15, 2025

Industrial Customers Group
c/o Robert Hobbs
2206 Happy Valley Road
PO BOX 1552
Rossland, BC
V0G 1Y0

Attention: Robert Hobbs

Dear Robert Hobbs:

Re: FortisBC Inc. (FBC)

2025 Cost of Service Allocation (COSA) and Revenue Rebalancing (Application)

Response to the Industrial Customers Group (ICG) Information Request (IR) No. 1

On February 14, 2025, FBC filed the Application referenced above. In accordance with the regulatory timetable established in BCUC Order G-60-25 for the review of the Application, FBC respectfully submits the attached response to ICG IR No. 1.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC INC.

Original signed:

Sarah Walsh

Attachments

cc (email only): Commission Secretary
Registered Interveners

1 Reference: 2017 COSA proceeding, Exhibit 8, BCUC IR 1.3.3

"The transition to the flat rate derived from the COSA model, coupled with FBC's proposal for a higher percentage of cost recovery through fixed charges, will improve the cost causation and intra-class economic fairness."

1.1 Please comment on current cost causation and intra-class economic fairness with the transition to the flat rate implemented with the 2017 COSA model?

Response:

The elimination of the two-tiered inclining block energy rate and transition to a flat residential energy rate was approved by the BCUC as part of the 2017 COSA and RDA Decision (and Order G-40-19). The review of the transition is not part of the 2025 COSA study and FBC is not seeking approval of rate design changes as part of this Application.

As noted in the 2017 COSA and RDA, there was no cost basis to support the Tier 1 and Tier 2 inclining block energy rates. Further, the fixed monthly charge was also increased when the flattening of the residential rates was implemented. The 2025 COSA study shows that the cost recovery of customer-related costs has risen from 45 percent in 2017 to 65 percent in 2025. The increased recovery of fixed costs generally indicates better intra-class fairness as it reduces the impact of load variations from individual customers.

FBC also notes that the R/C ratio for the residential class is 99.5 percent in 2025 as shown in Table 5-5 of the Updated Application filed concurrently with these IR responses. The R/C ratio result indicates that there is good alignment between the cost-causation for the residential class and its rates.

1.2 Please file the most recent Residential End-Use Survey?

Response:

Please refer to Attachment 1.2 for the most recent Residential End-Use Survey.

2 Reference: Exhibit B-1, pp. 28-35, Table 7-1 to Table 7-6

"The rate impacts to the other rate schedule (RS 21, RS 31, and RS 50) are approximately 1 percent (credit). FBC notes that the rate impact under Option 1 of 14.6 percent for RS 60 (equivalent to approximately $47.80 per month for the average RS 60 customer) would be considered rate shock."

2.1 Please confirm that FBC believes the RoR establishes the range of fair R/C and confirm that FBC would recommend Option 1 but for the rate impact on RS 60 customers?

Response:

While responding to BCUC and Intervener IRs, FBC identified some errors in the COSA model. As a result of correcting these errors, the R/C ratios of most rate classes have changed. While for most rate classes the adjustments to the R/C ratios are minor, one rate class – Large Commercial Transmission (RS 31) – has now moved outside of the range of reasonableness (RoR), and one rate class – Wholesale Transmission (RS 41) – has moved within the RoR. Given the updated R/C ratios, FBC has developed new rebalancing options and proposed a new preferred rebalancing option. These new options and new rebalancing proposal are presented in Sections 7.2 and 7.3 of the Updated Application filed concurrently with these IR responses.

The following response reflects the new Option 1 presented in the Updated Application which is similar to Option 1 in the original Application, i.e., it involves rebalancing all out-of-range rate schedules (including RS 60) to the boundary of the RoR, with the additional credit from rebalancing allocated to all other rate schedules that have R/C ratios above 100 percent.

FBC confirms that it considers that an R/C ratio within the RoR between 95 percent and 105 percent indicates the individual customer group is fully recovering their fair apportionment of costs.

However, FBC does not confirm that it would recommend Option 1 but for the impact on RS 60 customers because, as discussed in Section 7.2.1 of the Updated Application, Option 1 also includes rebalancing RS 21 and 30, whose R/C ratios are already within the RoR. Rebalancing customer classes that are already within the RoR does not fully align with Bonbright Principle 4, as it may be difficult for customers to understand and accept changes when their rates are already considered to be recovering a fair apportionment of the costs to serve them.

2.2 Please provide illustrate the distribution of increases in RS 60 bills in order to rebalance so that all rate schedules are within the RoR? For example, how many customers will see an increase above 10% under Option 1?

<u>Response:</u>

As discussed in the response to ICG IR1 2.1, FBC has filed an Updated Application concurrently with these IR responses with new rebalancing options and a new rebalancing proposal. The following response reflects the new Option 1 presented in Section 7.2.1 of the Updated Application.

Please refer to Figure 1 below for the distribution of percentage increases in the bills of RS 60 customers under the new Option 1 based on the 2024 actuals.

FBC notes that customers with only three months of data in 2024 (approximately 27 customers) were excluded from Figure 1. These customers may be new or may have stopped taking service from FBC in 2024. FBC excluded these customers from the analysis because the limited data for 2024 from these customers would not be adequately representative of the bill impact that a typical RS 60 customer would see due to revenue rebalancing.

Figure 1: Distribution of Bill Impact to RS 60 Customers in Percentage Under New Option 1

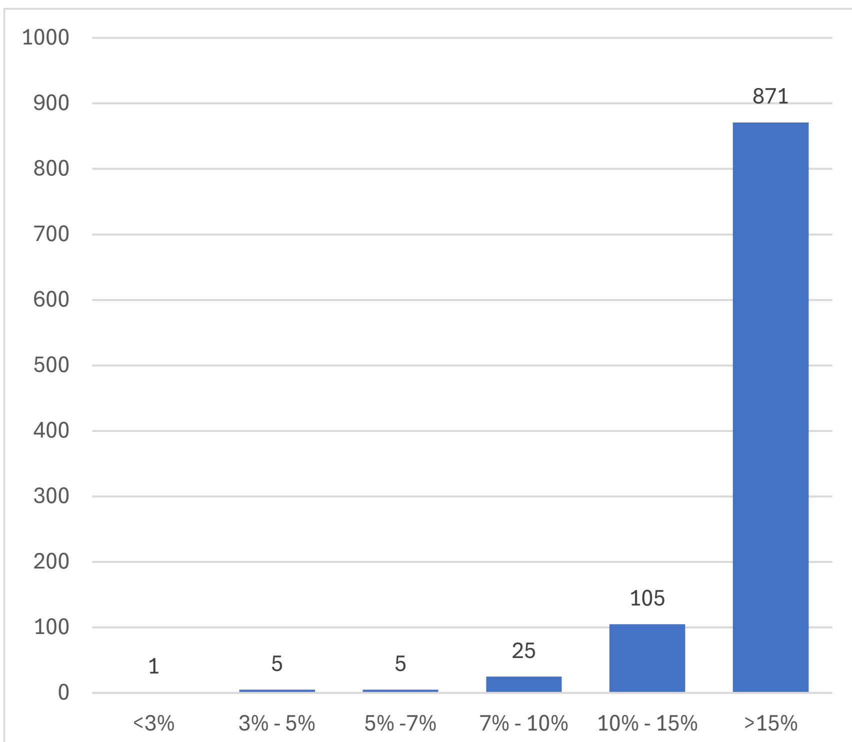

Figure 1 above shows that almost all RS 60 customers (i.e., 976 customers or 96 percent) would see a bill impact of over 10 percent under Option 1. In fact, the majority of these customers (i.e., 871 out of the 976, or 86 percent) would see a bill impact of over 15 percent under Option 1. Further, the bill impacts shown in Figure 1 are only due to revenue rebalancing; the bill impacts do not include FBC's annual general rate increases. If the general rate increase was included, those RS 60 customers with bill increases due to revenue rebalancing between 7 percent and 10 percent would also likely see an overall bill increase of greater than 10 percent.

FBC notes that RS 60 customers are charged at RS 20 or RS 21 rates[1] during the off-season (i.e., from November to March). As shown in Table 7-1 of the Updated Application, RS 20 and RS 21 rates will be reduced by 2.4 percent and 0.3 percent, respectively, due to the rebalancing under Option 1. Therefore, for the overall revenue from RS 60 to increase by 22.9 percent (or a revenue shift of approximately $933 thousand on an annual basis), the Irrigation in-season rates from April to October will need to increase by 28.4 percent to offset the off-season reduction from RS 20 and RS 21 rates as illustrated in Table 1 below. As such, for those RS 60 customers that only have in-season use from April to October, their overall bill will increase by 28.4 percent.

Table 1: Calculation of In-season RS 60 Rate Impact (%)

	Revenue before Rebalancing ($000s)	Revenue after Rebalancing - Option 1 ($000s)	% Change
RS 60 In-season (Apr to Oct)	$ 3,316.8	$ 4,259.3	28.4%
RS 60 Off-season (Nov to Mar) @ RS 20 Rates	339.8	331.8	-2.4%
RS 60 Off-season (Nov to Mar) @ RS 21 Rates	425.7	424.2	-0.3%
Total RS 60 Revenue ($000s)	**$ 4,082.3**	**$ 5,015.3**	**22.9%**

2.3 Please assume the increase to RS60 customers was 10% in any year, how many years of rebalancing would be necessary to bring the R/C of all customer classes within the RoR?

Response:

As shown in the response to BCUC IR1 8.1.2, if FBC phases in the rebalancing for RS 60 customers equally over a three-year period (to achieve an R/C ratio of 95 percent based on the results from the Updated Application), then the effective rate impact will be approximately 7.6 percent per year on an annual basis (before the impact due to the annual general rate increase). Alternatively, if the increase in the first and second years of the phase-in for RS 60 customers is set at 10 percent, then the increase in the third year of the phase-in would be approximately 2.9 percent to bring the R/C ratio to 95 percent.

[1] During the non-irrigation off-season, RS 60 customers will be automatically charged at the applicable RS 20 or RS 21 rate based on their service and load.

2.4 Please explain why FBC did not propose an Option so that after several years of rebalancing all R/C will be within the RoR? Please prepare a Table similar to the Table 7.1 for each year of the rebalancing period?

Response:

Please refer to the response to BCUC IR1 8.1.2. Please also refer to the response to BCOAPO IR1 10.3 for a table similar to Table 7-1 of the Updated Application filed concurrently with these IR responses, assuming a phase-in period of three years.

3 Reference: Exhibit B-1, Appendix A, EES Report, p .24 and Table 3-6

"The most notable change in load factors over the course of the studies are the increase in RS 31 load factors due to the addition of one large and steady running service and slight declines in irrigation and wholesale factors. The removal of the above 15 MW from [one] RS 31 customer also keeps that class load factor high under a reduced overall load scenario."

3.1 Please explain what is meant by "reduced overall load scenario" in the quote above?

Response:

The following response has been provided by EES Consulting:

EES' reference to a "reduced overall load scenario" is referring to the removal of the metered load above 15 MW from one RS 31 customer that is now receiving service for load above 15 MW through RS 38.

3.2 Please confirm that there has been no change in the load factor for the one customer referred to in the above quote?

Response:

The following response has been provided by EES Consulting:

It is unclear over what time period or circumstance leading to a potential change in load factor is being referenced by the question. For the purpose of the COSA, the only relevant inputs are the amount of RS 31 load and consumption reflected in the study that led to the resulting class load factor.

EES did not alter the load factor of the one large and steady running service for the study. EES only made adjustments to the class loads to account for the fact that one customer has moved a portion of its load to RS 38.

3.3 Please provide calculations or estimates that isolate the impact on revenue cost ratios of the increase in the load factor for the RS31 customers from 63.7% in 2020 to 88.3% 2024?

Response:

The following response has been provided by EES Consulting:

The revenue to cost (R/C) ratio in 2020 for RS 31 with a 63.5 percent load factor was 110.4 percent. If demands were adjusted (both noncoincident and coincident) to produce an 88.3 percent load factor and no other changes were made to the model, the resulting R/C ratio would be 122.3 percent.

The R/C ratio result described above is in line with what EES Consulting would expect for isolating the impact of an improved load factor of this magnitude.

3.4 Please explain the calculation in the previous IR? Would EES have expected a larger change in the revenue to cost ratio given the very larger increase in load factor for the RS31 customers?

Response:

Please refer to the response to ICG IR1 3.3.

4 Reference: Exhibit B-1, Appendix A, EES Report, p. 24

"EES also used actual billed demand results for larger customers to check against the hourly data, and in a couple instances, adjusted for lagged billing across months. Overall, the data indicates slightly different load factors than previous studies with relative results overall in line with the previous samples except those trending as noted."

Reference: Exhibit B-1, Appendix A, EES Report, p. 26

"All transmission rate base accounts allocate based on the 2 CP methodology."

4.1 Please explain the use of the 2CP methodology?

<u>Response:</u>

The following response has been provided by EES Consulting:

The demand allocation method was selected after consideration of past precedent, FERC and OEB tests, comparisons of load shapes, and growth of winter and summer peaks.

EES Consulting rejected the 12 CP approach because FBC does not have a flat load shape over the year. Further, the 2 CP approach was selected rather than a 1 CP or 4 CP approach because FBC has a significant summer peak.

Please also refer to the response to BCMEU IR1 5.1.

4.2 Is the RS31 peak seasonal? Can it be considered either a winter or summer peak? Please confirm that if the RS31 peak is not seasonal it is also not coincident with the system peak? Please confirm that if it is not coincident with the system peak it benefits the system?

<u>Response:</u>

The following response has been provided by EES Consulting:

RS 31 class load has a higher peak in the winter during the test year, but it is generally less seasonal than other classes. RS 31 is generally coincident with the system peak due to its load being close to its maximum most of the time and hence contributing to system peak in all seasons. If RS 31 load were not coincident, that would be a benefit to the system.

4.3 Please provide the revenue to cost ratio for RS 31 customers using 1CP methodology?

Response:

The following response has been provided by EES Consulting and reflects the results from the corrected COSA model included in the Updated Application filed concurrently with these IR responses:

If the allocation of power supply demand and transmission rate base were both changed to a 1 CP methodology with no other changes to the model, then the RS 31 R/C ratio would change from 105.3 percent to 96.9 percent.

5 Reference: Exhibit B-1, Appendix A, EES Report, p. 29-30

"For commercial classes, there has been both growth and improvement in load factors with a reduction in system coincidence compared to residential class. For the large commercial transmission (RS 31) class, a new large customer led to an increase in revenues and allocated costs, with allocated costs increasing less than revenues due to the high load factor for the new customer without the change to RS 38 treatment."

5.1 Please explain "without the change to RS 38 treatment."? Please how a change to the RS 38 treatment would impact the change in revenues and allocated costs?

<u>Response:</u>

The following response has been provided by EES Consulting:

The quoted statement refers to the examination during the study process of the implementation of a new rate for load that was previously served as RS 31 for one large high-load factor customer. It is not intended to mean a change to the treatment of RS 38. Rather, it is intended to mean the change to a portion of the total RS 31 class load by recognizing it as RS 38 load within the COSA. Without this change to the load in question, RS 31 load would have been higher, but the allocated costs would also have been higher in relation to the total RS 31 load since the class load factor would be lower.

6 Reference: Exhibit B-1, Appendix A, EES Report, p. 33

"For large commercial rates, demand and energy collection reasonably track unit cost for these services. Energy is slightly higher than the melded production for RS 30/32, and slightly lower for RS 31. The monthly fixed charge for RS 31 could be lower."

6.1 Please explain any changes FBC made to the monthly fixed charge for RS31?

<u>Response:</u>

FBC is not proposing changes to the RS 31 monthly charge as part of this Application.

7 Reference: Exhibit B-1, Appendix A, EES Report, p. 37

"With respect to rate design, looking to the pressures of electrification, there should be a focus on increasing on-peak charges for on-peak costs, whether that be with demand charges or on-peak energy charges. Generally, monthly fixed charges could adjust up and down in some cases, and energy unit costs have increased over time so higher energy charges excluding demand may be appropriate for some rates."

7.1 Please identify rate design changes proposed by FBC given this EES conclusion.

Response:

FBC is not proposing rate design changes as part of this Application. The purpose of this Application is to provide an updated COSA study and determine whether some rate classes require rebalancing (as well as to update the transformation discounts).

7.2 Please provide a load forecast for the Large Commercial Interruptible Rate?

Response:

For the purposes of the 2025 COSA study, the RS 38 load was determined by looking at the RS 38 customer's historic load, subtracting the RS 31 Contract Demand, and making certain assumptions about the interruptions that may occur pursuant to the RS 38 tariff schedule. Given that FBC currently has only a single RS 38 customer, FBC declines to provide the load forecast for this individual customer as the information is commercially sensitive and confidential.

8 Reference: Exhibit B-1, Appendix A, EES Report, p. 36 and p. 37

"Overall, considering previous results and approved rates, there is general alignment of rate components with the primary variance being the lack of a capacity charge for some classes and lower collection of fixed costs in the fixed charge which is common for regulated utilities."

"With respect to rate design, looking to the pressures of electrification, there should be a focus on increasing on-peak charges for on-peak costs, whether that be with demand charges or on-peak energy charges. Generally, monthly fixed charges could adjust up and down in some cases, and energy unit costs have increased over time so higher energy charges excluding demand may be appropriate for some rates."

8.1 Please identify any rate design recommendations, other than those identified in this report, that EES considered while preparing this report?

Response:

The following response has been provided by EES Consulting:

EES provided general best practice recommendations like the above quotes. However, specific rate proposals were not part of the study.

8.2 Did EES consider the demand billing interval period, specifically, the use of a 15 or 30 minute demand interval? What effect would this have on the R/C ratio for the customer classes that incorporate a demand charge?

Response:

The following response has been provided by EES Consulting:

EES did not consider 15-minute or 30-minute demand for the analysis. It is likely that using 15-minute demand would provide similar results to using hourly demand, but this was not part of the analysis.

9 Reference: Exhibit A-5, BCUC Information Request No.1, IR 1.1

"Please confirm, or explain otherwise, that customers taking service under RS 37 for standby service must also take service under RS 31 for standard firm power, and that those customers pay for their share of the system through RS 31 rates that reflect the full embedded cost resulting from the COSA framework."

9.1 Please confirm the number of customers taking RS 37, and provide the R/C ratio for the Large Commercial Transmission customer class if all RS 37 revenues were allocated to this customer class rather than applying it as an offset to the overall revenue requirement?

<u>**Response:**</u>

The following response has been provided by EES Consulting and reflects the results from the corrected COSA model included in the Updated Application filed concurrently with these IR responses:

Confirmed, customers taking service under RS 37 must also take service under RS 31. There is one customer taking service at RS 37.

If the revenues were directly assigned to the Large Commercial Transmission customer class without an increase in directly assigned costs for standby service to RS 31, the R/C ratio for RS 31 would change from 105.3 percent to 117.6 percent. However, it is likely there would be a matching increase in directly assigned costs and the impact negligible to the class.

Attachment 1.2

FBC 2022
Residential End-Use Study

Prepared for:

FortisBC Inc.
Kelowna, BC

April 30, 2023

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Disclaimer

Any opinions expressed in this report are the responsibility of the author, Sampson Research, and do not necessarily represent the views of FortisBC Energy Inc. or FortisBC Inc.

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This document is formatted for double-sided printing to save paper. Blank pages are inserted where necessary to preserve proper formatting.

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All dollar figures presented in this report, unless stated otherwise, are expressed in Canadian funds.

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Walter Wright

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Dr. Joe Kelly

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ABBREVIATIONS AND ACRONYMS

AFUE	Average Fuel Utilization Efficiency
ASHP	Air Source Heat Pump
BBQ	Barbeque
CDA	Conditional Demand Analysis
CDD	Cooling Degree Day
DK	Don't Know
DWH	Domestic Water Heater
DSM	Demand-Side Management
ECM	Energy Conservation Measure
FAF	Forced Air Furnace
FBC	FortisBC Inc. (Electric)
FEI	FortisBC Energy Inc. (Gas)
Gas	Natural gas and/or piped propane
GJ	Gigajoule
HDD	Heating Degree Day
KB	Kootenay / Kootenay Boundary
KE	Kelowna / Central Okanagan
kWh	Kilowatt-Hour
NA	Not Applicable
NR	Non-Response
REUS	Residential End-Use Study
SFD	Single Family Detached
SH	Space Heating
SO	South Okanagan Region
SST	Shared Services Territory
UEC	Unit Energy Consumption

1 EXECUTIVE SUMMARY

This report summarizes the findings from a Residential End-Use Study (REUS) of FortisBC Inc. (FBC) electric customers conducted in the summer of 2022. This is the fourth comprehensive end-use survey of residential electric customers conducted by FBC and the third to be conducted jointly with FortisBC's natural gas division, FortisBC Energy Inc. (FEI). The joint process allows one survey to gather detailed dwelling, occupant, and energy end-use information for both residential electric and natural gas customers in the region where FortisBC's electric and gas services are shared (shared services region). Detailed results for FortisBC natural gas customers are published in a separate report.

1.1 Survey Background

The 2022 REUS questionnaire asked respondents a broad range of questions about their dwelling, its design and construction, appliances, and renovations. Other questions addressed characteristics of the home's occupants, energy-use behaviours, attitudes towards energy and energy conservation, and interest in a range of energy conservation program options.

Survey requests for the 2022 REUS were sent to a random sample of residential customers who receive their electrical service either directly from FortisBC or indirectly from one of FortisBC's wholesale electricity providers (municipal electric utilities operated by the cities of Summerland, Penticton, Grand Forks, and Nelson). Survey requests were delivered by email or, in cases where an email address was unavailable, by regular mail. Recipients of a survey request were encouraged to complete the survey online. A paper version of the survey was available upon request. In total, 1,933 valid surveys were received, of which, 93% were completed online.

1.2 Analysis of Results

Data from the survey were analyzed at the overall utility level, by region, and, depending upon the topic, by the five main dwelling types (single-family detached, semi-detached, townhouses, apartments, and mobile / manufactured homes) and by dwelling vintage (period of construction). Survey results at the utility level have an accuracy of plus or minus 2.5%, 19 times out of 20. Margins of error for regional results varied depending on the region, ranging from plus or minus 3.7% to 4.0%.

A conditional demand analysis (CDA) was conducted using the FBC REUS dataset paired with respondent's electric consumption data. The analysis produced estimates of average annual electricity consumption (unit energy consumption or UEC) for each major electric end-use. Comparisons were made with UEC estimates from similar analyses conducted as part of FBC's 2012 and 2017 residential end-use studies.

1.3 Survey Highlights

Highlights from the FBC's 2022 REUS are summarized below by topic. Readers are directed to the respective sections in the main report for a detailed presentation and discussion of results by region, dwelling type, dwelling vintage and other criteria.

1.3.1 Customer Characteristics

- On average, there are 2.2 persons per residential dwelling in FBC's service area. The majority (77%) of homes have one or two occupants.
- More than half (55%) of dwellings are home to a senior (individuals aged 65 years or older). Fifteen percent (15%) of dwellings are home to children (persons aged 18 years or younger).
- One-in-five (21%) respondents indicated their dwelling has one or more persons working either part-time or full-time from home. More than half (54%) of these respondents indicated the number of days worked from home by these individuals increased during the past two years.

1.3.2 Dwelling Characteristics

- Single-family detached (SFD) dwellings accounted for six-in-ten (59%) residential dwellings in FBC's service region in 2022. Apartments and apartment-style condominiums are the next most common dwelling type, accounting for 26% of residential dwellings, up from 21% in 2012.
- The majority (82%) of FBC residential customers own and live full-time in their residence. Twelve percent (12%) rent part or all of their dwelling to others.
- Average home sizes (ft^2) vary by dwelling type and vintage. The median size of a single-family detached (SFD) dwelling is 2,150 ft^2 compared to 1,430 ft^2 for row / townhouses, and 1,043 ft^2 for apartments / apartment-style condominiums. The median size of newer single-family detached dwellings (those constructed since 2015) is 2,400 ft^2.
- The proportion of homes with basements that are partially or fully finished (88%) is statistically unchanged from 2017. Compared to the KE and SO regions, dwellings in the KB region are more likely to have a basement and the least likely to have finished the basement either partially or completely.
- Double pane (clear, no low-E) glass windows continue to be the most common window type, present in FBC residential dwellings (61% of all windows in 2022, statistically unchanged over the last three surveys). Double-pane windows with low-E coatings account represent 23% of all windows, statistically unchanged from 2017.
- The proportion of respondents indicating their home is drafty (either sometimes or always drafty) has declined steadily over FBC's last three REUS surveys, suggesting that actions taken to improve the efficiency of the building envelop for existing dwellings (e.g., upgrading windows, exterior

doors, and insulation, draft sealing, etc.) combined with improvements in building envelope efficiency in new construction are having a positive effect. Respondents living in older homes are much more likely to say their home is sometimes or always drafty compared to those in newer homes.

1.3.3 Energy-Related Renovations – Past and Planned

- Four-in-ten (39%) FBC residential customers completed one or more energy-related improvements to their homes in the last five years. The top three energy-related renovations included installing energy-efficient windows, installing weather stripping or caulking and installing low-flow showerheads.
- In the last five years, one-quarter (25%) of FBC residential customers upgraded some or all of their windows and two-in-ten (21%) upgraded some or all of their exterior doors.
- One-in-five (19%) residential customers intend to complete at least one energy-related renovation to their home in the next two years. The most frequently indicated renovations include improving insulation, installing weather stripping or caulking, and installing energy-efficient windows. Two percent (2%) indicated they are intending to install an air source heat pump.

1.3.4 Space Heating and Cooling

- Of the different fuels used for space heating, electricity and natural gas are the most popular with 67% of respondents using either as their main or secondary space heating fuel. Wood is the third most popular heating fuel, used by 14% of FBC residential customers either as a main or secondary space heating fuel. Six percent (6%) changed their main space heating fuel during the last five years, a rate unchanged from the 2017 survey.
- The top three main (primary) methods of space heating are forced air furnaces (56% of FBC residential customers), wired-in electric baseboards (13%), and fireplaces or heater stoves (9%). The three most commonly used secondary methods include fireplaces or heater stoves (27%), wired-in electric baseboards (16%), and portable electric space heaters (11%).
- One-third (34%) of homes have one or more manual thermostats and somewhat less than six-in-ten (58%) have one or more programmable thermostats. Learning-style thermostats are present in 8% of homes, up from 2% in 2017.
- One-in-three (29%) respondents indicated their dwelling uses a heat pump, up from 23% in 2017 and 14% in 2012. Three-quarters (75%) of these heat pumps are ducted models, 20% are ductless (mini-split) units, and the remainder are ground source (geothermal) units. The SO region has a significantly higher penetration of ducted heat pumps (31%) compared to the KE and KB regions (19% and 16% respectively).

- If heat pumps are included, 85% of residential dwellings have some form of air conditioning that requires electricity (e.g., heat pumps, central air conditioning units, window air conditioners, and portable air conditioners).
- Heat recovery ventilators (HRVs) are present in 6% of residential dwellings, up from 3% in 2017. Energy recovery ventilators (ERVs), queried for the first time in 2022, have a penetration rate of 1%. Penetration and saturation rates for both HRVs and ERVs are highest in dwellings constructed since 2015.

1.3.5 Domestic Water Heating

- Penetration of in-home domestic water heaters (any type) is estimated at 81%, statistically unchanged from 2017. All other households have their domestic hot water centrally provided (e.g., apartments, apartment-style condominiums). Roughly equal proportions of in-home water heaters use natural gas (51%) versus electricity (46%).
- Among dwellings with in-home DWH equipment, 84% use storage-type water heaters (any fuel), 8% use on-demand DWH units (up from 4% in 2017), and 1% have a heat pump water heater tank.
- Eight-in-ten (80%) dwellings with in-home DWH equipment have the water heater located in a heated space within or attached to the dwelling (heated basement, main living area, or heated garage). Nine percent (9%) have their DWH equipment located in an unheated space; typically an unheated basement, garage or crawl space).

1.3.6 Fireplaces and Heating Stoves

- Two-thirds (67%) of FBC residential customers have a fireplace or heater stove, statistically unchanged from 2017. The three most popular fireplace types are gas heater-style fireplaces (25% of FBC customers), gas decorative fireplaces (13%) and electric fireplaces (11%).
- Penetration rates for wood-burning fireplaces and heater stoves are declining. One-in-five dwellings constructed since 2005 have an electric fireplace.
- Use of a fireplace or heating stove to supplement the home's main space heating system varies by region, fireplace/stove type, fireplace fuel, and dwelling type.

1.3.7 Appliances

- Gas ranges (gas cooktop and oven), dual fuel ranges (gas cooktop, electric oven), and gas cooktops continue to be popular in new construction, displacing traditional electric ranges (electric cooktop and oven) and electric cooktops. Induction ranges, queried for the first time in the 2022 survey, are present in 7% of dwellings and popular in new construction (11% of dwellings constructed since 2015).

- Half (51%) of FBC residential customers with in-home laundry appliances have an energy-efficient front-loading clothes washer, up from 42% in 2017. While top-loading clothes washers have seen their share decline commensurately over this time, many newer top-loading washing machines on the market are ENERGY STAR® qualified models.
- Automatic defrost refrigerators are present in 85% of FBC homes, while the remaining units are manual defrost. One-in-four (26%) homes have a compact bar fridge / wine cooler.
- Five percent (5%) of households have a smart power bar with automatic shut-off.
- Twelve percent (12%) of respondents have an electric bicycle or scooter. Four-in-ten (40%) homes have a toaster oven.

1.3.8 Connected Devices

- Thirteen percent (13%) of FBC residential customers have at least one connected appliance or device (i.e., an appliance or other home device that can be monitored and controlled remotely from either inside or outside the home by 'connecting' them wirelessly to a smart phone, tablet or computer). Connected appliances include clothes washers, dishwashers and other devices such as security systems, smart plugs, and thermostats.
- Connected appliances and devices that are popular among FBC customers include thermostats, security systems, smart speakers, smart plugs/electrical outlets, and lighting. Penetration rates for connected appliances such as clothes washers, dishwashers, and fridges are quite low (typically less than 2%).
- An estimated 2% of FBC residential customers have a smart hub. Penetration of smart hubs is highest in KE and lowest in SO.

1.3.9 Plug-In Electric Passenger Vehicles

- Penetration of battery electric passenger vehicles is 2%, up from 0.6% in 2017. The penetration of plug-in-electric hybrid vehicles is 0.7%, up from 0.3% in 2017.
- Forty-three percent (43%) of electric vehicle owners acquired their vehicles in the last two years.
- Respondents with an electric vehicle drive 12,800 kilometres per year on average, with 44% averaging less than 10,000 kilometres per year.
- Three-quarters (73%) of plug-in electric vehicle users charge their vehicle at home, one-quarter (24%) charge it both at home and away from home, and the remaining 3% charge their vehicle exclusively at a location or locations away from home. Respondents with an electric vehicle have either a Level 1 (120V) or Level 2 (240V) charger at their residence. No respondents to the 2022 survey had a Level 3 (480V) fast charger.

1.3.10 Lighting

- The share of all household lights that are LED is now 50%, up from 21% in 2017 and 2% in 2012. Their increased share has come at the expense of incandescent light bulbs (share declined from 44% to 19% during the same period) and CFLs (down from 29% to 10%).
- Thirty-seven percent (37%) of respondents purchased at least one LED bulb in the last 12 months. In contrast, 8% purchased a CFL during the same period.
- Sixteen percent (16%) of FBC residential customers used one or more strings of incandescent holiday lights during the 2021 holiday season, unchanged from the proportion recorded in the 2017 REUS.

1.3.11 Pools and Hot Tubs

- Seven percent (7%) of FBC residential customers have a swimming pool for their exclusive use, 12% have a hot tub/Jacuzzi, and 2% have a sauna.
- The most common fuel for heating swimming pools is natural gas (40% of pools). Electricity is the most common fuel used to heat hot tubs and saunas (89% and 75% respectively).

1.3.12 Energy-Use Behaviours

The 2022 REUS queried the frequency of which households completed a number of different space heating, water heating, air conditioning, lighting, food storage, and entertainment system behaviours to understand which behaviours have the most potential for energy conservation.

- Space heating behaviours with the greatest room for improvement include draft proofing, installing plastic window coverings, and closing window coverings (curtains, blinds, etc.) to retain heat.
- The top three air conditioning behaviours with remaining potential include setting the thermostat to 26°C or higher during the summer, using either a smart/programmable thermostat or manually turning off their air conditioning at night, and only cooling occupied rooms rather than the whole home.
- Lighting behaviours with the greatest potential for improvement include turning off outdoor lighting (or installing motion-sensing lights) and checking timers for daylight savings time.
- Varying degrees of potential for behavioural savings remain for laundry, dishwashing and drying, food storage, computers, and entertainment systems.
- One-half (50%) of customers responding to the 2022 REUS are making either “somewhat more” or “much more” of an effort to conserve energy compared to two years ago.
- Less than half (44%) of FBC residential customers feel they have reduced their household’s energy use as much as reasonably possible.

1.3.13 Products and Services

- In the last five years, 21% of FBC residential customers participated in a FortisBC energy (gas and/or electric) conservation program and 3% in a federal, provincial or municipal program.
- From a list of potential energy conservation programs and initiatives, survey respondents expressed the most interest in a furnace or heat pump tune-up program, home energy audit, and a do-it-yourself online energy audit (38% of respondents for each). One-third (33%) expressed interest in a program to purchase rooftop solar panels and 28% expressed interest in a program to purchase an electric automobile.

1.4 Conditional Demand Analysis Highlights

A conditional demand analysis (CDA) was conducted with FBC customers who participated in the 2022 REUS. The analysis used their survey data, electrical consumption histories, and region-specific weather data to estimate unit energy consumption (UEC) values for each of the major electrical end-uses (space heating, water heating, lighting, refrigerators, cooking appliances, laundry appliances, entertainment systems, pumps, and electric passenger vehicles). UEC estimates represent the average annual electrical consumption of an end-use and their size is influenced by usage behaviours, the mix of older and newer equipment, and the composition of dwelling types with the end-use. All UECs are adjusted to reflect normal 10-year weather conditions (heating and cooling degree days). Like that of previous CDAs for FortisBC Inc., the 2022 analysis excluded indirectly served customers because their consumption data was unavailable.

The two-year period of electric consumption data used to conduct the analysis (February 2020 to January 2022) coincided with the COVID-19 pandemic, in which many people worked and studied from home or were on furlough. The analysis period also included the months of extreme weather (heat dome) in the early summer months of 2021. Despite these two events, estimated UECs for several major end-uses are lower than those estimated in the 2017 and 2012 studies, reflecting, in part, growth in the share of apartments and apartment-style condominiums in the mix of dwelling types in FBC's service area. These dwelling types have smaller interior spaces and fewer occupants compared to single-family detached dwellings and, as a result, require relatively less energy for space heating and cooling, domestic hot water use, and lighting. Other factors contributing to the lower UECs include improvements in the thermal efficiency of the dwelling stock, and increased penetration of energy-efficient appliances and lighting in existing dwellings (e.g., via turnover of old, less efficient stock) and in new construction.

Utility level highlights from the analysis include:

- UECs for primary and secondary space heating are estimated at 3,533 kWh/year and 1,184 kWh/year, respectively. UECs for central air conditioning and portable air conditioners are estimated at 480 kWh/year and 250 kWh/year, respectively.
- Other major electrical end-use UECs include water heating (2,302 kWh/year), lighting (968 kWh/year), refrigerators (712 kWh/year), home entertainment equipment (1,266 kWh/year), and clothes washers and electric dryers (829 kWh/year).

- The UEC for battery electric vehicles was estimated at 655 kWh/year. Sample limitations meant that a UEC for electric-hybrid vehicles could not be estimated. The accuracy and reliability of UEC estimates for plug-in electric passenger vehicles (battery electric and plug-in hybrids) are expected to improve over time as the penetration rates for these vehicles (and participation of their owners in future residential end-use studies conducted by FortisBC) are expected to increase significantly over the next decade.

* * * * *

2 INTRODUCTION

This report presents detailed results and analyses from a comprehensive residential end-use study (REUS) of FortisBC Inc. (FBC) residential electricity customers conducted in the summer of 2022. The study was conducted jointly with FortisBC's natural gas division, FortisBC Energy Inc. (FEI). Results for FortisBC's residential natural gas customers are published in a separate report.

Information from the 2022 REUS is designed to support a broad range of activities and processes for FortisBC's gas and electric divisions, including:

- Revenue requirement, rate design, and other applications to the British Columbia Utilities Commission
- Preparation and updating of long-term resource plans
- Inputs for pricing models and tests for system extensions (mains and services)
- Reviews of conservation potential
- Demand-side management (DSM) opportunity assessments and program designs
- Inputs for load forecast models
- Development of marketing programs and advertising

2.1 Research Objectives

Research objectives for the 2022 REUS focused on documenting and advancing the understanding of factors that directly or indirectly influence the consumption of natural gas and electricity by FortisBC's residential customers. Research objectives included:

- Collecting information on appliance end-use stocks including age, efficiency, and usage. End-uses include space heating and cooling, water heating, cooking, refrigeration, dishwashing, laundry, swimming pools, hot tubs, and saunas.
- Determining primary and secondary energy (fuel) sources for space and water heating.
- Determining dwelling characteristics that directly or indirectly influence energy consumption, including building envelope, vintage, floor space, number of stories, tenure, length of residency, ceiling heights, window types, and insulation levels.
- Identifying past and planned energy-related renovation activities.
- Detailing energy-conserving behaviours that affect energy use associated with heating, cooling, laundry, dishwashing, bathing, showering, draft proofing, furnace maintenance, food storage, lighting, and small appliance use.
- Discerning attitudes and beliefs regarding energy conservation and other energy-related issues.
- Assessing interest in potential utility programs and services.
- Performing a conditional demand analysis (CDA) to develop unit energy consumption (UEC) estimates for major gas and electrical appliances and end-uses.

- Comparing findings with previous residential end-use surveys, where applicable, to assess changes and trends in dwelling composition, penetration and saturation of appliances and other end-uses, appliance and end-use efficiency, renovations, and demographic characteristics.

2.2 History of FortisBC REUS Studies

The 2022 FBC REUS represents the fourth comprehensive end-use study of residential electricity customers conducted by FortisBC Inc. since 2009. It is the third end-use study conducted jointly with FortisBC's natural gas division (FortisBC Energy Inc. or FEI). The combined study provides data to each division about its respective residential customers but also offers a holistic view of customers in the shared services territory (i.e., customers who receive natural gas and electricity services from FortisBC). The 2022 REUS is the third REUS conducted by FBC to include a conditional demand analysis (CDA) of residential electrical end-uses. These analyses generate unit-energy consumption (UEC) estimates for the major electrical end-uses in the home.

While the majority of questions on the REUS questionnaire applied to both residential gas and electric customers of FortisBC, the questionnaire for FBC customers was augmented with questions on lighting and smaller electrical end-uses such as entertainment and computer systems. The sample size for the combined survey was large enough to ensure adequate regional representation for both divisions.

Topics addressed by FortisBC's residential end-use surveys have evolved over time, reflecting trends in residential end-use equipment, building characteristics, and other residential market trends. Refinements have been made to the questionnaire in an ongoing effort to improve the accuracy and reliability of the results. While changes in topic coverage and/or the wording of questions from one survey to the next have sometimes occurred, attention was paid to maintaining consistency and compatibility with past questionnaire designs. This maximizes FortisBC's ability to monitor trends in residential energy use equipment and behaviours over time.

2.3 Report Organization

This report is organized into 16 sections including an executive summary and two appendices. Following this introduction, the Background and Methodology section addresses the sampling strategy, sample design, questionnaire design, and survey response statistics. The following sections address key findings from the 2022 REUS survey, organized by the respective topic areas of the survey instrument. These include:

- Building envelope and renovations
- Space heating
- Domestic hot water
- Fireplaces and heating stoves
- Appliances including air conditioning
- Plug-in electric vehicles

- Lighting
- Pools, hot tubs, and saunas
- Energy use behaviours
- Products and services
- Demographics

Findings from the conditional demand analysis, including regional-specific Unit Energy Consumption (UEC) estimates by end-use, are provided in Section 15. A bibliography of referenced research and articles is included in Section 16.

This document includes two appendices. Appendix A includes the 2022 REUS questionnaire. Appendix B presents the background methodology and detailed equations for the conditional demand analysis.

Results for FortisBC's residential natural gas customers are published in a separate report.

2.4 Using this Report

This report presents a substantial body of information and data about FortisBC's residential electric customers. Trends are identified through comparisons with past REUS studies and/or using information and statistics sourced from third-party sources.

Considerable effort has been made to ensure the data presented are accurate and statistically representative of FortisBC's residential customer base. The quality of the analysis and interpretation of the data are dependent, in part, on the accuracy of the information provided by survey respondents. The technical nature of many of the questions in the REUS survey invariably means that some unintentional misclassifications by survey respondents are possible. Where misclassifications are evident, the report identifies them and discusses any remedies or adjustments applied to the data.

The large volume of information collected by the REUS survey means the primary purpose of this report is as a reference document. Analyses and observations made in the report are intended to further discussion and improve the understanding of factors that influence residential energy consumption.

3 BACKGROUND & METHODOLOGY

This section addresses the sample frame and sampling plan for FortisBC Inc's 2022 residential end-use survey, its questionnaire design and topics, implementation, weighting of results, and survey accuracy. Key definitions and explanatory notes are supplied at the end of this chapter.

3.1 Sample Frame and Sampling Plan

The sample frame for the 2022 FBC REUS consisted of residential (Rate 1 – Residential) households that received their electrical service either directly from FortisBC or indirectly from one of FortisBC's wholesale electricity providers (municipal electric utilities operated by the cities of Summerland, Penticton, Grand Forks, and Nelson) as of March 2022. The sample frame included customers from FBC's three service regions:

- Kelowna (KE)
- South Okanagan/Similkameen (SO)
- Kootenay/Boundary (KB)

Table 1 summarizes the sample frame for the FBC's 2022 REUS.

Table 1: FBC Residential Sample Frame (Customer Counts) as of March 2022

Region / Business Unit	FBC Direct	FBC Indirect	FBC Total	Percent Distribution
Kelowna / Central Okanagan (KE)	69,600	--	69,600	43%
South Okanagan (SO)	24,400	22,100	46,500	29%
Kootenay / Kootenay Boundary (KB)	34,500	11,300	45,800	28%
Total (FBC)	**128,500**	**33,400**	**161,900**	**100%**

The sampling procedure for FBC's 2022 REUS included randomly selecting residential electric customers from FBC's customer accounts for each of the three regions and then augmenting the sample with indirectly served customers identified through third-party sources. These customers were merged with the shared services sample of residential natural gas customers drawn for FEI's 2022 REUS to (i) identify customers with both electrical and natural gas services provided by FortisBC directly or indirectly and (ii) eliminate duplicates.

3.2 Questionnaire Design and Topics

In addition to satisfying FortisBC's research objectives, the design of the 2022 REUS questionnaire placed considerable emphasis on comparability and consistency with past REUS surveys. Any modifications to questions and/or response categories were made to either improve question performance or accommodate trends in residential construction and end-use equipment options. Explanatory text was used to help respondents correctly identify their space heating equipment, appliances, and household features. In situations where several different models of an end-use appliance are possible (e.g., differing types of domestic water heaters), questions referenced the physical appearance or characteristics of the appliance to assist respondents in correctly classifying their appliances.

Two versions of the REUS questionnaire were developed. Customers identified as having both gas and electric (direct or indirect) service provided by FortisBC received a questionnaire with sections dedicated to electrical end-uses such as lighting, entertainment systems, power control devices, and electric vehicles. Gas-only customers (those whose service address was outside the shared services territory) completed a questionnaire that excluded these dedicated electric-only sections.

Subject areas addressed by the 2022 REUS with comparisons to past FBC and FEI REUS surveys are summarized in Table 2.

Table 2: REUS Survey Topics – Comparisons to Past REUS Surveys

Survey Topic Group	FortisBC Inc. (Electric)				FortisBC Energy Inc. (Natural Gas & Piped Propane)			
	FBC 2022	FBC 2017	FBC 2012	FBC 2009	FEI 2022	FEI 2017	FEI 2012	FEI 2008
Dwelling characteristics	◆	◆	◆	◆	◆	◆	◆	◆
Space heating	◆	◆	◆	◆	◆	◆	◆	◆
Fireplaces	◆	◆	◆		◆	◆	◆	◆
Domestic water heating	◆	◆	◆	◆	◆	◆	◆	◆
Appliances	◆	◆	◆	◆	◆	◆	◆	◆
Indoor and outdoor lighting	◆	◆	◆	◆				
Other electrical end-uses	◆	◆	◆	◆				
Pools and hot tubs	◆	◆	◆	◆	◆	◆	◆	◆
Energy-related renovations	◆	◆	◆		◆	◆	◆	◆
Energy use behaviours	◆	◆	◆	◆	◆	◆	◆	◆
Products and services	◆	◆	◆		◆	◆	◆	◆
Energy attitudes & preferences	◆	◆	◆	◆	◆	◆	◆	◆
Demographic & socio-demographics	◆	◆	◆	◆	◆	◆	◆	◆

The 2022 FBC REUS questionnaire (paper version) can be found in Appendix A.

3.3 Survey Implementation

The 2022 FBC residential end-use survey was available online to randomly selected electric customers of FortisBC (direct or indirectly served). Those without an email address were mailed a hardcopy version, accompanied by a self-addressed return envelope. All customers who received their invitation to complete the survey via email were offered the option of having a hardcopy version of the questionnaire mailed to them. Incentives to complete the survey included a chance at winning one of four prepaid VISA cards worth $1,000. To encourage online responses, respondents completing their survey online had their name entered in the prize draw an additional time, effectively doubling their chances of winning. Each recipient was assigned a unique entry code allowing only one survey to be completed per household. Mustel Group of Vancouver, BC was responsible for implementing the survey, data cleaning, tabulating results, and incentive management.

Survey invitations were emailed / mailed June 20th, 2022. Three reminders were sent. Recipients of a survey invite had until August 7th to complete the survey.

3.4 Survey Response

A total of 1,933 valid surveys were received from FBC customers, equivalent to a response rate of 18%. Ninety-three percent (93%) of surveys were completed online. Survey response rates by region are summarized in Table 3.

Table 3: FBC 2022 REUS Survey Response

Region	Survey Invites	Completed Surveys	Response Rate	Surveys Completed Online
Kelowna / Central Okanagan (KE)	4,220	697	17%	93%
South Okanagan (SO)	3,130	613	20%	92%
Kootenay / Kootenay Boundary (KB)	3,150	623	20%	94%
Total (FBC)	**10,500**	**1,933**	**18%**	**93%**

3.5 Weighting of Results

Weights were used to restore the relative proportions of FBC residential customers by region, service type (direct versus indirect), and dwelling type. The latter requirement was necessary because of a disproportionately low response by customers living in apartments / apartment-style condominiums.

Customer counts by region and service type used for weighting were provided by FBC. Data to determine the population-based distribution of dwelling types by region and customer service type was sourced from Statistics Canada's 2021 Census of Population.

Weights for FBC's 2022 REUS were calculated using equation (1):

$$W^{r,t,b} = (P^{r,t,b}/P^{FBC}) \,/\, (S^{r,t,b}/S^{FBC}) \qquad (1)$$

W = Weight
P = Population
S = Survey
r = FBC region (KE, SO, KB)
t = Customer type (direct, indirect)
b = Building type (single-family detached, semi-detached, row/townhouse, apartment / apartment-style condominium, mobile / other)
FBC = Total of all FBC regions, customer types, and building types

Table 4 presents the weights calculated using this formula and used in the analysis of FBC's 2022 REUS survey data:

Table 4: FBC 2022 REUS Weights

	Direct			Indirect		
	KE	SO	KB	KE [1]	SO	KB
Single-family detached	1.0203	0.6844	0.7672	1.0000	0.9810	1.0767
Semi-Detached	0.9370	0.4450	0.5133	1.0000	1.2411	6.5083
Row/townhouse	0.8001	0.4880	1.0632	1.0000	1.7751	7.2972
Apt or Apt-style condominium	1.7870	1.0143	1.8344	1.0000	6.6766	37.8664
Mobile or manufactured home	1.2191	0.6007	0.4315	1.0000	0.6253	0.3057

[1] All residential customers in this region are directly served by FBC

3.6 Accuracy of Survey Estimates

The margin of error (accuracy level) for 2022 REUS questions varies by region and the degree of consensus for the question. Table 5 summarizes the accuracy of the survey estimates using a 95% confidence level for a typical range of "yes-no" type questions for each of the three FBC regions and the overall utility (FBC).

Table 5: Accuracy Levels for Proportional Responses by Region (%)
Percent Plus or Minus at the 95% Confidence Level

Accuracy / Proportional Response	KE +/-	SO +/-	KB +/-	FBC 2022 +/-
50%	3.7	4.0	3.9	2.5
40% or 60%	3.6	3.9	3.8	2.5
30% or 70%	3.4	3.6	3.6	2.3
20% or 80%	3.0	3.2	3.1	2.0
10% or 90%	2.2	2.4	2.4	1.5
Number of respondents (unweighted)	**697**	**613**	**623**	**1,933**

At the utility level, a typical question with a "50-50" response (e.g., 50% answering yes, 50% answering no) will have an accuracy of plus or minus 2.5%, 19 times out of 20.[1] The margin of error varies by region reflecting differing proportions of completed surveys to the respective populations. Regardless of region or service type, margins of error decrease as the consensus of the survey estimate increases. For example, a yes-no type question with 90% answering "yes" will be accurate at the utility level to plus or minus 1.5%, 19 times out of 20, versus plus or minus 2.5% if 50% answered "yes".

[1] The formula used to calculate the margin of error for the overall FBC sample at the 95% confidence level is:

$$= 1.96 * SQRT\ (\ \textstyle\sum_i (W^2_i\ ((1\text{-}f_i)\ x\ (s^2_i/(n_i\text{-}1))))\quad \text{for } i = 1 \text{ to } g$$

where:

SQRT = square root
W = stratum population divided by the total population
f = stratum sample divided by stratum population
s = variance in the stratum
n = stratum sample size
i = sample stratum
g = total number of sample strata (30)

3.7 Definitions & Explanatory Notes

The following definitions and notes, listed alphabetically, are provided to assist the reader in the interpretation of survey results and in the general readability of the report.

Conditional Demand Analysis (CDA) – An econometric method for proportioning household electricity consumption into the consumption of individual gas end-uses (e.g., space heating, domestic hot water, cooking, etc.). CDA requires data on the penetration and saturation of end-uses by customer, matched to their billing consumption data. It is an indirect approach to estimating end-use consumption.[2] Diversity in the penetration, saturation, and usage of end-uses within the sample population is required for the model to isolate the consumption of any particular end-use.

Data presentation – Data and statistics are presented in a variety of formats, including tabular, graphical, and within descriptive paragraphs.

FBC (FortisBC Inc.) – The utility responsible for providing electrical service, either directly or indirectly through wholesale (municipal) utilities to residential households in Kelowna / Central Okanagan, South Okanagan, and Kootenay / Kootenay Boundary regions.

FEI (FortisBC Energy Inc.) – Includes all residential dwellings in the Lower Mainland / Fraser Valley, Interior, Columbia, Vancouver Island / Sunshine Coast, and Fort Nelson regions that receive natural gas service from FortisBC.

Footnotes – Footnotes referenced in the text of the report are found at the bottom of the page. Footnotes pertaining to data in tables are situated immediately below the table in question.

KE – Direct and indirect residential customers of FortisBC located in FBC's Central Okanagan region.

KB – Direct and indirect residential customers of FortisBC located in FBC's Kootenay / Kootenay Boundary region

Non-Response (NR) – Sometimes categorized as a missing value, a non-response occurs when a respondent chooses not to answer a question. Non-responses are treated differently from "Don't Know" (DK) responses. They imply neither uncertainty nor certainty of a response, providing no information from which to extrapolate a response. All calculations in this report, unless stated or otherwise indicated, exclude missing or NR values. This is done to avoid distorting the proportions assigned to the response categories based on those who answered the question.

Penetration (Incidence) – The number of households with a particular appliance or end-use divided by the total number of households with or without the appliance or end-use. Typically expressed as a percentage, penetration rates are used to understand the proportion of FBC's residential customer base with at least

[2] As opposed to a more direct method of metering of individual end-uses.

one of the appliance or end-use in question. Penetration rates do not provide information on how many of the particular appliance or end-use households have, only the proportion of households that have at least one. By definition, penetration rates cannot exceed 100%.

Saturation - Population-Based – The total number of an appliance or end-use divided by the number of households with and without the appliance or end-use. Saturation provides an estimate of the average number of appliances or end-uses per residential customer. At the utility level, saturation estimates are influenced by the number of appliances present in user households and the penetration of the appliance in the general population. For example, the saturation of low-flow showerheads is a function of how many households have a low-flow showerhead and the total number installed across all households. As homes may have more than one appliance or end-use there is no theoretical upper limit on saturation estimates. Population-based saturation estimates are useful for estimating how many appliances (e.g., gas cooktops) are installed across the entire residential customer base.

Saturation - User-Based – The total number of appliances or end-uses divided by the number of households with the appliance or end-use. User-based saturation provides an estimate of the average number of a specific appliance or end-use used by customers that have at least one of the appliance or end-use (e.g., average number of LEDs per household with at least one LED).

SO – Direct and indirect residential customers of FortisBC located in FBC's South Okanagan region.

Significant Digit Conventions – Except where otherwise indicated, all data reported in the text of this report have been rounded to the nearest significant digit. To facilitate analyses and calculations by FBC, data presented in tables and figures are expressed to one decimal place, and in some cases (e.g., saturation rates) two decimal places. This allows tables to accommodate the occasional small response proportion (i.e., penetrations of less than 1%). Data from FBC's 2009 REUS are available only in whole numbers (no significant digits). Data from the 2009 REUS, even if presented with one significant digit, should be interpreted as being rounded to the nearest whole number.

Uncertainty – Some survey questions allow respondents to answer "Don't know" (DK) if they are unsure of their response. Knowing the proportion of respondents answering DK is important to correctly interpret the question's results. In some cases, it is legitimate to recalculate proportions for the question excluding DK responses (rebasing). Effectively, this recalculation assumes the distribution of the DK responses is proportional to those who provided a response. This implicit "re-proportioning" of DK responses is not valid in cases where the proportionate distribution assumption does not apply. For example, uncertainty regarding the efficiency of an end-use may be proportionately higher for households with older models of the end-use than for those with newer models. In a case such as this, a DK response should be treated as a legitimate response and included in the base for calculating the relative proportions of the other response categories.

Unit Energy Consumption (UEC) – The annual electricity consumed by an end-use in a given year. The size of a UEC estimate is determined, in part, by the purpose of the end-use (e.g., cooking, space heating, etc.), the efficiency of the end-use equipment, and its usage (occupant behaviours). UECs for some end-uses are also weather dependent (i.e., vary with the number of heating degree days (HDDs) or cooling degree days (CDDs)). HDD-dependent end-uses include, for example, space heaters and fireplaces. Examples of CDD-dependent end-uses include air conditioners and ceiling fans.

Unweighted Base – All tables whose data and/or calculations share the same base will have the unweighted base for the statistics indicated. Knowing the size of the unweighted base is useful to help guide comparisons with other data and to understand the relative accuracy of the estimates. The size of the unweighted base may change from question to question depending upon whether the question was applicable to all respondents (e.g., floor space of the residence) or a subset of the respondents (e.g., those whose residence has a gas forced air furnace).

Weighted Results – All utility level results (FBC) are based on weighted data to ensure proportionate representation from the respective regions, customer service types, and dwelling types.

Additional Notes to Tables

n/a Not Applicable – Used when data are unavailable for comparison.

-- No responses were received for the particular category or cell.

0.0* Value less than 0.1 or 0.1%

0.00* Value less than 0.01

4 DWELLING CHARACTERISTICS

This section provides detail on the characteristics of residential dwellings in FBC's service area, including:

- type, size, vintage (period of construction), number of stories, tenure, maintenance fees, and length of residency;
- characteristics and upgrades of the building envelope including insulation, window glazing, window frame materials, exterior doors, and exterior door materials; and
- renovations undertaken during the past five years and planned for the next two years.

4.1 Dwelling Characteristics

4.1.1 Dwelling Types and Vintages

Single-family detached (SFD) dwellings are the most common dwelling type among FBC's residential customer base, accounting for 59% of all dwellings (Table 6). Apartments and apartment-style condominiums (apts/condos) are the next most common dwelling type, accounting for 26% of all dwellings. Apts / condos have been steadily increasing in their share of the dwelling mix since 2009. Regionally, KE and to a lesser extent, SO are notable in the share of dwellings that are apts/condos (37% and 21% respectively) compared to KB (14%).

Table 6: Residential Dwelling Types (%)

Dwelling Type	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1970*
Single Family Detached	46.0	60.9	75.6	58.7	61.5	64.4	69.0
Semi-Detached	5.1	2.8	2.6	3.7	4.0	3.2	4.0
Row / Townhouse	6.8	6.9	3.1	5.8	5.2	5.0	7.0
Apt / Apt-Style Condo	37.4	21.3	13.6	26.0	23.6	21.2	13.0
Mobile & Other	4.7	8.1	5.1	5.8	5.7	6.1	8.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Table 7 summarizes the distribution of residential dwellings by vintage (period of construction). Of note, approximately six-in-ten (58%) residential dwellings were constructed prior to 1996. Dwellings constructed since 2005 represent 21% of all dwellings. Regionally, KB is notable in that its stock of housing is significantly older, with three-quarters (74%) of residential dwellings constructed prior to 1996 compared to 59% for SO and 47% for KE.

Table 7: Residential Dwelling Stock by Period of Construction (%)

Period of Construction	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Before 1950	2.6	5.0	16.7	7.3	8.5
1950 -1975	11.5	16.4	25.2	16.8	22.5
1976 -1985	14.1	14.6	21.4	16.3	16.0
1986 -1995	18.9	22.5	10.4	17.5	17.9
1996 -2005	20.5	15.0	10.0	16.0	15.2
2006 - 2015	17.6	11.6	8.9	13.4	13.0
2016 or newer	8.9	10.8	3.5	7.9	1.7
Age unknown	6.0	4.0	3.8	4.8	5.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Built prior to 1996	**47.0**	**58.6**	**73.8**	**57.9**	**64.9**
Built since 1995	**47.1**	**37.4**	**22.4**	**37.3**	**29.9**

Totals may not sum due to rounding.

Table 8 explores the composition of dwellings by vintage for each of the five main dwelling types. The data confirm the increased popularity of semi-detached dwellings and apts/condos in new construction during the past two decades. Half (49%) of all semi-detached dwellings and apts/condos in the survey were constructed since 1995. In comparison, one-third of all SFDs and mobile and other manufactured dwellings in FBC's service region were constructed during the same timeframe.

Table 8: Residential Dwelling Types by Dwelling Vintage (%)

Period of Construction	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Before 1950	11.7	3.4	0.0	1.1	0.0
1950 -1975	23.2	16.1	5.4	3.5	23.5
1976 -1985	15.7	6.6	16.0	17.5	24.2
1986 -1995	15.6	19.0	36.7	18.1	13.7
1996 -2005	14.9	22.3	17.3	17.1	16.0
2006 – 2015	11.6	16.2	12.1	18.9	7.6
2016 or newer	5.4	9.9	8.2	12.8	9.6
Age unknown	1.9	6.6	4.3	11.1	5.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Built prior to 1996	**66.2**	**45.0**	**58.1**	**40.1**	**61.4**
Built since 1995	**31.9**	**48.5**	**37.6**	**48.8**	**33.2**

Totals may not sum due to rounding.

4.1.2 Residency and Tenure

The 2022 REUS asked respondents to describe the relationship to their dwelling and whether some or all of the dwelling was rented to others. The results, summarized in Table 9, show that the majority (82%) of respondents own and live full-time in their home while 12% rent part or all of the residence to others. Customers in KE are significantly more likely than those in other regions to rent all or part of their homes (18%) compared to those in KB and SO (10% and 6%, respectively). The higher proportion of rental properties in the KE region is consistent with the region's proportionately higher share of apts/condos.

Table 9: Respondent Relationship to Dwelling (%)

Relationship to Dwelling	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Own and live full-time at property	76.9	86.1	85.2	81.9	82.9
Own and live part-time at property	2.8	4.9	1.9	3.1	2.0
Own / live & rent part to others	2.3	2.0	1.8	2.1	1.2
Own property but live elsewhere	2.5	2.6	3.4	2.8	2.6
Renter who lives at property	15.6	4.4	7.8	10.2	11.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Dwellings partially or fully rented	**17.9**	**6.4**	**9.6**	**12.3**	**12.4**

Totals may not sum due to rounding.

Table 10 explores these data by dwelling type. Of note, 26% of apts/condos are partially or fully rented. In comparison, 14% of semi-detached and 16% of townhouses are partially or fully rented. Only 6% of SFDs are partially or fully rented.

Table 10: Respondent Relationship to Dwelling by Dwelling Type (%)

Relationship to Dwelling	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Own and live full-time at property	89.7	80.0	72.7	65.8	85.4
Own and live part-time at property	2.3	3.0	3.4	5.0	3.1
Own / live & rent part to others	3.1	4.0	0.4	0.4	0.0
Own property but live elsewhere	2.0	3.0	7.2	2.9	5.9
Renter who lives at property	3.0	9.9	16.2	26.0	5.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Dwellings partially or fully rented	**6.1**	**13.9**	**16.6**	**26.4**	**5.6**

Totals may not sum due to rounding.

Three percent (3%) of respondents to FBC's 2022 REUS live in a housing cooperative (Table 11). Housing cooperatives are significantly more common in the KE and SO regions compared to KB (5% and 3% versus 1% respectively).

Table 11: Incidence of Housing Co-operatives (%)

	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Housing co-operative	4.7	3.0	0.9	3.1	4.3

4.1.3 Length of Residency / Ownership

FBC residential customers have occupied (lived in or owned) their current residence for an average of 14 years (Table 12).[3] Regionally, the average length of residence varied from 12 years for KE to 18 years for KB.

[3] The question on length of residency was changed in the 2017 REUS to address the length of residency and/or ownership of the property. Previous surveys asked about length of residency only without reference to whether the occupant owned or rented the property.

Table 12: Average Length of Residence (Years)

Length of Residence (years)	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1960*
Mean	12.3	13.6	17.5	14.1	14.9	13.9	10.2
Standard Deviation	11.0	10.5	12.8	11.6	11.7	11.7	n/a

The average length of residence for respondents varies depending on their dwelling type (Table 13). FBC customers living in SFDs have the longest average tenure (17 years) and customers in apts/condos reported the shortest average tenure (9 years).

Table 13: Average Length of Residence (Years) by Dwelling Type

Length of Residence (years)	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Mean	16.9	13.0	9.9	9.3	13.4
Standard Deviation	11.9	8.7	8.0	10.2	8.7

4.2 Dwelling Sizes

Dwelling size is defined as the total floor area of the dwelling including the basement and any unfinished areas but excluding garages or carports. As the data included a small number of responses considered unrealistically high or low, an outlier analysis was used to remove the bottom 0.5% and top 0.5% of the estimates, ordered from lowest to highest. This eliminated 1% of the unweighted sample from floor area calculations.

Residential dwellings included in FBC's 2022 REUS averaged 1,925 ft^2 (Table 14), compared to 1,996 ft^2 in 2017. The median size of dwellings in the 2022 REUS is 1,800 ft^2, compared to 1,950 ft^2 in 2017. The somewhat lower numbers for 2022 are attributed to the relatively larger proportion of apartment-style condominiums in the most recent survey (Section 4.1.1, page 21). Differences in the average (mean) dwelling size between the three regions are not statistically significant at the 95% confidence level.

Table 14: Dwelling Size (Square Feet)

Floor Space (ft^2)	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1892*
Mean [1]	1904	1893	1978	1925	1996	2092	1960
Median	1632	1800	1955	1800	1950	2000	n/a
Standard Deviation	1144	830	886	972	1283	1126	n/a

[1] Mean for 2022 REUS calculated excluding the 0.5% largest and smallest values

Table 15 summarizes floor space statistics for the five main dwelling types. On average, SFDs are the largest dwellings (average of 2,220 ft^2) and apts/condos are the smallest (1,042 ft^2). The median size for SFDs is 2,150 ft^2, compared to 1,430 ft^2 for townhouses and 1,043 ft^2 for apts/condos.

Table 15: Dwelling Size (Square Feet) by Dwelling Type

Floor Space (ft²)	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1925*	*116*	*142*	*290*	*155*
Mean [1]	2220	1860	1498	1042	1159
Median	2150	1800	1430	1043	1056
Standard Deviation	873	554	704	620	774

[1] Mean calculated excluding the 0.5% largest and smallest values

Consistent with trends identified in previous FBC residential end-use studies, the median size of a newly constructed SFD dwelling increased over time (Table 16). The median size of a single-family detached dwelling constructed before 1950 was 1,700 ft^2 compared to 2,700 ft^2 during the 2006-2015 period. The median size of SFDs constructed since 2015 is 2,400 ft^2; a slight deviation from the long-term trend. As the sample for this dwelling-age group is small, future surveys will confirm whether this is the start of a new trend.

Table 16: Floor Space of Single Family Detached Dwellings by Dwelling Vintage

Floor Space (ft²)	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base [1]	*158*	*310*	*211*	*200*	*191*	*153*	*71*	*28*
Mean [2]	1741	2016	2215	2304	2508	2722	2444	1467
Median	1700	2025	2156	2100	2400	2700	2400	1500
Standard Deviation	698	642	675	995	1003	976	847	741

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
[2] Mean calculated excluding the 0.5% largest and smallest values

4.3 Number of Heated Floors (Stories)

Knowing the number of heated floors (stories) in a residential dwelling helps understand its space conditioning requirements, with multi-story dwellings having different space heating and cooling profiles than their single-story counterparts.

The 2022 REUS queried the number of heated floors (stories), including basements if heated. Overall, 44% of residential dwellings have one floor, 42% have two, and the remainder have three or more floors (Table 17). Regional differences reflect differences in the mix of dwelling types. For example, homes in KE and SO are much more likely than those in KB to have only one heated floor, consistent with the relatively higher proportion of apts/condos in these two regions.

Table 17: Number of Heated Floors (Stories) Including Basements (%)

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1968*
Distribution (%)							
One floor	51.3	48.6	29.0	44.2	39.2	36.2	36.0
Two floors	35.5	42.2	51.0	41.8	45.0	46.8	49.0
Three floors	11.0	7.2	19.0	12.2	12.7	14.1	13.0
More than three floors	2.3	1.9	1.0	1.8	3.1	2.9	2.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Data on the number of heated floors (stories) by dwelling type are summarized in Table 18. The most common configuration for SFDs is two floors (62% of SFDs); while apts/condos and mobile homes typically have one heated floor (92% and 95% respectively).[4]

Table 18: Number of Heated Floors (Stories) Including Basements by Dwelling Type (%)

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1925*	*116*	*142*	*290*	*155*
One floor	21.2	14.5	34.0	92.1	94.5
Two floors	61.5	61.2	42.9	2.0	4.4
Three floors	16.4	22.6	22.4	1.3	1.1
More than three floors	0.9	1.7	0.7	4.6	--
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

4.4 Basements and Crawlspaces

Two-thirds (65%) of dwellings have either a full or partial basement, or crawlspace, significantly less than 72% of dwellings in the 2017 REUS (Table 19). The decline is attributed to the growing share of apts/condos in FBC's service area. Basements or crawlspaces are most common in dwellings in KB (77% of dwellings), followed by SO (68%) and KE (56%).

Table 19: Incidence of Basements and Crawlspaces (%)

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1962*
Full basement	31.8	33.6	56.7	39.3	45.3	46.4	48.0
Partial basement	4.8	9.0	10.6	7.7	10.0	10.3	24.0
Crawlspace	19.2	25.2	9.8	18.2	16.9	17.0	19.0
No basement or crawlspace	44.2	32.3	22.9	34.7	27.8	26.3	24.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Basement or crawlspace	**55.8**	**67.8**	**77.1**	**65.3**	**72.2**	**73.7**	**76.0**

Totals may not sum due to rounding.

[4] While the REUS questionnaire reminded respondents living in apartments and apartment-style condominiums to count only the floors in their unit, the results suggest a small portion of these respondents counted the total number of floors (stories) in their building.

The incidence of basements and crawlspaces varies by dwelling type (Table 20). Single-family detached and semi-detached dwellings are the dwelling types most likely to have a basement or crawlspace (92% and 90% respectively) compared to townhouses (63%) and apts/condos (9%). Somewhat more than one-third (35%) of mobile and other manufactured homes have a basement or crawlspace but the majority of these are crawlspaces.

Table 20: Incidence of Basements and Crawlspaces by Dwelling Type (%)

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1925*	*116*	*142*	*290*	*155*
Full basement	59.1	53.6	19.8	5.1	3.6
Partial basement	11.2	5.2	4.2	2.6	0.0
Crawlspace	21.6	31.3	39.1	1.1	31.3
No basement or crawlspace	8.0	9.9	36.9	91.2	65.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Basement or crawlspace	**92.0**	**90.1**	**63.1**	**8.8**	**34.9**

Totals may not sum due to rounding.

Somewhat more than half (54%) of basements are completely finished, 34% are partially finished, and 12% are unfinished (Table 21). At the utility level, these proportions are not significantly different than those recorded in 2017. Regionally, dwellings with basements in KB are the least likely to have a completely finished basement and the most likely for the basement to not be finished at all.

Table 21: Basement Finishing (%)

Dwellings with Basements	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*122*	*356*	*548*	*1026*	*1659*	*1089*	*1431*
Unfinished	8.0	10.2	17.2	12.3	13.6	12.1	31.0
Partially finished	26.7	30.4	42.5	34.1	34.7	37.5	28.0
Completely finished	65.3	59.4	40.3	53.6	51.7	50.4	41.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Nine-in-ten (89%) respondents living in dwellings with basements indicated they heat their basements during the heating season (Table 22). In contrast, only 30% of respondents living in a dwelling with a crawlspace indicated the crawlspace is heated during the winter months. The incidence of a heated basement or crawlspace is highest in KE and lowest in KB.

Table 22: Heating of Basements vs. Crawl Spaces (%)

Basement /Crawlspace Heating	KE	SO	KB	2022 FBC	2017 FBC	2017 FBC
Percent of basements heated	91.3	85.7	88.0	88.6	86.7	84.7
Percent of crawlspaces heated	37.8	29.3	9.1	30.1	36.7	34.8

4.5 Insulation & Insulation Upgrades

Consistent with the 2017 residential end-use survey, the 2022 REUS did not query respondents about the *amount* of insulation in attics, exterior walls, and basements, only whether these areas were insulated and whether the insulation had been improved or updated. The decision to remove questions regarding insulation levels in 2017 was made over concerns regarding the accuracy of the data captured in FEI's earlier residential end-use studies.

4.5.1 Attics

The incidence of insulated attics is summarized by region in Table 23. On average, 84% of respondents living in dwellings with an attic indicated the attic was insulated, 4% indicated it was not insulated, and 12% were unsure whether it was insulated or not. Regionally, the proportion of dwellings with insulated attics varies but so too the relative proportions of respondents unsure whether their attic was insulated.

Table 23: Attic Insulation (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Dwellings with attics (%)	77.1	83.5	93.7	83.6
Distribution: [1]				
Insulated	76.8	86.5	90.6	83.9
Not insulated	4.6	3.7	4.1	4.2
Don't know	18.6	9.8	5.3	11.9
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with attics.
Totals may not sum due to rounding.

Table 24 summarizes the proportion of dwellings with attics by dwelling vintage and the proportion of these attics that are insulated. Some degree of uncertainty and possibly self-reporting error is apparent (e.g., 14% of respondents living in homes with attics constructed since 2015 were unsure whether their attic was insulated and 3% indicated their attic was not insulated).

Table 24: Attic Insulation by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Dwellings with attics (%)	95.8	90.6	86.2	84.2	81.0	81.2	68.2	70.9
Distribution: [1]								
Insulated	88.4	90.3	87.8	86.1	83.7	79.4	83.3	36.8
Not insulated	5.6	3.9	3.6	4.8	3.2	5.0	2.5	6.2
Don't know	6.0	5.7	8.6	9.1	13.1	15.6	14.2	57.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with attics.
Totals may not sum due to rounding.

Three-in-ten (30%) of respondents living in dwellings with insulated attics indicated their attic insulation has been upgraded at some point in the dwelling's history. Conversely, more than half (54%) indicated their attic's insulation has not been upgraded (Table 25). Sixteen percent 16%) were unsure.

Table 25: Attic Insulation Upgrades (%)

Insulated Attics	KE	SO	KB	2022 FBC
Unweighted base [1]	*466*	*499*	*523*	*1488*
Upgraded	28.8	33.6	28.8	30.2
Not upgraded	54.2	55.7	52.7	54.2
Don't know	16.9	10.8	18.4	15.6
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with insulated attics.
Totals may not sum due to rounding.

4.5.2 Exterior Walls

The incidence of dwellings with insulated exterior walls is summarized in Table 26. The proportion of dwellings with un-insulated walls is very small (2%). Of note, 12% of respondents were unsure whether the exterior walls of their homes are insulated.

Table 26: Exterior Wall Insulation (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Insulated	82.8	88.1	89.2	86.1
Not insulated	1.6	1.0	3.9	2.1
Don't know	15.6	10.9	6.9	11.8
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Table 27 shows that the proportion of dwellings with no insulation in their exterior walls is highest for dwellings constructed prior to 1950 (11% of dwellings). This proportion falls to 1% to 2% of dwellings constructed in the subsequent years.

Table 27: Exterior Wall Insulation by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Insulated	74.1	90.9	89.4	88.4	90.8	83.6	85.1	59.0
Not insulated	11.1	3.0	1.4	0.8	--	1.0	1.7	3.0
Don't know	14.7	6.1	9.2	10.8	9.2	15.4	13.2	38.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Twelve percent (12%) of respondents indicated their home has upgraded exterior wall insulation (Table 28). Regionally, the percentage varies from 7% of KE homes to 17% of homes in KB. Uncertainty regarding upgrades is significant (19%).

Table 28: Exterior Wall Insulation Upgrades (%)

	KE	SO	KB	2022 FBC
Unweighted base [1]	*595*	*561*	*556*	*1712*
Upgraded	7.1	12.5	17.3	11.7
Not upgraded	70.3	75.6	63.6	69.8
Don't know	22.6	11.9	19.1	18.5
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with insulated exterior walls.
Totals may not sum due to rounding.

The incidence of upgraded exterior wall insulation is highest in older dwellings (Table 29). For example, one-half (48%) of dwellings built prior to 1950 have had their exterior wall insulation improved compared to 4% to 5% of homes built during the 1986-2015 period. Respondents in homes constructed since 2015 who indicated their wall insulation has been upgraded may be interpreting this question as referring to insulation options available when their homes were being constructed.

Table 29: Exterior Wall Insulation Upgrades by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base [1]	*121*	*344*	*283*	*289*	*285*	*221*	*114*	*53*
Upgraded	48.1	19.0	10.6	4.5	4.4	3.7	14.9	9.1
Not upgraded	34.0	67.3	60.9	78.9	82.6	80.6	77.2	27.6
Don't know	17.9	13.7	28.5	16.6	13.0	15.7	7.9	63.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with insulated exterior walls.
Totals may not sum due to rounding.

4.5.3 Basements

Three-quarters (81%) of basements are insulated and 12% are not insulated (Table 30). The remaining respondents were unsure. Regionally, the proportion of unsure respondents varies, limiting regional comparisons. Basements without insulation can account for approximately 20% of the total heat loss of a house.[5]

Table 30: Basement Insulation (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Dwellings with basements (%)	36.6	42.6	67.3	47.0
Distribution [1]				
Insulated	86.5	79.0	77.4	80.9
Not insulated	5.8	9.9	18.0	11.8
Don't know	7.7	11.0	4.6	7.3
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with basements.
Totals may not sum due to rounding.

[5] Natural Resources Canada (2012).

Consistent with the relationship between dwelling vintage and the proportion of dwellings with finished basements, dwellings constructed since the 1950s are more likely than their older counterparts to have insulated basements (Table 31).

Table 31: Basement Insulation by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Homes with basements (%)	75.6	72.5	47.2	36.9	42.2	41.1	24.6	21.6
Distribution [1]								
Insulated	55.1	79.3	88.7	81.2	85.1	94.8	100.0	42.0
Not insulated	38.9	14.3	6.5	11.2	3.4	1.0	--	15.1
Don't know	6.0	6.3	4.9	7.7	11.4	4.3	--	42.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with basements.
Totals may not sum due to rounding.

While one-quarter (26%) of respondents living in dwellings with insulated basements indicated that insulation in the basement has been improved or upgraded, two-thirds (64%) indicated that no improvements have been made, and 11% were unsure whether their basement's insulation had been upgraded or improved (Table 32). These data exclude respondents who were unsure whether their basements were insulated.

Table 32: Basement Insulation Upgrades (%)

Insulated Basements	KE	SO	KB	2022 FBC
Unweighted base [1]	*260*	*237*	*345*	*842*
Upgraded	18.0	24.3	34.0	25.7
Not upgraded	67.7	66.8	58.0	63.8
Don't know	14.3	8.9	8.0	10.5
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Dwellings with insulated basements.
Totals may not sum due to rounding.

4.5.4 Crawl Spaces

Somewhat less than one-in-five (18%) crawlspaces are insulated (Table 33). Eight percent (8%) are not insulated and the remaining 75% may or may not be insulated.

Table 33: Crawl Space Insulation (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Homes with crawlspaces (%)	19.2	25.2	9.8	18.2
Distribution [1]				
Insulated	21.3	23.1	8.2	17.5
Not insulated	10.0	9.7	4.4	8.0
Don't know	68.6	67.2	87.4	74.5
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with crawlspaces.
Totals may not sum due to rounding.

The incidence of insulated and un-insulated crawlspaces by dwelling vintage is summarized in Table 34. The proportion of respondents unsure whether their home's crawlspace is insulated is high regardless of the dwelling's vintage.

Table 34: Crawl Space Insulation by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base [1]	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Homes with crawlspaces (%)	18.9	11.5	15.0	30.8	22.8	14.8	7.7	17.6
Distribution [1]								
Insulated	12.5	8.2	14.7	28.0	22.3	21.9	20.3	7.7
Not insulated	7.5	5.3	9.6	14.2	7.5	3.0	3.5	12.7
Don't know	80.0	86.6	75.7	57.8	70.2	75.2	76.2	79.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with crawlspaces.
Totals may not sum due to rounding.

On average, one-quarter (24%) of respondents whose dwelling has an insulated crawlspace indicated its insulation has been upgraded at some point in the dwelling's history (Table 35).

Table 35: Crawl Space Insulation Upgrades (%)

Insulated Crawl Spaces	KE	SO	KB	2022 FBC
Unweighted base [1,2]	*97*	*116*	*47*	*260*
Upgraded	20.9	20.5	42.9	24.3
Not upgraded	70.8	69.2	53.5	67.4
Don't know	8.3	10.3	3.6	8.3
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with insulated crawlspaces.
[2] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Totals may not sum due to rounding.

4.5.5 Heated Garages / Workshops

Slightly less than two-thirds (64%) of dwellings have a heated garage or workshop (Table 36). These spaces may be part of the dwelling (i.e., workshop in the basement), attached to the dwelling (e.g., attached garage) or situated as a standalone detached structure (e.g., detached workshop and/or garage).

Table 36: Heated Garage / Workshop Insulation (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Homes with heated garages / workshops (%)	65.8	64.0	61.6	64.1
Distribution [1]				
Insulated	41.9	44.1	44.9	43.3
Not insulated	35.6	40.1	49.2	40.6
Don't know	22.5	15.8	6.0	16.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with heated garages/workshops.
Totals may not sum due to rounding.

Forty-three percent (43%) of respondents with a heated garage or workshop indicated these spaces are insulated, 41% indicated they are not insulated, and the remaining 16% were unsure. Regional variations are noted but so too the proportions of respondents unsure whether their heated garage or workshop is insulated.

One-quarter (26%) of respondents with garages or workshops that are both insulated and heated indicated the insulation has been upgraded (Table 37). The majority (60%) indicated they have not been upgraded and 13% were unsure.

Table 37: Insulation Upgrades for Insulated Heated Garages / Workshops (%)

Insulated Heated Garages / Workshops	KE	SO	KB	2022 FBC
Unweighted base [1]	*381*	*346*	*347*	*1074*
Upgraded	19.1	28.2	35.5	26.3
Not upgraded	59.9	62.7	59.0	60.4
Don't know	21.0	9.2	5.5	13.3
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Dwellings with garages / workshops both heated and insulated.
Totals may not sum due to rounding.

4.5.6 Draft Proofing Effectiveness

Approximately one-third (34%) of respondents to the 2022 FBC REUS indicated their homes were either "sometimes drafty" or "always drafty" (Table 38). The proportion of homes sometimes or always drafty varied from 32% for KE customers to 40% for KB customers.

Table 38: Draftiness of the Home (%)

How effective is your draft proofing?	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1950*
Not at all drafty	68.3	66.9	60.2	65.6	57.4	55.7	62.0
Sometimes drafty	27.7	31.4	36.3	31.2	38.6	38.9	33.0
Always drafty	4.0	1.7	3.5	3.2	4.0	5.4	5.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Sometimes or always drafty	**31.7**	**33.1**	**39.8**	**34.4**	**42.6**	**44.3**	**38.0**

Totals may not sum due to rounding.

At the utility level, the proportion of respondents indicating their home is sometimes or always drafty has declined steadily over the last three residential surveys, suggesting that actions taken to improve the efficiency of the building envelop (e.g., upgrading windows, exterior doors, and insulation, draft sealing, etc.) for existing and newly constructed dwellings are having a positive effect.

The data in Table 39 shows that respondents living in older homes are much more likely to say their home is sometimes or always drafty compared to those living in newer homes For example, somewhat less than half (46%) of respondents living in a home built before 1950 indicated their home was sometimes or always drafty compared to 12% of respondents in homes constructed since 2015.

Table 39: Draftiness of the Home by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Not at all drafty	53.8	58.2	48.7	67.4	75.3	84.0	87.7	39.2
Sometimes drafty	39.3	36.8	46.4	31.5	24.1	14.8	10.3	51.4
Always drafty	6.9	5.0	5.0	1.1	0.6	1.2	2.0	9.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Sometimes or always drafty	**46.2**	**41.8**	**51.4**	**32.6**	**24.7**	**16.0**	**12.3**	**60.8**

Totals may not sum due to rounding.

4.6 Windows and Window Upgrades

Respondents to the 2022 REUS were asked to specify the percentage of their dwelling's windows that had the following types of glass:

- Single-pane regular (clear) glass
- Double-pane regular (clear) glass
- Double-pane low-E glass
- Triple-pane regular (clear) glass
- Triple-pane low-E glass

Respondents with double and/or triple-glazed windows with low-E coatings were also asked whether these windows are ENERGY STAR® rated.

Average (mean) percentages for the five window types (glazing) by FBC region are provided in Table 40.

Table 40: Window Glazing (Mean %)

Window Type	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1785*
Single pane (clear) glass	14.7	10.7	9.5	12.0	11.9	11.3	15.0
Double pane (clear) glass	61.0	57.8	65.3	61.3	61.1	61.0	62.0
Double pane low-E	21.7	26.7	21.1	23.0	24.3	23.7	21.0
Triple pane (clear) glass	0.8	2.1	2.0	1.5	1.4	0.9	1.0
Triple pane low-E	1.8	2.8	2.2	2.2	1.2	1.2	2.0
Other [1]	n/a	n/a	n/a	n/a	n/a	1.8	n/a

[1] No "Other" category response option was provided in the 2002, 2009, and 2017 surveys.

Highlights include:

- Double-pane (clear) glass windows continue to be the most common window type present in FBC residential dwellings (61% of all windows in 2022, statistically unchanged over the last three surveys);
- The share of double-pane windows with low-E coatings accounts for 23% of all windows, unchanged from 2017.

- Penetration of double-pane low-E windows is highest in the SO (27%).
- Triple-pane windows, either with or without low-E coatings, account for less than 4% of all windows.

The proportion of respondents with double-pane or triple-pane windows with low-E coatings that are ENERGY STAR rated is 55% and 64% respectively (Table 41). However, 39% of respondents with double-pane low-E units and 33% of respondents with triple-pane low-E units were unsure whether these units are ENERGY STAR rated.

Table 41: ENERGY STAR Windows (% ENERGY STAR)

ENERGY STAR Windows?	KE	SO	KB	2022 FBC
Double pane with low-E				
Yes	55.0	51.3	59.0	54.8
No	5.0	7.3	6.7	6.2
Don't know	40.0	41.4	34.3	38.9
Triple pane with low-E				
Yes	66.1	51.3	78.2	64.4
No	--	7.8	--	2.9
Don't know	33.9	40.9	21.8	32.8

Data on the distribution of window glazing by dwelling vintage are summarized in Table 42. The data show that the older the dwelling, the more likely it will have one or more single-pane windows. The effect of renovation activity among the older housing stock is evident from the percentage of windows for homes constructed prior to 2006 that have double-pane windows with low-E coatings (19% to 25% of all windows).

Table 42: Window Glazing by Dwelling Vintage (Mean %)

Window Type	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Single pane (clear) glass	21.2	12.9	12.6	9.5	11.2	5.4	11.5	25.4
Double pane (clear) glass	53.4	60.4	61.1	66.6	68.7	63.3	37.2	67.3
Double pane with low-E coat	23.0	24.9	22.0	21.7	18.6	29.3	31.9	6.4
Triple pane (clear) glass	1.9	0.7	1.5	1.5	0.7	0.4	6.9	0.9
Triple pane with low-E coat	0.6	1.1	2.8	0.7	0.9	1.7	12.5	0.0

4.6.1 Window Frames

Respondents to FBC's 2022 REUS were asked to estimate the percentage of their dwelling's windows by frame material (e.g., aluminum, wood, vinyl, and/or other). The results, summarized in Table 43, show that vinyl-framed windows are the most common, accounting for one-half (52%), on average, of all windows, followed by aluminum (26%), and wood (21%). The share of windows using vinyl as the frame material has been increasing over time (up from 42% in 2009) at the expense of wood frame windows (down from 29% in 2009).

Table 43: Window Frame Material (Mean %)

Window Frame Material	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1893*
Aluminum	32.4	28.3	14.5	26.2	27.2	29.8	27.0
Wood	22.6	16.5	24.1	21.3	22.1	23.9	29.0
Vinyl	44.2	54.6	60.3	51.7	47.6	44.0	42.0
Other	0.8	0.6	1.2	0.8	0.6	2.3	1.0

The popularity of different window frame materials, notably wood, varies by the age of the dwelling (Table 44). For example, homes built prior to 1950 are most likely to have windows with wood frames (36% of windows) compared to just 5% of homes constructed since 2015. Vinyl-framed windows, a popular choice for retrofits and new construction, represent anywhere from 48% of windows in pre-1950 homes to 55% of homes constructed since 2015. Aluminum-framed windows appear to be experiencing a resurgence in popularity in new construction with 30% and 37% of windows framed with this material in homes built since 2005.

Table 44: Window Frame Material by Dwelling Vintage (Mean %)

Window Frame Material	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Aluminum	15.3	23.5	25.9	29.2	20.2	30.1	36.6	31.8
Wood	36.2	23.2	20.3	25.2	19.6	14.4	5.1	32.4
Vinyl	48.1	52.5	52.8	45.6	59.6	54.7	55.4	33.9
Other	0.4	0.8	1.1	0.0	0.6	0.8	2.8	1.9

4.6.2 Window Upgrades

One-quarter (25%) of respondents indicated they have upgraded some or all of their dwelling's windows (windows and frames) in the last five years (Table 45). Regionally, dwellings in the SO and KB regions were significantly more likely than those in the KE to have had some or all of their windows upgraded in the last five years.

Table 45: Windows Upgraded Last Five Years (%)

Windows upgraded last five years?	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Yes - all of them	10.8	10.5	5.0	9.1
Yes - some of them	9.7	17.7	21.5	15.4
No - none of them	73.3	66.9	69.6	70.4
Don't know	6.2	4.8	3.9	5.1
Total	**100.0**	**100.0**	**100.0**	**100.0**
Some or all upgraded	**20.5**	**28.2**	**26.5**	**24.5**

Totals may not sum due to rounding.

The proportion of dwellings that upgraded some or all of their windows in the last five years is typically highest among older dwellings, notably those built prior to the mid-1990s. For example, between 29% and 36% of homes built prior to 1996 have upgraded some or all of their windows in the last five years, compared to between 2% and 11% for homes built between 1996 and 2015. Respondents in homes constructed since 2015 who indicated they upgraded all of their windows may have interpreted the question as referring to options available to them at the time of construction (i.e., made the decision to upgrade their window package during construction).

Table 46: Windows Upgraded Last Five Years by Dwelling Vintage (%)

Windows upgraded last five years?	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Yes - all of them	9.6	8.6	11.3	10.6	1.2	0.8	32.1	8.6
Yes - some of them	26.7	27.2	17.3	22.3	10.1	1.5	1.0	5.1
No - none of them	60.0	60.9	68.8	62.2	85.2	91.8	59.6	63.3
Don’t know	3.7	3.2	2.6	5.0	3.5	5.9	7.3	23.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Some or all upgraded	**36.3**	**35.8**	**28.6**	**32.9**	**11.3**	**2.3**	**33.1**	**13.7**

Totals may not sum due to rounding.

4.7 Exterior Door Materials and Upgrades

4.7.1 Exterior Door Materials

REUS 2022 respondents were asked to itemize (count) their home’s exterior doors (doors that open to the outdoors) by door material and material combinations including:

- Wood doors
- Wood doors with aluminum storm doors
- Insulated steel or fibreglass doors
- Glass doors with wood frames
- Glass doors with aluminum frames
- Glass doors with vinyl or fibreglass frames

Respondents living in apartments or apartment-style condominiums were asked to count only doors in their unit that open directly to the outdoors.

Table 47 summarizes the percentage distribution of the six door types. Insulated steel or fibreglass doors are the most common type of exterior door, accounting for one-third (35%) of all exterior doors in 2022. Wood doors and glass doors with aluminum frames (e.g., sliding patio doors) are the next two most common door types, representing 20% and 15% of exterior doors respectively. Notable regional differences include a significantly higher share for wood doors in KB (23%) and a significantly lower share for insulated steel or fibreglass doors in KE (31%).

Table 47: Exterior Doors by Region (% of all Outside Doors)

Outside Door Type	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Wood doors	18.5	18.3	23.2	19.9
Wood doors with aluminum storm doors	6.5	5.6	6.9	6.4
Insulated steel or fibreglass doors	30.7	36.1	39.1	35.0
Glass doors with wooden frames	15.1	8.7	10.7	11.8
Glass doors with aluminum frames	17.1	15.8	10.8	14.7
Glass doors with vinyl or fibreglass frames	12.0	15.5	9.2	12.2
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Table 48 summarizes the incidence of exterior door materials by dwelling vintage. While insulated steel or fibreglass doors are the most popular exterior door type regardless of vintage, wooden doors are typical of older dwellings (e.g., 27% of exterior doors in homes built before 1950). Also of note, patio doors (glass doors with aluminum frames) appear to regained popularity in new construction with between 18% and 23% of dwellings constructed since 2005 having at least one of this exterior door type, up from 13% to 15% of dwellings constructed between 1986 and 2005. This trend is consistent with the increased share of apartments and apartment-style condominiums in new residential construction.

Table 48: Outdoor Door Type by Dwelling Vintage (% of all Outside Doors)

Outside Door Type	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Wood doors	26.8	23.2	22.6	15.5	15.6	21.6	13.8	22.0
Wood doors with aluminum storm doors	10.5	11.6	6.5	4.8	3.2	4.3	2.1	7.1
Insulated steel or fibreglass doors	33.2	39.4	32.4	38.0	42.1	27.2	27.9	27.0
Glass doors with wooden frames	7.9	6.8	15.0	13.8	13.6	15.5	6.1	12.3
Glass doors with aluminum frames	11.4	10.4	13.1	14.7	13.4	18.4	22.9	25.8
Glass doors with vinyl frames or fibreglass frames	10.2	8.7	10.4	13.1	12.1	13.0	27.3	5.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Table 49 summarizes the average number of exterior doors per dwelling, by door material. Insulated steel or fibreglass doors are the most common, averaging 1.1 doors per dwelling, followed by wood doors (0.6) and glass doors with aluminum frames (0.5). The average dwelling has 3.1 exterior doors (median 3.0).

Table 49: Exterior Door Saturation Rates
Average Number per Dwelling

Outside Door Type	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Wood doors	0.5	0.6	0.8	0.6
Wood doors with aluminum storm doors	0.2	0.2	0.2	0.2
Insulated steel or fibreglass doors	0.9	1.2	1.4	1.1
Glass doors with wooden frames	0.4	0.3	0.4	0.4
Glass doors with aluminum frames	0.5	0.5	0.4	0.5
Glass doors with vinyl frames	0.3	0.5	0.3	0.4
Average # per dwelling (all types)	**2.8**	**3.3**	**3.5**	**3.1**

4.7.2 Exterior Door Upgrades Last Five Years

Two-in-ten (21%) FBC residential customers upgraded some or all of their exterior doors with new doors during the last five years (Table 50). Regionally, households in KB and SO were most likely to upgrade (25% and 24% of households respectively) compared to 16% of KE households.

Table 50: Exterior Door Upgrades Last Five Years (%)

Exterior doors upgraded last five years?	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Yes - all of them	6.4	12.0	6.8	8.1
Yes - some of them	9.7	11.7	18.3	12.7
No - None of them	75.8	71.8	71.1	73.3
Don't know	8.0	4.5	3.8	5.8
Total	**100.0**	**100.0**	**100.0**	**100.0**
Some or all upgraded	**16.1**	**23.7**	**25.1**	**20.8**

Totals may not sum due to rounding.

Like that of windows and insulation, older dwellings are significantly more likely than newer dwellings to have had some or all of their exterior doors upgraded during the last five years (Table 51). Roughly three-in-ten dwellings built prior to the mid-1980s have had all or some of their exterior doors upgraded during the last five years. In contrast, 10% of homes built in the 1996-2005 period and 5% of homes built in 2006-2015 have had some or all of their exterior doors upgraded.

Table 51: Exterior Door Upgrades Last Five Years by Dwelling Vintage (%)

Exterior doors upgraded last five years?	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Yes - all of them	12.1	9.5	9.4	6.1	1.9	0.7	29.9	5.8
Yes - some of them	17.2	19.7	19.0	15.7	8.1	4.4	1.0	8.0
No - None of them	67.5	67.6	66.5	72.5	86.1	89.2	60.9	61.6
DK	3.2	3.2	5.2	5.6	3.8	5.8	8.2	24.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Some or all upgraded	**29.3**	**29.2**	**28.4**	**21.8**	**10.0**	**5.1**	**30.9**	**13.8**

Totals may not sum due to rounding.

4.8 Electricity Bill Coverage – Rental Suites, Garages, Workshops, Other Structures, and Pumps

Table 52 summarizes the proportion of FBC customers whose electricity bill from FortisBC covers a rental suite, coach or laneway house, detached garage/workshop, other buildings (sheds, farm buildings, etc.), and/or pumps (for wells, irrigation, etc.).

Table 52: Electricity Bill Coverage (%)
Multiple Responses Allowed

Electricity bill includes service to:	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1965*
Rental Suite [1]	15.5	4.7	11.4	11.3	10.7	5.7	3.0
Coach house or laneway house [2]	0.6	1.1	1.0	0.8	n/a	n/a	n/a
Detached garage / workshop	10.9	20.4	30.7	19.2	21.1	16.9	n/a
Other buildings (e.g., sheds, farm buildings, etc.)	5.0	9.5	16.5	9.6	10.0	9.5	n/a
Pumps (e.g., wells, irrigation, etc.)	8.6	15.4	17.1	13.0	12.3	11.8	n/a

[1] Includes respondents who are renting their home from someone else.
[2] Not queried prior to the 2022 survey

Somewhat more than one-in-ten (11%) respondents indicated their electricity bill covers a rental suite and one percent (1%) indicated it covers a coach house or laneway house.[6] One-in-five (19%) indicated it covers a detached garage or workshop and 10% indicated it includes buildings such as sheds and farm buildings. Finally, 13% indicated it covered electrical service for pumps.

By region, KB has a significantly higher incidence of detached garages or workshops, other buildings, and pumps covered by the respondent's electrical service compared to other regions. KE has the highest proportion of respondents indicating their electricity bill covers a rental suite (16%).

4.9 Payment of Utility Bills

Respondents were asked who pays the electricity bill for their residence: the property owner, renter or someone else. The majority (90%) of respondents indicated the owner of the property pays the electricity bill (Table 53). Renters accounted for 10% of bill payers.

Table 53: Electricity Bill Payment (%)

Who pays the electricity bill?	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Property owner	84.0	95.2	92.2	89.5
Renter	15.6	4.6	7.8	10.3
Someone else	0.4	0.2	0.0	0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Table 54 summarizes the breakdown of who in the home pays the natural gas bill (i.e., FBC customers that also receive natural gas service from FortisBC). Seven-in-ten (69%) are property owners, 4% are renters, and 2% percent are someone other than the property owner or renter. One-quarter (25%) do not have natural gas service.

[6] Data for rental suites represents both (i) respondents who own the property and rent all or some of it to others, and (ii) respondents who rent their home from someone else.

Table 54: Natural Gas Bill Payment (%)

Who pays the natural gas bill?	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Property owner	65.6	74.5	69.6	69.3
Renter	5.7	2.2	2.8	3.8
Someone else	5.3	0.3	0.0	2.3
No natural gas service	23.4	23.1	27.6	24.5
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

4.10 End-Uses Covered by Rent or Maintenance Fees

Slightly more than one-third (34%) of FBC residential customers pay rent or maintenance fees (Table 55). Regional variations in this percentage are consistent with the proportions of respondents living in condominiums, co-operatives, and other residential dwellings with shared services in each region. The proportion of respondents paying rent or maintenance fees varies from 15% in KB to 50% in KE.

Table 55: Households Paying Maintenance Fees (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Pay rent or maintenance fees	49.7	29.9	14.5	34.0

The three most common services covered by rent or maintenance fees include hot water (40% of those paying rent or fees), heat (17%), and fuel for gas fireplaces (10%) (Table 56). Three percent (3%) indicated their rent or maintenance fees include the cost of electricity for charging their electric vehicle.

Table 56: End-Uses Covered by Maintenance Fees (%)
Percent of respondents paying maintenance fees.[1]

	KE	SO	KB	2022 FBC
Unweighted base	*299*	*141*	*75*	*515*
Heat	17.6	7.7	32.2	16.9
Hot water	48.0	16.6	48.5	40.1
Fuel for gas fireplace	11.8	1.6	18.1	10.0
Electricity for electric vehicle charging	2.4	4.1	2.3	2.8
None of the above	41.8	78.1	47.5	51.6
Don’t know	4.6	1.3	1.6	3.5

[1] Multiple responses allowed. Percentages may not add to 100%

4.11 Business Use of Property

One-in-ten (10%) respondents to the 2022 REUS operate either a full or part-time business from their residence (Table 57).

Table 57: Use of Dwelling for Full or Part-time Business by Region (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Full-time business	4.0	2.4	3.7	3.4
Part-time business	5.3	6.0	8.0	6.3
Full or part-time business	**9.3**	**8.4**	**11.7**	**9.7**

Totals may not sum due to rounding.

4.12 Energy-Related Renovations

4.12.1 Renovations Completed Last Five Years

Respondents to the 2022 FBC REUS were provided with a list of common energy-related renovations and asked to indicate which, if any, they completed in the last five years and if it was completed with the help of a government or utility rebate. An energy-related renovation is defined as a renovation that directly or indirectly impacts the dwelling's use of energy. Renovations queried ranged from low-cost activities like weather stripping to more expensive actions like installing an air source heat pump, energy-efficient windows or an on-demand water heater.

Four-in-ten (39%) respondents completed at least one of the listed energy-related renovations during the last five years (Table 58).

Table 58: Energy-Related Renovations – Last Five Years
Percent of Respondents [1]
Multiple Responses Allowed

Type of Renovation	With Rebate	Without Rebate	With or Without Rebate	Percent Using Rebate
Install energy-efficient window(s)	1.9	11.2	13.1	14.7
Install weather stripping or caulking	1.7	11.4	13.1	13.1
Install low-flow showerhead(s)	1.3	11.4	12.7	10.4
Improve insulation	1.8	7.7	9.4	18.7
Install high-efficiency hot water tank	3.1	6.4	9.4	32.4
Install outdoor clothesline / drying rack	n/a	8.4	8.4	n/a
Install a smart / learning-style thermostat(s)	2.8	4.8	7.6	37.0
Install insulated outside door(s) or storm doors	1.0	6.2	7.2	13.9
Install pipe wrap	0.6	4.6	5.2	12.4
Install on-demand (tankless or hybrid) water heater	2.2	1.2	3.4	65.1
Install an air source heat pump	1.9	1.2	3.1	60.4
Install hot tub	n/a	2.3	2.3	n/a
Install hot water heater blanket	0.1	1.3	1.4	10.0
Install sauna	n/a	0.6	0.6	n/a
Install heated swimming pool	n/a	0.4	0.4	n/a
Install drainpipe waste heat recovery system	0.1	0.2	0.3	30.9
At least one of the above (%)	**11.6**	**34.5**	**39.1**	**n/a**

[1] Calculated using a weighted base of n = 1,933
Totals will not sum to 100% because multiple responses were allowed.
n/a = not applicable

The top three renovations included installing energy-efficient windows, installing weather stripping or caulking and installing low-flow showerheads (each completed by 13% of respondents). The percentage of renovations completed with a rebate (where available) varied from a high of 65% for installations of an on-demand water heater to 10% for installing either a low-flow showerhead or a water heater blanket. Of note, 3% of respondents indicated they had installed an air source heat pump in the last five years.

Energy-related renovations undertaken during the last five years are summarized by dwelling vintage in Table 59. The data confirm that the older the home, the more likely it underwent one or more energy-related renovations during the past five years. For example, more than half (53%) of dwellings built before 1950 had at least one energy-related renovation compared to one-quarter (26%) of dwellings constructed between 2006 and 2015. Older homes were more likely to have upgraded their weather stripping, insulation, windows, and doors.

Table 59: Energy-Related Renovations – Last Five Years by Dwelling Vintage
Percent of Respondents
Multiple Responses Allowed

Type of Renovation	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Improve insulation	20.1	12.4	9.9	10.9	6.4	3.2	7.8	6.0
Install energy-efficient window(s)	19.2	19.4	16.8	21.1	6.4	1.3	7.1	4.9
Install insulated outside door(s) or storm doors	13.9	11.1	9.6	8.2	2.8	1.3	5.3	5.2
Install low-flow showerhead(s)	15.2	14.3	12.8	17.8	15.2	5.3	6.7	6.3
Install a smart / learning-style thermostat(s)	5.8	7.6	7.0	6.7	7.7	2.7	4.1	1.7
Install pipe wrap	6.1	8.3	4.9	6.0	3.4	2.3	3.0	3.4
Install weather stripping or caulking	20.6	22.3	13.8	12.3	12.0	6.5	6.0	3.9
Install hot water heater blanket	1.7	1.6	2.0	1.4	1.0	1.0	0.0	2.2
Install drainpipe waste heat recovery system	0.7	0.0	0.0	0.2	0.3	0.3	0.5	1.5
Install an air source heat pump	1.6	2.8	4.5	6.0	2.7	0.6	2.1	1.2
Install on-demand (tankless or hybrid) water heater	8.0	3.1	2.4	3.9	3.9	2.0	4.5	0.9
Install high-efficiency hot water tank	7.8	10.5	11.5	11.2	12.6	6.4	2.4	3.8
Install hot tub	3.1	1.5	2.6	2.8	1.1	3.3	3.2	1.2
Install sauna	0.5	0.2	0.3	1.3	0.8	0.8	0.0	0.0
Install heated swimming pool	0.0	0.6	0.2	0.3	0.6	1.7	4.4	0.0
Install outdoor clothesline / drying rack	15.6	12.7	8.8	8.6	7.1	4.4	3.0	4.1
At least one of the above	**52.5**	**49.4**	**42.7**	**48.0**	**35.9**	**26.4**	**20.5**	**16.2**

Totals will not sum to 100% because multiple responses were allowed.

4.12.2 Planned Energy-Related Renovations – Next Two Years

Using the same list of renovations from the previous section, respondents were asked which, if any, they intended to complete during the next two years. While speculative, these intentions provide a general indication of the types of energy-related renovations most likely to be completed in the short term. The results are presented in Table 60.

One-in-five (19%) of respondents indicated they are planning one or more energy-related renovations during the next two years. The most frequently indicated renovations include improving insulation, installing weather stripping or caulking, and installing energy-efficient windows (each indicated by 6% of respondents). Two percent (2%) indicated they are intending to install an air source heat pump in the next two years.

Table 60: Planned Energy-Related Renovations - Next Two Years
Percent of Respondents - Multiple Responses Allowed

Type of Renovation	% of Respondents
Unweighted base	*2628*
Improve insulation	6.1
Install weather stripping or caulking	6.0
Install energy-efficient window(s)	5.7
Install insulated outside door(s) or storm doors	4.1
Install high-efficiency hot water tank	4.1
Install a smart / learning-style thermostat(s)	3.9
Install low-flow showerhead(s)	3.0
Install on-demand (tankless or hybrid) water heater	2.8
Install hot water heater blanket	2.7
Install outdoor clothesline / drying rack	2.7
Install hot tub	2.3
Install an air source heat pump	2.2
Install drainpipe waste heat recovery system	2.0
Install pipe wrap	1.9
Install sauna	1.5
Install heated swimming pool	1.5
At least one of the above	**18.7**

Calculated using weighted base of n = 1,933
Totals will not sum to 100% because multiple responses were allowed.

The proportions of respondents likely to undertake one or more energy-related renovations to their home over the next two years, by renovation type and dwelling vintage, are presented in Table 61.

Like that found with past renovation actions, the likelihood of future renovations increases with the age of the home. For example, 36% of respondents living in a dwelling constructed before 1950 are planning one or more energy-related renovations during the next two years compared to 8% of those living in homes constructed since 2015.

Table 61: Planned Energy-Related Renovations - Next Two Years by Dwelling Vintage
Percent of Respondents – Multiple Responses Allowed

Planned Renovations – Next Two Years	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Improve insulation	11.6	15.0	8.1	6.7	5.0	3.2	1.3	4.5
Install energy-efficient window(s)	12.5	12.6	8.7	11.9	5.2	2.4	0.0	1.9
Install insulated outside door(s) or storm doors	5.7	10.1	18.6	7.5	5.8	1.8	1.0	1.9
Install low-flow showerhead(s)	4.6	1.7	3.7	2.6	2.7	2.4	0.7	2.8
Install a smart / learning style thermostat(s)	4.3	5.1	3.2	3.9	3.6	2.6	0.5	2.4
Install pipe wrap	5.0	2.5	2.3	1.4	2.7	2.0	0.3	1.9
Install weather stripping or caulking	8.3	10.8	4.5	7.7	5.5	3.2	0.7	1.9
Install hot water heater blanket	4.3	5.6	2.9	5.0	2.6	1.9	0.7	1.9
Install drainpipe waste heat recovery system	1.9	2.1	1.9	1.3	1.9	1.3	0.0	1.9
Install an air source heat pump	4.2	4.6	3.5	2.8	3.2	2.5	1.2	3.7
Install on-demand (tankless or hybrid) water heater	4.6	5.8	2.5	2.6	1.9	2.5	0.7	1.9
Install high-efficiency hot water tank	4.5	6.7	4.9	3.6	5.2	3.7	0.0	3.2
Install hot tub	1.9	2.3	3.1	2.4	2.5	2.2	2.6	2.8
Install sauna	2.6	1.0	1.6	1.6	1.0	1.4	0.0	2.8
Install heated swimming pool	0.0	0.2	1.9	1.0	0.7	1.1	0.0	2.8
Install outdoor clothesline / drying rack	7.5	3.8	2.4	2.4	1.4	3.5	1.3	7.2
At least one of the above	**36.3**	**32.8**	**39.2**	**27.4**	**19.3**	**13.6**	**8.4**	**10.0**

Totals will not sum to 100% because multiple responses were allowed.

5 SPACE HEATING

This section presents detailed data and analyses on space heating fuels and methods (equipment); fuel switching; furnace and boiler efficiencies, replacement and installation frequencies; heat pumps; and heating system maintenance behaviours.

5.1 Determining How Dwellings are Heated

Respondents to FortisBC's 2022 REUS were asked to identify the fuels used for space heating separately from the methods (equipment) used to heat their homes. This approach is needed as some space heating methods (e.g., forced air furnaces, boilers, fireplaces, etc.) may use different fuels depending upon their design. The alternative is to provide a list of space heating equipment-fuel combinations (e.g., electric forced air furnace, natural gas forced air furnace, oil-fired forced air furnace, etc.). The primary drawback to this approach is the large number of equipment-fuel combinations that exist and would need to be queried of respondents.

5.2 Space Heating Fuels

Respondents were asked to identify the main space heating fuel used to heat their home and then, all other fuels used for space heating. Respondents were advised to consider the main space heating fuel as the fuel "that provides most of the heat in the home during a typical year".

5.2.1 Main Space Heating Fuel

Table 62 summarizes the main (primary) space heating fuel used by FBC residential customers. Natural gas is the main (primary) space heating fuel for 58% of FBC residential customers, followed by electricity (34%) and wood (5%). All other fuels, individually, are used by less than 1% of respondents. At the utility level, the distribution of main space heating fuels is statistically unchanged from 2017 based on a 95% confidence interval.

Table 62: Main Space Heating Fuel (%)

Main Space Heating Fuel	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1968*
Electricity	38.6	29.7	29.5	33.5	35.8	39.9	38.0
Natural gas	56.1	61.6	55.6	57.5	57.7	50.4	52.0
Piped propane	--	0.3	--	0.1	0.4	0.1	1.0
Bottled propane	1.5	1.2	1.4	1.4	0.4	1.3	1.0
Oil	--	0.1	0.8	0.3	0.5	0.7	1.0
Wood	0.7	6.2	10.9	5.2	4.0	5.9	7.0
Other	1.6	0.9	1.5	1.4	0.8	1.4	n/a
Don't know	1.5	--	0.1	0.7	0.4	0.4	0.0*
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

* Value less than 1%
n/a – data not available
Totals may not sum due to rounding.

Space Heating

Use of electricity as the main space heating fuel varies from 30% of KB households to 39% of KE households. The use of wood as a main space heating fuel is highest in the KB region (11%) but is used by less than 1% of homes in the KE region.

Main space heating fuel shares by the five main dwelling types are summarized in Table 63. Natural gas is the main space heating fuel for seven-in-ten (69%) single-family detached dwellings. In contrast, natural gas is the main space heating fuel for one-quarter (24%) of apts/condos. Electricity as a main fuel ranges from 15% of semi-detached dwellings to 71% of apts/condos. Of note, wood is the main space heating fuel for 8% of single-family detached dwellings and 7% of mobile and other manufactured dwellings.

Table 63: Main Space Heating Fuel by Dwelling Type (%)

Main Space Heating Fuel	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Electricity	20.1	15.2	29.0	70.6	18.3
Natural gas	69.1	82.4	70.3	24.1	62.2
Piped propane	0.1	--	--	--	--
Bottled propane	1.0	1.7	--	0.4	11.3
Oil	0.4	--	--	--	0.5
Wood	8.0	0.6	--	0.4	6.5
Other	1.2	--	0.7	2.1	1.1
Don't know	0.1	--	--	2.5	--
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Main space heating fuels for FBC residential customers by dwelling vintage (period of construction) are summarized in Table 64. Variations in the relative popularity of electricity versus natural gas as the main space heating fuel are influenced by both the mix of dwelling types constructed during the period in question and builder choices of space heating methods at the time of construction. Somewhat more than half (53%) of the newest homes (those built since 2015) use natural gas as their main space heating fuel compared to 64% of dwellings constructed between 1986 and 2005.

Table 64: Main Space Heating Fuel by Dwelling Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Electricity	10.1	19.9	42.7	31.2	29.9	47.7	35.9	61.0
Natural gas	80.7	67.0	45.0	63.9	64.4	44.7	53.4	30.1
Piped propane	0.5	--	--	0.2	--	--	--	--
Bottled propane	--	0.4	0.8	1.3	2.5	1.2	5.1	--
Oil	--	1.6	--	--	--	--	--	--
Wood	8.7	8.8	8.3	2.9	2.6	3.7	1.2	4.4
Other	--	2.1	2.6	--	0.6	2.8	0.8	0.8
Don't Know	--	0.2	0.6	0.5	--	--	3.5	3.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

5.2.2 Secondary Space Heating Fuels

With the increased penetration of heat pumps (Section 5.5), there was the concern that some respondents might not identify electricity used by their heat pump as either a main or other space heating fuel.[7] To explore the extent that this omission might be occurring, data on space heating fuels for each respondent using a heat pump (either a ducted or mini-split) to heat their home were reviewed. The review found 132 respondents with a heat pump that did not indicate electricity as a secondary (other) space heating fuel. The data for these respondents was changed to indicate they used electricity as a secondary (other) space heating fuel.

Following adjustments to correct secondary space heating fuel data, 54% of respondents to the 2022 REUS are estimated to use one or more secondary fuel(s) to heat their dwelling (Table 65). Regionally, secondary space heating fuel use is highest in the KB region (66%) and lowest in KE (44%). Caution is advised when comparing 2022 data with previous REUS surveys due to the change in the treatment of secondary space heating fuels in the 2022 dataset.

Table 65: Secondary Space Heating Fuel Use (%)

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2044*
Use secondary fuel(s)	44.1	57.3	66.3	54.2	43.2	48.2	35.0

When analyzed by dwelling type, the incidence of secondary space heating fuels is highest among SFDs (60%), followed by mobile and other manufactured dwellings (55%), and semi-detached dwellings (50%) (Table 66). Townhouses and apts/condos are the least likely dwelling types to use a secondary fuel (44% for each).

Table 66: Secondary Space Heating Fuel Use by Dwelling Type (%)

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Use secondary fuel(s)	59.7	50.1	43.6	44.4	55.0

Details on secondary space heating fuels are provided in Table 67. Electricity is the most common secondary heating fuel, used by 62% of FBC customers who use a secondary fuel. The next most common secondary fuels are natural gas and wood (17% for each). The use of wood as a secondary heating fuel is highest in KB (30%) and lowest in KE (7%).

[7] Aware of this possibility, both paper and online survey respondents were reminded to identify electricity as either a main or other space heating fuel if they used a heat pump for space heating.

Table 67: Secondary Space Heating Fuel(s) (%)
Base: Dwellings Using More than One Space Heating Fuel
Multiple Responses Allowed

Secondary Space Heating Fuels	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base [1]	*314*	*354*	*392*	*1060*	*1134*	*884*
Electricity	64.5	65.8	56.5	62.1	56.9	59.5
Natural gas	16.0	16.0	18.3	16.8	23.3	16.6
Piped propane	0.3	--	0.2	0.2	0.5	1.5
Bottled propane	1.1	3.8	1.4	2.0	2.0	2.8
Oil	0.7	--	0.2	0.3	0.3	0.8
Wood	6.8	14.3	29.5	17.0	29.7	26.8
Other	3.5	2.7	1.9	2.7	2.7	1.9

[1] Base: Dwellings using a secondary space heating fuel.
Columns do not sum to 100% because of multiple responses.

Table 68 summarizes data on secondary fuels by dwelling type. With the exception of apts/condos, electricity is the main secondary fuel among dwellings using more than one fuel for space heating. Of note, 24% of SFDs using one or more secondary space heating fuels use wood as a secondary fuel. Caution is advised in the interpretation of data for dwelling types other than SFDs, as their sample sizes are small.

Table 68: Secondary Space Heating Fuel by Dwelling Type (%)
Base: Dwellings Using More than One Heating Fuel
Multiple Responses Allowed

Secondary Space Heating Fuels	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base [1,2]	*797*	*36*	*50*	*83*	*94*
Electricity	67.3	85.5	68.5	35.9	79.4
Natural gas	11.2	9.2	18.4	39.3	1.5
Piped propane	0.3	--	--	--	--
Bottled propane	1.7	1.4	8.4	0.8	5.4
Oil	0.1	--	1.6	0.8	--
Wood	24.0	1.1	16.0	--	10.7
Other	2.3	--	2.7	4.5	1.9

[1] Base: Dwellings using a secondary space heating fuel.
[2] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Columns do not sum to 100% because of multiple responses.

5.2.3 Net Space Heating Fuels

Fuels used for space heating, regardless of whether they are used as the main or secondary heating fuel, are summarized in Table 69. At the overall utility level, the proportions of dwellings using natural gas versus electricity as their main or secondary fuel are statistically equal (67% for each). Regionally, similar results are observed.

Table 69: Net Space Heating Fuel(s) (%)
Multiple Responses Allowed

Main or Secondary Space Heating Fuel	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Electricity	66.6	67.4	66.9	66.9	61.7	68.3
Natural gas	63.0	70.7	67.7	66.6	65.0	58.0
Piped propane	0.1	0.3	0.1	0.2	0.5	0.9
Bottled propane	1.9	3.4	2.4	2.5	1.1	2.6
Oil	0.3	0.1	1.0	0.4	0.6	1.1
Wood	3.7	14.4	30.5	14.4	13.2	18.7
Other	3.1	2.5	2.7	2.8	1.7	2.3

Columns do not sum to 100% because of multiple responses.

5.2.4 Change in Main Space Heating Fuel – Last Five Years

Table 70 shows that 6% of FBC customers changed the main fuel used to heat their homes during the last five years, statistically unchanged from 2017. A change in main space heating fuel may come about because of a change in space heating equipment, a decision to use one fuel-specific system more than another (e.g., switch to using a wood stove over electric baseboard heat), or because there is access to a fuel not previously available in the area (e.g., expansion of the natural gas distribution system).

Table 70: Change in Main Space Heating Fuel in Last Five Years (%)

Changed main fuel used for space heating?	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Yes	3.1	8.2	7.5	5.8	5.8

Totals may not sum due to rounding.

Table 71 shows that 37% of FBC customers who switched their main space heating fuel in the last five years had previously used electricity, 11% had used natural gas, and 13% had used wood. Notable regional differences include the 4% of fuel switchers in SO who switched away from heating oil and the 22% of switchers in KB that no longer use wood as their main space heating fuel.

Table 71: Previous Main Space Heating Fuel (%)

Previous Main Space Heating Fuel	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base [1]	*23*	*52*	*53*	*128*	*152*
Electricity	36.8	37.1	38.3	37.4	57.0
Natural gas	4.0	13.2	11.9	10.6	21.6
Piped propane	--	--	2.9	1.1	0.7
Bottled propane	--	1.3	2.2	1.3	1.7
Oil	--	4.2	--	1.7	7.1
Wood	--	12.9	22.3	13.5	6.7
Other	27.3	10.3	13.1	15.2	2.4
Don’t know	32.0	21.1	9.2	19.3	2.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Totals may not sum due to rounding.

5.3 Space Heating Methods

There are a variety of methods (equipment) that can provide space heating for residential dwellings. The 2022 REUS questionnaire asked respondents to indicate their dwelling's main (primary) space heating method from a list of common space heating methods and then any other (secondary) methods used. Methods differ from fuels in that they refer to an appliance or technology (e.g., forced air furnaces, air source heat pumps, etc.).

5.3.1 Number of Space Heating Methods

Six-in-ten (59%) respondents to FBC's 2022 REUS indicated they use more than one method to heat their home (Table 72). Regionally, dwellings in the KE region are the least likely to use a secondary method of space heating (49%) compared to dwellings in the SO and KB regions (63% and 69% respectively). FBC residential customers use an average of 1.7 methods to heat their homes.

Table 72: Number of Space Heating Methods (%)

Number of Space Heating Methods	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
1	50.9	37.4	31.1	41.4
2	39.2	49.1	53.3	46.0
3	8.3	10.4	11.5	9.8
4	1.0	2.9	3.8	2.4
5	0.3	0.1	0.3	0.3
6	0.2	--	--	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**
Two or more methods	**49.1**	**62.6**	**68.9**	**58.6**
Average	1.6	1.8	1.9	1.7
Standard Deviation	0.8	0.7	0.7	0.8

Totals may not sum due to rounding.

The number of space heating methods varies by type of dwelling (Table 73). SFDs are the most likely to use more than one method (65%), while apts/condos are the least likely (48%).

Table 73: Number of Space Heating Methods by Dwelling Type (%)

Number of Space Heating Methods	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
1	34.9	43.3	49.9	52.3	49.5
2	48.8	46.2	33.0	44.4	38.2
3	12.2	9.2	16.0	3.1	9.7
4	3.6	1.3	0.4	0.2	2.6
5	0.4	--	0.7	--	--
6	0.2	--	--	--	--
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Two or more methods	**65.1**	**56.7**	**50.1**	**47.7**	**50.5**
Average	1.9	1.7	1.7	1.5	1.7
Standard Deviation	0.8	0.7	0.8	0.8	0.6

Totals may not sum due to rounding.

5.3.2 Main Space Heating Method

The main methods used for space heating are summarized in Table 74. Forced air furnaces (any fuel) are the most common main heating method, used by 56% of respondents, followed by wired-in electric baseboards (13%), and fireplaces or heater stoves (9%). Heat pumps (any type) are used as the main method of space heating by 10% of respondents.

Table 74: Main Space Heating Method (%)

Main Space Heating Method	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Forced air furnace	56.4	58.7	50.9	55.5	56.4
Wired-in electric baseboards	20.4	6.9	8.3	13.1	18.7
Boiler with hot water baseboards or radiators	1.4	0.2	3.7	1.7	1.7
Boiler with hot water in-floor / under-floor heat	0.8	2.1	2.6	1.7	2.2
Combined space and water heating system	1.4	2.6	0.4	1.5	1.5
Fireplace or heater stove	4.3	11.3	12.6	8.7	7.0
Heat pump - air source	3.8	12.4	8.6	7.6	5.9
Heat pump - geothermal	4.0	2.7	0.5	2.6	1.4
Wired-in electric wall heater (fan forced)	0.8	0.4	0.7	0.7	1.2
Electric radiant heat (floors, walls, and/or ceilings)	2.5	0.7	7.3	3.4	1.4
Gas wall heater	0.7	0.6	0.6	0.7	0.5
Portable electric heaters	2.8	1.2	2.3	2.2	1.4
District or community heating system	0.4	--	--	0.2	0.1
Other	0.2	0.1	1.6	0.6	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

KE differs from the other two regions with its significantly higher incidence of electric baseboards as a main space heating method (20%) and its lower incidence of heat pumps (8%) and fireplaces or heater stoves (4%). Air or ground source heat pumps are the main method of space heating for 15% of SO dwellings versus 8% to 9% of KE and KB dwellings.

Main space heating methods by dwelling type are summarized in Table 75. The data show that SFDs predominately use forced air furnaces (67% of all SFDs), followed by fireplaces or heater stoves (10%), air source heat pumps (10%) and wired-in electric baseboards (5%). Apts / condos are also the least likely to use a forced air furnace and much more likely to use electric baseboards.[8] Of note, portable space heaters are the main space heating method for 6% of respondents living in mobile and other manufactured dwellings.

[8] The majority of apartments and apartment-style condominiums with forced air furnaces use a type of furnace known as a wall furnace or wall heater. These self-contained units are mounted on the wall and vent to the outside of the unit.

Space Heating

Table 75: Main Space Heating Method by Dwelling Type (%)

Main Space Heating Method	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Forced air furnace	66.9	69.7	62.5	22.8	70.8
Wired-in electric baseboards	4.5	2.8	13.1	35.9	4.4
Boiler with hot water baseboards or radiators	0.9	--	6.9	2.9	0.5
Boiler with hot water in-floor / under-floor heat	1.7	1.7	--	2.4	--
Combined space and water heating system	1.1	--	0.4	3.0	--
Fireplace or heater stove	9.9	9.8	1.7	7.6	6.7
Heat pump - air source	9.5	7.5	5.6	3.9	8.1
Heat pump - geothermal	1.8	3.9	5.0	4.2	0.8
Wired-in electric wall heater (fan forced)	0.4	--	--	1.4	1.1
Electric radiant heat (floors, walls, and/or ceilings)	0.8	1.3	2.3	10.4	0.4
Gas wall heater	0.7	1.4	0.7	0.4	1.5
Portable electric heaters	1.3	2.0	1.7	3.8	5.7
District or community heating system	--	--	--	0.7	--
Other	0.7	--	--	0.7	--
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Because they represent the largest share of FBC's residential customer base, the main space heating method used by SFDs by period of construction is explored in Table 76.

Table 76: Main Space Heating Method by Dwelling Vintage – Single Family Detached Dwellings (%)

Main Space Heating Method	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base[1]	*158*	*310*	*211*	*200*	*191*	*153*	*71*	*28*
Forced air furnace	74.1	65.2	62.1	71.8	75.2	61.6	54.6	43.8
Wired-in electric baseboards	4.1	6.4	5.5	3.3	2.8	3.5	1.3	11.4
Boiler with hot water baseboards or radiators	3.5	1.9	--	--	--	--	1.8	--
Boiler with hot water in-floor / under-floor heat	--	--	0.8	2.3	1.7	6.0	4.2	--
Combined space and water heating system	2.0	0.4	0.6	0.6	1.8	0.8	3.3	3.2
Fireplace or heater stove	10.8	11.3	14.5	8.9	6.9	5.8	3.3	25.1
Heat pump - air source	3.6	9.2	12.2	9.7	6.9	12.3	15.8	9.6
Heat pump - geothermal	--	0.4	--	0.8	3.2	5.5	8.3	--
Wired-in electric wall heater (fan forced)	0.5	--	0.4	--	--	1.1	1.3	3.7
Electric radiant heat (floors, walls, and/or ceilings)	--	0.7	--	1.7	--	1.1	4.6	--
Gas wall heater	0.5	2.0	0.4	--	0.5	--	--	--
Portable electric heaters	0.8	2.5	1.2	1.0	0.6	--	1.6	3.2
Other	--	--	--	--	--	--	--	--
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Totals may not sum due to rounding.

The data show forced-air furnaces (FAF) (any fuel) declining as a main method for space heating in new construction with 55% of SFDs constructed since 2015 using a FAF compared to 75% of SFDs constructed between 1996 and 2005. Consistent with this decline is the increased use of air source heat pumps in the newest builds (16% of those constructed since 2005).

5.3.3 Secondary Space Heating Methods

Secondary space heating methods are summarized in Table 77. The three most commonly used secondary methods include fireplaces or heater stoves (27% of FBC customers), wired-in electric baseboard heaters (16%), and portable electric space heaters (11%). Forced air furnaces are used as a secondary method by 6% of households and air source heat pumps by 5% of customers. The proportion of dwellings using fireplaces or heater stoves as a secondary method is relatively constant across the three regions (25% to 29%). Four-in-ten respondents (41%) to the 2022 REUS indicated they have no secondary space heating method.

Table 77: Secondary Space Heating Methods (%)
Multiple Responses Allowed

Secondary Space Heating Methods	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Forced air furnace	3.7	7.4	8.4	6.1	7.4
Wired-in electric baseboards	11.3	12.9	25.7	15.8	11.9
Boiler with hot water baseboards or radiators	0.3	0.2	0.5	0.3	0.4
Boiler with hot water in-floor / under-floor heat	0.7	0.7	1.3	0.9	0.5
Combined space and water heating system	0.7	0.1	0.2	0.4	0.3
Fireplace or heater stove	25.0	28.7	427.8	26.8	24.8
Heat pump - air source	2.9	6.6	4.6	4.5	5.2
Heat pump - geothermal	0.5	--	--	0.2	0.4
Wired-in electric wall heater (fan forced)	2.6	1.9	2.3	2.3	3.3
Electric radiant heat (floors, walls, and/or ceilings)	2.3	5.9	3.4	3.6	3.9
Gas wall heater	0.6	2.5	1.6	1.4	1.1
Portable electric heaters	10.5	11.4	12.3	11.3	14.1
Other	0.2	0.6	0.8	0.5	0.4
No second method	**50.9**	**37.4**	**31.1**	**41.4**	**44.9**

Columns do not sum to 100% because of multiple responses.

Secondary space heating methods by dwelling type are summarized in Table 78. The data show that fireplaces and heater stoves are a commonly indicated second method, used by 32% of single-family detached and townhouses. Air source heat pumps are a secondary method for 6% of SFDs. Use of electric baseboard heaters as a secondary heat source ranges from 10% for townhouses to 19% for semi-detached dwellings.

Table 78: Secondary Space Heating Methods by Dwelling Type (%)
Multiple Responses Allowed

Secondary Space Heating Methods	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Forced air furnace	7.9	4.6	4.2	3.1	4.2
Wired-in electric baseboards	16.3	19.3	10.4	16.8	10.5
Boiler with hot water baseboards or radiators	0.2	--	--	0.7	--
Boiler with hot water in-floor / under-floor heat	1.4	--	--	--	0.9
Combined space and water heating system	0.3	--	0.4	0.7	--
Fireplace or heater stove	31.5	25.3	31.8	17.2	12.0
Heat pump - air source	6.0	6.3	4.8	1.1	3.2
Heat pump - geothermal	0.2	--	--	0.4	--
Wired-in electric wall heater (fan forced)	3.2	--	1.2	0.4	4.8
Electric radiant heat (floors, walls, and/or ceilings)	3.8	2.7	2.9	4.0	1.7
Gas wall heater	1.5	1.3	1.6	1.3	1.2
Portable electric heaters	12.5	8.9	11.0	5.4	26.3
Other	1.0	5.0	4.5	2.0	0.4
No second method	**34.9**	**43.3**	**49.9**	**52.3**	**49.5**

Columns do not sum to 100% because of multiple responses.

5.4 Furnaces, Boilers and Combination Systems

In addition to questions about space heating methods, respondents to the 2022 REUS were asked whether their home had a natural gas furnace, natural gas boiler, combined space and water heating system, or electric furnace. Respondents with gas furnaces and boilers were asked to provide additional information on the efficiency, age, and ENERGY STAR® status of their equipment, and whether they had installed the system in the last five years.

Table 79 summarizes the incidence of these four methods of space heating.

Table 79: Furnaces, Boilers and Combination Systems (%)

	KE	SO	KB	2022 FBC	2017 FBC [1]	2012 FBC [1]
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Gas boiler	3.4	2.4	5.3	3.7	5.8 [3]	2.6 [3]
Gas furnace	54.0	56.3	49.8	53.5	52.9	51.4
Combination system [2]	7.7	6.2	3.1	6.0	n/a	n/a
Electric furnace	8.5	13.8	11.5	10.9	12.2	11.7
None of the above	26.5	21.3	30.1	26.0	29.1	34.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Data for 2008 and 2012 adjusted for misclassification error.
[2] First queried in the 2022 REUS
[3] May include combination boiler systems
Totals may not sum due to rounding.

Gas furnaces were present in more than half (54%) of homes surveyed in 2022. Eleven percent (11%) have an electric furnace, 4% have a gas boiler and 6% have a combined space and water heating system.[9] Regionally, customers in the SO and KB regions are notable for having the highest incidence of electric furnaces (14% and 12% respectively).

The incidences of furnaces and boilers by dwelling type are presented in Table 80. Semi-detached dwellings are the most likely of the five dwelling types to have a gas furnace (76%) and apts/condos are the least likely (12%).[10] The incidence of gas boilers ranges from <1% for mobile homes and other manufactured homes to a high of 8% for townhouses. Penetration of combined space and water heating systems ranges from <1% of semi-detached dwellings to 12% for apts/condos.

Table 80: Furnaces, Boilers and Combination Systems by Dwelling Type (%)

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Gas boiler	2.2	1.7	7.7	7.1	0.4
Gas furnace	67.8	76.1	60.4	12.3	72.1
Combination system	4.1	0.7	6.3	11.8	1.4
Electric furnace	10.0	5.2	6.1	15.1	9.5
None of the above	15.9	16.3	19.6	53.7	16.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Table 81 summarizes the penetration of furnaces and boilers by dwelling vintage. Data on the most recently built homes suggests a reversal in the trend away from gas furnaces in new construction with 56% of dwellings constructed since 2015 having a gas furnace compared to 43% of dwellings constructed in the previous ten-year period (Table 74). Combined space and water heating systems are present in 14% of residential dwellings constructed between 2006 and 2015, and 10% of dwellings constructed since 2015.

Table 81: Furnaces and Boilers by Dwelling Construction Date (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Gas boiler	7.8	2.8	1.8	4.4	2.1	7.1	0.5	4.7
Gas furnace	71.2	63.0	45.8	54.3	59.7	42.6	56.2	22.7
Combination system	4.9	1.7	2.8	5.0	7.2	14.1	9.8	3.5
Electric furnace	5.1	6.0	13.0	12.7	7.8	15.9	12.4	16.9
None of the above	11.0	26.5	36.6	23.7	23.2	20.2	21.0	52.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

[9] Caution is advised in interpreting the difference in the penetration (incidence) of gas boilers between the 2022 and previous REUS surveys as respondents with gas combination boilers in past surveys may have recorded them as a boiler.

[10] The majority apartments / apartment-style condominiums with forced air furnaces use a type of furnace known as a wall furnace or wall heater. These self-contained units are mounted on the wall and vent to the outside of the unit.

5.4.1 Ages of Gas Furnaces, Boilers and Combination Systems

The average age of gas furnaces used by FBC residential customers is 11 years and the median age is 8 years (Table 82). Regionally, furnaces in the KB region skew somewhat older than the other two regions (differences in the averages between KB and the other two regions are statistically significant at the 95% confidence level).

Table 82: Age of Gas Forced Air Furnaces (Years)

Gas Furnace Age	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*435*	*365*	*353*	*1153*	*1390*
Mean	10.3	9.4	12.7	10.7	12.4
Median	9.0	8.0	9.0	8.0	10.0
Standard deviation	8.0	7.8	10.4	8.8	8.8

The average age of gas boilers used by FBC residential customers is 18 years, while the median age is 12 years (Table 83). Regional data are not provided due to the relatively small number of respondents to the 2022 REUS who indicated their dwelling uses a gas boiler.

Table 83: Age of Gas Boilers (Years)

Gas Boiler Age	2022 FBC
Unweighted base	*52*
Mean	17.8
Median	11.5
Standard deviation	15.0

The average age of combined space and water heater systems is 8 years, while the median age is 6 years (Table 84). Regional data are not provided due to the relatively small number of respondents to the 2022 REUS whose dwelling uses a combined space and water heating system.

Table 84: Age of Combined Space and Water Heater Systems (Years)

Combination System Age	2022 FBC
Unweighted base	*93*
Mean	8.3
Median	6.0
Standard deviation	6.8

5.4.2 Gas Furnace Efficiencies

Respondents with a gas furnace were asked to indicate the efficiency of their furnace by choosing from one of the following category descriptions:

- Low (standard) efficiency – less than 78% efficient (25 years or older, pilot light and metal flue exiting through the roof)
- Mid efficiency – 78% to 85% efficient (10 years or older, no pilot light and metal flue exiting through the roof)
- High efficiency – 90% efficient or higher (No pilot light, flue is a plastic pipe exiting the side of the home)

Providing efficiency-specific details such as age, type of flue, and the presence or absence of a pilot light was intended to help respondents correctly categorize the efficiency of their furnace. While newer furnaces are more likely to indicate their efficiency (AFUE) rating on a label attached to the unit, older low or mid-efficient furnaces are less likely to have this information.

Table 85 summarizes the distribution of furnaces by efficiency based on non-furnace age-adjusted data. Among those able to classify their furnace's efficiency, half (50%) indicated their unit was a high-efficiency unit, up from 43% in 2017. The incidence of the least efficient furnaces (less than 78% efficient) is 12%, statistically unchanged from 2017. Nearly one-quarter (24%) of all furnaces are mid-efficiency units, down from 30% in 2017. Similar to that found in past surveys, a significant proportion of respondents (13%) were unable to identify their furnace's efficiency.

Table 85: Gas Forced Air Furnace Efficiency – Before Adjustments for Age (%)

Gas Furnace Efficiency	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC [1]
Unweighted base	*435*	*365*	*353*	*1153*	*1390*	*963*
Low (standard) efficiency (< 78% AFUE)	11.1	10.2	17.1	12.4	11.0	16.7
Mid efficiency (78% to 85% AFUE)	27.7	21.5	20.5	23.9	29.9	34.5
High efficiency (90% AFUE or higher)	45.6	53.9	53.9	50.3	43.3	35.9
Don't know	15.6	14.4	8.4	13.4	15.8	12.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Data for 2012 adjusted for misclassification error.
Totals may not sum due to rounding.

These findings, notably the less-than-expected decline in the share of low-efficiency furnaces in the five years since the last REUS, suggest that some misclassification of furnace efficiency may be occurring. To understand whether this is the case, data on the age and efficiency of each respondent's gas furnace were reviewed.

The comparison of furnace age and efficiency data revealed that some respondents with a low or mid-efficiency furnace, assuming their estimate of the furnace age is reasonably accurate, likely misclassified their furnace's efficiency. For example, some respondents indicated they have low-efficiency (<78% AFUE) furnaces but also indicated they are less than 25 years old; highly unlikely given government regulations restricting the sale of low-efficiency furnaces (i.e., less than 78% AFUE) effective February 1995.[11] Similarly,

[11] The minimum AFUE for gas furnaces sold in Canada was set to 78% as of February 1995. As a result, any furnaces with an AFUE of less than 78% still in service as of August 2022 should at least 27 years or older.

some respondents with mid-efficiency furnaces indicated their units are less than 12 years of age; again, high unlikely given government regulations restricting the sale of furnaces of less than 90% efficiency went into effect between 2008 and 2010.[12] As there was no other data from the survey to suggest the correct efficiency categorization of these respondents' furnaces, their furnace efficiency data were removed from the analysis of furnace efficiency.[13] A total of 205 cases were removed.

The results from the reclassification of the furnace efficiency data are summarized in Table 86. The revised data suggest that low-efficiency furnaces made up 6% of the stock of furnaces in 2022, down from 11% in 2017. Mid-efficient furnaces represent 17% of the installed stock, down from 30% in 2017. Finally, high-efficiency furnaces accounted for 61% of the residential furnace stock in 2022. The proportion of respondents who were unsure of their furnace's efficiency made up 16% of respondents with a gas furnace, statistically unchanged from 2017.

Table 86: Revised Furnace Efficiency by Region Including "Don't Know" Responses (%)

Gas Furnace Efficiency	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC [1]
Unweighted base	*353*	*304*	*291*	*948*	*1390*	*963*
Low (standard) efficiency (< 78% AFUE)	4.0	5.5	10.8	6.3	11.0	16.7
Mid efficiency (78% to 85% AFUE)	20.6	14.4	13.2	16.7	29.9	34.5
High efficiency (90% AFUE or higher)	56.2	63.2	65.7	60.9	43.3	35.9
Don't know	19.2	16.8	10.3	16.1	15.8	12.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Data for 2012 adjusted for misclassification error.
Totals may not sum due to rounding.

Table 87 summarizes the efficiency mix of the gas-fired furnace stock in FBC's service region excluding respondents who did not know the efficiency of their gas furnace.[14] Of the remaining respondents, slightly less than three-quarters (73%) indicated they have a high-efficiency furnace, up from 51% in 2017 and 41% in 2012. Shares for mid-efficiency and low-efficiency furnaces have declined commensurately, to 20% and 8% of furnaces respectively.[15]

[12] The minimum AFUE for gas forced air furnaces installed in new construction in British Columbia was set at 90% on January 1, 2008. This requirement was extended to all new gas forced air furnaces sold in British Columbia as January 1, 2010. These regulations effectively mean that any mid-efficiency (80% to 83% AFUE) furnaces still in service as of August 2022 would be at least 12 years old.

[13] Respondents were asked whether their unit is ENERGY STAR qualified but, traditionally, these data have been unreliable, characterized by significant numbers of respondents unable to answer the question (i.e., indicated they were unsure).

[14] Excluding "don't know" responses and rebasing the data implicitly assumes that the mix of furnace efficiencies for those unsure of their furnace's efficiency is comparable to those who knew their unit's efficiency. This assumption will be invalid if the mix of furnace efficiencies within the "don't know" response differs from those who knew the efficiency of their furnace.

[15] A review of data by age of the furnace suggests that the group of respondents unable to categorize the efficiency of their furnace includes a mix of low-, mid- and high efficiency furnaces with a somewhat higher proportion of older units relative to other respondents. This suggests that the proportion of low- and mid-efficiency units is somewhat understated if "don't know" responses are excluded. Due to the difficulty categorizing furnace efficiency by age, however, no quantification of the understatement was attempted.

Table 87: Gas Forced Air Furnace Efficiency – Excluding Don't Know Responses (%)

Gas Furnace Efficiency	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*289*	*258*	*260*	*807*	*1170*	*842*
Low (standard) efficiency (< 78% AFUE)	5.0	6.7	12.0	7.5	13.1	19.2
Mid efficiency (78% to 85% AFUE)	25.5	17.3	14.7	20.0	35.5	39.6
High efficiency (90% AFUE or higher)	69.6	76.0	73.2	72.6	51.4	41.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Data for 2012 adjusted for misclassification error.
Totals may not sum due to rounding.

One-half (50%) of respondents with a gas furnace indicated their unit is ENERGY STAR® qualified and 18% indicated it was not (Table 88). One-third (32%) were unsure whether their furnace was ENERGY STAR qualified.

Table 88: Incidence of ENERGY STAR Gas Furnaces (%)

Is gas furnace ENERGY STAR qualified?	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*435*	*367*	*353*	*1155*	*1390*	*964*
Yes	48.4	50.6	50.8	49.7	38.6	36.6
No	18.1	15.4	22.6	18.4	31.7	30.6
Don't Know	33.6	34.0	26.6	31.9	29.7	32.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

5.4.3 Gas Boiler Efficiencies

Respondents indicating they have a gas boiler were asked to indicate the efficiency of their boiler based on the following descriptions:

- Low efficiency (60% to 70% efficient)
- Mid efficiency (80% to 85% efficient)
- High efficiency (90% efficient or higher)

The questionnaire included information on the characteristics of boilers in each efficiency group to further assist the respondent in correctly identifying their boiler's efficiency.

Despite efforts to reduce uncertainty, nearly half (48%) of respondents with a gas boiler did not know the efficiency of their boiler (Table 89). One-in-five (20%) indicated they had a high-efficiency unit, 13% indicated a mid-efficiency unit, and 19% a low-efficiency unit. Regional details are not provided due to the small number of respondents with a gas boiler. Comparative data from previous REUS surveys are not provided as these surveys did not distinguish gas boilers from gas combined space and water heating systems (combi/combo boilers).

Table 89: Natural Gas Boiler Efficiency (%)

Gas Boiler Efficiency	2022 FBC
Unweighted base	*52*
Low efficiency (60%)	19.1
Mid efficiency (80% to 85%)	12.9
High efficiency (90% or higher)	20.3
Don't know	47.7
Total	**100.0**

Totals may not sum due to rounding.

Table 90 rebases these data by removing respondents who were unsure of their boiler's efficiency.

Table 90: Natural Gas Boiler Efficiency – Excluding Don't Know Responses (%)

Gas Boiler Efficiency	2022 FBC
Unweighted base [1]	*32*
Low efficiency (60%)	36.6
Mid efficiency (80% to 85%)	24.7
High efficiency (90% or higher)	38.8
Total	**100.0**

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Totals may not sum due to rounding.

One-in-five (19%) respondents indicated their gas boiler was ENERGY STAR qualified (Table 91). Like that observed in past REUS surveys, the proportion of respondents that did not know whether their boiler is ENERGY STAR qualified is high (53%). Regional findings are not presented due to small sample sizes.

Table 91: Incidence of ENERGY STAR Gas Boilers (%)

Is gas boiler ENERGY STAR qualified?	2022 FBC
Unweighted base [1]	*52*
Yes	19.3
No	28.2
Don't Know	52.5
Total	**100.0**

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Totals may not sum due to rounding.

On average, 44% of respondents indicated their combination systems are ENERGY STAR qualified, 6% indicated it is not, and 49% were unsure (Table 92). Regional findings are not presented due to the relatively small number of survey respondents that have a combination system.

Table 92: Incidence of ENERGY STAR Combination Systems (%)

Is gas boiler ENERGY STAR qualified?	2022 FBC
Unweighted base	*93*
Yes	44.4
No	6.2
Don't Know	49.4
Total	**100.0**

Totals may not sum due to rounding.

5.4.4 Furnace, Boiler and Combination System Installations – Last Five Years

On average, one-third (32%) of FBC customers with a gas furnace installed a gas furnace in the last five years (Table 93). Somewhat more than one-in-five (21%) with a gas boiler indicated they installed a gas boiler during the same time period. Finally, 30% of respondents with a combination system indicated they installed their system sometime in the last five years. Caution is advised in the interpretation of differences between the regions for boilers and combination systems due to the small number of applicable respondents.

Table 93: Installed Gas Furnace or Boiler in Last Five Years (%)

Installed last five years?	KE	SO	KB	2022 FBC
Installed gas furnace [1]	29.5	38.0	29.6	32.1
Installed gas boiler [2]	25.3	34.9	11.6	21.4
Installed combination system [3]	20.5	41.0	43.9	30.1

[1] Asked only of respondents whose dwelling has a gas furnace (n=948).
[2] Asked only of respondents whose dwelling has a gas boiler (n=52).
[3] Asked only of respondents whose dwelling has a combination system (n=93).

5.4.5 Likelihood of Furnace, Boiler, or Combination System Replacement – Next Two Years

Respondents with gas furnaces, gas boilers, and combination systems were asked about the likelihood of replacing their heating system during the next two years.

Furnaces

Five percent (5%) of respondents with a gas furnace indicated it was *very likely* they would replace their furnace in the next two years and another 13% indicated it was *somewhat likely* (Table 94).

Table 94: Likelihood of Furnace Replacement in Next Two Years (%)

	KE	SO	KB	2022 FBC
Unweighted base	*435*	*367*	*353*	*1155*
Very likely	5.2	4.8	6.5	5.4
Somewhat likely	15.3	10.3	11.6	12.8
Not at all likely	65.2	70.5	67.0	67.3
Don't know	14.4	14.4	14.9	14.5
Total	**100.0**	**100.0**	**100.0**	**100.0**
Very or somewhat likely	**20.5**	**15.1**	**18.1**	**18.2**

Totals may not sum due to rounding.

Boilers and Combination Systems

One-third (29%) of respondents with boilers indicated it was either *very likely* or *somewhat likely* they would replace their boiler in the next two years (Table 95). Of those with combination systems, one-quarter

(25%) indicated it was very or somewhat likely. Of note, 30% of respondents with a gas boiler and 26% of those with a combination system were unsure whether they would replace their systems in the next two years. Regional data are not presented due to small samples.

Table 95: Likelihood of Boiler and Combination System Replacement in Next Two Years (%)

	Boilers	Combination Systems
Unweighted base	*52*	*93*
Very likely	4.8	6.1
Somewhat likely	23.8	18.6
Not at all likely	41.0	49.8
Don't know	30.4	25.5
Total	**100.0**	**100.0**
Very or somewhat likely	**28.6**	**24.7**

Totals may not sum due to rounding.

5.5 Heat Pumps

The 2022 REUS asked a series of questions regarding the incidence and use of heat pumps including ducted air source models (heat pumps that distribute conditioned air via the home's duct work, typically connected to a forced air furnace or combination system), ductless (mini-split) models (standalone units that distribute conditioned air via one or more interior air handling units or "heads"), and ground source (geothermal) models. Respondents who indicated they have one or more of the heat pump types were then asked whether they use their units for heating only, cooling only, or for both heating and cooling.

Overall, 29% of FBC residential customers who responded to the 2022 REUS indicated they have one or more heat pumps (Table 96).[16] By type, 22% have a ducted air source unit, 6% have a ductless mini-split, and 3% have a ground source (geothermal) unit.

Table 96: Heat Pumps by Type and Region (%)
Multiple Responses Allowed

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Ducted air source	19.4	31.0	15.6	21.7
Ductless air source	3.6	7.6	6.1	5.5
Ground source	4.9	1.4	0.6	2.7
One or more heat pumps	**27.5**	**39.3**	**22.3**	**29.4**

Columns do not sum to 100% because of multiple responses.

The SO region stands out in having a significantly higher penetration of ducted air source heat pumps (31%) compared to the KE and KB regions (19% and 16% respectively). A few respondents (less than 1%) indicated their dwelling has more than one type of heat pump (data not shown).

[16] Penetration of heat pumps among FBC's residential customers in 2017 was estimated at 23% (Sampson Research (2019) and in 2012 at 14% (Sampson Research 2014). Caution is advised in interpreting these estimates as they were derived using a different set of survey questions than the 2022 REUS.

Penetration of ducted air source heat pumps is highest in single-family detached dwellings (24% of SFDs), mobile and other manufactured dwellings (23%), and semi-detached dwellings (Table 97). Ductless mini-split models are most commonly found in townhouses (10%).

Table 97: Heat Pumps by Dwelling Type (%)
Multiple Responses Allowed

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Ducted air source	23.7	22.1	13.7	18.4	23.4
Ductless air source	5.7	6.3	10.0	4.0	4.6
Ground source	1.9	3.9	4.3	4.6	0.0
One or more heat pumps	**30.7**	**32.2**	**27.3**	**26.9**	**27.7**

Columns do not sum to 100% because of multiple responses.

Penetration of heat pumps (any type) is highest among dwellings built since 2005. For example, half (50%) of dwellings constructed between 2006 and 2015 and 43% of dwellings constructed since 2015 have a heat pump (any type) (Table 98).

Table 98: Heat Pumps by Dwelling Vintage (%)
Multiple Responses Allowed

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*164*	*377*	*314*	*317*	*302*	*246*	*131*	*80*
Ducted air source	11.0	20.2	15.9	21.3	18.8	36.3	31.0	15.9
Ductless air source	3.4	5.9	6.4	7.3	3.0	3.2	9.0	5.9
Ground source	--	0.2	1.7	1.4	2.3	10.0	4.1	2.0
One or more heat pumps	**13.5**	**26.4**	**23.1**	**29.8**	**23.6**	**49.5**	**42.8**	**23.3**

Columns do not sum to 100% because of multiple responses.

Table 99 explores the penetration of heat pump types by whether the dwelling has a gas boiler, gas forced air furnace, gas combination boiler, electric forced air furnace, or something else. The incidence of ducted air source heat pumps is highest for dwellings with an electric forced air furnace (39%), followed by combined space and water heating systems (34%) and gas forced air furnaces (25%). As expected, the incidence of ductless heat pump models for dwellings with these heating system types is low, ranging from 2% for those with a gas furnace to 12% for those with a heating system other than a boiler, furnace, or combination system (i.e., typically electric baseboard heating).

Table 99: Heat Pump and Space Heating Equipment Pairings (%)
Multiple Responses Allowed

	Gas Boiler	Gas Furnace	Combined System	Electric Furnace	Other
Unweighted base	*52*	*1153*	*93*	*217*	*418*
Ducted air source	19.2	24.7	34.0	39.3	5.5
Ductless air source	3.5	1.9	7.5	7.8	11.7
Ground source	--	0.6	10.2	5.3	4.6
One or more heat pumps	**21.4**	**26.7**	**50.9**	**52.4**	**21.6**

Columns do not sum to 100% because of multiple responses.

As heat pumps can be used to either heat or cool the home, respondents to the 2022 REUS that indicated they have a heat pump were asked whether they use it for heating only, cooling only, or for both heating and cooling. Slightly more than eight-in-ten (82%) indicated they use their heat pump to heat their home (12% use it exclusively for heating and 70% for heating and cooling)(Table 100). A similar percentage (81%), use their heat pump for cooling (11% for cooling only and 70% for both cooling and heating). Slightly more than one-in-ten (11%) use their heat pump exclusively for cooling. Finally, seven percent (7%) were unsure of how they use their heat pump.

Table 100: Heat Pump Use by Region (%)

Heat pump use	KE	SO	KB	2022 FBC
Unweighted base [1]	*193*	*239*	*160*	*592*
Both heating and cooling	66.4	78.6	62.7	70.3
Heating only	16.0	5.3	14.2	11.5
Cooling only	8.3	11.9	15.8	11.3
Don't know	9.3	4.2	7.3	6.9
Total	**100.0**	**100.0**	**100.0**	**100.0**
Total heating	**82.4**	**83.9**	**76.9**	**81.8**

[1] Respondents with heat pumps
Totals may not sum due to rounding.

Regionally, respondents in the SO are the most likely to use their heat pumps for both heating and cooling (79%) compared to those in KE (66%) and KB (63%). Seven percent (7%) were unsure how their heat pump is used.

5.6 Maintenance Behaviours for Furnaces, Boilers and Combinations Systems

Respondents with a gas furnace, gas boiler or a gas combination system were asked to rate the frequency (always, usually, occasionally or never) in which they undertake three common maintenance behaviours, including:

- Changing the furnace filter regularly
- Servicing the heating system annually using a contractor
- Servicing the heating system annually themselves

Respondents were also allowed to specify "don't know" or "not applicable" for each behaviour.

Two-thirds (66%) of respondents indicated they *always* change their furnace filter, and another 16% indicated they *usually* do (Table 101). Five percent (5%) only *occasionally* change the filter and 3% indicated they *never do*.

Less than half of respondents with a gas furnace or boiler indicated they *always* (25%) or *usually* (16%) have their heating system serviced annually by a contractor. Eighteen percent (19%) of respondents indicated they always or usually service their heating systems themselves.

Table 101: Frequency of Furnace and Boiler System Maintenance Behaviours (%)
Rows Sum Across

Heating system maintenance	Always	Usually	Occasion-ally	Never	Don't Know	Not Applicable	Total
Change furnace filter regularly (gas furnaces only)	66.1	16.1	5.4	2.8	2.5	7.0	100.0
Service heating system annually by contractor	25.3	16.1	28.4	19.8	4.0	6.4	100.0
Service heating system annually myself	11.2	7.4	9.6	58.2	3.0	10.7	100.0

Totals may not sum due to rounding.

5.7 Maintenance Behaviours for Heat Pumps

Respondents whose dwelling had a heat pump were asked to rate the frequency (always, usually, occasionally or never) in which they undertake the following maintenance behaviours:

- Changing the heat pump filter regularly
- Servicing the heat pump annually using a contractor
- Servicing the heat pump system annually themselves

Respondents were also allowed to specify "don't know" or "not applicable" for each behaviour.

Thirty-six percent (36%) of respondents with a heat pump indicated they *always* change their heat pump filter regularly, and another 12% indicated they *usually* do (Table 101). One-in-five (19%) *always* have their heat pump serviced annually by a contractor and another 15% indicated they *usually* do. Finally, 14% indicated they *always* or *usually* service their heat pump annually themselves.

Table 102: Frequency of Heat Pump Maintenance Behaviours (%)
Rows Sum Across

Heat pump maintenance	Always	Usually	Occasion-ally	Never	Don't Know	Not Applicable	Total
Change heat pump filter regularly	36.2	11.7	10.0	14.5	11.8	15.7	100.0
Service heat pump annually by contractor	19.4	14.7	25.4	21.7	7.0	11.8	100.0
Service heat pump annually myself	7.8	5.7	8.3	56.8	5.3	16.1	100.0

Totals may not sum due to rounding.

5.8 Heating System Controls

The proportions of FBC residential customers with one or more of the three different thermostat types (manual, programmable, and smart or learning style) are summarized in Table 103. One-third (34%) of homes have one or more manual thermostats and somewhat less than six-in-ten (58%) have one or more programmable thermostats. Learning-style thermostats are present in 8% of homes, up from 2% in 2017.

Table 103: Heating System Controls (%)
Multiple Responses Allowed

Heating System Controls	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Manual (non-programmable) thermostats	34.6	31.4	35.0	33.8	49.3
Programmable thermostats	54.0	62.7	58.1	57.7	49.3
"Smart" or learning-style thermostats	10.2	5.8	6.5	7.9	2.3
Don't know	4.4	2.5	4.3	3.8	2.5

Columns do not sum to 100% because of multiple responses.

Penetration rates for the three different types of heating controls by dwelling type are summarized in Table 104. The data show SFDs and semi-detached dwellings are more likely than the other dwelling types to have a programmable thermostat and less likely to have a manual (non-programmable) unit. The incidence of "smart" thermostats is highest in SFDs, semi-detached, and townhouses.

Table 104: Heating System Controls by Dwelling Type (%)
Multiple Responses Allowed

Heating System Controls	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Manual (non-programmable) thermostats	26.3	20.9	34.8	51.7	36.9
Programmable thermostats	64.3	66.1	55.2	42.5	56.1
"Smart" or learning-style thermostats	9.8	13.7	8.3	3.6	4.9
Don't know	3.1	50.4	33.1	7.6	35.1

Columns do not sum to 100% because of multiple responses.

Respondents using programmable or smart thermostats were asked to indicate how many (all of them, some of them, none of them, don't know) are programmed. Eight-in-ten (83%) indicated *all* were programmed and another 4% indicated that *some* were programmed (Table 105). Eleven percent (11%) indicated none were programmed and 2% were unsure whether their unit or units were programmed. These results mirror those recorded in 2017.[17]

Table 105: Programmable Thermostats (incl. Smart Thermostats) by Programming (%)

How many programmed?	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*479*	*410*	*396*	*1285*	*1296*
All of them	84.7	82.3	82.0	83.2	82.8
Some of them	3.5	3.3	5.8	4.1	4.7
None of them	9.2	12.8	10.6	10.7	10.7
Don't know	2.6	1.6	1.6	2.0	1.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

[17] See Section 12.2 for detailed information on thermostat set-back behaviours for space heating and cooling.

6 Domestic Hot Water

This chapter presents and discusses domestic water heating (DWH) systems. These systems provide hot water for domestic activities such as clothes washing, dishwashing, showering, bathing, and the like. This section addresses the following topics:

- Penetration and saturation of DWH equipment by fuel and equipment type
- DWH equipment installations
- DWH fuel switching
- Age of DWH equipment
- Location of DWH equipment
- Sizes of conventional storage tanks
- Penetration of showerheads, aerators, and other miscellaneous hot water appliances
- Water use metering

6.1 Penetration and Saturation

The proportion of households with DWH equipment (i.e., not centrally provided as is the case in many apartment buildings and condominium complexes), including penetration and saturation rates, are summarized in Table 106. Eight-in-ten (81%) of respondents to FBC's 2022 REUS indicated their dwelling is equipped with a domestic water heater. The remaining 19% have their domestic hot water supplied via central systems.[18]

Table 106: Hot Water Heater Penetration and Saturation

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*672*	*589*	*600*	*1861*	*2628*	*1668*
Penetration (%) [1]	68.7	91.5	87.9	80.7	81.7 [2]	82.4 [2]
Saturation [1]	1.04	1.02	1.04	1.03	1.04	1.05
Households with >1 water heater (%)	2.2	2.1	3.4	2.5	4.3	3.6
No water heater in residence (%)	31.3	8.4	12.0	19.3	18.3	17.6

[1] Excludes non-responses and respondents living in apartments, row houses, and townhouses where hot water is centrally provided.
[2] Includes a small proportion of single-family detached and semi-detached dwellings that indicated they do not have a water heater in the residence.

Consistent with the higher incidence of apartments and apartment-style condominiums in the KE region, penetration of in-home DWH systems in KE is significantly lower than SO and KB (69% versus 88% to 92%).

[18] These data exclude 72 respondents (4% of respondents to FBC's 2022 REUS) that live in single family detached and semi-detached dwellings and indicated their dwelling does not have a water heater. These respondents may have misunderstood the question or wanted to avoid answering questions about their hot water heating systems. Programming embedded in the online survey automatically forwarded these respondents to the next section of the survey. As a result, all remaining questions in the domestic water heating section of the survey exclude these respondents. The remaining sample (n=1,861) is more than adequate to ensure a high degree of statistical accuracy for the remaining questions on domestic water heating.

FBC customers with at least one in-home DWH heater have an average of 1.03 units per home. Three percent (3%) of FBC residential customers reported having more than one DWH unit.

Penetration and saturation rates for domestic water heaters by dwelling type are presented in Table 107. Penetration of in-dwelling water heaters is highest for SFDs and semi-detached dwellings (100%) and lowest in apts/condos (33%). The latter is consistent with the tendency for this dwelling type to have centrally provided hot water systems.

Table 107: Water Heater Penetration and Saturation - by Dwelling Type

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Penetration (%) [1]	100.0	100.0	89.0	32.6	90.9
Saturation [2]	1.04	2.00	1.00	1.01	1.00
Households with >1 water heater (%) [2]	4.1	50.3	--	0.4	--
No water heater in residence (%)	--	--	11.0	67.4	9.1

[1] Excludes respondents in single-family detached and semi-detached dwellings that indicated there was no water heater in the residence
[2] Excludes non-responses and respondents living in apartments, row houses, and townhouses where hot water is centrally provided.

All remaining questions about domestic hot water equipment and fuels were directed to households with in-home DWH systems. Respondents living in apartments, townhouses and other complexes where DWH is centrally provided, and all others who indicated there was no domestic water heater in the residence, were skipped forward in the survey and, for obvious reasons, not asked questions about their DWH equipment or fuels.

6.2 Fuels

6.2.1 Adjustments to Water Heater Fuel Data

Data on DWH fuels for the first (main) water heater are summarized in Table 108. Electricity and natural gas are the top two fuels, used by 46% and 51% of main DWH units, respectively.

Table 108: DWH Fuels (Adjusted) (%)
Main DWH Unit

DWH Fuel	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*525*	*563*	*581*	*1669*	*2361*	*1295*
Electricity	33.5	50.2	56.0	45.9	48.5	51.3
Natural gas	62.3	47.0	41.5	50.9	49.3	46.8
Piped propane	0.4	0.5	0.2	0.4	0.1	0.3
Other	1.3	1.2	1.3	1.3	0.4	1.1
Don't know	2.4	1.1	1.0	1.6	1.6	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Regionally, dwellings in KE are significantly more likely to use natural gas (62%) for their main DWH unit compared to SO (47%) and KB (42%). Fuels other than electricity or natural gas, including piped or bottled propane, solar and geothermal, accounted for 3% of domestic water heaters. Compatibility issues with the 2009 FBC REUS prevented comparisons to 2022 and 2017 data.

Table 109 explores DWH fuel shares by dwelling vintage for SFDs, the single most common dwelling type. Of note, the proportion of SFDs using electric DWH (main unit) constructed since 2005 is up significantly (46% to 47%) compared to those built during the previous two decades (28%). Electricity's increased share of DWH equipment came at the expense of natural gas DWH units.

Table 109: DWH Fuels (Adjusted) for Main DWH Unit – SFDs by Vintage (%)

	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base [1]	*155*	*296*	*197*	*192*	*180*	*147*	*64*	*28*
Electricity	48.8	50.4	47.1	28.1	28.2	46.2	47.4	46.3
Natural gas	49.5	49.6	49.2	68.9	69.8	48.5	42.5	44.0
Piped propane	--	--	1.1	--	--	--	1.3	--
Other	--	--	0.5	--	--	--	--	--
Don't know	1.6	--	1.7	2.6	0.9	1.2	1.8	6.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Totals may not sum due to rounding.

6.2.2 Fuel Switching

Table 110 summarizes the percentage of respondents with DWH equipment in their home or suite that switched the fuel used to provide domestic hot water in the last five years. Five percent (5%) of respondents switched their main DWH fuel in the last five years, a statistically significant increase over the rates recorded during FBC's last three residential end-use surveys (between 1% and 3%). There are no statistically significant differences between the three regions in the incidence of fuel switching during the last five years.

Table 110: Change in DWH Fuel Last Five Years (%)

Changed DWH Fuel Last Five Years?	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*525*	*563*	*581*	*1669*	*2361*	*1295*	*1868*
Yes	4.8	4.6	4.5	4.7	2.5	1.6	1.2

Totals may not sum due to rounding.

Current versus previous DWH fuels for households who switched their DWH fuel in the last five years are summarized in Table 111. All data are expressed as a percent of respondents who changed their DWH fuel in the last five years and were able to identify their previous DHW fuel. Seven-in-ten (71%) switched from electricity to natural gas, one-in-ten (11%) switched from natural gas to electricity, and 5% switched from electricity to a fuel other than natural gas. The number of respondents who were able to answer this question is small (n=64) so caution is advised in the interpretation of these numbers.

Table 111: Change in Domestic Water Heating Fuel during Last Five Years (%)

Previous fuel ▸ / Current fuel ▾	Electricity	Natural Gas	Piped Propane	Other	Any Previous Fuel
Electricity	--	11.3	--	4.5	15.8
Natural gas	71.1	--	2.3	--	73.4
Piped propane	2.7	--	--	--	2.7
Other	8.1	--	--	--	8.1
Any current fuel	81.9	11.3	2.3	4.5	100.0

Calculations based on a sample of 64 respondents.
Totals may not sum due to rounding.

6.3 Equipment

Respondents to the 2022 REUS were asked to indicate the type of equipment used to provide their domestic hot water from a list of the following common types:

- Conventional storage (tank)
- On-demand (tankless)
- Combined space and water heating system
- Heat pump water heater tank

Respondents could specify up to three DWH systems with the first system being defined as the main system (i.e., the one that provides more hot water than the others). Respondents with conventional storage (tank) water heaters (first, second and/or third units) were asked whether the units had a vent (roof or sidewall) or no vent (electric).

6.3.1 Penetration Rates

Penetration rates for domestic water heater equipment, regardless of whether they are the household's main, secondary or tertiary unit, are summarized in Table 112.

Table 112: Water Heater Type Penetration Rates (%)
Includes First, Second and Third Water Heaters

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*525*	*563*	*581*	*1669*	*2275*	*1501*
Conventional storage tank	83.4	83.0	85.4	83.9	88.3	94.6
On-demand (tankless)	7.8	8.3	9.3	8.4	3.7	1.8
Combined space and water heater	2.8	2.8	2.0	2.6	2.5	0.3
Heat pump heater tank	1.8	0.9	1.6	1.4	0.9	0.1
Don't know [1]	4.1	5.0	1.8	3.7	4.7	3.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Represents uncertainty across all DWH types, including conventional storage tanks.
Totals may not sum due to rounding.

Conventional storage tanks represent 84% of all water heaters among FBC customers. This style of water heater dominates in all regions, ranging from 83% to 85% of water heaters. Of note, the penetration rate for conventional storage tanks has been steadily declining over the last three surveys (95% in 2012, 88% in 2017). The decline is due to the increased penetration of on-demand units, up from 2% in 2012 to 8% in 2022. The penetration rate for combined space and water heating systems is unchanged from 2017 (3%). Heat pump water heaters are present in less than 2% of FBC residential dwellings.

6.3.2 Saturation Rates

Saturation rates for water heaters, by water heater type, are summarized in Table 113. Saturation refers to the average number of water heaters, by type, per the base of FBC residential customers with in-home DWH systems. The saturation rate for conventional storage-style tanks (any fuel) is 0.87 (i.e., for every 100 residential customers, there are 87 conventional storage tanks installed). Consistent with their relatively low penetration, saturation rates for heat pump water heaters and combined systems are very low (0.01 and 0.03 respectively).

Table 113: Water Heater Type Saturation (Units)
Includes First, Second and Third Water Heaters

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*525*	*563*	*581*	*1669*	*2275*	*1501*
Conventional storage tank	0.86	0.85	0.89	0.87	0.93	0.98
On-demand (tankless)	0.08	0.09	0.10	0.09	0.04	0.01
Combined space and water heater	0.03	0.03	0.02	0.03	0.03	0.00*
Hybrid heat pump heater (tank)	0.02	0.01	0.02	0.01	0.01	0.00*

* Saturation less than 0.01
Totals may not sum due to rounding.

Table 114 provides the distribution of gas-fired conventional DWH storage tanks by their venting arrangement. Those with venting through the side wall are more efficient than those with through-the-roof venting. Somewhat less than one-in-five (19%) respondents with a gas-fired tank indicated the tank's venting was through the side wall, 26% indicated it was through the roof, and 55% were unsure.

Table 114: Gas-fired Conventional Storage (Tank) Water Heaters by Venting Arrangement (%)
Includes First, Second and Third Water Heaters

Gas-fired storage tanks	LM	INT	VI	2022 FEI
Unweighted base	*519*	*553*	*573*	*1645*
Vent through the side wall	22.0	16.6	18.3	19.1
Vent through the roof	31.3	25.5	19.8	25.9
Don't know [1]	46.7	57.9	61.9	55.0
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Represents uncertainty across all conventional gas-fired storage tanks regardless of the number of units.
Totals may not sum due to rounding.

6.3.3 Conventional Tank Sizes

Table 115 details the distribution of conventional hot water tanks by size. As some dwellings have more than one DWH tank, respondents were asked to answer this question thinking about the largest tank in the house. Tanks sized between 40 and 59 imperial gallons are the most common (41% of all tanks), followed by tanks sized between 30 and 39 gallons (21%) and tanks sized 60 gallons or more (9%). Of note, somewhat more than one-quarter (27%) of respondents were unsure of their water heater tank size.

Table 115: DWH Tank Sizes – Conventional Storage Tanks (Any Fuel) (%)
Largest Tank in the Home

DWH Tank Size	KE	SO	KB	2022 FBC
Unweighted base	*525*	*563*	*581*	*1669*
Less than 30 imperial gallons	3.5	3.2	3.6	3.4
30 to 39 imperial gallons	19.0	19.3	23.7	20.6
40 to 59 imperial gallons	38.1	42.5	42.4	40.8
60 or more imperial gallons	8.1	7.4	10.7	8.7
Don't know	31.3	27.6	19.6	26.5
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

6.3.4 Replacements and New Installations

Forty-three percent (43%) of FBC residential customers replaced or installed a new DWH heater in the last five years, statistically unchanged from 2017 (Table 116). Regionally, FBC customers in KB were less likely than those in the other two regions to have installed a water heater in the last five years (40% versus 42% to 46%). The 2022 results suggest that one-in-ten water heaters are replaced in any given year.

Table 116: New DWH Heater Installations Last Five Years (%)

Installed water heater last five years?	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*525*	*563*	*581*	*1669*	*2275*	*1501*	*529*
Yes	45.7	42.3	40.4	43.0	44.1	36.5	36.4

Totals may not sum due to rounding.

Table 117 summarizes the main reasons for installing a new water heater. The top three most frequently mentioned reasons were because the water heater had failed (41%), the water heater was expected to fail soon (25%), and to qualify for home insurance (10%). Nine percent (9%) indicated it was because they wanted a more energy-efficient water heater.

Table 117: Main Reason for Installing a New Water Heater in Last Five Years (%)

Reason	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*232*	*235*	*241*	*708*	*1003*	*559*
Water heater had failed	40.8	29.3	53.1	40.7	48.3	58.1
Anticipated water heater failure	29.0	26.4	18.4	25.1	29.5	23.1
Required to qualify for home insurance	8.6	12.7	8.4	9.9	6.4	n/a
Wanted more efficient water heater	7.1	9.1	9.7	8.5	5.8	7.4
New home	4.2	10.7	3.2	6.0	5.2	5.9
Wanted to change to gas	1.6	2.5	2.1	2.1	0.7	0.1
Needed more hot water	1.5	1.0	2.8	1.7	0.6	0.7
Other	6.4	8.0	1.8	5.6	3.4	4.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

6.3.5 Ages

Table 118 summarizes the mean (average) age of the first and second water heaters, regardless of type or fuel. The average age of the first water heater in FBC's service area is 6.5 years. Regionally, the average age of the first water heater ranges from a low of 6.0 years in SO to a high of 7.3 years in KB.

Table 118: Average Age of Water Heaters (Any Fuel) (Years)

DWH Age	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base [1]	*525*	*563*	*581*	*1669*	*2275*	*1295*	*1454*
Average age of first water heater (years)	6.2	6.0	7.3	6.5	6.6	7.1	6.6
Average age of second water heater (years)	7.0	7.1	12.6	9.1	7.0	8.2	n/a

[1] Unweighted base for first water heater only.
n/a – data not available

6.3.6 Water Heater Location

Respondents were asked to indicate where in the home their domestic water heater is located. The water heater's location, particularly if it is located in a conditioned space, is particularly relevant for conventional storage-type water heaters, as the energy required to maintain the temperature of the large volume of stored water is dependent, in part, upon the effectiveness of the tank's insulation and the ambient temperature in the space where it is located.

Eight-in-ten (80%) FBC customers with DWH units indicated their water heater is located in a heated space within or attached to the home (50% in a heated basement, 29% in the main living area, and 1% in a heated garage) (Table 119). Seven percent (7%) have their water heater located in an unheated space (unheated garage or basement). Another 6% have their unit located in a crawlspace, of which 30% indicated elsewhere in the REUS survey that this space is unheated during the winter heating season.

Table 119: Location of Water Heater in the Home (%)

Location of Main Water Heater	KE	SO	KB	2022 FBC
Unweighted base	*525*	*563*	*581*	*1669*
Heated basement	47.2	40.4	64.2	50.3
Main living area of the home	31.2	34.7	21.0	29.2
Crawlspace	9.2	7.4	2.1	6.4
Unheated basement	1.8	2.8	9.2	4.4
Unheated garage	3.4	2.7	0.8	2.4
Heated garage	1.1	1.5	0.8	1.1
Other	5.7	9.6	1.9	5.8
Don't know	0.5	0.8	0.0	0.4
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

6.4 Water Use Metering

Respondents to the 2022 REUS were asked a short series of questions to explore the incidence of water metering and, if metered, whether they had to pay for the water based on the volume used. The findings, summarized in Table 120, show 39% of FBC customers have their home's water use metered. Metering was most prevalent in the KE and SO regions (55% and 36% respectively) and least prevalent in KB (24%). Nine percent (9%) of respondents were unsure whether their water supply is metered.

Table 120: Incidence of Water Use Metering by Region (%)

Home's water use is metered?	KE	SO	KB	2022 FBC
Unweighted base	*525*	*563*	*581*	*1669*
Yes	55.3	36.2	24.0	39.4
No	32.3	54.8	70.3	51.3
Don't know	12.4	9.0	5.7	9.2
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Of those who indicated their water use is metered, 86% are charged based on the volume of water they use (Table 121). The incidence of water consumption charges ranges from 81% for KB to 90% for SO.

Table 121: Incidence of Water Use Charges by Region (%)

Home receives a bill for amount of water used?	KE	SO	KB	2022 FBC
Unweighted base	*300*	*198*	*141*	*639*
Yes	85.0	89.8	80.5	85.6
No	11.2	7.9	10.0	10.0
Don't know	3.8	2.2	9.5	4.4
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

6.5 Showerheads, Aerators, and Miscellaneous Hot Water Appliances

Like the previous two REUS surveys, the 2022 survey asked respondents to indicate how many showerheads, low-flow showerheads, water heater blankets, instant hot water dispensers, and bathroom and kitchen aerators are installed in their homes. Penetration and saturation rates for these appliances are summarized in Table 122.

Table 122: Hot Water Appliances (%)

Hot Water Appliance	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*525*	*563*	*581*	*1669*	*2628*	*1668*
Showerheads						
Penetration (%)	93.1	91.0	89.4	91.3	83.5	86.1
Saturation	2.09	1.84	1.67	1.88	1.60	1.62
Low-flow showerheads						
Penetration (%)	35.7	38.5	36.0	36.7	38.5	38.8
Saturation	0.71	0.74	0.64	0.70	0.70	0.68
Water heater blankets						
Penetration (%)	1.8	3.0	4.5	3.0	4.5	7.0
Saturation	0.02	0.03	0.05	0.03	0.05	0.07
Instant Hot Water Dispensers						
Penetration (%)	2.7	2.0	1.0	2.0	2.5	1.4
Saturation	0.03	0.03	0.02	0.03	0.04	0.02
Bathroom & Kitchen Aerators						
Penetration (%)	45.4	44.4	52.3	47.2	46.9	44.9
Saturation	1.53	1.33	1.56	1.47	1.37	1.23

The penetration of showerheads (any kind) increased to 91% from 84% in 2017 but the penetration of low-flow showerheads remained unchanged at 37% (not significantly different than 2017 at the 95% confidence level).[19] The penetration of water heater blankets continues to decline, now at 3% of all dwellings with in-dwelling DWH systems. All other changes from 2017 are not statistically significant at the 95% confidence level.

[19] These results should be treated with caution as many showerheads sold today are considered water efficient or low flow but the packaging may not necessarily indicate as such.

7 FIREPLACES AND HEATER STOVES

This section presents data on the penetration, saturation, and use of fireplaces and heater stoves. Types of fireplaces and heater stoves queried in the 2022 REUS included:

- Gas (decorative)
- Gas (heater type)
- Gas (free standing)
- Electric
- Wood burning fireplaces
- Wood burning stoves

Consistent with FBC's previous two residential end-use surveys, the 2022 survey differentiated gas fireplaces and heater stoves by type and function. Survey respondents were provided with the following descriptions to assist them in correctly classifying their gas units:

- *Decorative fireplaces* – Provide ambiance but have little or no heating ability. The hearth is often open to the room or equipped with opening glass doors.
- *Heater-type fireplaces (built-ins and inserts)* – These fireplaces are efficient heaters with fixed glass fronts and may have features such as fans and thermostatic control. They may be built-in at the time of construction or inserted into an existing masonry or other fireplace as an upgrade.
- *Free-standing fireplaces and heater stoves* – These are stand-alone units that can be used for both ambiance and heating. Gas heater stoves resemble wood stoves in appearance but use gas instead of wood.

7.1 Penetration and Saturation

7.1.1 All Fireplace / Heater Stove Types

Table 123 summarizes the penetration and saturation rates for all fireplaces and heater stoves regardless of type or the fuel they use. Overall, 67% of FBC residential customers have a fireplace or heater stove, statistically unchanged from 2017 but significantly higher than in 2012 (63%). Differences in the proportions at the regional level are not statistically significant at the 95% confidence level.

Table 123: Penetration and Saturation of Fireplaces and Heater Stoves by Region
Any Type, Any Fuel

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Penetration (%)	64.1	68.7	68.7	66.7	64.0	63.1
Saturation	0.81	0.85	0.83	0.83	0.83	0.88

Fireplaces and Heater Stoves

Penetration of fireplaces and heater stoves (any fuel, any type) is highest among SFDs (76%), and lowest among mobile and other manufactured homes (39%) (Table 124).

Table 124: Fireplaces and Heater Stoves by Dwelling Type
Any Type, Any Fuel

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Penetration (%)	76.0	68.2	65.5	51.9	38.8
Saturation	1.00	0.83	0.72	0.53	0.45

Table 125 provides detail on the distribution of FBC customers based on the number of fireplaces and heating stoves per dwelling. Most commonly, FBC customers have one fireplace (52% of all FBC customers). Another 13% have two units and a small percentage (1%) have three or more. These relative proportions are generally the same across the regions.

Table 125: Number of Fireplaces and Heater Stoves per Dwelling (%)
Any Type, Any Fuel

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
None	35.9	31.3	31.3	33.3	35.5	37.6
1 unit	49.5	54.3	55.0	52.4	48.1	42.0
2 units	12.8	13.2	12.7	12.9	14.5	17.1
3 units	1.7	0.9	0.8	1.2	1.5	2.5
More than 3 units	0.1	0.4	0.1	0.2	0.4	0.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

Table 126 summarizes the distribution of fireplace and heater stoves by dwelling type. The data show that SFDs and semi-detached dwellings are more likely than other dwelling types to have a second fireplace or heater stove (19% and 14%, respectively). By comparison, 6% of townhouses and mobiles, and less than 2% of apts/condos have more than one fireplace or heater stove.

Table 126: Number of Fireplaces and Heater Stoves per Dwelling by Dwelling Type (%)
Any Type, Any Fuel

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
None	24.0	31.8	34.5	48.1	61.2
1 unit	54.4	53.8	59.3	50.6	33.2
2 units	19.2	14.4	6.2	1.3	5.7
3 units	2.1	--	--	--	--
More than 3 units	0.3	--	--	--	--
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

7.1.2 Gas Fireplaces and Heater Stoves

Penetration and saturation rates for gas fireplaces and heater stoves, by type, are summarized in Table 127. Gas heater-type fireplaces are the most common gas fireplace type, present in one-in-four (25%) residential dwellings. Thirteen percent (13%) of homes have decorative-style fireplaces, and 3% have free-standing models.

Table 127: Gas Fireplace and Heater Stove Penetration and Saturation Rates by Region
Base: All Households With or Without a Fireplace / Heater Stove

Fireplace / Heater Stove Type	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Gas (decorative)						
Penetration (%)	16.5	9.0	11.7	13.0	10.0	9.7
Saturation	0.19	0.10	0.12	0.15	0.11	0.11
Gas (heater type)						
Penetration (%)	29.0	28.9	16.0	25.3	25.6	23.8
Saturation	0.35	0.32	0.19	0.29	0.30	0.29
Gas (free standing)						
Penetration (%)	1.5	4.3	4.9	3.3	3.1	4.3
Saturation	0.02	0.05	0.05	0.04	0.03	0.05

Penetration and saturation rates for gas fireplace and heater stoves by the five main dwelling types are presented in Table 128. Gas heater-type fireplaces are the most common fireplace type regardless of dwelling type. Apts/condos are more likely to have a heater-type gas fireplace (20%) rather than a decorative (13%) or free-standing (2%) model.

Table 128: Gas Fireplace and Heater Stove Penetration and Saturation Rates by Dwelling Type
Base: All Households With or Without a Fireplace / Heater Stove

Fireplace / Heater Stove Type	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Gas (decorative)					
Penetration (%)	13.1	18.9	19.0	12.7	3.8
Saturation	0.15	0.22	0.21	0.13	0.05
Gas (heater type)					
Penetration (%)	29.5	26.0	27.5	19.5	6.3
Saturation	0.36	0.32	0.27	0.20	0.06
Gas (free standing)					
Penetration (%)	3.5	11.6	2.3	1.7	3.7
Saturation	0.04	0.12	0.02	0.02	0.04

Table 129 presents penetration and saturation rates of gas fireplace and heater stove types by dwelling vintage. The data show the penetration of the lesser-efficient decorative models is highest for dwellings constructed between 1976 and 2005 (17% to 21%). Penetration of gas heater-type fireplaces is highest among residential dwellings built between 1996 and 2005 (42%). These data reflect both new construction trends and retrofits to existing dwellings.

Table 129: Gas Fireplace and Heater Stove Penetration and Saturation Rates by Dwelling Vintage
Base: All Households With or Without a Fireplace / Heater Stove

Fireplace / Heater Stove Type	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Gas (decorative)								
Penetration (%)	4.3	4.8	18.9	16.6	20.9	12.6	8.5	4.5
Saturation	0.04	0.06	0.21	0.18	0.25	0.14	0.10	0.05
Gas (heater type)								
Penetration (%)	16.5	17.8	15.3	31.7	42.2	35.5	16.6	4.4
Saturation	0.17	0.23	0.18	0.34	0.48	0.43	0.20	0.04
Gas (free standing)								
Penetration (%)	2.8	5.1	4.4	5.2	2.6	0.5	0.5	1.6
Saturation	0.03	0.06	0.05	0.05	0.03	0.01	0.00	0.02

7.1.3 Wood and Electric Fireplaces / Heater Stoves

Table 130 summarizes penetration and saturation rates for fireplaces and heater stoves using fuels other than natural gas. Of the three types, electric fireplaces are the most common, present in 11% of FBC residential dwellings in 2022, followed by wood-burning stoves (10%) and wood-burning fireplaces (9%). Regionally, penetration of electric fireplaces is highest in KE and SO (13% for each). Penetration of wood-burning stoves is highest in KB (22%), followed by SO (8%) and KE (3%).

Table 130: Fireplace and Heater Stove Penetration and Saturation Rates by Region – All Other Fuels
Base: All Households With or Without a Fireplace / Heater Stove

Fireplace / Heater Stove Type	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Electric						
Penetration (%)	13.2	12.6	6.4	11.1	9.1	10.5
Saturation	0.14	0.15	0.07	0.13	0.10	0.12
Wood burning fireplace						
Penetration (%)	5.5	10.4	12.4	8.9	13.0	14.5
Saturation	0.07	0.12	0.14	0.10	0.15	0.17
Wood burning stove						
Penetration (%)	2.9	8.0	22.0	9.8	10.2	11.5
Saturation	0.03	0.08	0.24	0.10	0.11	0.12

Dwelling type-specific data for fireplaces and heater stoves using fuels other than natural gas are provided in Table 131. Of note, penetration rates for electric fireplaces range from 8% for SFDs to 16% of apts/condos. Fifteen percent (15%) of SFDs have a wood-burning stove and 14% have a wood-burning fireplace.

Table 131: Fireplace and Heater Stove Penetration and Saturation Rates by Dwelling Type – All Other Fuels
Base: All Households With or Without a Fireplace / Heater Stove

Fireplace / Heater Stove Type	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Electric					
Penetration (%)	8.2	11.6	13.7	16.4	13.6
Saturation	0.10	0.13	0.14	0.18	0.16
Wood burning fireplace					
Penetration (%)	14.4	4.3	0.4	0.0	3.8
Saturation	0.17	0.04	0.00	0.00	0.04
Wood burning stove					
Penetration (%)	15.0	0.0	6.5	0.4	8.9
Saturation	0.16	0.00	0.07	0.00	0.09

Penetration and saturation rates for fireplaces and heater stoves using fuels other than natural gas by period of construction confirm trends noted in previous residential end-use surveys conducted by FBC (Table 132). For example, the data show a decline in the penetration of wood-burning fireplaces and heater stoves beginning in the mid-1980s. Electric fireplaces are popular in dwellings constructed since 2005, present in one-in-five (20% to 21%) homes. In contrast to wood-burning fireplaces which tend to be built-in at the time of construction, electric fireplaces and wood-burning stoves can be added to a dwelling any time after construction.

Table 132: Fireplace and Heater Stove Penetration and Saturation Rates by Dwelling Vintage – All Other Fuels
Base: All Households With or Without a Fireplace / Heater Stove

Fireplace / Heater Stove Type	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Electric								
Penetration (%)	2.4	10.0	7.3	9.8	9.4	20.1	21.4	9.1
Saturation	0.02	0.11	0.08	0.11	0.11	0.24	0.23	0.09
Wood burning fireplace								
Penetration (%)	18.6	18.1	14.1	5.1	3.1	3.7	1.6	3.5
Saturation	0.19	0.23	0.16	0.05	0.03	0.04	0.02	0.04
Wood burning stove								
Penetration (%)	11.8	15.8	13.9	9.8	6.1	6.6	2.3	4.8
Saturation	0.12	0.17	0.14	0.10	0.07	0.07	0.03	0.05

7.2 Gas Fireplace Ages and Features

Data on the average age of the first gas fireplace (any type) installed in residential homes are summarized in Table 133. The average gas fireplace in 2022 was 15.9 years old, up from an average of 14.5 years in 2017.

Table 133: Age of First Gas Fireplace (Years)

Age of Gas Fireplace (years)	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base [1]	*276*	*171*	*124*	*571*	*807*	*520*
Mean	16.5	16.5	14.2	15.9	14.5	12.9
Standard deviation	9.8	9.8	8.7	9.6	7.9	6.7

Age statistics for second gas fireplaces are provided in Table 134. Regional detail is not shown due to the relatively small number of dwellings with more than one gas fireplace (n=110). The average age for second gas fireplaces is 16.2 years, not statistically significantly different than the average recorded in 2017.

Table 134: Age of Second Gas Fireplace (Years)

Age of Gas Fireplace (years)	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*110*	*79*	*121*
Mean	16.2	14.9	12.1
Standard deviation	8.2	7.6	5.5

Of the three possible designs for gas fireplaces (fixed glass front, glass doors that open, open hearth (no glass), somewhat more than eight-in-ten (83%) have a fixed glass front, significantly higher than those with opening glass doors (14%), and open hearth models (3%) (Table 135). Over time, the proportion of gas fireplaces with fixed glass fronts has increased and the proportion of gas fireplaces with opening doors has declined.

Table 135: Gas Fireplace Characteristics by Region
Percent of All Gas Fireplaces [1]

Gas Fireplace Features	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Fixed glass front	79.1	83.1	89.6	82.5	79.1	78.9
Glass doors that open	17.1	12.9	9.7	14.3	17.9	18.5
No glass (open hearth)	3.8	4.0	0.8	3.2	3.0	2.7
Remote control	19.0	17.8	41.8	23.6	18.8	n/a
Standing pilot light	44.3	48.2	65.4	50.0	46.2	n/a

[1] Includes homes with more than one gas fireplace or heater stove

One-in-four (24%) gas fireplaces can be operated with remote controls. Remote controls are associated with newer, more energy-efficient gas fireplace models. Regionally, the incidence of models with remote controls is highest in the KB region (42%) and lowest in SO (18%). Half (50%) of gas fireplaces have a standing pilot light.

7.3 Fireplace and Heater Stoves – Operating Behaviours

7.3.1 Hours-of-Operation

Average weekly hours-of-use for fireplaces and heater stoves by season are presented in Table 136. Usage is highest during the fall and winter (average of 22 and 27 hours per week on average, respectively) and lowest during the spring and summer (6 and 1 hours per week, respectively). Overall, the average operating hours for fireplaces and heater stoves is 711 hours per year. Regionally, annual usage is highest among KB residents (1,083 hours).

Table 136: Weekly Average Hours of Fireplace / Heater Stove Operation
All Fireplaces and Heater Stoves per Dwelling

Season [1]	KE	SO	KB	2022 FBC
Summer	0.5	0.9	1.0	0.8
Fall	13.0	21.8	33.2	21.6
Winter	16.4	26.6	41.4	26.8
Spring	3.1	6.5	7.7	5.5
Annual Average Hours [2]	**429**	**725**	**1,083**	**711**

[1] Assumes each season is 13 weeks long.
[2] Average hours of operation per year

Examining hours of use data for only those households with a single fireplace or heater stove (79% of all homes with a fireplace or heater stove) allows a detailed analysis of how different fireplace and heater type units are used.[20] For example, Table 137 shows that annual usage is highest for fireplace and heater stoves whose design, by default, allows them to provide significant heat in addition to providing ambiance. Gas free-standing heater stoves and wood-burning stoves have the highest use, averaging 1,528 hours and 1,728 hours per year respectively. Gas (heater type) fireplaces are used 563 hours per year, 57% more than decorative gas fireplaces (358 hours per year). Of the six types, electric fireplaces are used the least (251 hours per year).

Table 137: Seasonal Hours of Use - Fireplace / Heater Stoves

	Average Weekly Hours per Season				Annual Average Hours
Fireplace Type [1]	Summer	Fall	Winter	Spring	
Gas (decorative)	1.2	10.5	13.8	2.0	358
Gas (heater type)	0.4	17.3	21.2	4.4	563
Gas (free standing)	3.8	45.9	49.2	18.6	1,528
Electric	0.5	8.0	9.2	1.6	251
Wood burning fireplace	0.8	27.2	34.6	5.4	884
Wood burning stove	0.5	51.9	66.9	13.6	1,728

[1] Dwellings with only one of any fireplace / heater stove type (n=989)

7.3.2 Contribution to Space Heating – All Fireplace / Heater Stove Types

Respondents to the 2022 REUS with fireplaces and/or heater stoves were asked to estimate how much their units contribute to their dwelling's space heating requirement. Three-in-ten (29%) respondents with a fireplace and/or heater stove indicated it contributed as much as ten percent (10%) of their home's space heating requirements and another 17% indicated it met up to 25% percent (Table 138). Slightly less than

[20] Respondents with multiple fireplaces and heater stoves were not asked to provide hours of use for each fireplace / heater stove.

one-in-ten (9%) suggested it was as high as 50% and 7% indicated their unit(s) met up to 100% of their dwelling's space heating needs. One-in-four (25%) indicated their fireplace unit(s) do not contribute to their home's heating requirements.

Table 138: Fireplace and Heater Stove Contribution to Space Heating Load (%)

Share of Space Heating Load	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*475*	*411*	*411*	*1297*	*1767*	*1109*
0%	31.9	22.5	16.1	24.5	28.8	26.1
Up to 10%	33.5	26.8	23.7	28.7	25.2	30.1
Up to 25%	14.2	16.3	20.4	16.6	14.3	15.7
Up to 50%	6.3	8.4	12.0	8.6	9.8	11.7
Up to 75%	2.5	6.2	12.2	6.4	7.8	6.1
Up to 100%	4.4	7.9	11.2	7.4	7.4	6.6
Don't know	7.2	11.8	4.4	7.7	6.8	3.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

Regional differences are consistent with other data on fireplaces and heater stoves collected in the 2022 REUS. For example, households in KB are much more likely than the other regions to use their fireplaces and heater stoves to heat their home and their contribution to the home's space heating requirements is higher.

The contribution of fireplaces and heater stoves to the space heating requirements of residential dwellings are explored by type of dwelling in Table 139. Sample sizes for dwelling types other than SFDs are small, so caution is advised in the interpretation of the data for the other dwelling types.

Table 139: Fireplace and Heater Stove Details by Dwelling Type (%)

Share of Space Heating Load	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*995*	*52*	*72*	*108*	*70*
0%	27.1	31.6	26.8	14.5	21.1
Up to 10%	30.0	30.5	40.4	20.5	29.0
Up to 25%	14.5	12.1	13.2	26.2	13.7
Up to 50%	9.6	2.9	7.1	6.6	8.6
Up to 75%	6.5	15.2	0.0	6.1	6.7
Up to 100%	6.7	1.0	3.3	11.4	13.2
Don't know	5.6	6.8	9.4	14.7	7.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

7.4 Fireplace and Heater Stove Installations

Respondents with a fireplace or heater stove were asked whether one or more of their units had been installed in the last five years. Those indicating that was the case were then asked what type of fireplace /

heater stove they installed. The results, summarized in Table 140, show that somewhat less than one-in-ten (9%) of respondents installed a fireplace or heater stove during the last five years. Differences in installation rates between regions (7% to 13%) are not statistically significant at the 95% confidence level. Gas fireplaces / heater stoves and electric fireplaces each represented 40% of new installs.

Table 140: Fireplace and Heater Stove Installations – Last Five Years (%)

Fireplace Installations Last Five Years	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Installed at least one (%) [1]	6.5	13.0	9.1	9.1
Installations (% Distribution): [2]				
Gas fireplace or heater stove	47.7	39.6	28.8	39.8
Wood heater stove	1.8	12.1	39.8	17.6
Electric fireplace	46.5	44.0	23.6	39.7
Don't know	4.0	4.3	7.8	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: all dwellings with or without a fireplace or heater stove
[2] Base: respondents who installed a fireplace or heater stove in the last five years
Totals may not sum due to rounding

7.4.1 Gas Fireplace Installations

Of those who installed a gas fireplace or heater stove in the last five years, one-third (32%) indicated it was installed where no previous fireplace or heater stove existed, 39% indicated it replaced a gas fireplace or heater stove, and 27% indicated it replaced a wood fireplace or heater stove (Table 141). Regional details are not provided due to the small number of respondents answering this question.

Table 141: What Replaced by New Fireplace and Heater Stove (%)
Gas Fireplace and Heater Stove Installations Only

What replaced by new fireplace or heater stove?	2022 FBC
Unweighted base[1]	*81*
Wood fireplace or heater stove	26.6
Gas fireplace or heater stove	39.2
Electric fireplace	1.3
Nothing - New installation	31.5
Don't know	1.5
Total	**100.0**

Totals may not sum due to rounding

8 APPLIANCES

This section summarizes penetration and saturation rates of a comprehensive list of cooking, refrigeration, cleaning, and space heating and space cooling appliances; computers and home office equipment; home entertainment equipment; and connected appliances and other equipment. The penetration rate for an appliance indicates the proportion of dwellings that have at least one of the appliance. The saturation rate indicates how many, on average, are present in a typical home in the general population of residential dwellings. Where comparisons allow, results are compared with data from the FBC's 2017, 2012 and 2009 residential end-use surveys.[21]

8.1 Cooking Appliances

Penetration and saturation rates for gas and electric cooking appliances are summarized in Table 142 and Table 143.

Table 142: Penetration and Saturation Rates for Cooking and Related Appliances – Part I of II

Cooking and Related Appliances	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2004*
Electric range (cook top & oven)							
Penetration (%)	76.5	71.4	76.8	75.1	81.1	79.9	81.0
Saturation	0.81	0.76	0.85	0.81	0.87	0.86	n/a
Gas range (cook top & oven)							
Penetration (%)	13.3	13.1	12.4	13.0	10.6	10.2	11.0
Saturation	0.13	0.13	0.13	0.13	0.11	0.10	n/a
Dual fuel range (gas cook top and electric oven)							
Penetration (%)	4.6	6.0	4.2	4.9	3.2	2.4	n/a
Saturation	0.05	0.06	0.04	0.05	0.03	0.74	n/a
Electric cook top							
Penetration (%)	14.4	13.7	12.9	13.8	10.9	8.8	11.0
Saturation	0.15	0.15	0.16	0.15	0.11	0.09	n/a
Gas cook top							
Penetration (%)	7.0	11.3	5.5	7.8	4.2	3.1	5.0
Saturation	0.07	0.11	0.06	0.08	0.04	0.03	n/a
Induction range							
Penetration (%)	6.2	6.6	7.0	6.5	n/a	n/a	n/a
Saturation	0.06	0.07	0.08	0.07	n/a	n/a	n/a
Electric wall oven							
Penetration (%)	10.9	16.6	7.9	11.7	9.1	8.0	10.0
Saturation	0.12	0.17	0.09	0.13	0.10	0.09	n/a
Gas wall oven							
Penetration (%)	1.2	1.1	1.0	1.1	0.8	0.4	n/a
Saturation	0.01	0.01	0.01	0.01	0.01	0.01	n/a

n/a – data not available

[21] A non-response for an appliance or end-use in the 2012 and 2017 surveys is interpreted as not having the appliance or end-use in question (i.e., quantity of zero). Caution is advised in comparison with 2009 data as the treatment of non-responses was different in that survey year.

Table 143: Penetration and Saturation Rates for Cooking and Related Appliances – Part II of II

Cooking and Related Appliances	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2004*
Microwave oven							
Penetration (%)	89.2	92.4	85.5	89.1	81.3	80.4	87.0
Saturation	0.95	1.00	0.94	0.96	0.87	0.85	n/a
Toaster oven							
Penetration (%)	40.2	42.7	36.3	39.8	n/a	n/a	n/a
Saturation	0.42	0.45	0.37	0.41	n/a	n/a	n/a
Gas barbeque (piped gas)							
Penetration (%)	27.3	25.7	14.2	23.2	15.8	17.0	n/a
Saturation	0.28	0.26	0.14	0.23	0.16	0.17	n/a
Gas barbeque (bottled gas)							
Penetration (%)	35.7	45.9	50.8	42.9	39.7	38.5	n/a
Saturation	0.37	0.47	0.52	0.44	0.41	0.39	n/a
Electric barbeque							
Penetration (%)	3.5	3.1	1.9	2.9	n/a	n/a	n/a
Saturation	0.03	0.03	0.02	0.03	n/a	n/a	n/a

n/a – data not available

8.1.1 Cooking Appliances by Dwelling Vintage

The next two tables present penetration and saturation rates for cooking appliances by dwelling vintage (period of construction).

Table 144: Penetration and Saturation Rates for Cooking and Related Appliances by Dwelling Vintage – Part I of II

Cooking and Related Appliances	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Electric range (cook top & oven)								
Penetration (%)	73.4	82.8	84.2	76.6	75.9	67.0	42.7	89.5
Saturation	0.80	0.92	0.91	0.84	0.78	0.70	0.44	0.92
Gas range (cook top & oven)								
Penetration (%)	14.1	12.2	8.7	11.1	13.5	18.4	20.9	6.7
Saturation	0.15	0.12	0.09	0.11	0.14	0.18	0.21	0.07
Dual fuel range (gas cook top, electric oven)								
Penetration (%)	4.3	4.5	2.6	5.1	3.0	7.9	11.4	1.4
Saturation	0.04	0.05	0.03	0.05	0.03	0.08	0.11	0.01
Electric cook top								
Penetration (%)	12.3	14.8	11.6	16.9	12.4	12.5	13.8	14.9
Saturation	0.15	0.15	0.13	0.22	0.13	0.13	0.14	0.15
Gas cook top								
Penetration (%)	4.6	3.6	4.6	5.4	8.1	10.9	28.3	2.7
Saturation	0.05	0.04	0.05	0.05	0.08	0.11	0.28	0.03
Induction range								
Penetration (%)	7.1	4.8	6.1	8.1	4.5	7.1	11.1	4.9
Saturation	0.07	0.06	0.06	0.08	0.05	0.07	0.12	0.05

Table 145: Penetration and Saturation Rates for Cooking and Related Appliances by Dwelling Vintage – Part II of II

Cooking and Related Appliances	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Gas wall oven								
Penetration (%)	1.0	1.1	1.2	0.7	1.0	0.9	3.1	--
Saturation	0.01	0.01	0.02	0.01	0.01	0.01	0.03	--
Microwave oven								
Penetration (%)	82.7	89.0	91.7	87.7	93.9	89.9	86.9	82.4
Saturation	0.88	0.99	0.98	0.99	0.99	0.96	0.89	0.84
Toaster oven								
Penetration (%)	37.0	39.1	37.8	46.4	41.5	37.7	37.2	34.9
Saturation	0.39	0.40	0.39	0.48	0.43	0.39	0.37	0.35
Gas barbeque (piped gas)								
Penetration (%)	12.7	14.0	13.6	21.2	30.7	41.8	40.5	5.6
Saturation	0.13	0.14	0.14	0.21	0.31	0.42	0.41	0.06
Gas barbeque (bottled gas)								
Penetration (%)	61.3	59.0	44.8	37.0	40.7	32.4	31.3	30.3
Saturation	0.63	0.61	0.47	0.37	0.42	0.33	0.32	0.30
Electric barbeque								
Penetration (%)	2.4	3.2	3.1	2.2	4.4	2.8	3.3	--
Saturation	0.02	0.03	0.03	0.02	0.04	0.03	0.03	--

The data show a shift from traditional electric cooking appliances (e.g., electric cook top and range) to gas cooking appliances for homes constructed since 1995. The newer homes are much more likely than their older counterparts to have a gas range (gas cook top and gas oven), gas cook top, or dual fuel range (gas cook top and electric oven). Induction ranges have also become a popular cooking appliance in new construction (present in 11% of dwellings constructed since 2015). Newer homes are also much more likely to have a piped natural gas barbeque (e.g., 41% to 42% of homes constructed since 2005).

The average ages of cooking appliances (main unit in cases of more than one appliance) are provided in Table 146.

Table 146: Average Age (Years) of Cooking and Related Appliances
First Appliance Only

Cooking and Related Appliances [1]	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Electric range (cook top & oven)	10.5	11.0	10.6	10.5	10.1	9.3	8.4
Gas range (cook top & oven)	7.6	7.8	10.1	8.3	7.7	8.4	7.0
Dual fuel range (gas cook top, electric oven)	7.7	6.8	8.9	7.8	6.6	6.5	n/a
Electric cook top	7.5	9.4	9.5	8.9	9.8	10.6	9.0
Gas cook top	8.5	5.1	10.7	8.4	6.1	10.0	6.5
Induction range	5.5	5.8	5.0	5.4	n/a	n/a	n/a
Electric wall oven	8.3	7.8	14.9	10.5	10.5	11.2	8.8
Gas wall oven	3.3	12.3	4.8	6.5	1.6	5.8	n/a

[1] Age data not collected for microwave ovens, toaster ovens, or BBQs (piped gas, propane, or electric)
n/a = data not available

The average age of the cooking appliance stock reflects both the rate of turnover in the stock (influenced by the average lifespan of the appliance) and the popularity of the appliance type in renovations and new construction. For example, the popularity of dual fuel ranges (gas cook top, electric oven) is reflected by the relatively young age of the appliance stock (average of 7.8 years versus 10.5 years for electric ranges).

8.2 Refrigerators and Freezers

Penetration and saturation rates for refrigerators and freezers are presented in Table 147. The 2022 REUS queried the presence of refrigerators with either manual or automatic defrost, compact bar fridges / wine coolers, and stand-alone freezers (chest and upright). Consistent with past surveys, manual defrost refrigerators are considerably less common than auto-defrost models and chest-style freezers are more common than upright models. The substantial increase in the penetration of compact bar fridges since the last survey (17% in 2017 compared to 26% in 2022) may be due to the expansion of the category description in the 2022 REUS to include wine coolers.

Table 147: Penetration and Saturation Rates for Refrigerators and Freezers

Refrigerators & Freezers	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1996*
Refrigerator – manual defrost							
Penetration (%)	19.4	17.9	17.1	18.3	16.5	15.6	20.0
Saturation	0.22	0.21	0.22	0.22	0.19	0.18	n/a
Refrigerator – auto defrost							
Penetration (%)	83.3	85.8	87.0	85.1	85.5	85.8	90.0
Saturation	1.05	1.08	1.14	1.08	1.05	1.05	n/a
Compact bar fridge / wine cooler							
Penetration (%)	27.4	32.0	18.8	26.3	16.5 [1]	n/a	n/a
Saturation	0.31	0.36	0.20	0.30	0.18 [1]	n/a	n/a
Stand-alone freezer – upright							
Penetration (%)	26.3	30.1	27.6	27.8	26.1	22.5	21.0
Saturation	0.27	0.32	0.30	0.29	0.28	0.23	n/a
Stand-alone freezer – chest style							
Penetration (%)	36.4	43.1	53.3	43.1	45.3	49.3	52.0
Saturation	0.39	0.50	0.66	0.50	0.51	0.58	n/a

[1] Category description in 2017 did not include wine coolers.
n/a = data not available

The average ages of refrigerators and stand-alone freezers (first units) are summarized in Table 148.

Table 148: Average Age (Years) of Refrigerators and Freezers First Appliance Only

Refrigerators & Freezers – 1st unit	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Refrigerator – manual defrost	8.8	13.2	14.9	12.1	11.2	12.1	8.6
Refrigerator – auto defrost	9.0	8.6	9.3	8.9	9.0	8.0	7.3
Compact bar fridge / wine cooler	7.5	6.1	8.4	7.5	7.1 [1]	n/a	n/a
Stand-alone freezer – upright	8.2	8.3	8.9	8.7	8.4	8.4	6.9
Stand-alone freezer – chest style	13.4	13.3	14.5	13.8	13.9	12.2	12.6

[1] Category description in 2017 did not include wine coolers
n/a = data not available

8.3 Laundry Machines and Dishwashers

8.3.1 Access to Laundry Facilities

The majority (92%) of FBC residential customers have laundry facilities (equipment) in their homes, while 7% have access to laundry facilities located elsewhere in their building (e.g., apartments) (Table 149). One percent (1%) indicated they access laundry facilities in another building or use a laundry business (Laundromat, dry cleaners, etc.).

Table 149: Location of Laundry Equipment (%)

Location of laundry equipment	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
In my own home	92.5	96.5	86.6	92.0
In a laundry room located elsewhere in the building	7.0	1.6	12.3	6.9
In another building or at a laundry business	0.5	1.9	1.1	1.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

8.3.2 Penetration and Saturation Rates

Penetration and saturation rates for automatic dishwashers, clothes washers, and clothes dryers, collectively referred to as cleaning appliances, are summarized in Table 150.

Table 150: Penetration and Saturation Rates for Cleaning Appliances

Cleaning Appliances	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1971*
Dishwasher							
Penetration (%)	87.3	85.1	68.3	81.3	80.5	76.8	82.0
Saturation	0.92	0.88	0.70	0.85	0.84	0.79	n/a
Clothes washer - top loading							
Penetration (%)	42.8	40.7	49.9	44.2	51.0	53.9	64.0
Saturation	0.44	0.41	0.50	0.45	0.53	0.55	n/a
Clothes washer - front loading							
Penetration (%)	52.9	58.2	41.9	51.3	42.3	37.4	35.0
Saturation	0.55	0.59	0.45	0.53	0.44	0.38	n/a
Electric clothes dryer							
Penetration (%)	89.7	92.1	83.2	88.5	87.4	85.7	92.0
Saturation	0.94	0.94	0.89	0.93	0.91	0.88	n/a
Gas clothes dryer							
Penetration (%)	2.5	3.2	2.6	2.7	2.0	2.3	2.0
Saturation	0.03	0.03	0.03	0.03	0.02	0.02	n/a
Heat pump clothes dryer							
Penetration (%)	0.4	0.2	0.1	0.3	n/a	n/a	n/a
Saturation	0.00*	0.00*	0.00*	0.00*	n/a	n/a	n/a

n/a = data not available
* Value less than 0.01

Appliances

Front-loading (horizontal axis) clothes washers are present in 51% of homes in 2022 up from 42% in 2017. Top-loading clothes washers have seen their share of the FBC customer base decline commensurately over the same period.[22]

The average ages of cleaning appliances (main unit only) are summarized by appliance type in Table 151.

Table 151: Average Age (Years) of Cleaning Appliances
First Appliance Only

Cleaning Appliances	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Dishwasher	7.5	8.0	8.4	7.9	8.0	7.8	7.0
Clothes washer - top loading	9.8	11.0	10.8	10.3	10.2	9.9	9.5
Clothes washer - front loading	7.3	7.1	7.5	7.6	6.6	5.0	3.6
Electric clothes dryer	8.8	9.0	10.2	9.4	9.3	8.2	7.8
Gas clothes dryer	9.8	10.1	14.3	11.6	5.8	10.1	8.7
Heat pump clothes dryer	1.3	0.5	--	0.6	n/a	n/a	n/a

n/a = data not available

8.4 Make-Up Air Units

Table 154 presents penetration and saturation rates for make-up air units including heat recovery ventilators (HRVs) and energy recovery ventilators (ERVs). Of note, the penetration rate for HRV units is 6%, up from 3% in 2017. ERVs, queried for the first time in the 2022 REUS, have a penetration rate of 1%.

Table 152: Penetration and Saturation Rates for Make-Up Air Units

Make-Up Air Units	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC [1]
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1965*
Heat recovery ventilator (HRV)							
Penetration (%)	5.9	6.3	5.6	5.9	2.9	2.3	n/a
Saturation	0.06	0.06	0.06	0.06	0.03	0.02	n/a
Energy recovery ventilator (ERV)							
Penetration (%)	1.4	0.7	0.7	1.0	n/a	n/a	n/a
Saturation	0.01	0.01	0.01	0.01	n/a	n/a	n/a

n/a – data not available

Penetration and saturation rates for both HRVs and ERVs are highest in dwellings constructed since 2015 (Table 155). Retrofitting an existing dwelling with a make-up air unit is possible and the penetration rates for ERVs and HRVs for older dwellings likely reflect this.

[22] It is noteworthy that some top loading washing machines are now ENERGY STAR® qualified models. While less energy efficient than horizontal axis washers, their existence along with traditional or standard top loading models means that future surveys should require survey respondents to differentiate between the two types of top loading units.

Table 153: Penetration and Saturation Rates for Make-Up Air Units by Dwelling Vintage

Make-Up Air Units	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*530*	*1121*	*729*	*842*	*770*	*431*	*251*	*114*
Heat recovery ventilator (HRV)								
Penetration (%)	4.5	2.3	3.5	3.5	5.4	8.1	26.3	--
Saturation	0.05	0.03	0.04	0.03	0.06	0.09	0.27	--
Energy recovery ventilator (ERV)								
Penetration (%)	--	0.9	0.3	0.3	0.4	1.0	6.9	0.4
Saturation	--	0.01	0.00*	0.00*	0.01	0.01	0.07	0.00*

* Value less than 0.01

8.5 Outdoor Heating Equipment

8.6 Heating Appliances

Table 154 presents penetration and saturation rates for select space heating equipment and appliances, including outdoor heaters (bottled and piped gas), gas outdoor fireplaces or fire pits, and portable electric space heaters. Not previously queried in past REUS surveys, 3% of dwellings in the 2022 REUS have an electric outdoor heater. Gas outdoor fire pits/fireplaces have a penetration rate of 8%, up significantly from 3% in 2017.

Table 154: Penetration and Saturation Rates for Heating Equipment

Heating Equipment	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC [1]
Unweighted base	*927*	*832*	*869*	*1933*	*2628*	*1668*	*1965*
Portable electric heater							
Penetration (%)	26.6	33.6	36.2	31.3	26.5	22.1	10.0
Saturation	0.35	0.43	0.51	0.42	0.35	0.30	n/a
Gas outdoor heater (piped gas)							
Penetration (%)	1.1	1.2	0.3	0.9	1.9	1.3	n/a
Saturation	0.02	0.01	0.00*	0.01	0.02	0.01	n/a
Gas outdoor heater (bottled gas)							
Penetration (%)	4.1	3.4	1.7	3.2	1.4	2.1	n/a
Saturation	0.04	0.04	0.02	0.03	0.02	0.02	n/a
Gas outdoor fire pit or fireplace							
Penetration (%)	10.0	9.7	4.7	8.4	3.0	1.5	n/a
Saturation	0.11	0.10	0.05	0.09	0.03	0.02	n/a
Electric outdoor heater							
Penetration (%)	2.4	5.1	1.0	2.8	n/a	n/a	n/a
Saturation	0.03	0.06	0.01	0.03	n/a	n/a	n/a

* Value less than 0.001
n/a – data not available

Penetration and saturation rates for heating equipment by dwelling vintage are summarized in Table 155. Of note, the penetration rate for portable electric heaters increases with the age of the dwelling. For example, 45% of dwellings constructed prior to 1950 have a portable electric space heater compared to

22% of those constructed since 2005. Fifteen percent (15%) of dwellings built since 2015 have an electric outdoor heater and 21% have a gas outdoor fire pit/fireplace.

Table 155: Penetration and Saturation Rates for Heating Equipment by Dwelling Vintage

Heating Equipment	Before 1950	1950 - 1975	1976 - 1985	1986 - 1995	1996 - 2005	2006 - 2015	2016 or Newer	Age Un-known
Unweighted base	*163*	*375*	*314*	*315*	*301*	*245*	*131*	*78*
Portable electric heater								
Penetration (%)	44.9	40.5	32.3	33.7	23.1	21.5	21.8	37.4
Saturation	0.61	0.55	0.47	0.41	0.33	0.25	0.26	0.55
Gas outdoor heater (piped gas)								
Penetration (%)	--	1.0	0.5	0.9	1.1	1.3	1.3	--
Saturation	--	0.01	0.01	0.01	0.01	0.02	0.03	--
Gas outdoor heater (bottled gas)								
Penetration (%)	2.3	3.5	0.9	2.9	3.8	3.5	8.9	1.3
Saturation	0.03	0.03	0.01	0.03	0.04	0.03	0.10	0.01
Gas outdoor fire pit or fireplace								
Penetration (%)	6.7	7.0	5.6	6.0	10.0	10.0	20.9	4.1
Saturation	0.07	0.07	0.06	0.06	0.11	0.11	0.21	0.04
Electric outdoor heater								
Penetration (%)	0.5	1.2	2.1	0.8	0.7	4.3	15.1	3.5
Saturation	0.01	0.01	0.02	0.01	0.01	0.06	0.19	0.05

8.7 Air Conditioning

Table 156 summarizes penetration and saturation rates for central air conditioning systems, portable air conditioners, and room window air conditioners.

Table 156: Penetration and Saturation Rates for Cooling Equipment

Air Conditioning	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1854*
Central air conditioner							
Penetration (%)	62.1	61.1	28.7	52.4	47.5	41.6	50.0
Saturation	0.63	0.63	0.29	0.53	0.49	0.43	n/a
Portable air conditioner							
Penetration (%)	11.3	10.2	15.8	12.3	11.3	9.2	16.0
Saturation	0.13	0.12	0.18	0.14	0.14	0.10	
Room window air conditioner							
Penetration (%)	23.2	17.4	16.5	19.6	19.3	17.9	n/a
Saturation	0.29	0.25	0.22	0.26	0.24	0.21	n/a
Air conditioning – any type							
Penetration (%)	88.7	80.9	55.3	77.0	78.1	68.7	n/a
Saturation	1.06	1.00	0.70	0.94	0.87	0.74	n/a

n/a = data not available

Overall, somewhat more than three-quarters (77%) of FBC customers have some form of dedicated air conditioning equipment, statistically unchanged from 2017.[23] Central air conditioning systems are the most common air conditioning appliance, present in 52% of homes. Window air conditioners and portable units were present in 20% and 12% of homes, respectively. Penetration of air conditioning equipment (any type) is highest in KE (89%) and SO (81%) and lowest in KB (55%). On average, there are 0.94 air conditioners (any type) per FBC residential customer, a seven percentage point increase since 2017. Saturation rates confirm that some households have more than one appliance that can provide air conditioning.

Penetration and saturation rates for air conditioning equipment by dwelling type are provided in Table 157. While the penetration of air conditioning equipment (any type) is high for regardless of dwelling type (75% to 85%), differences between dwelling types in the type of air conditioning equipment used are evident. For example, central air conditioning systems are most typical in SFDs, semi-detached dwellings, and townhouses (58% to 62%). Room window air conditioning units are most common in apts/condos (37%) and mobile and other manufactured dwellings (26%). Portable air conditioners, while found in all dwelling types, are a popular choice for respondents living in semi-detached dwellings and mobile homes (18% for each).

Table 157: Penetration and Saturation Rates for Cooling Equipment by Dwelling Type

Air Conditioning	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Central air conditioner					
Penetration (%)	57.9	62.4	60.0	37.4	49.5
Saturation	0.59	0.63	0.61	0.38	0.51
Portable air conditioner					
Penetration (%)	10.9	17.9	7.9	14.1	17.9
Saturation	0.13	0.22	0.09	0.16	0.21
Room window air conditioner					
Penetration (%)	12.1	9.9	17.0	37.2	25.8
Saturation	0.17	0.13	0.20	0.47	0.35
Air conditioning – any type					
Penetration (%)	74.7	84.8	79.8	79.6	80.8
Saturation	0.90	0.98	0.90	1.00	1.07

8.8 Fans, Dehumidifiers, and Humidifiers

Penetration and saturation rates for portable fans, dehumidifiers, humidifiers, and ceiling fans are presented in Table 158.

[23] If heat pumps (any type) are included, 85% of FBC customers had some form of air conditioning for their dwelling in 2022.

Table 158: Penetration and Saturation Rates for Ceiling Fans, Portable Fans, Dehumidifiers, and Humidifiers

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*1854*
Portable fan							
Penetration (%)	61.7	60.0	64.0	61.8	46.2	42.3	44.0
Saturation	1.03	0.94	1.12	1.03	0.77	0.67	n/a
Humidifier							
Penetration (%)	21.3	17.7	10.0	17.1	12.8	8.9	9.0
Saturation	0.23	0.21	0.12	0.19	0.14	0.10	n/a
Dehumidifier							
Penetration (%)	7.5	6.4	11.1	8.2	4.7	3.6	3.0
Saturation	0.08	0.07	0.12	0.08	0.05	0.04	n/a
Rotating ceiling fan without light fixture							
Penetration (%)	12.7	14.5	10.8	12.7	12.5	14.4	18.0
Saturation	0.17	0.22	0.13	0.18	0.17	0.19	n/a
Rotating ceiling fan with light fixture							
Penetration (%)	50.2	60.4	50.6	53.2	52.7	47.6	51.0
Saturation	0.83	1.13	0.85	0.92	0.90	0.82	n/a

n/a = data not available

8.9 Computers & Home Office Equipment

Penetration and saturation rates for computers, computer peripherals, and home office equipment are summarized in Table 159.

Table 159: Penetration and Saturation rates for Computers, Computer Peripherals & Home Office Equipment

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2008*
Desktop computer							
Penetration (%)	45.3	44.9	46.3	45.5	49.9	54.2	69.0
Saturation	0.54	0.56	0.56	0.55	0.59	0.63	n/a
Laptop / notebook computer							
Penetration (%)	80.5	71.4	70.1	75.0	63.5	52.9	49.0
Saturation	1.18	0.99	1.05	1.09	0.87	0.70	n/a
Tablet computer							
Penetration (%)	59.1	58.8	60.9	59.5	47.8	n/a	n/a
Saturation	0.82	0.82	0.84	0.82	0.65	n/a	n/a
Computer printer – inkjet or laser							
Penetration (%)	76.5	79.3	70.9	75.7	70.2	67.5	80.0
Saturation	0.85	0.90	0.80	0.85	0.79	0.73	n/a
Stand-alone fax machine							
Penetration (%)	2.8	3.6	3.0	3.1	5.1	7.7	19.0
Saturation	0.03	0.04	0.03	0.03	0.05	0.08	n/a
Computer router (with or without Wi-Fi)							
Penetration (%)	75.8	72.2	74.9	74.5	65.9	n/a	n/a
Saturation	0.80	0.76	0.80	0.79	0.70	n/a	n/a

[1] Other computers including tablet-style models

8.10 Home Entertainment Systems

Penetration and saturation rates for a broad selection of home entertainment equipment are summarized in Table 160. Any differences in category descriptions of the various systems between survey years are noted at the bottom of the table.

Table 160: Penetration and Saturation Rates for Home Entertainment Equipment

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2008*
Standard CRT colour television							
Penetration (%)	7.2	6.4	7.0	6.9	19.1	37.1	n/a [1]
Saturation	0.09	0.08	0.08	0.08	0.25	0.51	n/a
LCD or LED flat screen television							
Penetration (%)	77.0	74.8	75.2	75.9	76.6	81.1	38.0 [2]
Saturation	1.30	1.24	1.18	1.25	1.30	1.01	n/a
4k LED flat screen television							
Penetration (%)	33.0	29.9	24.3	29.6	n/a	n/a	n/a
Saturation	0.42	0.38	0.33	0.39	n/a	n/a	n/a
8k QLED flat screen television							
Penetration (%)	3.5	2.6	2.2	2.8	n/a	n/a	n/a
Saturation	0.04	0.03	0.03	0.03	n/a	n/a	n/a
Plasma flat screen television							
Penetration (%)	13.1	10.6	8.6	11.1	14.4	12.0	13.0
Saturation	0.16	0.12	0.10	0.13	0.18	0.14	n/a
Front or rear projection television							
Penetration (%)	2.3	0.6	1.2	1.5	2.4	4.6	7.0
Saturation	0.02	0.01	0.01	0.02	0.03	0.05	n/a
Digital/cable/satellite set-top box [3]							
Penetration (%)	54.3	60.8	44.7	53.5	58.9	69.3	47.0 [4]
Saturation	0.92	1.01	0.74	0.89	1.03	0.90	n/a
DVD / Blue Ray / VCR units							
Penetration (%)	40.2	45.1	45.2	43.0	49.4	49.9	75.0
Saturation	0.51	0.53	0.55	0.52	0.64	0.68	n/a
Media streaming device (Apple TV box / Slingbox, etc.)							
Penetration (%)	32.7	25.6	26.0	28.8	n/a	n/a	n/a
Saturation	0.43	0.32	0.36	0.38	n/a	n/a	n/a
Surround sound home theatre							
Penetration (%)	33.2	35.9	27.5	32.4	27.7	22.0	32.0
Saturation	0.37	0.40	0.31	0.36	0.31	0.24	n/a
Traditional stereo systems (amp/receiver/speakers)							
Penetration (%)	31.3	31.5	35.0	32.4	32.5	33.1	n/a
Saturation	0.35	0.34	0.37	0.35	0.36	0.35	n/a
Video game consoles							
Penetration (%)	28.0	16.8	21.8	23.0	19.2	19.8	24.0 [5]
Saturation	0.39	0.23	0.31	0.32	0.26	0.26	n/a

[1] CRT TVs queried for two sizes
[2] Flat screen TVs, any size
[3] With or without a PVR
[4] Digital cable or satellite TV only. Presence of PVR not queried.
[5] Includes audio and entertainment systems, and video game equipment.
n/a – data not available

8.11 Connected Appliances

In a series of new questions added to the 2022 REUS, respondents were queried on the presence of "appliances and other home equipment that can be monitored and controlled remotely from either inside or outside the home by 'connecting' them wirelessly to a smart phone, tablet or computer". Connected appliances can include clothes washers, dishwashers and other electronic products or devices such as security systems, smart plugs, and thermostats. The results, summarized in Table 161, show that 13% of households have at least one connected appliance or device.

Table 161: Connected Appliances & Equipment by Region (%)

Have connected appliance or other equipment?	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Yes	15.9	11.3	9.9	12.9
No	82.5	86.5	89.6	85.7
Don't know	1.5	2.2	0.4	1.4
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

Respondents who indicated they have a connected appliance or device in the home were provided with a list of the most common connected devices and asked to indicate which ones they have. Of those with connected equipment, somewhat less than six-in-ten (58%) have one or two devices that can connect wirelessly with their smart phone, tablet or computer, 27% had three to four devices, and the remaining 15% had five or more devices (Table 162).

Table 162: Number of Connected Appliances & Equipment by Region (%)

Number	KE	SO	KB	2022 FBC
Unweighted base [1]	*115*	*65*	*70*	*250*
1 – 2	48.4	72.6	64.6	58.0
3 – 4	32.9	20.3	19.7	26.9
5 – 6	14.1	4.5	11.2	11.0
More than 6	4.6	2.7	4.4	4.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: respondents with at least one connected appliance
Totals may not sum due to rounding

Table 163 summarizes the population-based penetration rates for each type of connected appliance and device, ordered by those most frequently mentioned. The top three wirelessly connected appliances or devices in FBC's residential customer homes include thermostats (6% of REUS respondents), security systems, smart speakers, smart plugs/electrical outlets, and lighting (4% for each). Penetration rates for connected appliances such as clothes washers, dishwashers, and fridges were typically less than 2%. Saturation rates are not presented as the REUS survey did not query quantities of connected appliances and devices.

**Table 163: Penetration Rates of Connected Appliances & Equipment by Region (%)
Multiple Responses Allowed**

Connected Appliance or Device	KE	SO	KB	2022 FBC
Unweighted base [1]	*697*	*612*	*624*	*1933*
Thermostats (for heating and/or cooling	8.0	5.4	4.0	6.1
Security system	6.6	3.8	1.8	4.4
Smart speakers (e.g. Google Home, Alexa)	6.6	2.5	3.2	4.4
Smart plugs/smart electrical outlets	5.2	2.1	3.2	3.7
Lighting	5.1	1.4	3.7	3.6
Other entertainment items (e.g. televisions,	4.4	1.6	2.6	3.1
Clothes washer	2.4	0.4	0.8	1.4
Stove/Oven	1.1	1.6	1.2	1.3
Clothes dryer	2.0	0.5	0.4	1.1
Fridge	0.8	0.6	0.6	0.7
Water heating equipment	0.5	0.6	1.1	0.7
Dishwasher	0.5	0.7	0.7	0.6
Other	2.6	0.6	1.4	1.7
Don't know	0.7	1.4	0.1	0.7

[1] Base: all REUS respondents with or without a connected appliance or device
Totals will not sum to 100% due to multiple responses

Respondents were also provided with the option to specify a connected appliance or device in their home that was not listed in the survey. A review of the verbatim responses revealed a broad list of home appliances and devices that can be controlled wirelessly (e.g., ceiling fans, air conditioners, window blinds, portable heaters and fans, flood detection devices, garage doors, heat pumps, sprinkler and other irrigation systems, vacuums, and in-floor heating).

Respondents indicating the presence of one or more connected appliances were asked whether they had a smart home hub/gateway system installed. This hub/gateway was described as follows:

> *A small standalone box that allows all smart products to "speak the same wireless language" so they can be monitored and controlled from one app. Not to be confused with a modem or wi-fi router.*

The results, summarized in Table 164, show 18% of respondents who have at least one connected appliance or device also have a smart hub (equivalent to 2% of all respondents to the FBC 2022 REUS). Penetration of smart hubs among those with a connected appliance is highest in KE and lowest in SO.

Table 164: Smart Home Hubs / Gateways by Region (%)

Have smart home hub or gateways?	KE	SO	KB	2022 FBC
Unweighted base [1]	*115*	*65*	*70*	*250*
Yes	22.5	11.1	17.5	18.5 [2]
No	68.8	77.5	74.0	72.1
Don't know	8.7	11.4	8.5	9.3
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: respondents with at least one connected appliance or device
[2] Equivalent to 2.4% of all respondents to FBC's 2022 REUS
Totals may not sum due to rounding

8.12 Miscellaneous Electrical Devices

Table 165 summarizes penetration and saturation rates for miscellaneous electric devices including chargers, cordless appliances, and personal electric rechargeable vehicles (bicycles, scooters, and mobility carts).

Table 165: Penetration and Saturation Rates – Miscellaneous Electrical Devices

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Power bars with an on-off switch				
Penetration (%)	83.1	85.0	83.2	83.7
Saturation	2.25	2.49	2.37	2.35
Smart power bars with automatic shut-off				
Penetration (%)	5.6	4.5	3.5	4.7
Saturation	0.10	0.09	0.11	0.10
Chargers for cell phones, smart phones, tablets, etc.				
Penetration (%)	92.7	93.2	95.0	93.5
Saturation	2.90	2.60	2.73	2.77
Cordless vacuums / robot vacuums				
Penetration (%)	39.4	43.4	29.6	37.8
Saturation	0.50	0.52	0.37	0.47
Portable power banks / batteries				
Penetration (%)	20.9	16.8	21.9	20.0
Saturation	0.38	0.35	0.40	0.38
Electric bicycles / scooters (2 wheels)				
Penetration (%)	11.7	12.0	12.5	12.0
Saturation	0.17	0.19	0.17	0.18
Personal mobility carts / power chairs (4 wheels)				
Penetration (%)	1.5	1.9	1.2	1.5
Saturation	0.02	0.02	0.01	0.02
Golf cart style vehicles				
Penetration (%)	2.2	1.5	0.6	1.5
Saturation	0.02	0.02	0.01	0.02
Hand-held cordless power tools				
Penetration (%)	48.0	58.9	63.7	55.6
Saturation	1.38	1.77	1.95	1.65
Uninterruptable power supply (UPS)				
Penetration (%)	6.9	8.3	8.4	7.7
Saturation	0.09	0.13	0.12	0.11
Electric garden implements				
Penetration (%)	27.9	39.4	38.3	34.1
Saturation	0.53	0.74	0.69	0.64

8.13 Garages, Workshops, Aquariums, Solariums, and Greenhouses

Table 166 summarizes penetration rates for garages, workshops (separate from the garage), aquariums, solariums and personal greenhouses. Penetration rates are differentiated by whether the end-use/space is heated or not. For example, slightly more than one-half (52%) of FBC residential customers have a garage, of which one-quarter of these garages (26%) are heated.

Table 166: Penetration Rates – Garages, Workshops, Solariums, and Greenhouses (%)

Penetration Rates	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Car garage				
Heated or unheated	49.7	58.0	49.5	52.0
Heated	12.2	15.5	12.6	13.3
% Heated	*24.6*	*26.7*	*25.5*	*25.5*
Workshop (separate from garage)				
Heated or unheated	11.3	18.3	26.5	17.6
Heated	5.0	7.0	12.2	7.6
% Heated	*43.9*	*38.5*	*46.0*	*43.2*
Aquariums				
Heated or unheated	2.9	3.1	2.1	2.7
Heated	1.6	1.5	1.4	1.5
% Heated	*56.7*	*48.5*	*66.4*	*56.1*
Solariums				
Heated or unheated	1.3	2.9	2.1	2.0
Heated	0.3	1.5	0.8	0.8
% Heated	*26.9*	*50.0*	*36.0*	*39.5*
Personal greenhouse				
Heated or unheated	2.2	4.6	10.3	5.2
Heated	0.5	0.9	1.0	0.8
% Heated	*22.5*	*20.6*	*9.4*	*14.6*

8.14 Elevators, Block Heaters, Pumps, & Miscellaneous

Penetration rates for elevators, automotive block heaters/interior car warmers, pumps, water coolers, wine cooler fridges, home security systems, jetted bathtubs, and other miscellaneous electrical end-uses are provided in Table 167. Saturation rates are not presented as the REUS survey did not ask about quantities of these end-uses.

Table 167: Penetration Rates – Elevators, Block Heaters, Coolers, Jetted Tubs, and Waterbeds (%)

Penetration Rates	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Electric elevator/lift [1]	5.4	3.3	1.0	3.6
Electric car block heater / interior car warmer (plugs into an outlet)	5.6	7.7	11.0	7.7
Electric water pump (well, sump, sewage, etc.)	5.7	9.6	18.3	10.4
Plug-in bottled water cooler	7.2	9.3	4.0	6.9
Home security system (hard-wired)	16.6	12.3	4.7	12.0
Electric towel warmer	2.3	0.9	1.2	1.6
Jetted bathtub	6.2	6.0	5.7	6.0
Exterior landscape fountain	6.8	7.5	4.9	6.5
Electric respiratory medical equipment	4.8	6.2	4.5	5.1

[1] Respondents living in apartments or other multi-family dwellings were asked to exclude elevators or other items accessible by all residents.

9 Plug-in Electric Passenger Vehicles

FortisBC's 2022 REUS asked a series of questions about the incidence, characteristics and charging behaviours of plug-in electric passenger vehicles. These vehicles were defined to include cars, trucks, mini-vans and sport utility vehicles that either run exclusively on batteries that are recharged via an electrical outlet or that run mostly on batteries that are recharged either by the small onboard gasoline engine while driving or via an electrical outlet when the car is parked (hybrid models).

The reader is cautioned in the interpretation of data in this section as the number of respondents in the 2022 REUS that own or lease an electric vehicle matching the above descriptions is relatively small (n=59). Responses to questions on electric vehicles and their usage will have large variances, meaning small differences in respondent answers or the distribution of responses can exert an outsized influence on question outcomes. With the growing adoption of electric vehicles, future residential end-use studies are expected to have more responses and, as a result, greater precision and accuracy on electric vehicle usage and charging behaviours.

9.1 Penetration and Saturation Rates

Penetration and saturation rates for the two types of electric plug-in passenger vehicles are provided in Table 168. Penetration of battery electric models is 2%, up from 0.6% in 2017. The penetration of plug-in-electric hybrids is lower at 0.7%, up from 0.3% in 2017. All but one respondent owned or leased a single plug-in electric vehicle (either type). The remaining respondent had two electric vehicles. As the number of respondents with an electric vehicle is quite low, caution is advised in the interpretation and extrapolation of the data in this section. Regional results are not provided due to the small number of REUS respondents who have one or more electric vehicles.

Table 168: Plug-in Electric Passenger Vehicles – Penetration and Saturation Rates (%)

Own or lease	2022 FBC	2017 FBC
Unweighted base	*1933*	*2628*
Battery electric		
Penetration (%)	2.0	0.6
Saturation	0.020	n/a
Plug-in electric hybrid		
Penetration (%)	0.7	0.3
Saturation	0.008	n/a

9.2 Vehicle Characteristics & Usage

Electric passenger vehicles in FBC's service area are, on average, 2.9 years old (Table 169). The oldest EV is 10 years old.

Table 169: Age of Electric Passenger Vehicles (Years)

	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
Mean	2.9	2.9	2.9
Median	2.0	2.5	2.0
Standard deviation	2.2	2.3	2.2

The majority (78%) of respondents with an electric vehicle acquired their first electric vehicle in the last five years. Of note, 43% acquired their first electric vehicle in the last two years (Table 170). A review of the data by year (not shown) shows a dip in acquisitions during 2020.

Table 170: Year Purchased First Electric Passenger Vehicle (% Distribution)

When did you purchase your first EV?	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
Within the last 2 years	47.8	28.6	42.6
3 to 5 years ago	31.7	47.1	35.9
6 to 10 years ago	4.6	0.0	3.3
More than 10 years ago	6.7	0.0	4.9
Total	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

On average, respondents with an electric vehicle drive 12,800 kilometres per year, with 44% driving less than 10,000 kilometres per year (Table 171).

Table 171: Annual Kilometres Travelled using Electric Passenger Vehicles Average per Year

Kilometres per year	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
Distribution (%)			
<10,000	47.9	35.3	44.3
10,000 to 19,999	24.8	39.1	28.9
20,000 to 39,999	22.7	25.6	23.5
40,000 or more	4.5	0.0	3.2
Total	**100.0**	**100.0**	**100.0**
Annual Statistics (km/yr)			
Mean	12,834	12,717	12,800
Median	14,000	12,000	13,000
Standard deviation	10,856	6,265	9,643

Totals may not sum due to rounding.

9.3 Vehicle Charging

Three-quarters (73%) of plug-in electric vehicle users charge their vehicle at home, one-quarter (24%) charge them both at home and away from home, and the remaining 3% charge their vehicle exclusively at a location or locations away from home (Table 172).

Table 172: Plug-in Electric Passenger Vehicles – Locations Used for Charging (%)

	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
At home	66.1	90.0	72.7
At locations away from home	4.7	--	3.4
Both at home and locations away from homes	29.2	10.0	23.9
Total	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Statistically-equal proportions of respondents with an electric vehicle have either a Level 1 (120V) or Level 2 (240V) charger at their residence (Table 173). None had a Level 3 (480V) fast charger. Nine percent (9%) were unsure about what level of charger they had at home.

Table 173: Charging Voltage Levels at Home (%)

Charging Level	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
Level 1 (120V)	41.9	78.4	41.7
Level 2 (240V)	48.0	21.6	49.3
Level 3 (480V)	--	--	--
Don't know	10.1	--	9.0
Total	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.

Thirteen percent (13%) indicated they took advantage of the FortisBC rebate to install their home charger (Table 174).

Table 174: Received FortisBC Rebate to Install Electric Vehicle Home Charger (%)

Received FortisBC rebate?	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
Yes	15.3	5.7	12.6
No	73.0	87.1	76.9
Don't know	11.7	7.1	10.5
Total	**100.0**	**100.0**	**100.0**

Table 175 provides information on charging behaviours for electric vehicles when at home and when away from home, differentiated by weekdays versus weekends. The REUS questionnaire queried home charging differentiated by period of the day. Charging at locations other than the home was queried only for a typical weekday or weekend day (i.e., no time of day information). Charging electric vehicles at home typically occurs in the evening and/or overnight (i.e., between the hours of 9 p.m. and 9 a.m.) regardless of whether it is a weekday or the weekend.

Table 175: Plug-in Electric Passenger Vehicles – Charging Behaviours (Average Hours per Day)

	Electric	Electric Hybrid	2022 FBC
Unweighted base	*43*	*16*	*59*
Charging at Home			
Weekday			
9 a.m. to 4 p.m.	0.5	0.2	0.4
4 p.m. to 9 p.m.	1.2	1.4	1.2
9 p.m. to 9 a.m.	2.7	5.2	3.4
Weekend			
9 a.m. to 4 p.m.	0.5	0.2	0.4
4 p.m. to 9 p.m.	0.9	1.5	1.1
9 p.m. to 9 a.m.	2.4	2.7	2.5
Charging away from home			
Typical weekday	0.9	0.8	0.9
Typical weekend day	0.5	0.8	0.6

* Insufficient sample for reporting purposes

10 LIGHTING

This section provides information on residential lighting including light bulb types, controls, seasonal lighting, and recent lighting purchases.

10.1 Penetration and Saturation

The 2022 REUS asked respondents to count the number of lights in their home for each of the following types:

- Incandescent light bulbs
- Fluorescent tubes
- Compact fluorescent lamps (CFLs)
- Halogen bulbs and tubes
- LED bulbs
- Other bulb types

Data on the number of lights by type, compared to similar data from previous residential end-use surveys, allows an understanding of trends in the penetration of energy-efficient versus standard lighting. Counts by type of lighting, when combined with wattage assumptions and data on usage patterns, also allows modeling of lighting loads and an understanding of how these loads can vary by dwelling type, vintage, and size.

In previous REUS surveys conducted by FortisBC, respondents were asked to differentiate the counts by area of the home (e.g., bedrooms, bathrooms, kitchen, dining room, etc.). This requirement was removed from the 2022 REUS.

10.1.1 Underreporting of Lighting Counts

Analysis of data on the number of lights by type from the 2022 REUS revealed counts per-dwelling significantly below those recorded in previous residential end-use surveys conducted by FBC. For example, residential dwellings included in the 2012 and 2017 residential end-use surveys had an average of 41.9 lights. In contrast, the average per-dwelling count from FBC's 2022 REUS is 28.7 lights, a decline of 31% from the previous two surveys. Significantly lower lighting counts were observed by region, dwelling type, and dwelling size – variables known to influence the total number of lights per dwelling. Based on these findings, it appears there was a systemic underreporting of all lighting types, including both energy-efficient and standard lighting, in the 2022 REUS. Despite an extensive review of the lighting data and survey programming, an explanation for the underreporting was not found.[24]

Underreporting of lighting counts by type prevents reporting of penetration rates by lighting type for 2022 (i.e., the percentage of dwellings with at least one LED, at least one CFL, etc.). However, if the degree of underreporting for each lighting type is proportional to their share of total household lighting, saturation rates for the six lighting types can be approximated by applying the distribution of lighting by lighting type from the 2022 survey to the estimate of total household lighting from the 2017 REUS.[25]

To explore whether the proportional error distribution assumption is valid, the distributions of lighting by type from FBC's last two residential end-use surveys were compared with the 2022 data. As shown in Table 176, the data confirm several known trends in residential lighting, namely declining shares of incandescent lights and CFLs, and a proportionate increase in the share of lighting represented by LEDs. For example, from 2012 to 2022, the share of household lighting represented by incandescent light bulbs declined from 44% to 19%, CFLs declined from 29% to 10%, and LEDs increased from 2% to 50%. The increased penetration of LED lighting is consistent with improvements in the retail availability, accessibility and affordability of LEDs. While these results are consistent with known lighting trends, they do not preclude the possibility that the proportionate distribution of the underreporting error assumption is valid. As a result, the findings for 2022 should be treated as directional only.

Table 176: Distribution of Lighting by Lighting Type by Survey Year (%)

Population-Based Rates	2022 FBC	2017 FBC	2012 FBC
Unweighted base [1]	*1933*	*2628*	*1484*
Incandescent bulbs	19.2	36.6	43.8
Fluorescent tubes	7.0	8.2	10.0
Compact fluorescent lamps	9.7	19.5	29.2
Halogen bulbs and tubes	7.6	8.0	11.3
LED bulbs	49.7	21.4	2.1
Other bulb types	6.7	6.1	3.5
Total	**100.0**	**100.0**	**100.0**

[1] Excludes respondents who left this section of the 2012 and 2017 surveys blank.

An proxy estimate of lighting saturation by light type at the utility level for 2022 was developed by taking the distribution of lighting by type at the utility level from the 2022 REUS (Table 176) and applying it to the average lighting count per dwelling (41.9 lights) from the 2017 REUS survey. The results, summarized in

[24] One possible reason might be because respondents were no longer required to provide counts by individual area of the home. Another is that respondents may have failed to consider that some fixtures can have more than one light bulb. The latter reason is less likely as the 2022 questionnaire, like previous REUS surveys conducted by FBC, reminded respondents to consider this possibility and to count all lights in all fixtures. Underreporting was not a problem in previous REUS surveys.

[25] This assumption implies the degree of underreporting is proportional to lighting type's share of total household lighting. For example, if LEDs accounted for 40% of the all lights reported, they will also account for 40% of all lights not reported (underreported). Similarly, if incandescent lights represent 10% of all lights reported in 2022, it is assumed they would also account for 10% of all underreported lights.

Table 177, show the average residential dwelling in FBC's service area to have 20.8 LEDs, up from 0.9 LEDs in 2012. In comparison, the average dwelling is estimated to have 8.1 incandescent bulbs compared to 18.4 ten years prior.[26] Again, the reader is reminded that these are proxy estimates for lighting saturation and should be used with caution.

Table 177: Population-Based Saturation Rates by Lighting Type Per-Dwelling Averages

Population-Based Rates	2022 FBC*	2017 FBC	2012 FBC	2009 FBC
Unweighted base[1]	*1933*	*2628*	*1484*	*2026*
Incandescent bulbs	8.1	15.3	18.4	17.7
Fluorescent tubes	3.0	3.4	4.2	5.4
Compact fluorescent lamps	4.1	8.2	12.2	11.3
Halogen bulbs and tubes	3.2	3.3	4.8	8.4
LED bulbs	20.8	9.0	0.9	n/a [2]
Other bulb types	2.8	2.6	1.5	7.1 [2]
All light bulb types	**41.9**	**41.9**	**41.9**	**n/a**

* Proxy estimate calculated by applying the 2022 distribution of lighting by type to the long-term average of 41.9 light bulbs per dwelling.
[1] Excludes respondents who left this section of the 2012 and 2017 surveys blank.
[2] Presence of LEDs not specifically queried. Assumed to be included in "Other bulb types"

Applying a similar methodology to the distributions of lighting types by dwelling type, saturation rates by lighting type for the five main dwelling types were estimated. Distributions of the lighting types by dwelling type using 2022 data are provided in Table 178.

Dwelling types with the highest share of incandescent lights include townhouses and apartments (26% of all lights). Apartments and mobile dwellings are also more likely to have proportionately more CFLs than the other dwelling types.

Table 178: Distribution of Lighting by Lighting Type by Dwelling Type (%)

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base [1]	*1,322*	*81*	*123*	*233*	*174*
Incandescent bulbs	17.1	19.1	26.2	25.9	18.7
Fluorescent tubes	7.6	4.6	5.7	5.6	7.6
Compact fluorescent lamps	9.4	7.3	7.4	11.8	11.5
Halogen bulbs and tubes	7.8	7.3	5.6	8.4	4.3
LED bulbs	50.9	55.6	48.2	43.7	51.0
Other bulb types	7.2	6.8	6.8	4.6	7.0
Total	**100.0**	**100.7**	**100.0**	**100.0**	**100.0**

[26] It is noted that current fashion trends in residential light fixtures (e.g., open wire frame or farmhouse style fixtures) appear to encourage the use of decorative incandescent light bulbs, possibly countering some of the gains achieved to date in encouraging households to switch to energy-efficient lighting.

Population-based saturation rates for each of the five main dwelling types based on the above distributions and 2017 total light counts by dwelling type are provided in Table 179. The reader is cautioned that these are proxy estimates for 2022 and should be used with caution.

Table 179: Population-Based Saturation Rates by Lighting Type – by Dwelling Type (%)

	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
Incandescent bulbs	8.5	8.9	9.4	6.5	4.7
Fluorescent tubes	3.8	2.2	2.1	1.4	1.9
Compact fluorescent lamps	4.7	3.4	2.7	3.0	2.9
Halogen bulbs and tubes	3.9	3.4	2.0	2.1	1.1
LED bulbs	25.4	26.0	17.3	11.0	12.8
Other bulb types	3.6	3.2	2.4	1.2	1.7
Total	**49.9**	**47.1**	**35.9**	**25.1**	**25.0**

10.2 Lights Purchased Last 12 Months

Table 180 summarizes the number of lights, by type, purchased by survey respondents in the 12 months prior to the 2022 survey. The proportions of respondents purchasing at least one of each light type and the average quantity purchased per purchaser are provided. Previous REUS surveys asked only about purchases of LEDs and CFLs. As a result, comparable data from past surveys for lighting types other than LEDs and CFLs are not available.

Table 180: Lighting Purchases - Last 12 Months
By Region

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1484*	*2026*
Incandescent Bulbs							
Purchased last 12 months (%)	15.9	14.5	14.3	15.0	n/a	n/a	n/a
Quantity purchased (average per purchaser)	5.5	6.3	5.9	5.8	n/a	n/a	n/a
Fluorescent Tubs							
Purchased last 12 months (%)	5.0	7.4	7.8	6.5	n/a	n/a	n/a
Quantity purchased (average per purchaser)	2.4	3.7	2.9	3.0	n/a	n/a	n/a
Compact Fluorescent Lamps							
Purchased last 12 months (%)	7.7	7.4	7.3	7.5	43.4	28.6	62.0
Quantity purchased (average per purchaser)	5.6	4.1	5.8	5.2	6.3	6.2	9.2
LED Bulbs							
Purchased last 12 months (%)	33.8	40.2	38.0	36.8	52.2	5.2	n/a
Quantity purchased (average per purchaser)	9.8	10.0	9.1	9.7	10.0	5.4	n/a
Halogen Bulbs							
Purchased last 12 months (%)	7.2	11.6	6.4	8.2	n/a	n/a	n/a
Quantity purchased (average per purchaser)	4.2	4.3	4.8	4.4	n/a	n/a	n/a
Other Bulb Types							
Purchased last 12 months (%)	8.3	6.9	5.6	7.1	n/a	n/a	n/a
Quantity purchased (average per purchaser)	4.0	4.5	6.1	4.6	n/a	n/a	n/a

n/a – data unavailable

As expected, purchases of CFLs have dramatically declined since the 2017 REUS as the availability and affordability of LEDs have improved. Somewhat less than four-in-ten (37%) of respondents purchased an LED in the last 12 months compared to just 8% who purchased a CFL. Purchasers of LEDs acquired 10 LEDs each, on average, in the last 12 months, compared to purchasers of CFLs who acquired 5 CFLs each, on average, during the same period.

10.3 Lighting Controls

Lighting controls queried in the 2022 REUS included dimmers, timers, and occupancy sensors on indoor lights; and timers, motion sensors, and daylight sensors on outside lights.

10.3.1 Controls for Indoor Lights

Table 181 summarizes the penetration and saturation of *indoor* lights (any type) controlled by dimmers, timers, or motion sensors by region. Somewhat less than six-in-ten (56%) FBC customers reported having one or more indoor lights controlled by dimmers. In contrast, only 9% reported having one or more indoor lights controlled by a timer and 12% reported having one or more lights controlled by a motion sensor. Two types of saturation numbers are provided: population and user-based. User-based saturation rates represent the average number of lights controlled by households that have at least one of the particular control in question.

Table 181: Indoor Lighting Controls by Region

Indoor Lighting Controls	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Dimmers				
Penetration (%)	54.7	59.4	54.7	56.0
Saturation (Pop)	2.34	2.85	2.00	2.39
Saturation (User)	4.27	4.79	3.67	4.26
Timers				
Penetration (%)	10.2	9.2	5.2	8.5
Saturation (Pop)	0.26	0.25	0.15	0.22
Saturation (User)	2.54	2.71	2.83	2.64
Motion sensors				
Penetration (%)	12.2	11.0	12.1	11.8
Saturation (Pop)	0.26	0.19	0.28	0.25
Saturation (User)	2.09	1.75	2.34	2.07

10.3.2 Controls for Outdoor Lights

Penetration and saturation rates for *outdoor* lights controlled by timers, motion sensors or daylight sensors by region type are summarized in Table 182. At the utility level, 9% of FBC residential customers have one or more outside lights on a timer, 29% have lights controlled by a motion sensor, and 9% have outdoor lights controlled by a daylight sensor.

Table 182: Outdoor Lighting Controls by Region

Outdoor Lighting Controls	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Timers				
Penetration (%)	9.7	9.8	6.9	9.0
Saturation (Pop)	0.35	0.37	0.19	0.31
Saturation (User)	3.56	3.75	2.75	3.45
Motion sensors				
Penetration (%)	20.7	33.1	37.5	29.1
Saturation (Pop)	0.43	0.66	0.77	0.59
Saturation (User)	2.07	2.00	2.04	2.04
Daylight sensors				
Penetration (%)	8.5	10.0	8.4	8.9
Saturation (Pop)	0.30	0.23	0.19	0.25
Saturation (User)	3.51	2.27	2.21	2.76

10.4 Holiday Lighting

The 2022 REUS queried respondents about the number of strings of incandescent versus LED holiday lights they used during the 2021 holiday season. The results, summarized in Table 183, show that 56% of respondents used incandescent and/or LED holiday lighting in 2021 and, on average, they used 5.9 strings. Thirteen percent (13%) of those using holiday lights in 2021 used a mix of LED and incandescent strings (data not shown). The remainder used either incandescent or LED strings exclusively.

Table 183: Use of Holiday Lighting during the 2021 Holiday Season

Holiday lights	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Incandescent holiday lights				
Used in 2021 (% Yes)	15.5	16.8	15.6	15.9
Average # used	4.41	3.38	3.35	3.78
LED holiday lights				
Used in 2021 (% Yes)	51.0	56.6	55.3	53.9
Average # used	5.81	5.42	5.57	5.61
LED and/or incandescent holiday lights				
Used in 2021 (% Yes)	52.7	59.2	58.4	56.2
Average # used	6.12	5.69	5.80	5.89

11 POOLS, HOT TUBS & SAUNAS

This section presents penetration rates for swimming pools, hot tubs/jacuzzis, and saunas, and the fuels used for heating these amenities. All questions were directed at respondents who had exclusive access to these amenities (i.e., excludes those amenities shared with other residences in a townhouse or condominium complex).

11.1 Penetration Rates

Penetration rates of exclusive-use pools, hot tubs and saunas are provided in Table 184. Saturation figures are not presented as homes with more than one of any of these end-uses would be very uncommon.

Seven percent (7%) of FBC customers, on average, reported having a swimming pool for their exclusive use. The majority of these are outdoor pools. Twelve percent (12%) of respondents reported having a hot tub for their exclusive use. Two percent (2%) of respondents indicated their dwelling has a sauna.

Table 184: Penetration of Pools, Hot Tubs, and Saunas (%)

Exclusive Use Only	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2049*
Swimming pool	9.3	6.0	4.0	6.9	5.2	5.4	7.0 [1]
Indoor	1.0	0.3	0.2	0.6	0.2	n/a	n/a
Outdoor	8.4	5.6	3.8	6.3	5.0	n/a	n/a
Hot tub / Jacuzzi	12.5	10.8	12.2	12.0	10.2	14.8	13.0
Sauna	2.9	1.2	2.3	2.2	2.0	3.3	3.0

[1] No distinction was made between exclusive use only pools and those shared with other households.
Totals may not sum due to rounding
n/a – data not available

Data from the 2009 REUS are presented, but that survey did not distinguish between exclusive-use facilities versus facilities shared with other households.

11.2 Heating Fuels

Respondents were asked to indicate the fuel(s) used to heat their exclusive-use pools, hot tubs and saunas.

11.2.1 Pools

Table 185 provides detail on fuels used for pools heated by electricity, natural gas, or solar energy. Natural gas is the main fuel used to heat four-in-ten (40%) exclusive-use pools. The next most common heating fuels are solar energy and electricity (10% for each). Somewhat less than one-quarter (22%) of pools are not heated. Regional comparisons are not presented due to small sample sizes. The table does not differentiate between indoor and outdoor pools because of the very small number of respondents with indoor pools.

Table 185: Main Fuel used to Heat Swimming Pool (%)
Exclusive-use pools only

	2022 FBC	2017 FBC	2012 FBC	2009 FBC [1]
Unweighted base	*127*	*140*	*100*	*124*
Natural gas	40.1	30.0	25.7	27.0
Solar	10.4	19.9	25.9	n/a
Electricity	9.7	7.1	12.8	6.0
Other	0.8	3.6	1.4	n/a
Not heated	22.0	26.1	34.2	60.0
Don't know	16.5	13.3	n/a	n/a
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Outdoor pools only
Totals may not sum due to rounding
n/a – data not available

One quarter (27%) of respondents using either natural gas, electricity or some other fuel to heat their *outdoor* pool indicated they use solar energy to supplement the pool's primary fuel.

11.2.2 Hot Tubs / Jacuzzis

The vast majority (89%) of hot tubs / jacuzzis are heated using electricity (Table 186).

Table 186: Hot Tub / Jacuzzi Fuels (%)

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*95*	*77*	*85*	*257*	*297*	*242*	*213*
Electricity	78.9	94.0	98.8	88.6	90.5	97.6	92.0
Natural gas	3.7	1.2	--	1.9	4.2	2.4	4.0
Other	1.0	1.2	1.2	1.1	0.6	--	3% [1]
Don't know	16.4	3.7	--	8.3	4.7	n/a	n/a
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Includes Don't Know responses
Totals may not sum due to rounding

11.2.3 Saunas

Predominately, saunas are heated using electricity (75% of all respondents with exclusive access to a sauna) (Table 187). Thirteen percent (13%) of respondents were unsure what fuel their sauna uses. Regional results are not presented due to small sample sizes.

Table 187: Sauna Fuels (%)

	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*46*	*57*	*58*	*54*
Electricity	74.8	80.2	94.4	93.0
Natural gas	4.2	--	1.6	2.0
Other	7.6	5.1	4.0	5.0 [1]
Don't know	13.4	14.7	n/a	n/a
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Includes "Don't Know" responses
Totals may not sum due to rounding

12 Energy Use Behaviours

FBC's 2022 REUS queried respondents about how often they undertake energy-conserving behaviours around the home including those related to space heating and hot water use (e.g., bathing, laundry, dishwashing, etc.).

12.1 Methodology

Respondents were asked to indicate how often they did each behaviour using a four-point scale (always, usually, occasionally, never). If unsure, respondents could answer "don't know". They were also allowed to indicate the behaviour was not applicable to them. The latter is required as one or more behaviours may not apply to some households (e.g., use of storm windows is only relevant to homes with older-style windows).

Energy use behaviours were analyzed from two perspectives. The first perspective was the proportion of households that regularly undertake the behaviour (i.e., *always* or *usually*). These households are the least likely to deliver incremental energy savings by increasing the frequency in which they undertake these behaviours. The second perspective was the proportion of households that *occasionally* or *never* undertake the energy-saving behaviour, or are unsure how often they undertake the behaviour. This perspective helps define the market potential for behavioural change. Market potential excludes respondents who indicated the behaviour was not applicable to them (e.g., storm windows). Some respondents, however, may have selected "never" rather than the more appropriate "not applicable" for some behaviours, so the reader is cautioned that the market potential may be somewhat overstated for some behaviours. This is more likely to be the case where the behaviour is linked to a technology that has less than 100% penetration.[27]

Due to constraints on the length of the 2022 REUS questionnaire, the survey did not explore barriers preventing households from increasing the frequency of their energy-conserving behaviours. Estimating or otherwise quantifying the energy savings associated with any specific behaviour or the amount of the remaining potential that could be realistically captured through utility programming or other means is outside the scope of the 2022 REUS.

12.2 Space Heating Behaviours

Respondents were asked to indicate the temperature they usually keep their residence at during the winter (heating) season for three common situations:

- When someone is at home
- When no one is at home
- During the night

[27] As an example, respondents who do not have an automatic dishwasher may choose "never" rather than "not applicable" for how often they undertake conserving behaviours associated with the use of automatic dishwashers. In these cases, their answer would be included with other households who suggest there is room for improvement.

The results, including daytime and night time set-backs, are summarized in Table 188. On average, respondents keep their dwelling internal temperature at 21 degrees Celsius when someone is at home. When no one is at home during the day, thermostats are turned down by an average of 3.0 degrees. During the night, respondents turned down their thermostats by an average of 2.7 degrees. Differences in thermostat set-backs based on main space heating (SH) fuel are significant at the 95% confidence level.

Table 188: Winter (Heating Season) Room Temperatures (Degrees Celsius)

					Main SH Fuel	
	KE	SO	KB	2022 FBC	Electric	Gas
Unweighted base	*697*	*612*	*624*	*1933*	*542*	*1186*
When someone is at home	21.2	21.1	20.6	21.0	20.8	21.2
When no one is at home	18.4	17.8	17.5	18.0	17.5	18.4
During the night	18.7	18.3	17.7	18.3	18.4	18.4
Daytime set-back[1]	2.8	3.2	3.1	3.0	3.2	2.8
Night time set-back[2]	2.5	2.8	2.9	2.7	2.4	2.8

[1]Difference in daytime temperature when someone is at home versus no one is at home – respondent average
[2]Difference between night-time temperature and daytime temperature when someone is at home – respondent average

Somewhat less than three-quarters (73%) of FBC households have the ability to reduce the temperature in unused rooms by turning down individual room thermostats or by closing registers or vents (Table 189). There are no statistically significant differences in the proportion of FBC homes able to control the temperature in individual rooms based on the main space heating fuel.

Table 189: Ability to Reduce Temperature in Unused Rooms (%)

Ability to reduce temperature in unused rooms?					Main SH Fuel	
	KE	SO	KB	2022 FBC	Electric	Gas
Unweighted base	*697*	*612*	*624*	*1933*	*542*	*1186*
Yes	72.0	71.0	76.4	73.0	74.2	72.3
No	23.7	23.4	20.7	22.8	19.0	25.3
Don't know	4.3	5.6	2.9	4.3	6.8	2.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

Table 190 summarizes the percentage of REUS respondents who indicated they *always* or *usually* undertake behaviours to reduce the energy used to heat their homes. The frequency of leaving windows open during the winter, an action sometimes used to improve ventilation, was also queried. As some behaviours are not applicable for some respondents (e.g., the ability to install storm windows), these behaviours will have lower percentages of respondents indicating they always or usually undertake these behaviours.

Behaviours that respondents most frequently indicated they always or usually undertake include keeping windows closed during winter (86% always or usually), turning down the heat at night (77%), and turning down the heat when no one is home (72%).

Table 190: Space Heating Behaviours
Percent who always or usually undertake the behaviour

					Main SH Fuel	
Behaviours Impacting Space Heating	**KE**	**SO**	**KB**	**2022 FBC**	**Electric**	**Gas**
Unweighted base	*697*	*612*	*624*	*1933*	*542*	*1186*
Keep windows closed during winter	82.9	87.2	87.7	85.5	86.7	84.7
Turn down heat - at night	74.9	78.2	79.3	77.1	70.7	83.6
Turn down heat - no one at home	69.9	74.5	71.2	71.6	71.3	74.5
Close window coverings	69.2	71.1	69.8	69.9	71.6	69.8
Close vents / turn down thermostats in unused rooms	59.7	55.3	62.4	59.2	65.4	56.5
Draft proof at least once a year	28.0	32.8	41.2	33.1	32.2	33.6
Install plastic window coverings during winter months	7.4	7.5	9.2	7.9	7.7	6.9
Install storm windows (single pane windows only)	3.8	2.3	4.7	3.6	3.0	3.8

Compared to homes whose main space heating fuel is natural gas, electrically heated households are less likely to turn down the heat at night (71% for electrically heated homes versus 84% for gas heated homes) and more likely to close vents / turn down thermostats in unused rooms (65% vs. 57%). All other differences between electric versus gas heated homes are not statistically significant.

Table 191 summarizes the remaining market potential for the eight behaviours affecting space heating. Behaviours with the largest market potential include draft proofing (56% of respondents could do more), installing plastic window coverings (41%), and closing window coverings (curtains, blinds, etc.) to keep the heat in (27%). Homes whose main space heating fuel is electricity have greater remaining potential than their gas counterparts for turning down the heat at night. Conversely, respondents living in gas heated homes have more potential than their electrically heated counterparts to draft proof at least once a year and to close vents / turn down thermostats in unused rooms.

Table 191: Space Heating Behaviours – Remaining Potential
Percent who occasionally, never or are unsure they undertake the behaviour

					Main SH Fuel	
Behaviours Impacting Space Heating	**KE**	**SO**	**KB**	**2022 FBC**	**Electric**	**Gas**
Unweighted base	*697*	*612*	*624*	*1933*	*542*	*1186*
Draft proof at least once a year	58.8	54.2	52.9	55.8	52.2	58.3
Install plastic window coverings during winter months	44.2	39.7	38.3	41.2	41.9	41.0
Close window coverings	28.0	25.2	25.9	26.6	25.4	27.6
Close vents / turn down thermostats in unused rooms	26.9	27.0	24.8	26.3	18.8	31.7
Install storm windows (single pane windows only)	22.4	21.9	17.8	21.0	22.3	19.8
Turn down heat - no one at home	22.7	18.3	20.0	20.6	22.5	19.8
Turn down heat - at night	21.6	16.3	15.3	18.3	25.7	14.2
Keep windows closed during winter [1]	16.2	12.1	11.6	13.7	12.1	14.8

[1] Respondents who always or usually leave one or more windows open during winter

12.3 Air Conditioning \ Cooling Behaviours

Respondents with air conditioning were asked to indicate the temperature they usually keep their residence in the summer (cooling) season for three common situations:

- When someone is at home
- When no one is at home
- During the night

Average temperatures for each situation are summarized in Table 192. Average temperatures are higher when no one is at home and lower at night; behaviours consistent with air conditioning use. Similar findings are observed in the three regions.

Table 192: Summer (Cooling Season) Room Temperatures (Degrees Celsius)

	KE	SO	KB	2022 FBC
Unweighted base [1]	*697*	*612*	*624*	*1933*
When someone is at home	22.6	23.0	22.3	22.6
When no one is at home	23.3	23.5	23.1	23.3
During the night	22.0	22.3	21.7	22.0
Daytime change[2]	0.4	0.3	0.4	0.4
Night time change[3]	-0.4	-0.5	-0.3	-0.4

[1] Households with air conditioning
[2] Calculated as the difference in daytime temperature when someone is at home and when no one is at home – respondent average
[3] Calculated as the difference in daytime temperature when someone is at home and night time temperature – respondent average

Table 193 summarizes the proportion of households with air conditioning that always or usually undertake space cooling behaviours. Overall, 88% of FBC households with air conditioning indicated they always or usually use window coverings to reduce solar gain and 83% only turn on their air conditioning when it is very hot and natural ventilation is insufficient. Three-quarters (74%) always or usually clean their unit's filters and coils at least once a year. Roughly three-in-ten (29%) always or usually set their thermostat to 26 degrees Celsius or higher during the summer months, and two-thirds (63%) use either their smart/programmable thermostat or manually turn off their air conditioning at night.

Table 193: Air Conditioning Behaviours
Percent who always or usually undertake the behaviours

Behaviours Impacting Space Cooling	KE	SO	KB	2022 FBC
Unweighted base [1]	*620*	*514*	*382*	*1516*
Close window coverings during hot weather	87.0	89.2	89.9	88.4
Turn on AC only when very hot	82.4	81.7	85.9	82.9
Clean AC filter and coils at least once per season	71.6	77.5	73.7	73.8
Only cool occupied rooms rather than whole home	67.4	61.6	71.1	66.5
Use smart / programmable thermostat or manually turn off AC at night	64.8	58.4	66.6	63.1
Set thermostat at 26°C or higher during summer	27.8	32.3	24.2	28.5

[1] Households with air conditioning

Table 194 summarizes the remaining potential for the six air conditioning behaviours. The top three behaviours with the most remaining potential include setting the thermostat to 26ºC or higher during the summer (72% of respondents with air conditioning could do more), using either a smart/programmable thermostat or manually turning off their air conditioning at night (37%), and only cooling occupied rooms rather than the whole home (34%).

Table 194: Air Conditioning Behaviours – Remaining Potential
Percent who occasionally, never or are unsure they undertake the behaviour

Behaviours Impacting Space Cooling	KE	SO	KB	2022 FBC
Unweighted base [1]	*620*	*514*	*382*	*1516*
Set thermostat at 26ºC or higher during summer	72.2	67.7	75.8	71.5
Use smart / programmable thermostat or manually turn off AC at night	35.2	41.6	33.4	36.9
Only cool occupied rooms rather than whole home	32.6	38.4	28.9	33.5
Clean AC filter and coils at least once per season	28.4	22.5	26.3	26.2
Turn on AC only when very hot	17.6	18.3	14.1	17.1
Close window coverings during hot weather	13.0	10.8	10.1	11.6

[1] Households with air conditioning

12.4 Lighting Behaviours

Table 195 summarizes the percentage of respondents who indicated they always or usually practice energy-saving behaviours associated with interior and exterior lighting. The results show that 97% of FBC residential customers usually or always use the minimum number of lights and/or turn off lights when no one is in the room and 78% leave outside lights turned off during the night (occasionally, never, or are unsure they leave their outdoor lights on at night). Lastly, three-in-ten (30%) who use timers, check their timers to ensure they are set to daylight savings time.

Table 195: Lighting Behaviours
Percent who always or usually undertake the behaviour

Behaviours Impacting Lighting	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Use minimum number of lights	96.3	97.9	95.6	96.6
Turn off lights when no one is in the room	97.6	96.1	95.2	96.5
Leave outdoor lights on at night [1]	72.0	81.0	82.4	77.5
Check timers for daylight savings time	30.6	31.3	26.1	29.5

[1] Occasionally or never leave lights on at night

The remaining potential for saving energy via the four lighting behaviours is presented in Table 196. As expected, turning off outdoor lighting at night has the largest potential (78% usually or always leave an outside light on at night). As this behaviour is often driven by concerns over security, some of these households may be able to convert to motion-controlled security lighting. Seventeen percent (17%) of households are also good candidates for a reminder to adjust the timers on their lights to reflect daylight savings. Behaviours with the least potential include using the minimum number of lights and turning off lights in empty rooms (3% for each).

Table 196: Lighting Behaviours – Remaining Potential
Percent who occasionally, never or are unsure they undertake the behaviour

Behaviours Impacting Lighting	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Leave outdoor lights on at night [1]	72.0	81.0	82.4	77.5
Check timers for daylight savings time	17.1	14.5	18.7	16.8
Use minimum number of lights	3.2	1.9	4.3	3.2
Turn off lights with room is empty	2.2	3.9	4.8	3.4

[1] Always or usually undertake the behaviour

12.5 Food Storage Behaviours

Table 197 summarizes the percentages of respondents that always or usually undertake energy-conserving behaviours associated with food storage (refrigerators and freezers). These behaviours include:

- cleaning refrigerator coils at least once a year
- checking the temperature of the refrigerator to ensure food is not too cold or too warm
- checking the temperature of the freezer (if present) to ensure food remains frozen but the freezer is not too cold

Respondents were most likely to check the temperature of their refrigerator (64% usually or always), check the temperature of their freezer (59%), and clean their refrigerator coils at least once a year (38%).

Table 197: Food Storage Behaviours
Percent who always or usually undertake the behaviour

Behaviours Impacting Food Storage	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Check refrigerator temperature	61.7	63.7	65.8	63.5
Check freezer temperature	60.0	61.2	53.9	58.6
Clean refrigerator coils annually	31.0	42.1	43.5	37.8

The market potential for each of the three food storage behaviours is summarized in Table 198. As expected, the greatest market potential for saving energy from food storage includes cleaning the refrigerator's coils, and checking refrigerators and freezers to ensure they are keeping food at the appropriate temperatures.

Table 198: Food Storage Behaviours – Remaining Potential
Percent who occasionally, never or are unsure they undertake the behaviour

Behaviours Impacting Food Storage	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Clean refrigerator coils annually	63.0	53.5	53.1	57.5
Check freezer temperature	37.2	33.8	36.8	36.1
Check refrigerator temperature	37.3	36.2	33.6	35.9

12.6 Laundry and Other Domestic Hot Water Use Behaviours

FBC's 2022 REUS queried respondents on a variety of household activities and behaviours that affect the amount of energy needed to heat water for domestic uses. Domestic uses of hot water include clothes washing, dishwashing, bathing, and showering. The frequency of shutting off the hot water tank while away on holidays was also queried.

Table 199 summarizes the percentage of respondents who always or usually do laundry with full loads and run the dishwasher when full (87% and 75% respectively). Homes with gas water heaters are significantly more likely than those with electric water heaters to run dishwashers when full (86% versus 70%). Four-in-ten (40%) households usually or always turn off the water when washing hands. One-quarter (26%) of respondents usually turn off their water heater when away from the home for an extended time. Respondents with gas water heaters are much more likely than those with electric water heaters to turn off their unit when away for an extended time (35% versus 27%).

Table 199: Domestic Hot Water Behaviours
Percent who always or usually undertake the behaviours

					Main DWH Fuel	
Behaviours Impacting DWH	KE	SO	KB	2022 FBC	Electric	Gas
Unweighted base	*697*	*612*	*624*	*1933*	*790*	*823*
Only do laundry with full loads	87.9	88.0	84.5	87.0	89.4	90.7
Only run dishwasher when full	80.8	77.0	65.2	75.3	70.1	85.8
Turn off water when washing hands	38.2	37.4	46.4	40.3	41.6	38.6
Turn off water heater when away	23.5	34.1	22.4	26.2	26.7	34.6

Consistent with the proportion of households who regularly undertake hot water conserving activities, Table 200 shows the market potential for saving energy from changes to hot water use behaviours is highest for turning off the water heater while away (45%), followed by turning off water when washing hands (40%), doing laundry with full loads (9%), and running dishwashers only when full (4%).

Table 200: Domestic Hot Water Behaviours – Remaining Potential
Percent who occasionally, never or are unsure they undertake the behaviour

					Main DWH Fuel	
Behaviours Impacting DWH	**KE**	**SO**	**KB**	**2022 FBC**	**Electric**	**Gas**
Unweighted base	*697*	*612*	*624*	*1933*	*790*	*823*
Turn off water heater when away	40.3	47.1	50.4	45.1	56.3	48.7
Turn off water when washing hands	38.2	37.4	46.4	40.3	41.6	38.6
Only do laundry with full loads	9.6	9.6	6.4	8.7	8.1	8.7
Only run dishwasher when full	3.6	6.2	2.8	4.1	3.7	3.1

The 2022 REUS asked respondents to indicate the number of showers, baths, dishwasher loads, laundry loads (by water temperature) that occur in their household during a typical week. Respondents were also asked to estimate how long (minutes) the occupants of their household spent showering in a typical week.

Table 201 summarizes the frequency of dishwashing, laundry, bathing, and showering activities. All data are expressed on a per-average household basis. The frequency of each activity varies by size of household (number of occupants). Some activities occur more frequently than others. For example, showers are considerably more common than baths (average of 9.3 showers per week versus 1.4 baths). On average, FBC residential customers do 3.6 loads of laundry per week, of which 2.2 loads or 61% are done using cold water wash and rinse.

Table 201: Activities Affecting Hot Water Usage – Average per-Household

Activities Impacting DWH – All members of the household					Main DWH Fuel	
	KE	**SO**	**KB**	**2022 FBC**	**Electric**	**Gas**
Unweighted base	*697*	*612*	*624*	*1933*	*790*	*823*
Average # of people per home	2.2	2.1	2.2	2.2	2.2	2.3
Dishwasher loads per week	3.4	2.8	3.0	3.1	2.7	3.4
Laundry loads per week (any temperature)	3.8	3.4	3.6	3.6	3.5	4.0
Laundry loads using cold water	2.3	2.1	2.1	2.2	2.2	2.4
Baths per week	1.4	1.2	1.7	1.4	1.4	1.4
Showers per week	10.1	8.3	9.4	9.3	8.4	10.1
Average shower duration (minutes)	16.6	14.4	16.6	15.9	15.2	16.3

The number and frequency of most hot water use activities for a household typically vary with the number of people in the home. Table 202 restates the hot water-using behaviours on a per-person basis.

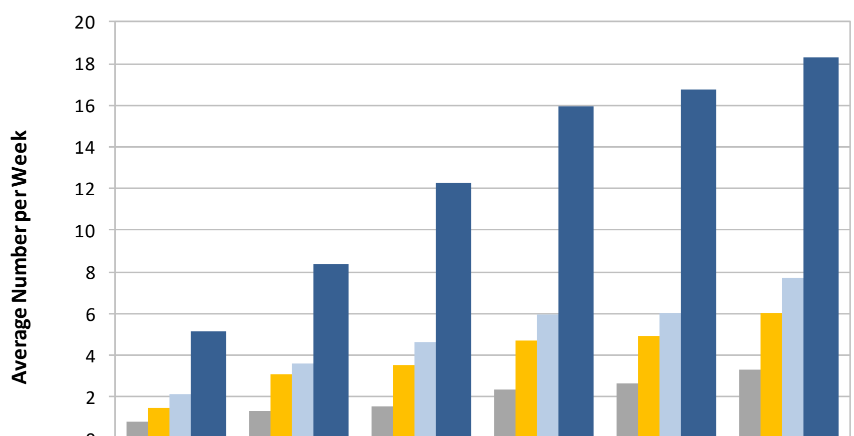
Table 202: Hot Water Usage Behaviours – Average per-Person

Behaviours Impacting DWH	KE	SO	KB	2022 FBC	Main DWH Fuel: Electric	Main DWH Fuel: Gas
Unweighted base	*697*	*612*	*624*	*1933*	*790*	*823*
Dishwasher loads per week	1.1	1.2	1.1	1.1	1.2	1.4
Laundry loads per week (any temperature)	1.8	1.7	1.6	1.7	1.6	1.7
Laundry loads using cold water	1.1	1.0	0.9	1.0	1.0	1.0
Baths per week	0.4	0.5	0.6	0.5	0.7	0.6
Showers per week	3.1	3.5	3.6	3.4	3.9	4.3
Average shower duration (minutes)	5.0	5.9	6.1	5.6	6.6	6.8

12.6.1 Household Characteristics Influencing Domestic Hot Water Use

Figure 1 shows the relationship between the number of people in the household and the average number of showers, laundry loads, dishwasher loads, and baths per week. Household size affects how many of each activity is performed and, as a result, the demand for hot water. The rate of increase in the activity as household size increases differs by activity.

Figure 1: Effect of Household Size (People) on Hot Water-Using Activities



	1	2	3	4	5	6 or more
Baths	0.8	1.4	1.5	2.4	2.7	3.3
Dishwasher Loads	1.4	3.1	3.5	4.7	4.9	6.0
Laundry Loads	2.1	3.6	4.7	5.9	6.1	7.7
Showers	5.1	8.4	12.3	15.9	16.8	18.3

Household Size (People)

12.6.2 Clothes Drying and Dish Drying

The frequency of common energy-conserving behaviours associated with drying clothes and dishes were queried. The results, summarized in Table 203, show that 98% of FBC residential customers always or usually clean their clothes dryer's lint screen before drying clothes, 70% use the dryer's moisture sensor to determine when clothes are sufficiently dry, and 36% always or usually hang some clothes to dry rather than use the dryer. Forty-six percent (46%) always or usually air dry their dishes in the dishwasher rather than using the dishwasher's heated dry function.

Table 203: Clothes Drying and Dish Drying Behaviours
Percent who always or usually undertake the behaviour

Clothes and Dish Drying Behaviours	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Clean dryer lint filter before drying clothes	98.7	98.8	96.7	98.2
Use dryer’s temperature / moisture sensor	69.1	71.4	68.9	69.7
Hang clothes rather than machine dry	33.1	37.3	38.6	35.9
Air dry dishes in dishwasher	43.2	47.4	51.4	46.4

The average household dries 3.1 loads of laundry per week (Table 204). Of these, 1.1 loads per week in the summer are dried using either an indoor or outdoor clothesline or drying rack. Fewer loads are dried on a line or rack in winter (average of 0.6 loads per week).

Table 204: Average Weekly Laundry Loads by Drying Method – Per Household

Loads per Week	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Number of dryer loads	3.2	2.9	3.0	3.1
Loads dried using a clothesline or drying rack during summer	0.9	1.0	1.5	1.1
Loads dried using a clothesline or drying rack during winter	0.6	0.6	0.6	0.6

As the percentage of households hanging clothes to dry reflects, in part, the tendency for some laundry to be unsuited for automatic clothes dryers, questions regarding access to an outdoor clothesline or drying rack were asked (Table 205). Somewhat less than four-in-ten (37%) FBC residential customers indicated they have access to an outdoor clothesline or outdoor clothes drying rack, 48% indicated they do not, and the remaining 16% indicated that outdoor clotheslines / drying racks were not permitted in their building or neighbourhood.

Table 205: Availability of Outdoor Clothesline or Other Means to Hang Clothes to Dry Outdoors (%)

Have a means to dry clothes outdoors?	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Yes	22.1	39.3	56.7	36.8
No	56.3	48.4	33.2	47.5
Not allowed in building or neighbourhood	21.7	12.2	10.1	15.7
Total	**100.0**	**100.0**	**100.0**	**100.0**

The remaining market potential for clothes and dish drying behaviours is summarized in Table 206. The behaviour with the highest remaining potential is hanging clothes to dry, with 64% of respondents indicating they never, occasionally or are unsure they do this activity. This is followed by air drying dishes in the dishwasher (54% able to do more) and using the clothes dryer's moisture sensing shut-off feature (30%). Only 2% of households could benefit from cleaning their dryer's lint screen more frequently.

Table 206: Clothes Drying and Dish Drying Behaviours – Remaining Potential
Percent who occasionally, never or are unsure they undertake the behaviour

Clothes and Dish Drying Behaviours	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Hang clothes rather than machine dry	66.9	62.7	61.4	64.1
Air dry dishes in dishwasher	56.8	52.6	48.6	53.6
Use dryer's temperature / moisture sensor	30.9	28.6	31.1	30.3
Clean dryer lint filter before drying clothes	1.3	1.2	3.3	1.8

12.7 Computer and Entertainment Systems Behaviours

A short list of energy-saving behaviours associated with the use of computers, televisions, and entertainment systems was queried in the 2022 REUS. These included turning off TVs and entertainment systems when not in use either manually or using a power bar, and turning off computers and printers when not in use. Among those who always or usually do the behaviours, the activity most frequently undertaken is turning off the TV and entertainment systems when not in use (92% always or usually), followed by turning off computers and related peripherals (74%) (Table 207). Only 22% always or usually turn off TVs or computers using a power bar or by unplugging them when not in use.

Table 207: Computer and Entertainment Systems Behaviours
Percent who always or usually undertake the behaviour

Computer and Other Behaviours	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Turn off TV/entertainment systems when not in use	91.1	93.6	92.1	92.1
Turn off computers and printers when not in use	75.5	74.8	70.9	74.0
Unplug or use power bar to turn off TVs / computers / etc. when not in use	22.8	23.4	18.3	21.7

Table 208 presents the remaining market potential for the three behaviours related to entertainment systems and computers. As expected, unplugging or using a power bar to turn off TVs and/or computer systems has the largest potential (69%). This figure, however, likely overstates the potential as many systems rely upon a continuous supply of power to maintain settings and other features, or require a specific shutdown procedure to avoid loss of data or data corruption (e.g., computers). There is, however, an opportunity to increase householders' diligence in turning off their systems when not in use (18% could do more).

Table 208: Computer and Entertainment Systems Behaviours – Remaining Potential Percent who occasionally, never or are unsure they undertake the behaviour

Computer and Other Behaviours	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Unplug or use power bar to turn off TVs / computers / etc. when not in use	70.2	69.2	67.8	69.2
Turn off computers and printers when not in use	20.3	20.1	17.8	19.6
Turn off TV/entertainment systems when not in use	7.7	5.3	5.3	6.3

12.7.1 Household Efforts to Conserve Energy

For most households, the degree to which energy-conserving behaviours are routinely followed will vary by household member with some being more energy conscious than others. To explore this dynamic, respondents were asked to indicate who in their household makes the most effort to conserve energy. The results, presented in Table 209, show that more than half (57%) indicated it was themselves (i.e., survey respondent), followed by 28% who indicated it was all members of the household and 13% indicated it was most members of their household. Two percent (2%) indicated it was someone else in the home and less than 1% indicated that no one makes an effort.

Table 209: Who Makes the Most Effort to Conserve Energy in the Home? (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Myself	60.0	53.4	54.6	56.6
All members of the household	24.3	31.6	28.6	27.6
Most members of the household	13.1	11.7	13.1	12.7
Someone else in the household	1.6	2.8	1.8	2.0
None of us	0.9	0.6	2.0	1.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

Respondents rated their household's current effort to conserve energy in the home using a four-point scale ranging from "no effort at all" to a "great amount of effort". The results, summarized in Table 210, show that 25% of households make a "great amount" of effort, 59% make a "fair amount" of effort, and 14% make only a "little effort". One percent (1%) indicated they make "no effort at all".

Table 210: Current Effort Made to Conserve Energy in the Home (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Great amount of effort	22.7	24.1	28.5	24.7
A fair amount of effort	60.6	61.6	55.4	59.4
A little effort	15.0	13.5	13.8	14.2
No effort at all	1.0	0.8	1.2	1.0
Don't know	0.8	0.1	1.1	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

Respondents were asked to compare their household's current effort made to conserve energy with their effort from two years ago. Table 211 shows that half of REUS respondents feel they are making either *somewhat more* or *much more* of an effort to conserve energy compared to two years ago (34% and 16% respectively). The majority (47%) of the remaining respondents indicated they are making about the same amount of effort as in the past.

Table 211: Current Effort to Conserve Energy Compared to Two Years Ago (%)

Compared to 2 Years Ago	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Much more of an effort	16.5	18.7	13.5	16.3
Somewhat more of an effort	33.8	30.7	38.0	34.1
Neither more nor less effort (no change)	46.3	49.1	45.4	46.9
Somewhat less of an effort	0.9	0.4	0.3	0.6
Much less of an effort	0.3	0.0	1.5	0.6
Don't know	2.1	1.2	1.3	1.6
Total	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding

12.8 Attitudes toward Energy & Energy Conservation

Table 212 summarizes the relative agreement or disagreement of FBC REUS 2022 respondents with a series of statements addressing beliefs, attitudes, and behaviours towards energy and energy conservation. Agreement with the statement is represented by either a four or five on the five-point scale, while disagreement is represented by either a one or two on the scale. Those undecided, unsure or with no strong opinion (neutral) are represented by a three. Attitudes and behaviours can influence how households use energy and respond to programs designed to encourage energy conservation. Responses to these questions can be used in psychographic segmentation studies.

Notable observations include:

- Six-in-ten (59%) of respondents feel knowledgeable about what affects energy use in their home, 10% do not, and 30% are neutral.

- Less than half (44%) of respondents feel they have reduced their household's energy use as much as reasonably possible.
- Nearly one-in-five (19%) felt they were too busy to research ways to save energy.

Table 212: Attitudes and Beliefs about Energy and Energy Conservation

Attitudes and Beliefs – Part I	Strongly Disagree (1)	(2)	Neither Agree or Disagree (3)	(4)	Strongly Agree (5)	Disagree (1 or 2)	Agree (4 or 5)
There are many ways that a person can save energy. When you add them up, they result in substantial savings	2.1	3.7	18.9	33.9	41.4	5.8	75.3
By making my home more energy-efficient, I am helping to do my part for the environment	2.3	4.2	17.1	31.4	45.0	6.5	76.4
I think natural gas is a clean and efficient energy source	4.5	6.6	30.3	24.8	33.8	11.1	58.6
Members of my household regularly limit the length of their showers to save energy	6.9	9.2	36.4	27.8	19.8	16.1	47.6
I don't want to think about natural gas or electricity. I simply want it to work.	18.9	15.8	35.3	17.4	12.5	34.7	29.9
When something needs to be done around home, I usually hire someone	21.2	18.1	26.4	16.3	17.9	39.3	34.2
I almost always have a home renovation on the go	43.0	18.4	21.7	10.4	6.6	61.4	17.0
Our household has reduced its energy use by as much as reasonably possible	4.3	11.1	40.6	26.7	17.3	15.4	44.0
I am a busy person with little or no time to research ways to save energy	19.1	19.4	42.7	12.7	6.1	38.5	18.8
I conserve energy because it saves money, not because it helps the environment	16.3	14.8	39.8	16.4	12.7	31.1	29.1
I am knowledgeable about what affects my home's energy use	3.6	6.8	30.3	36.3	23.1	10.4	59.4

13 PRODUCTS AND SERVICES

This section summarizes information on participation in utility and government energy efficiency programs, interest in energy-related products and services, and energy-related attitudes and beliefs.

13.1 Participation in Energy Efficiency Rebate Programs

The incidence of participation in a utility and/or government energy efficiency program in the last five years is summarized in Table 213. In the last five years, 21% of FBC residential customers participated in a FortisBC program, 2% in a federal, provincial or municipal government program, and 1% in a BC Hydro program. More than three-quarters (78%) of FBC residential customers did not participate in an energy efficiency program during the last five years. Customers in KB were the least likely to participate in a program during this period.

Table 213: Participation in Energy Efficiency Rebate Programs in the Last Five Years (%)

Program Sponsor	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
FortisBC	22.2	22.7	18.2	21.2
BC Hydro	1.2	1.6	0.7	1.2
Federal, provincial or municipal government	1.0	2.4	1.3	1.5
None of the above	**77.3**	**76.4**	**81.1**	**78.1**

Multiple responses allowed. Totals may not sum to 100%

13.2 Interest in Products and Services

Respondents to the 2022 REUS were provided with a list of potential energy-related programs and services and asked to rate their interest using a four-point scale where one meant “not at all interested” and four meant “very interested”. The results, ranked by the proportion that indicated an interest level of three or four (somewhat or very interested) are summarized in Table 214. As no financial obligation or commitment is implied or associated with a respondent’s answer, caution is advised in interpreting interest in any particular product or service. The results are directional in nature.

The three program suggestions that held the greatest interest include a furnace or heat pump tune-up program, a home energy audit, and a do-it-yourself online energy audit (38% of respondents interested for each), a program to improve draft proofing and a program to purchase rooftop solar panels (33% for each), and a program to compare their home’s energy use with other homes (31%).

Table 214: Interest in Products and Services (%)
Ordered by Percent Very or Somewhat Interested

Product / Service	Not at all Interested (1)	(2)	(3)	Very Interested (4)	Interested (3 or 4)
Furnace or heat pump tune-up	45.9	15.7	17.6	20.8	38.4
Home energy audit	41.1	20.7	18.4	19.8	38.1
Do-it-yourself online energy audit	40.1	22.1	22.0	15.8	37.7
Program to improve draft proofing	50.8	16.4	17.4	15.4	32.8
Program to purchase rooftop solar panels	54.0	13.4	11.8	20.8	32.6
Program to install an in-home energy use display	48.5	19.0	15.4	17.1	32.4
Program to compare home's energy use with other homes	49.7	19.5	15.7	15.2	30.9
Program to replace standard-efficiency water heater with high-efficiency water heater	57.7	12.0	13.0	17.2	30.3
Program to purchase an electric automobile	55.6	16.0	11.7	16.7	28.4
Program to replace standard-efficiency clothes washer with high-efficiency clothes washer	59.9	12.8	14.0	13.4	27.4
Program to install programmable or "smart" thermostats	59.4	14.0	13.5	13.2	26.7
Program to upgrade attic and wall insulation	62.6	12.5	10.2	14.8	24.9
Program to replace a lower-efficiency furnace with a high-efficiency furnace	64.2	11.1	9.7	15.1	24.8
Program to install high-efficiency gas fireplace	75.0	8.5	7.2	9.2	16.5

13.3 Respondent Characteristics Influencing Purchase Decisions

Table 215 offers insight into the relative importance of a variety of personality characteristics known to influence purchase decisions, including risk aversion, price, brand loyalty, and "buy local" preferences. REUS respondents were asked to rate their relative agreement or disagreement with statements addressing each of these factors using a five-point scale where one meant they "strongly disagreed" and five meant they "strongly agreed". Agreement with the statement is represented by indicating either a four or five on the five-point scale, while disagreement is represented by either a one or two. Those undecided, unsure or with no strong opinion (neutral) are represented by a three.

Table 215: Respondent Characteristics Influencing Purchase Decisions (%)

Respondent Characteristics	Strongly Disagree (1)	(2)	Neither Agree or Disagree (3)	(4)	Strongly Agree (5)	Disagree (1 or 2)	Agree (4 or 5)
I am usually the first one to try new products	15.6	14.5	48.4	14.8	6.8	30.1	21.6
I am usually willing to pay more for brand-name items	14.8	14.7	36.6	26.0	7.8	29.5	33.8
I prefer dealing with British Columbia-based companies	3.0	3.9	34.0	31.1	28.1	6.9	59.2
I always look for the best price when buying products or services	1.8	5.4	25.4	35.2	32.1	7.2	67.3
I usually take time to research issues thoroughly before making a decision	1.2	4.8	20.2	37.0	36.7	6.0	73.7
I am the type of person to have good insurance coverage	2.2	2.4	14.2	31.2	49.9	4.6	81.1

14 DEMOGRAPHICS

This section details the demographic and socio-demographic characteristics of respondents to FBC's 2022 REUS and those of their households. Comparisons are made, where appropriate, with data from previous residential end-use surveys conducted by FBC.

14.1 Survey Respondent Characteristics

14.1.1 Age Cohort

The distributions of survey respondents by age cohort are summarized in Table 216. Eighty-five percent (85%) of respondents to the 2022 REUS were aged 45 years or older, down from 90% of respondents to the 2017 REUS. Regionally, 93% of respondents from the SO region were 45 years or older compared to 80% for the KE region and 87% for the KB region.

Table 216: REUS Respondents by Age Cohort (%)

Age Cohort	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2015*
18 yrs or younger	--	--	--	--	--	0.0*	2.0 [1]
19 – 24 yrs	0.4	--	0.1	0.2	0.3	0.3	
25 – 34 yrs	7.8	1.2	2.5	4.4	3.4	5.1	7.0
35 – 44 yrs	12.1	5.9	10.8	10.0	6.4	8.6	11.0
45 – 54 yrs	12.0	8.6	11.3	10.8	11.6	16.9	19.0
55 – 64 yrs	21.7	22.8	23.8	22.6	23.3	25.3	27.0
65 yrs and older	45.9	61.5	51.6	52.0	54.9	43.8	34.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
44 yrs or younger	**20.4**	**7.1**	**13.4**	**14.6**	**10.1**	**14.0**	**20.0**
45 yrs or older	**79.6**	**93.0**	**86.7**	**85.4**	**89.9**	**86.0**	**80.0**

Totals may not sum due to rounding.
[1] 24 years old or younger
* Value less than 0.1%

14.1.2 Gender

Distributions of survey respondents by gender are provided in Table 217. The proportion of respondents to the survey who identified as female increased to 51% in 2022 from 46% in 2017 while the proportion who identified as males was statistically unchanged. Three percent (3%) chose not to answer the question.

Table 217: Survey Respondents by Gender (%)

Gender	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2006*
Female	50.3	52.8	50.9	51.2	45.9	45.3	53.0
Male	46.2	44.2	46.5	45.7	47.6	51.5	47.0
Self-describe	--	--	0.1	0.0*	n/a	n/a	n/a
No answer	3.6	3.0	2.5	3.1	6.5	3.2	n/a
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.
n/a – data not available
* Value less than 0.1%

14.1.3 Employment Status

Overall, 56% of respondents to the 2022 REUS are retired, 32% are employed full-time, and 9% are employed part-time (Table 218). Those remaining include homemakers, those on short or long-term disability, unemployed or attending school (students). Regionally, respondents from the KE region are the least likely to be retired and more likely to be employed full-time compared to respondents in the other two regions.

Table 218: Employment Status of Survey Respondents (%)
Multiple Responses Allowed

Employment Status	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
Retired	48.8	63.8	59.0	56.0	60.4
Employed full-time	37.7	25.2	30.6	32.1	27.5
Employed part-time	8.6	9.6	7.6	8.6	8.5
Short or long-term disability	3.9	1.5	2.0	2.7	3.1
Homemaker	1.9	1.9	2.5	2.1	3.9
Unemployed	1.7	0.9	1.3	1.4	0.8
Student	1.3	0.1	0.4	0.7	0.5

Columns do not sum to 100% because of multiple responses.

14.1.4 Educational Attainment

The distributions of survey respondents by the highest level of educational attainment are provided in Table 219. Of note, the proportion of respondents with less than a high school education declined from 8% in 2017 to 3% in 2022. Those with a minimum of a university or college degree represented 45% of survey respondents to the 2022 REUS. The proportion of respondents with a minimum of a university or college degree has been steadily increased over the last four residential end-use surveys.

Table 219: Respondent Education Status (%)
Highest Level of Education Achieved

<table>
<tr><th>Education</th><th>KE</th><th>SO</th><th>KB</th><th>2022 FBC</th><th>2017 FBC</th><th>2012 FBC</th><th>2009 FBC</th></tr>
<tr><td>Unweighted base</td><td>697</td><td>612</td><td>624</td><td>1933</td><td>2628</td><td>1668</td><td>2009 [1]</td></tr>
<tr><td>Some high school</td><td>3.2</td><td>3.2</td><td>2.8</td><td>3.1</td><td>7.5</td><td>8.3</td><td>9.0</td></tr>
<tr><td>Completed high school</td><td>12.4</td><td>15.3</td><td>19.7</td><td>15.3</td><td>15.8</td><td>17.0</td><td>16.0</td></tr>
<tr><td>Some trade / technical school</td><td>4.6</td><td>5.1</td><td>5.4</td><td>5.0</td><td>6.3</td><td>7.5</td><td>21.0</td></tr>
<tr><td>Completed trade / technical school</td><td>11.9</td><td>13.9</td><td>16.3</td><td>13.7</td><td>16.8</td><td>15.6</td><td>22.0</td></tr>
<tr><td>Some university / college</td><td>17.0</td><td>17.6</td><td>16.2</td><td>16.9</td><td>17.5</td><td>18.1</td><td>7.0</td></tr>
<tr><td>Completed university / college</td><td>34.4</td><td>31.5</td><td>28.8</td><td>32.0</td><td>25.0</td><td>23.6</td><td rowspan="2">24.0</td></tr>
<tr><td>Post graduate</td><td>15.5</td><td>12.5</td><td>10.3</td><td>13.1</td><td>9.0</td><td>7.9</td></tr>
<tr><td>No response</td><td>1.1</td><td>1.1</td><td>0.5</td><td>0.9</td><td>2.3</td><td>1.9</td><td>1.0%</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td></tr>
</table>

[1] The 2009 REUS grouped colleges (some or completed) with trade and technical schools.
Totals may not sum due to rounding.

14.2 Household Characteristics

14.2.1 Number of Occupants per-Dwelling

Table 220 summarizes the average number of occupants per dwelling (including renters). Data are further broken out to identify the proportion of homes with two occupants or less, between three and five occupants, and six or more occupants. The number of occupants in the home affects household energy use, particularly for domestic hot water activities including clothes washing, dishwashing, and showers (See Section 12.6.1 for additional information).

Table 220: Number of People per Dwelling by Region

Number of People per Dwelling	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Average per home (persons)	2.2	2.1	2.2	2.2	2.2	2.2
Standard Deviation (persons)	1.3	1.0	1.2	1.2	1.8	1.1
Homes by size:						
2 people or less (%)	74.9	82.7	74.5	77.0	78.3	75.5
3 - 5 people (%)	23.8	16.0	21.6	21.0	20.2	23.1
6 people or more (%)	1.3	1.3	3.9	2.0	1.5	1.3
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.
Comparable data for 2009 are not available

The proportion of homes with two occupants or less in 2022 (77%) is statistically unchanged from 2017 (78%); so too, the proportion of homes with three to five occupants and six occupants or more. Regionally, the SO region has a larger share of smaller households (two occupants or fewer) (83%) compared to KB and KE (75% for each).

Demographics

The distribution of occupants by age cohort is provided in Table 221. On average, 15% of FBC residential households have children at home (persons 18 years of age or younger). Regionally, SO households are less likely to have children at home (11% of SO households) than households in KE (17%) and KB (18%).[28] Finally, 55% of FBC residential households have one or more persons aged 65 years or older, up from 49% in 2012 but unchanged from 2017. Two-thirds (65%) of FBC customers in the SO region have at least one person aged 65 years and older in the home. This is significantly higher than KE and KB (49% and 56% respectively).

Table 221: Incidence of Household Members by Age Cohort
Percent of homes with at least one

Age Cohort of Home's Occupants	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
5 years or younger	5.2	3.0	3.4	4.0	3.9	5.1
6 – 12 yrs	8.3	5.3	8.4	7.4	5.4	6.8
13 – 18 yrs	7.8	6.3	9.8	7.9	6.3	8.3
19 – 24 yrs	7.0	3.8	8.6	6.5	6.2	7.6
25 – 44 yrs	28.9	13.9	24.3	23.3	16.7	19.9
45 – 64 yrs	38.9	41.4	42.7	40.7	41.1	49.9
65 yrs and older	49.1	64.5	55.6	55.4	56.4	48.5
Households with children (<19 yrs)	**17.0**	**11.0**	**17.5**	**15.4**	**12.2**	**15.1**

Columns do not sum to 100%
Comparable data for 2009 are not available

Table 222 explores the relationship between dwelling type and the occupant ages.

Table 222: Incidence of People in the Home by Age Cohort by Dwelling Type
Percent of homes with at least one

Age Cohort of Home's Occupants	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other
Unweighted base	*1322*	*81*	*123*	*233*	*174*
5 years or younger	5.0	5.1	3.6	2.2	1.7
6 – 12 yrs	9.4	8.4	9.5	3.5	2.5
13 – 18 yrs	10.7	6.1	18.0	1.1	1.3
19 – 24 yrs	7.7	8.0	15.6	2.2	4.5
25 – 44 yrs	22.9	28.7	29.2	24.0	14.5
45 – 64 yrs	48.6	40.8	32.1	25.0	40.7
65 yrs and older	53.2	60.7	49.8	58.6	64.2
Households with children (<19 yrs)	**19.9**	**13.7**	**24.0**	**6.2**	**4.7**

Columns do not sum to 100%

[28] When the data are reorganized to identify households with at least one child between the ages of 6 and 24 years, it suggests that up to 17% of FBC's residential customers would have had at least one primary or secondary school age child studying from home during the COVID pandemic. Regionally, the pandemic's effect on home schooling would highest for households in the KE and KB regions (19% and 20% of households, respectively, have school age children) and lowest in the SO region (12%). Having children who normally would attend school now required to study from home (possibly with an adult supervising) would, everything else held constant, increase energy use in home due to higher daytime thermostat settings.

Row/townhouses and single-family detached dwellings are the dwelling types most likely to have children living in the home (24% and 20% respectively). Apartments / apartment-style condominiums and mobile and other manufactured homes are the least likely to have children living in the home (6% and 5% respectively). Mobile and other manufactured homes and apts/apt-style condos are the most likely to house one or more seniors (64% and 59% respectively).

Fourteen percent (14%) of FBC households experienced a change in the number of people living in the home in the two years prior to the survey, a proportion statistically unchanged from 2017 (Table 223). Seven percent (7%) experienced an increase in household size and 5% experienced a decrease. Two percent (2%) indicated the number of occupants fluctuated both up and down over the last two years.

Table 223: Changes in the Number of People in the Home last Two Years (%)

Number of Occupants	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*
Yes – changed in the last two years	14.6	13.7	13.1	13.9	14.9	16.7
More people in the past	7.9	7.3	5.2	7.0	8.6	9.5
Fewer people in the past	4.7	4.4	6.1	5.0	4.8	5.0
Both fewer and more people in the past	1.8	1.9	1.8	1.8	1.4	2.2

14.2.2 Working from Home

In a new series of questions for the 2022 REUS, respondents were asked whether anyone in their residence works either part-time or full-time from home and, if so, whether the number of days working from home had increased over the past two years, and whether the number of days worked from home was expected to increase, decrease or remain the same over the next two years. Working from home versus outside the home tends, everything else held constant, to increase energy use in home due to increased use of hot water and higher thermostat settings during the day in winter and lower thermostat settings during the day in summer (i.e., dwellings with air conditioning). During the height of the COVID-19 pandemic, many businesses and organizations allowed or required their staff to work from home to minimize transfer of the contagion.

Table 224 shows one-in-five (21%) households had one or more persons working either part-time or full-time from the home at the time of the 2022 survey. Of these, 54% indicated that the number of days worked from home by this person / these persons increased during the past two years.[29] Regionally, the proportion of households with someone working from home is highest in KE (25%) and lowest in SO (15%).

[29] Households with one or more school age children (ages 6 to 24 years) were statistically more likely to (i) have someone working from home and (ii) to have experienced an increase in the number of hours worked from home during the past two years. While the reasons for working from home or why the number of hours working from home increased during the past two years were not queried, the relationship between school age children and hours worked from home is consistent the pandemic's effects on working families with school-age children (i.e., parents were required to work from home either full or part time, in part, to supervise younger school age children required to attend school online).

Table 224: Persons Working from Home (%)

	KE	SO	KB	2022 FBC
Unweighted base	*697*	*612*	*624*	*1933*
Yes – working from home either part-time or full-time (%)	25.2	14.5	20.3	20.8
Yes – Number of days working from home has increased past two years (%) [1]	60.8	38.1	53.6	54.2

[1] Base: Households with one or more persons working from home either part-time or full-time

In the next two years, two-thirds (67%) of respondents with persons working from home expect the number of hours worked from home to stay the same, 18% expect the number of hours to decrease and 7% expect the number of hours to increase (Table 225). Regionally, respondents in the SO region are more likely than those in KB region to expect a decrease in the number of days worked from home in the next two years. All other differences between the regions are not statistically significant.

Table 225: Days Working from Home – Next Two Years (%)

Days working from home in the next two years expected to…	KE	SO	KB	2022 FBC
Unweighted base [1]	*182*	*93*	*133*	*408*
Increase	7.8	3.7	7.5	7.0
Decrease	18.0	28.4	10.6	18.0
Stay the same	68.0	58.5	72.7	67.4
Don't know	6.1	9.2	9.2	7.6
Total	**100.0**	**100.0**	**100.0**	**100.0**

[1] Base: Respondent households with one or more persons working from home
Totals may not sum due to rounding.

14.2.3 Household Income

The distribution of 2022 REUS respondents by annual household income before taxes (2021) is provided in Table 226. The data are useful in providing context to income-driven differences affecting behaviours, attitudes, and equipment purchase decisions. While the proportion of respondents who chose not to answer this question is high (27%), the data are not rebased primarily because there are no apparent reasons why non-responses would be distributed across the income categories in the same relative proportions as responses. Regional comparisons should be made with caution as the proportion choosing not to answer the question varies.

Table 226: Annual Household Income (2021) before Taxes (%)

<table>
<tr><th>Annual Household Income</th><th>KE</th><th>SO</th><th>KB</th><th>2022 FBC</th><th>2017 FBC</th><th>2012 FBC</th><th>2009 FBC</th></tr>
<tr><td>Unweighted base</td><td>697</td><td>612</td><td>624</td><td>1933</td><td>2628</td><td>1668</td><td>2049</td></tr>
<tr><td>Less than $20,000</td><td>2.6</td><td>3.6</td><td>2.9</td><td>2.9</td><td>7.0</td><td>7.3</td><td>7.0</td></tr>
<tr><td>$20,000 to $29,999</td><td>3.8</td><td>5.2</td><td>6.0</td><td>4.8</td><td>8.0</td><td>11.1</td><td rowspan="2">21.0</td></tr>
<tr><td>$30,000 to $39,999</td><td>6.0</td><td>9.4</td><td>5.8</td><td>6.9</td><td>9.5</td><td>9.6</td></tr>
<tr><td>$40,000 to $49,999</td><td>5.5</td><td>6.2</td><td>7.3</td><td>6.2</td><td>8.1</td><td>8.5</td><td rowspan="2">19.0</td></tr>
<tr><td>$50,000 to $59,999</td><td>7.8</td><td>5.7</td><td>8.3</td><td>7.4</td><td>8.7</td><td>7.4</td></tr>
<tr><td>$60,000 to $79,999</td><td>10.2</td><td>12.1</td><td>12.0</td><td>11.3</td><td>10.9</td><td>12.5</td><td>16.0</td></tr>
<tr><td>$80,000 to $99,999</td><td>10.5</td><td>8.4</td><td>8.4</td><td>9.3</td><td>7.0</td><td>6.8</td><td rowspan="4">23.0</td></tr>
<tr><td>$100,000 to $109,999</td><td>5.3</td><td>8.4</td><td>4.1</td><td>5.9</td><td>3.2</td><td rowspan="3">13.5</td></tr>
<tr><td>$110,000 to $119,999</td><td>3.2</td><td>2.1</td><td>2.1</td><td>2.6</td><td>2.7</td></tr>
<tr><td>$120,000 or more</td><td>18.7</td><td>12.2</td><td>15.1</td><td>15.8</td><td>8.1</td></tr>
<tr><td>No response / Prefer not to answer</td><td>26.4</td><td>26.6</td><td>28.0</td><td>26.9</td><td>26.8</td><td>23.3</td><td>15.0</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td></tr>
<tr><td>Households with less than $40K</td><td>12.4</td><td>18.1</td><td>14.7</td><td>14.7</td><td>24.5</td><td>28.0</td><td>28.0</td></tr>
<tr><td>Households with less than $60K</td><td>25.7</td><td>30.1</td><td>30.2</td><td>28.2</td><td>41.3</td><td>43.9</td><td>47.0</td></tr>
<tr><td>Households with $100K or more</td><td>27.3</td><td>22.7</td><td>21.3</td><td>24.3</td><td>14.0</td><td>13.6</td><td>n/a</td></tr>
</table>

Totals may not sum due to rounding.
n/a – data not available

Household incomes by dwelling type are summarized in Table 227. As in past studies, occupants of mobile and other manufactured homes stand out as having significantly lower household incomes compared to occupants of other dwelling types. The table also summarizes the distribution of household incomes for renters versus owners. These data show that half (52%) of renters have household incomes of less than $60,000 per year compared to 26% of homeowners.

Table 227: Annual Household Income (2021) before Taxes by Dwelling Type (%)

Annual Household Income	Single Family Detached	Semi-Detached	Row / Town-house	Apt / Apt-Style Condo	Mobile & Other	Own	Rent
Unweighted base	*1322*	*81*	*123*	*233*	*174*	*1774*	*159*
Less than $20,000	1.8	2.8	2.5	5.1	5.0	2.5	7.0
$20,000 to $29,999	3.0	14.1	2.9	7.3	8.4	4.2	10.4
$30,000 to $39,999	4.6	3.9	5.1	11.4	14.3	6.1	14.3
$40,000 to $49,999	6.4	3.2	4.5	5.2	12.7	5.6	11.3
$50,000 to $59,999	7.1	6.0	8.4	7.8	8.3	7.2	8.9
$60,000 to $79,999	10.7	13.8	11.0	12.4	10.5	11.1	12.3
$80,000 to $99,999	10.5	5.9	10.4	7.2	8.0	9.8	5.2
$100,000 to $109,999	5.8	6.7	7.7	6.2	2.9	6.0	4.4
$110,000 to $119,999	3.1	2.7	1.9	1.8	1.9	2.8	0.9
$120,000 or more	21.2	13.8	10.4	7.6	4.6	16.7	8.2
No response / Prefer not to answer	25.9	27.2	35.3	28.1	23.5	28.0	17.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Households with less than $40K	**9.4**	**20.8**	**10.4**	**23.7**	**27.7**	**12.7**	**31.7**
Households with less than $60K	**22.8**	**30.0**	**23.4**	**36.8**	**48.7**	**25.6**	**51.8**
Households with $100K or more	**30.1**	**23.2**	**20.0**	**15.6**	**9.3**	**25.5**	**13.5**

Totals may not sum due to rounding.

14.2.4 Languages Spoken in the Home

Respondents to the 2022 REUS were asked to indicate the main language spoken in the home and then all other languages (if any) spoken in the home.

The majority (98%) of respondents indicated that English is the main language spoken in the home (Table 228). Other languages each represented less than one percent of REUS respondents.

Table 228: Main Language Spoken in the Home (%)

	KE	SO	KB	2022 FBC	2017 FBC	2012 FBC	2009 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*	*1668*	*2049*
English	97.1	98.0	98.0	97.6	97.0	97.5	96.3
Mandarin / Cantonese	0.5	--	--	0.2	0.2	0.1	0.2
Punjabi	0.1	0.2	--	0.1	0.1	0.2	0.1
Tagalog	0.2	--	--	0.1	--	--	n/a
French	0.5	0.3	0.6	0.4	0.2	0.2	0.2
German	0.1	0.5	0.2	0.2	0.1	0.4	0.7
Other	1.5	1.0	1.2	1.3	0.6	0.4	0.7
No response	--	--	--	--	1.8	1.1	1.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Totals may not sum due to rounding.
* Less than 0.1%

Other languages spoken in the home are listed in Table 229. All responses are expressed as a percent of the base of all REUS respondents and multiple responses were allowed.

Table 229: All Other Languages Spoken in the Home (%)
Multiple Responses Allowed

	KE	SO	KB	2022 FBC	2017 FBC
Unweighted base	*697*	*612*	*624*	*1933*	*2628*
English	2.4	1.3	1.6	1.9	1.0
Mandarin / Cantonese	1.0	0.4	0.1	0.6	0.4
Punjabi	0.2	0.1	0.1	0.2	0.1
Tagalog	0.8	0.3	0.2	0.5	0.4
French	6.6	6.1	2.9	5.4	4.4
German	3.5	3.7	2.6	3.3	2.9
Other	6.2	5.3	7.1	6.2	5.0

Totals will not sum to 100% because multiple responses were allowed.

15 CONDITIONAL DEMAND ANALYSIS

FortisBC Inc. (FBC) uses information on end-use electricity consumption for power system planning, load forecasting, marketing and demand-side management. End-use consumption refers to the energy used for space heating and cooling, water heating, lighting, cooking and other specific uses, as opposed to total consumption. The Unit Energy Consumption (UEC) for an end-use is defined as the quantity of energy consumed by that end-use in a given period of time.

This section summarizes the results of a Conditional Demand Analysis (CDA) applied to the 2022 REUS data that was used to estimate UEC values for major residential electric end-uses. CDA is a multivariate regression technique which combines utility consumption data with weather information and customer survey data. A detailed presentation of the methodology, equation specifications, and equation results for the CDA are provided in Appendix B.

15.1 Research Objectives

The objectives of this study are to:

- estimate weather-normalized UEC values for major residential electric end-uses, including space heating and cooling, water heating, lighting, cooking, and other specific uses;
- disaggregate UECs for key end-uses by the following dwelling types: single-family dwellings, multi-family dwellings, and apartments/condominiums; and
- compare the results with past CDA studies.

Table 230 lists the end-used modelled in the 2022 CDA.[30]

Table 230: Electric End-Uses Modelled

Primary Space Heating	Secondary Space Heating
Furnace Fan Motor (for gas furnaces)	Central Air Conditioning
Room and Portable Air Conditioning	Water Heating
Refrigerators	Freezers
Cooking (electric ranges, cooktops, ovens, dual fuel ranges)	Clothes Washers & Electric Dryers
Lighting	Home Entertainment Equipment (TVs, sound systems, etc.)
Swimming Pools	Hot Tubs
Electric and Plug-in Hybrid Automobiles	Car Block Heaters
Well Pumps	Baseload (miscellaneous plug loads, etc.)

[30] An attempt was made to individually model computers, electric fireplaces, furnace fan motors (for gas furnaces), electric barbeques, electric outdoor heaters, car block heaters and interior car warmers, and home security systems. These end-uses were not retained in the conditional demand analysis because they produced unreasonable results. Accordingly, their electricity usage may be captured as part of other end-uses (e.g., electric fireplaces used for secondary space heating) or the base consumption load of a household.

15.2 CDA Sample

The sample used for the electric CDA consisted of direct service customers in FBC's service area who participated in the FortisBC's 2022 Residential End-Use Study.[31] The REUS survey data from these customers was used in combination with two years' worth of monthly electricity consumption data for each customer and weather data for the same period. The two-year period was February 2020 to January 2022.[32]

Consistent with previous CDA studies conducted for FBC, the sample excluded customers who reported living in mobile homes or "other" dwelling types and customers who have not lived in their residence for at least two years (as indicated in the survey). Additionally, the sample excluded customers with incomplete or missing electricity consumption data. The resulting sample contained a total of 1,495 customers (Table 231).

Table 231: Sample Used in FBC Conditional Demand Analysis

	KE	SO	KB	2022 FBC
Single Family Detached	364	315	441	1,120
Multi-Family Dwelling	108	40	23	171
Apartment/Condominium	160	25	19	204
Total	**632**	**380**	**483**	**1,495**

15.3 Weather Data

Monthly weather data (heating and cooling degree days) were obtained for three representative weather stations in FBC's service area and then assigned to customers in the sample based on the location of their residence (Table 232).[33] Degree days were calculated as the difference between the average daily temperature and a balance point temperature of 18° Celsius.

Table 232: Representative Weather Stations

Customer Location	Weather Station
West Kelowna to Enderby	Kelowna (YLW)
Peachland to Osoyoos (incl. Princeton east to Greenwood)	Penticton (YYF)
Grand Forks to Creston (incl. Kootenay Lake area)	Castlegar (YCG)

Monthly averages of actual and 10-year average (normal) heating degree days and cooling degree days, calculated for the sample of households used in the CDA (weighted by region and dwelling type), are shown

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31 The sample used for the CDA excludes indirect customers of FBC (i.e.,those served by municipal utilities who source their electricity supply from FortisBC) as their residential consumption data was not available.

32 The REUS survey was fielded approximately six months after the end of this period. Given the lag, there may be some cases where the household characteristics and behaviours reported in the survey do not reflect actual conditions during the time of the survey. More recent electricity consumption data were not available at the time of this analysis.

33 Source: Weather Data Depot (www.weatherdatadepot.com).

in Table 233.[34] Note that actual HDDs are lower, on average, than normal HDDs, whereas actual CDDs are higher, on average, than normal CDDs. Actual CDDs, particularly for June and July, reflect the impact of the "heat dome" that occurred in British Columbia in the early summer of 2021.

Table 233: Comparison of Actual and 10-Year Average (Normal) Cooling and Heating Degree Days

	Actual CDDs [1]	10-Year Normal CDDs [2]	Actual HDDs [1]	10-Year Normal HDDs [2]
January	0.0	0.0	585.4	602.4
February	0.0	0.0	517.8	541.4
March	0.0	0.0	423.0	422.2
April	0.0	0.1	269.6	281.3
May	2.7	6.8	131.9	122.7
June	78.1	42.9	50.2	47.2
July	152.9	122.2	7.0	7.5
August	100.9	102.9	13.1	7.8
September	18.1	16.0	66.4	94.8
October	0.0	0.0	300.6	295.8
November	0.0	0.0	438.9	456.8
December	0.0	0.0	626.4	611.9
Average	**29.4**	**24.2**	**285.9**	**291.0**

[1] Monthly averages, calculated over the two-year period used for the CDA (weighted by region and dwelling type).

[2] Ten-year averages (weighted by region and dwelling type).

15.4 Utility Level UECs

The conditional demand model was estimated using ordinary least squares. The regression model performed well and most of the regression coefficients had the correct sign and were significant at the five percent level or better (see Appendix B for the detailed regression output).

The regression coefficients were used to calculate UEC values for major residential end-uses. UECs were calculated for each household possessing the end-use by substituting household variables into the end-use equations. Normal HDDs and CDDs were substituted to generate weather-normalized UECs for space heating and cooling, gas furnace fan motors, and water heating. Weighted-average UECs were then calculated across all households possessing the end-use (weighted by region and dwelling type).

An overall conditional demand model was constructed to estimate UECs for FBC's service area. The weather-normalized, weighted UECs are shown in Table 234. The main end-uses include primary space heating at 3,533 kWh per year, domestic water heating at 2,302 kWh per year, home entertainment equipment at 1,266 kWh per year, and secondary electric space heating at 1,184 kWh per year. Other key end-uses include lighting, refrigerators and freezers, cooking appliances, dishwashers, clothes washers and dryers, and central air conditioning. The base electricity load was estimated at 947 kWh per year.

[34] Normal heating degree days were calculated for each month using ten-year averages (November 2012 to October 2022).

Electric heated pools, electric heated hot tubs, and water pumps are heavy users of electricity, but have lower penetration rates than other major end-uses. UEC estimates for end-uses with low penetration rates should be interpreted with some caution due to the small sample sizes involved.

The average energy consumption per household (HEC) is calculated by multiplying each end-use's UEC by its penetration rate and summing across end uses. HEC is a measure of the average consumption of a household in FBC's service area. The weather-normalized, weighted HEC was estimated to be 9,879 kWh per year. In comparison, the actual weighted consumption for the sample was 9,838 kWh per year.

Table 234: Penetration Rates and Unit Energy Consumption by End-use – FBC's Overall Service Area

	Sample Size (unweighted)	Penetration (% presence)	Unit Energy Consumption (kWh/year)	Avg. Consumption per Household (kWh/year)	% Dist	UECs in 2017 (kWh/yr)	UECs in 2012 (kWh/yr)
Primary Space Heating	461	35%	3,532.9	1,246.5	13%	4,749.4	6,467.8
Secondary Space Heating	407	26%	1,184.1	305.8	3%	1,427.0	999.2
Furnace Fan Motors (Gas Furnaces)	842	52%	**	**	**	163.3	386.3
Central Air Conditioning	794	52%	479.9	250.8	3%	774.4	555.9
Room & Portable Air Conditioning	366	28%	249.5	69.6	1%	515.1	325.6
Domestic Water Heating	597	36%	2,301.8	830.2	8%	2,873.8	3,848.2
Refrigerators	1,481	99%	712.1	705.2	7%	993.2	626.1
Freezers	1,085	68%	795.1	538.1	5%	717.6	661.3
Cooking	1,333	90%	765.8	687.7	7%	119.8	537.9
Dishwashers	1,232	83%	808.1	668.6	7%	-	-
Clothes Washers & Electric Dryers	1,440	95%	829.0	784.9	8%	535.2	840.6
Lighting	1,495	100%	967.6	967.6	10%	1,102.9	2,216.3
Home Entertainment Equipment	1,464	98%	1,266.4	1,242.5	13%	1,000.7	942.7^
Computers	1,438	96%	**	**	**	-	325.6
Swimming Pools	12	1%	2,036.7*	17.0*	<1%	2,919.2	10,869.2
Hot Tubs	199	12%	3,294.1	405.9	4%	2,818.2	3,557.5
Saunas	31	2%	587.5	11.6	<1%	-	1,402.1
Battery Electric Vehicles	31	2%	654.5	13.1	<1%	3,178.0^^	-
Car Block Heaters & Interior Car Warmers	137	8%	**	**	**	373.3^^^	64.8^^^
Water Pumps	202	12%	1,600.9	187.3	2%	1,734.3	875.0
Baseload	1,495	100%	946.6	946.6	10%	1,736.1	1,359.1
Household Consumption							
Estimated				**9,879.0**			
Actual				**9,837.8**			

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.
** An attempt was made to include end-use in the CDA, but it was not retained in the model because the estimated UEC value was unreasonable.
^ Represents televisions only.
^^ Represents energy usage for charging either battery electric vehicles or plug-in electric hybrid vehicles.
^^^ Represents car block heaters only.

Table 234 also shows a comparison between this study's UEC estimates and those produced in two prior conditional demand analyses, conducted as part of the 2017 and 2012 Residential End-Use Studies.[35]

[35] Sources: Sampson Research (2014), Sampson Research (2019).

It is important to note that the two-year period used to conduct the current analysis (February 2020 to January 2022) coincides with the COVID-19 pandemic in Canada, in which many people worked and studied from home or were on furlough. The resultant effects on residential energy demand must be considered when interpreting the results and making comparisons with past studies. As well, comparisons with the 2012 study should be made with caution due to differences in the composition of the sample used for its CDA. Specifically, customers residing in Kelowna were excluded from the 2012 sample due to the unavailability of their billing consumption information at that time, whereas Kelowna households are included in the samples of the more recent studies.[36] Their inclusion has meant the utility level CDA results for 2017 and 2022 reflect the influence of proportionately more apartments and proportionately fewer single-family detached dwellings in the sample, leading to lower UEC values for some dwelling-dependent end-uses.[37]

15.4.1 Space Heating

The weather-normalized UEC for primary space heating was estimated to be 3,533 kWh per year in the current analysis, compared to 4,749 kWh per year in the 2017 study and 6,468 kWh per year in the 2012 study. This decline can be explained by several factors, including: a greater share of apartments in the sample (especially relative to the 2012 study), rising popularity of heat pumps and hybrid systems in which a heat pump is used in conjunction with an electric furnace, improvements in the thermal efficiency of building envelopes (insulation, windows, etc.), increasing use of supplementary non-electric heating equipment, adoption of energy conserving behaviours and technologies, as well as a general trend toward milder weather conditions, on average, during the typical heating period.[38] These factors more than offset any opposing forces, including those related to the COVID-19 pandemic (e.g., increase in daytime space heating requirements associated with people working / studying from home).

The decline in space heating UEC relative to the 2017 study contrasts with the findings from FEI's 2022 gas conditional demand analyses, which revealed an increase in the UEC for primary gas space heating over the same time frame, both in FEI's overall service area and its Interior region. Several differences in the customer and equipment characteristics and trends between the two FortisBC studies appear to have contributed to this outcome:

- *Change in the mix of dwelling types in FBC's service area over time* – Compared to 2017, the proportion of FBC customers residing in apartments that use electricity for primary space heating increased, while the proportion living in single-family detached dwellings decreased. Apartment and apartment-style condominium units tend to require less energy for space heating compared to

[36] Kelowna was a wholesale customer of FortisBC in 2012. Consequently, billing consumption data were unavailable to the consultants.

[37] The (unweighted) proportion of apartments and apartment-style condominiums in the CDA sample increased from approximately five percent in the 2012 study to 13 percent in the 2017 study and 14 percent in the current analysis. (The weighted proportion of apartments in the sample was 15 percent in the 2012 study compared to 25 percent in the latter studies.)

[38] The weighted average of normal heating degree days, calculated for the sample of households used in the CDA, has decreased over the span of these studies.

detached homes because they have smaller interior spaces, are bordered by other units or common areas on one or more sides, and typically have fewer windows. All else being equal, a higher proportion of apartments with electric primary space heating will yield a lower UEC value. In contrast, there was almost no change in the mix of dwelling types among FEI customers who use gas for primary space heating.

- *Declining number of occupants per dwelling over time among FBC's customer base* – Among FBC customers using electricity as their primary space heating fuel, the average number of people per dwelling has declined over time. This is consistent with the rising share of apartments and apartment-style condominiums in the sample. A similar trend was not apparent in the FEI studies.
- *Relatively higher proportion of new builds in the FBC sample* – There was a significant increase in the proportion of newer homes (i.e., those constructed since 2005) among FBC customers with electric primary space heating. Newer homes tend to be more energy efficient than older ones. Again, this trend was not mirrored in the FEI studies.
- *Increased penetration of heat pumps* – The use of heat pumps and hybrid systems (e.g., a heat pump paired with an electric furnace) for primary electric space heating increased significantly in the 2022 FBC sample compared to the samples used in previous FBC studies.
- *Pandemic effects on space heating less pronounced* – Data from the 2022 REUS indicated that FBC's customers using electricity for primary space heating were less likely to work from home and less likely to have school / university-aged children living in the home (who would have had to do remote learning during the pandemic) compared to FEI's customers who use gas for primary space heating. This suggests, everything else held constant, the pandemic's effect on space heating demand was not as pronounced for FBC customers as it was for FEI customers.

15.4.2 Air Conditioning

The weather-normalized UEC for central air conditioning was estimated at 480 kWh per year, compared to 774 kWh per year in the 2017 study and 556 kWh per year in the 2012 study. Similarly, the UEC for room and portable air conditioning (250 kWh) has decreased from the 2017 and 2012 analyses (515 kWh and 326 kWh, respectively). With the significantly warmer weather in June and July of 2021, the decline in the UEC value for air conditioning was surprising. However, it is supported by patterns in electricity consumption data during the summer months,[39] and is explained by several factors:[40]

- *Change in mix of dwelling types in the FBC sample over time* – Among FBC customers who have central air conditioning, the proportion residing in apartments increased compared to the 2017 study. Also, the average floor space of the dwellings in the 2022 was lower than in previous studies.

[39] Among households with central air conditioning, actual weighted electricity consumption in the summer months (June, July, and August) declined slightly over the three studies, even though cooling degree days have increased. (The percent change in actual electricity usage in the summer months was similar for households without air conditioning.)

[40] This list pertains to central air conditioning, but many of the same points apply to room and portable air conditioning.

All else being equal, this will yield a lower UEC for air conditioning as smaller spaces require less energy to cool.

- *Increasing efficiency of air conditioning equipment over time* – The efficiency of residential air conditioning stock has improved due to equipment turnover, as well as first-time installations in new construction and existing dwellings. The proportion of newer homes (i.e., constructed since 2005) with central air conditioning in the sample is up significantly compared to previous studies.
- *Pandemic effects on space cooling were relatively modest* – Adjustments to thermostat settings for when people are not home during the day are considerably smaller for months where air conditioning (cooling) is required (increase of 0.4 °C on average during the day when no one is at home) compared to months where heating is required (3 °C down on average when no one is at home). This suggests that the pandemic effects on air conditioning related to people working / studying from home are likely not as pronounced as they are with space heating during the winter months.
- *UEC values are based on average (10-year) weather patterns* – Weather normalizing UEC estimates is a common practice, designed to minimize short-term weather anomalies from having an outsized effect on the UEC estimates and, in turn, load and resource planning forecasts that rely upon these estimates. Effectively, the effects of the short, but intense, heat wave in 2021 are "normalized out" to some extent.[41]
- *Possible overestimation of the UEC for air conditioning in 2017* - The estimated model parameters for air conditioning in the 2017 analysis appear to have been influenced by an anomalous (unexplained) peak in household electricity consumption in July 2015.[42] This may have resulted in the over-estimation of air conditioning UEC in the 2017 study.[43] Consequently, it might be more credible to compare the results of the current analysis with the 2012 study, taking into consideration the sample used in that study had proportionally fewer apartments.

15.4.3 Domestic Water Heating

Similar to the trends observed for space heating and cooling, the weather-normalized UEC for domestic water heating is lower in the current analysis (2,302 kWh per year) than in the 2017 and 2012 studies (2,874 kWh per year and 3,848 kWh per year, respectively). The decline in UEC for water heating is consistent with behavioural changes observed during the pandemic (e.g., fewer showers and laundry loads, on average), as well as more persistent dynamics that affect demand for water heating, such as the trend

[41] The regression model is fit using actual weather data (heating and cooling degree days), and then ten-year averages are substituted into the regression equation to calculate weather-normalized UECs for space heating and cooling, and domestic water heating. Since normal CDDs are less than actual CDDs, on average, the estimated UEC for air conditioning is lower than if it had been calculated using actual cooling degree days data.

[42] Among FBC households with central air conditioning, weighted average electricity consumption in July 2015 was 1,338 kWh, 30 percent higher than the respective month's average during the heat wave in July 2021.

[43] The model's parameters related to air conditioning would be overestimated if all or part of the peak was attributable to other end-uses.

towards smaller households (number of occupants), improvements in the efficiency of electric hot water tanks (better tank wall insulation), adoption of water conserving behaviours and technologies (e.g., high efficiency washing machines and low flow showerheads), as well as milder weather conditions, on average, in the colder months. Note, the water heating UEC value was likely overestimated in the 2012 study and so caution should be exercised when comparing these results.

15.4.4 Home Entertainment & Related Equipment

The UEC for home entertainment equipment (televisions, set-top boxes, DVD/Blue Ray/VCR units, media streaming devices, surround sound systems, traditional stereo systems, and video game consoles) was estimated to be 1,266 kWh per year. In comparison, the 2017 study estimated UEC for home entertainment equipment at 1,001 kWh per year. The estimated UEC value from the 2012 study (943 kWh per year) represents televisions only.[44] The increase in UEC for home entertainment equipment is consistent with behavioural changes observed during the pandemic (more people at home, who would have used these devices more often) and is reflected in patterns of actual household consumption data.[45] An attempt was made to include computers in the conditional demand analysis, but it was not retained in the final model because the estimated UEC value was unreasonable. As a result, electricity use associated with computers may be captured as part of other end-uses or the base consumption load of a household. The UEC estimated for computers in 2012 can be used as a proxy.

15.4.5 Lighting

The estimated UEC for lighting decreased from 1,103 kWh per year in the 2017 study to 968 kWh per year in the current analysis. This decline can, in part, be explained by increased penetration of energy-efficient LED lighting since 2017. It appears that improvements in lighting efficiency more than offset any pandemic-related effects on lighting demand resulting from more people working/studying from home. The higher UEC value in the 2012 study is, in part, due to differences in sample composition (i.e., a greater proportion of larger single family detached dwellings, which tend to have more light fixtures than apartments).

15.4.6 Appliances

UECs for appliances include 712 kWh per year for refrigerators, 795 kWh per year for stand-alone freezers, 766 kWh per year for electric cooking appliances, 808 kWh per year for dishwashers, and 829 kWh per year for clothes washers and electric dryers. Notably, the estimated UECs for electric cooking appliances and

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[44] In the 2012 study, the UEC for televisions may be partially capturing the effect of TV peripherals, such as set-top boxes, DVD players, media streaming devices, surround sound systems, and video game consoles. Given the high correlation of ownership between TVs and these devices, their electricity consumption is considered in the aggregate in the current analysis, as it was in the 2017 study.

[45] Among households that do not use electricity for either primary space heating or water heating, weighted average electricity consumption increased by approximately five percent from the 2017 study. This is markedly different from the decline in average consumption observed for households using electricity for space heating and/or water heating.

dishwashers are relatively high, which can be explained, in part, by an increase in the number of people cooking at home, rather than dining out, during the pandemic.[46]

15.4.7 Electric Passenger Vehicles

The UEC value for electric vehicles corresponds to battery electric vehicles only, whereas the value from the 2017 study represents energy usage from charging either battery electric vehicles or plug-in electric hybrid vehicles. An attempt was made to include plug-in electric hybrids in the CDA, but the relevant variable was not retained in the model because its regression coefficient was negative, likely due to the small number of households in the sample that possess this type of electric vehicle.[47]

15.4.8 Other End Uses

The UECs for most of the other end-uses are relatively consistent between studies, except for electrically-heated pools. The UEC for pools was exceptionally high in the 2012 study. However, this result should be interpreted with caution due to the small number of households in the sample with electrically-heated pools. The estimates from the current analysis and the 2017 study are likely more representative of electricity usage for a typical pool.

15.5 UECs for Select Space Heating Equipment

One of the objectives of the analysis was to model the effects of electric furnaces and heat pumps on primary space heating demand. Exogenous variables were incorporated into the conditional demand model to estimate these effects (see Table 235). Approximately 4% of the households in the CDA sample reported using an electric furnace as their main heating source (excluding hybrid systems in which a heat pump is used in conjunction with an electric furnace). Among these customers, the weather-normalized, weighted UEC for primary space heating was 4,773 kWh per year (actual weighted consumption per household matching this space heating equipment set-up was 11,569 kWh per year).

Additionally, 9% of the sample reported using a heat pump (air or ground source) as their main heating source (excluding hybrid systems). Among these customers, the UEC estimate for primary space heating was 2,938 kWh per year. (The actual weighted consumption per household matching this heating equipment arrangement was 11,742 kWh per year.)

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[46] In Conditional Demand Analysis, it is often challenging to differentiate the electricity consumption of high-penetration end-uses, such as refrigerators, cooking appliances, dishwashers, clothes washers and dryers, etc. Their estimated consumption levels may mask the effects of other end-uses and/or partially capture the base consumption load of a household. A review of other CDA studies (see Table 236) shows considerable variation in UECs, confirming the difficulty in estimating energy demand for many of these appliances. Caution is advised when interpreting the results, as well as making comparisons with past studies.

[47] The accuracy and reliability of UEC estimates for plug-in electric passenger vehicles are expected to improve over time as the penetration rates for these vehicles (and participation of electric vehicle owners in future FortisBC residential end-use studies) are expected to increase significantly over the next decade.

Finally, 6% of the sample reported using a heat pump in conjunction with an electric furnace (hybrid systems). Among these customers, the UEC estimate for primary space heating was 4,476 kWh per year. (The actual weighted consumption per household with electric furnace-heat pump combinations was 13,838 kWh per year.)

Table 235: Penetration Rates and Unit Energy Consumption for Space Heating Equipment – FBC's Overall Service Area

Primary Space Heating Equipment [1]	Sample Size (unweighted)	Penetration (% presence)	Unit Energy Consumption (kWh/year)
Electric Furnace [2]	50	4%	4,773
Heat Pump [2]	128	9%	2,938
Heat Pump & Electric Furnace	95	6%	4,476

[1] Excludes cases in which equipment is used for secondary heating.
[2] Excludes cases in which a heat pump is used in conjunction with an electric furnace.

15.6 Comparisons with Other Studies

Table 236 shows a comparison of this study's UEC estimates with two previous FBC studies (2012 and 2017) and four studies in the public domain: one conducted by B.C. Hydro (2009); one conducted using a geographically representative sample from across Canada (2007); and two by the California Energy Commission (2009 and 2019).[48]

The B.C. Hydro study is based on a residential end-use survey completed in 2008, the Canada-wide study is based on a survey administered by Statistics Canada in partnership with Natural Resources Canada in 2007 and uses consumption data obtained from relevant utilities, and the California studies are based on surveys done in 2009 and 2019, respectively. Comparisons with these studies may not be entirely valid since some are several years old. They are also based on geographic regions with different weather conditions, dwelling characteristics, and household usage behaviours (particularly in California). Still, they provide a ballpark comparison for the UEC estimates produced in this study.

[48] Sources: Sampson Research Inc. (2014); Sampson Research Inc. (2009); Tiedemann, et. al. (2013); Newsham, et. al. (2013); California Energy Commission (2010); and California Energy Commission (2021).

Table 236: Comparison of UEC Estimates to those from Prior CDA Studies

Utility	FortisBC	FortisBC	FortisBC	BC Hydro	Multiple	California Energy Commission	California Energy Commission
Region	Okanagan/ Kootenays	Okanagan/ Kootenays	Okanagan/ Kootenays	British Columbia	Canada	California	California
Year	2022	2017	2012	2008	2007	2019	2009
Primary Space Heating	3,533	4,749	6,468	4,767	3,111/5,085[e] 9,194/8,149[f]	953/768[h]	709/642[h]
Southern Interior Region				*7,953*			
Secondary Space Heating	1,184	1,427	999	2,068	771	489	222
Furnace Fan Motors (Gas Furnaces)	-	163	386	-	-	130	180
Central Air Conditioning	480	774	556	230	323	1,163	766
Room & Portable Air Conditioning	250	515	326	34	396	620	206
Domestic Water Heating	2,302	2,874	3,848	2,790	4,891/4,275[e]	1,792	2,393
Southern Interior Region				*2,957*			
Refrigerators	712	993	626	1,120[d]	660/768[e]	1,130/1,081[i]	772/1,212[i]
Freezers	795	718	661	-	558	840	938
Cooking	766	120	538	347	425/509[e]	350	262
Dishwashers	808	-	-	372	458	84	74
Clothes Washers & Electric Dryers	829	535	841	256	1,023	89/502[j]	104/652[j]
Lighting	968	1,103	2,216	1,992	599[g]	-[k]	-[k]
Home Entertainment Equipment	1,266[a]	1,001[a]	-	-	-	-	-
Televisions	-	-	943	409	219	462	693
Computers	-	-	326	415	-	272	611
Swimming Pools	2,037	2,919	10,869	1,597	-	2,895	3,502
Hot Tubs	3,294	2,818	3,558	2,881	-	314/1,015[l]	290/1,006[l]
Saunas	588	-	1,402	-	-	-	-
Plug-in Electric Vehicles	655[b]	3,178[c]	-	-	-	971	-
Car Block Heaters	-	373	65	-	-	-	-
Water Pumps / Well Pumps	1,601	1,734	875	-	-	1,346	552
Baseload	947	1,736	1,359	-	-	1,769[m]	1,838[m]

[a] Includes televisions, set-top boxes, DVD/Blue Ray/VCR units, media streaming devices, surround sound systems, traditional stereo systems, and video game consoles.
[b] Represents energy usage for charging battery electric vehicles.
[c] Represents energy usage for charging battery electric vehicles or plug-in electric hybrid vehicles.
[d] Represents refrigerators and freezers in aggregate.
[e] New / old (>10 years) equipment.
[f] Represents room-level equipment (e.g., electric baseboards) used for primary space heating.
[g] Represents incandescent and halogen lights only.
[h] Primary conventional space heating / primary heat pump space heating.
[i] First refrigerators / additional refrigerators.
[j] Clothes washers / electric dryers.
[k] The California study was unable to model interior lighting due to a lack of information on lighting inventories.
[l] Spa pumps / electric spa heat.
[m] Includes interior lighting.

15.7 UECs by Dwelling Type

The overall conditional demand model was used to estimate UECs for key end-uses by the following dwelling types: single-family detached dwellings; multi-family attached dwellings (duplexes and row/townhouses); and apartments / apartment-style condominiums. However, sample size limitations meant that meaningful estimates could not be produced for multi-family attached dwellings or apartments. Results are presented for single family detached homes only.

15.7.1 Single-Family Detached Dwellings

Table 237 shows estimated weather-normalized UECs for select end uses for single-family detached dwellings with comparisons to the UECs for the all dwelling sample from Table 234.[49] As expected, unit energy consumption values are greater for this sub-sample of dwellings than for the overall (all dwelling type) sample.

Table 237: Penetration Rates and Unit Energy Consumption by End-Use – Single-Family Detached Dwellings

	Single-Family Detached Dwellings			All Dwellings
	Sample Size (unweighted)	Penetration (% presence)	Unit Energy Consumption ((kWh/year)	Unit Energy Consumption (kWh/year)
Primary Space Heating	263	22%	5,062	3,533
Secondary Space Heating	353	32%	1,427	1,184
Central Air Conditioning	620	58%	536	480
Domestic Water Heating	502	43%	2,395	2,302
Lighting	1,120	100%	1,134	968

15.8 Limitations

The results of this study should be interpreted with some caution due to several important limitations:

1. The estimated consumption levels of high-penetration end-uses (e.g., lighting or refrigerators) may mask the effects of other modelled end-uses and/or partially capture the base consumption load of a household. Conversely, the estimated baseload may capture some of the effects of high-penetration end-uses.
2. The effects of low-penetration end-uses (e.g., electric-heated pools or saunas) are difficult to estimate because of small sample sizes.
3. The effects of certain end-uses may be confounded because of a high correlation of ownership (e.g., televisions and peripherals, such as set-top boxes, DVD players, media streaming devices, surround sound systems, and video game consoles).
4. Unit energy consumption values could not be accurately estimated for multi-family dwellings or apartments due to small sample sizes.
5. Some information collected through the self-reported customer survey may be unreliable.

[49] UECs were calculated for only those end-uses with sufficiently rich model specifications (i.e., that accurately capture variation in energy demand between dwelling types).

6. The rich model specifications originally developed for some end-uses had to be simplified because of unreasonable regression results.

16 REFERENCES

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Appendix A

2022 REUS Questionnaire

Service Address

Survey ID

June 23, 2022

Dear Customer,

At FortisBC, we're committed to providing a range of energy services to meet your needs today and tomorrow. Planning for your future needs means understanding how residential customers like you currently use energy and if you plan to change how you use energy in the future.

Your household has been randomly selected from a list of our customers to complete this important survey. The survey will improve our understanding of how energy is used in homes, assist in the design of energy efficiency programs to help you reduce your energy bills and lower your greenhouse gas emissions.

Complete this survey by July 31, 2022 and you can enter your name for a chance to win one of four $1,000 pre-paid VISA® gift cards. If you complete the survey online your name will be entered in the draw twice, doubling your chances of winning. Full contest details are found below.

We have hired Mustel Group, an independent British Columbia-based market research firm to assist us in conducting this research. Your responses will be treated as strictly confidential by FortisBC and will be aggregated with those of other customers. FortisBC will use these results solely for research and planning purposes.

How to complete this survey

There are two ways you can complete this survey. Complete this printed version and return it using the self-addressed postage paid envelope provided, or complete the survey online (Internet) by typing the following website address into your browser's address window: **fortisbcreus.com** (Do not use a search engine). When prompted, enter the **SURVEY ID** located at the top right-hand corner of this covering letter to begin the survey. Only one survey (paper or online) will be accepted per household.

This survey should be completed by the person responsible for the maintenance and repair of your home.

Please ensure that your survey responses refer to the residence located at the SERVICE ADDRESS at the top of this page.

Privacy

The survey will tell us how you use energy in your home. To meet the goals of this survey, FortisBC will also analyze how much energy your home has used over the past two years.

To protect your privacy, Mustel Group, the market research company that is conducting this survey on behalf of FortisBC, will not have access to your account information. As well, FortisBC will not see your individual responses. The information collected will be treated confidentially and in accordance with the provisions of the *Personal Information Protection Act* (British Columbia). The information collected will not be used for any marketing or sales purpose.

If you have any questions about the survey or how the information will be used, please contact: Walter Wright or Roy Mokha, Market Research, FortisBC at 604-592-7653 or 778-578-8095 during business hours or market.research@fortisbc.com.

If you have mislaid the return envelope, please mail your completed questionnaire to: c/o FortisBC, élan Data Makers, Suite 350 11120 Horseshoe Way, Richmond, BC V7A 5H7.

Yours truly,

Mark Warren; Director Business Innovation, FortisBC

Contest rules can be viewed at www.mustelgroup.com/contestrules or are available upon request.

Dear Customer:

Throughout this questionnaire, when we ask about your home or residence, we are referring to the property at the SERVICE ADDRESS printed on the cover page of this survey**.** If you live in an apartment, apartment-style condominium or townhouse complex, we are interested only in the areas and appliances covered by your FortisBC bill.

A. About this residence

A1. Which of the following statements best describes your relationship to the residence located at the SERVICE ADDRESS printed on the cover page of this survey?

- ☐ 1 I (co) own and live full-time at this property
- ☐ 2 I (co) own and live part-time at this property
- ☐ 3 I own and live at this property but also rent part of it to others
- ☐ 4 I own this property but live elsewhere
- ☐ 5 I am a renter living at this property

Whenever you see this symbol, it means there is additional information available to help you answer one or more survey questions. Please review the information before answering the questions.

A2. How many years have you lived in or owned the residence at the SERVICE ADDRESS?

______ years

A3. How many weeks per year is this residence normally occupied?

______ weeks

A4. Has this residence at the SERVICE ADDRESS been occupied by the same person(s) for the last two years?

☐ 1 Yes ☐ 2 No

A5. Is this residence part of a housing co-op?

☐ 1 Yes ☐ 2 No

A6. Who pays the natural gas bill for the residence at the SERVICE ADDRESS?

- ☐ 1 Property owner(s)
- ☐ 2 Renter(s)
- ☐ 96 Other (please specify): _______________
- ☐ 99 No natural gas service

A7. Who pays the electricity bill for the residence at the SERVICE ADDRESS?

- ☐ 1 Property owner(s)
- ☐ 2 Renter(s)
- ☐ 96 Other (please specify): _______________

A8. Does the electricity bill for this residence cover any of the following?

	Yes	**No**	**Don't Know**	**Not Applicable**
Rental suite(s)	☐ 1	☐ 2	☐ 98	☐ 99
Coach house or laneway house	☐ 1	☐ 2	☐ 98	☐ 99
Detached garage / workshop	☐ 1	☐ 2	☐ 98	☐ 99
Other buildings (e.g., sheds, farm buildings)	☐ 1	☐ 2	☐ 98	☐ 99
Pumps (e.g., wells, irrigation, etc.)	☐ 1	☐ 2	☐ 98	☐ 99

A9. Do you pay rent or maintenance fees for this residence?

☐ 1 Yes ☐ 2 No → **GO TO QUESTION A11**

A10. If you pay rent or maintenance fees, which of the following are included in these fees? (Check all that apply)

- ☐1 Heat
- ☐2 Hot water
- ☐3 Fuel for gas fireplace
- ☐4 Electricity for electric vehicle charging
- ☐97 None of the above
- ☐98 Don't know
- ☐99 I do not pay rent or maintenance fees for this property

A11. Do you or anyone in your household use part of this residence to run a full-time or part-time business?

☐1 Yes, full-time business ☐2 Yes, part-time business ☐3 No

A12. Is this residence a…

- ☐1 Single family dwelling (detached)
- ☐2 Duplex
- ☐3 Row/townhouse (3 or more units attached, each with a separate entrance)
- ☐4 Apartment or apartment-style condominium
- ☐5 Mobile or manufactured home
- ☐96 Other (please specify): ________________

A13. When was this residence built?

- ☐1 Before 1950
- ☐2 1950-1975
- ☐3 1976-1985
- ☐4 1986-1995
- ☐5 1996-2005
- ☐6 2006-2015
- ☐7 2016 or later
- ☐98 Don't know

A14. What type of basement does this residence have?

- ☐1 Full basement
- ☐2 Partial basement
- ☐3 Crawlspace → **GO TO QUESTION A16**
- ☐4 No basement → **GO TO QUESTION A17**

A15. Is the basement of this residence unfinished, partly finished or completely finished?

☐1 Unfinished ☐2 Partly finished ☐3 Completely finished

A16. During the heating season, is the basement or crawlspace usually heated?

☐1 Yes ☐2 No ☐98 Don't know

A17. What is the total floor area of this residence, including the basement and unfinished areas but excluding the garage or carport?

_________ Square feet OR _________ Square metres

A18. How many floors (stories) of this residence are heated? Please include the basement if heated. If this residence is an apartment or condominium, this question refers only to your unit.

☐1 ☐2 ☐3 ☐4 ☐5+

A19. If this service address is an apartment or apartment-style condominium, how many floors (stories) does your building have in total? (Do not count floors used for parking)

____ floors or stories for this building ☐99 Not an apartment or apartment-style condominium

A20. Please indicate which areas of this residence have insulation.

	Have insulation?			
Location	**Yes**	**No**	**Don't know**	**Not applicable**
Attic	☐1	☐2	☐98	☐99
Exterior walls	☐1	☐2	☐98	
Basement	☐1	☐2	☐98	☐99
Crawlspace	☐1	☐2	☐98	☐99
Heated garages / workshops	☐1	☐2	☐98	☐99

A21. Has the insulation in this residence been improved or upgraded?

Location	Yes	No	Don't know	Not applicable
Attic	☐ 1	☐ 2	☐ 98	☐ 99
Exterior walls	☐ 1	☐ 2	☐ 98	
Basement	☐ 1	☐ 2	☐ 98	☐ 99
Crawlspace	☐ 1	☐ 2	☐ 98	☐ 99
Heated garages / workshops	☐ 1	☐ 2	☐ 98	☐ 99

A22. Which of the following best describes this residence?

☐ 1 Not at all drafty ☐ 2 Sometimes drafty ☐ 3 Always drafty

A23. Please indicate the number of outside doors in this residence. If this residence is an apartment or condominium, please count only doors in your unit that open directly to the outdoors.

	Number		Number
Wood doors	____ a	Glass doors with wooden frames	____ d
Wood doors with aluminum storm doors	____ b	Glass doors with aluminum frames	____ e
Insulated steel or fibreglass doors	____ c	Glass doors with vinyl or fibreglass frames	____ f

A24. Have any of the outside doors at this residence been upgraded with new doors in the last 5 years?

☐ 1 Yes – all of them
☐ 2 Yes – some of them
☐ 3 No – none of them
☐ 98 Don't know

A25. What type of windows does this residence have? Please estimate the percentage of windows by the following window types.

Window type	% of all windows		ENERGY STAR® rated?		
Single pane regular (clear) glass	_______%				
Double pane regular (clear) glass	_______%				
Double pane low-E*	_______%	→	☐ 1 Yes	☐ 2 No	☐ 98 Don't know
Triple pane regular (clear) glass	_______%				
Triple pane low-E*	_______%	→	☐ 1 Yes	☐ 2 No	☐ 98 Don't know
Total	**100%**				

** Low-E coated glass has a slight shading or tint when compared to standard windows.*

A26. Please estimate the percentage of your windows that have the following frames:

	% of windows
Aluminum frames	_______%
Wood frames	_______%
Vinyl frames	_______%
Other (please specify): _______________	_______%
Total	**100%**

A27. Have any of the windows at this residence been upgraded with new windows (frames and glass) in the last 5 years?

☐ 1 Yes – all of them
☐ 2 Yes – some of them
☐ 3 No – none of them
☐ 98 Don't know

B. Space heating

B1. Please indicate the fuel(s) used to heat this residence. First, indicate the main space heating fuel (check one only). The main fuel is the one that provides most of the heat in the home during a typical year. Next, indicate any other fuels used to provide heat for this home (check all that apply).

Space heating fuels	Main space heating fuel *(check one only)*	Other space heating fuels *(check all that apply)*
Electricity	☐ 1	☐ 1
Natural gas	☐ 2	☐ 2
Piped propane	☐ 3	☐ 3
Bottled propane	☐ 4	☐ 4
Oil	☐ 5	☐ 5
Wood	☐ 6	☐ 6
Other	☐ 96	☐ 96
Don't know	☐ 98	☐ 98
No other space heating fuel used ▶		☐ 99

Have a heat pump?

If this residence uses an air source heat pump or geothermal heat pump as a source of heat, select "electricity" under the appropriate column.

Piped propane service?

Piped propane is only applicable to FortisBC customers in Revelstoke

B2. Is the MAIN space heating fuel for this residence different from what was used five years ago?

☐ 1 Yes → **CONTINUE**
☐ 2 No → **GO TO QUESTION B4**

B3. What was the previous MAIN space heating fuel? (check one fuel only)

☐ 1 Electricity
☐ 2 Natural gas
☐ 3 Piped propane
☐ 4 Bottled propane
☐ 5 Oil
☐ 6 Wood
☐ 96 Other
☐ 98 Don't know

Gas: unless specified "gas" refers to natural gas or propane

Combined space and water heating systems

Combined or combination heating systems replace a traditional boiler and hot water tank or furnace and hot water tank with an integrated system that supplies both heat and hot water for the home.

B4. Which of the following does this residence have?

☐ 1 Gas boiler → **GO TO QUESTION B5**
☐ 2 Gas furnace → **GO TO QUESTION B6**
☐ 3 Combined space & water heating system → **GO TO QUESTION B7**
☐ 4 Electric furnace → **GO TO QUESTION B11**
☐ 99 None of the above → **GO TO QUESTION B12**

B5. GAS BOILERS ONLY: Boiler efficiency refers to how much useful heat your boiler extracts from the gas. The higher the efficiency of the boiler, the less fuel is required to heat your house. Boilers are categorized as low efficiency, mid-efficiency, or high efficiency.

What is the efficiency of your boiler?

☐ 1 Low efficiency – 60% to 70% efficient
☐ 2 Mid-efficiency – 80% to 85% efficient
☐ 3 High efficiency – 90% efficient or higher
☐ 98 Don't know

Gas boiler efficiencies

Low efficiency gas boilers:
- Less than 80% efficient
- Uses a standing pilot light

Mid-efficiency gas boilers:
- 80% to 85% efficient
- No pilot light, uses igniter instead

High efficiency gas boilers:
- 90% efficient or higher
- No pilot light, uses igniter instead
- Flue is a plastic pipe exiting the side of the house

B6. GAS FURNACES ONLY: Furnace efficiency refers to how much useful heat your furnace extracts from the gas. The higher the efficiency of the furnace, the less fuel is required is to heat your house. Furnaces are categorized as low efficiency, mid-efficiency, or high efficiency.

What is the efficiency of your gas furnace?

- ☐ 1 Low efficiency – less than 78% efficient *(25 years or older, pilot light and metal flue exiting through the roof)*
- ☐ 2 Mid-efficiency – 78% to 85% efficient *(10 years or older, no pilot light and metal flue exiting through the roof)*
- ☐ 3 High efficiency – 90% efficient or higher *(No pilot light, flue is a plastic pipe exiting the side of the home)*
- ☐ 98 Don't know

B7. Is your furnace, boiler or combination system an ENERGY STAR® qualified model? If yes, it should display the ENERGY STAR® symbol.

☐ 1 Yes ☐ 2 No ☐ 98 Don't know

B8. Has a new gas furnace, gas boiler or gas combination system been installed in this residence in the past five years?

- ☐ 1 Yes
- ☐ 2 No
- ☐ 98 Don't know

B9. How old is your gas furnace, boiler, or combination system?

_____ years ☐ 98 Don't know

B10. How likely is it that the furnace, boiler, or combination system for this residence will be replaced sometime during the next two years?

- ☐ 1 Very likely
- ☐ 2 Somewhat likely
- ☐ 3 Not at all likely
- ☐ 98 Don't know

B11. Please indicate whether you always, usually, occasionally or never do the following. (check one box per row)

	Always	Usually	Occasion-ally	Never	Don't know	Not applicable
Change the heating furnace filter regularly	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
Have the heating system serviced annually by a contractor	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
Service the heating system annually myself	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99

B12. Which of the following does this residence have?

- ☐ 1 Ducted air source heat pump
- ☐ 2 Ductless air source heat pump
- ☐ 3 Ground source heat pump (Geothermal)
- ☐ 99 None of the above → **GO TO QUESTION B15**

Air source heat pump types

Air source heat pumps provide efficient heating and cooling for your home. There are two types:

Ductless (mini-split) – Warm or cold air is provided by one or more air handling units or "heads" mounted on the inside walls of the home.

Ducted – these air source heat pumps may be connected to a forced air furnace. Warm or cold air from the heat pump is distributed throughout the home via the dwelling's duct work.

B13. Which of the following best describes how you use your heat pump?

- ☐ 1 Both heating and cooling
- ☐ 2 Cooling only
- ☐ 3 Heating only
- ☐ 98 Don't know

B14. Please indicate whether you always, usually, occasionally or never do the following. (check one box per row)

	Always	Usually	Occasion-ally	Never	Don't know	Not applicable
Change the heat pump filter regularly	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
Have the heat pump serviced annually by a contractor	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
Service the heat pump system annually myself	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99

B15. There are several METHODS (heating equipment) that can be used to heat a home. Please indicate the main method used to heat this residence (check one only), then any other methods used to heat this residence (check all that apply).

Heating methods	Main space heating method *(check one only)*	Other space heating methods used *(check all that apply)*
Forced air furnace	☐1	☐1
Wired-in electric baseboards	☐2	☐2
Boiler with hot water baseboards or radiators	☐3	☐3
Boiler with hot water in-floor / under-floor heat	☐4	☐4
Combined space and water heating system	☐5	☐5
Fireplace or heater stove	☐6	☐6
Heat pump – air source	☐7	☐7
Heat pump – geothermal	☐8	☐8
Wired-in electric wall heater (fan forced)	☐9	☐9
Electric radiant heat (floors, walls, and/or ceilings)	☐10	☐10
Gas wall heater	☐11	☐11
Portable electric heaters	☐12	☐12
District or community heating system	☐13	☐13
Other (please specify): ____________________	☐96	☐96
No other space heating method used →		☐99

B16. Which of the following thermostats are used in this residence? (Check all that apply)

☐1 Programmable thermostats
☐2 “Smart” or learning-style thermostats (Nest, ecobee, etc.)
☐3 Manual (non-programmable) thermostats → **GO TO SECTION C**
☐98 Don’t know → **GO TO SECTION C**

B17. How many of your programmable thermostat(s) are programmed?

☐1 All of them
☐2 Some of them
☐3 None of them
☐98 Don’t know

C. Fireplaces and heater stoves

Many homes are equipped with fireplaces or heater stoves. Some provide ambiance but little or no heat, while others can be used to heat one or more rooms.

Gas fireplace and heater stove types

Decorative fireplaces – Provide ambiance but have little or no heating ability. The hearth is often open to the room or equipped with opening glass doors.

Heater type fireplaces (built-ins and inserts) – These fireplaces are efficient heaters with fixed glass fronts and may have features such as fans and thermostatic control. They may be built-in at the time of construction or inserted into an existing masonry or other fireplace as an upgrade.

Free standing fireplaces and heater stoves – These are stand alone units that can be used for both ambiance and heating. Gas heater stoves resemble wood stoves in appearance but use gas instead of wood.

C1. How many fireplaces and heating stoves are there in this residence?

1☐ 2☐ 3☐ 4+ ☐ None ☐→ **GO TO SECTION D**

C2. For each fireplace / heating stove this residence has, please indicate the type of fireplace / heating stove.

	Fireplace 1	Fireplace 2	Fireplace 3
Gas (decorative)	☐ 1	☐ 1	☐ 1
Gas (heater type)	☐ 2	☐ 2	☐ 2
Gas (free standing)	☐ 3	☐ 3	☐ 3
Electric	☐ 4	☐ 4	☐ 4
Wood burning fireplace	☐ 5	☐ 5	☐ 5
Wood burning stove	☐ 6	☐ 6	☐ 6
Other: _______________	☐ 96	☐ 96	☐ 96

IF THIS RESIDENCE DOES NOT HAVE A GAS FIREPLACE OR HEATING STOVE, GO TO C5

C3. How old is (are) your gas fireplace(s)?

Gas fireplace 1	_____ years	Don't know ☐ 98
Gas fireplace 2	_____ years	Don't know ☐ 98
Gas fireplace 3	_____ years	Don't know ☐ 98

C4. Please indicate which of the following features each gas fireplace has (check all that apply for each fireplace).

	Gas Fireplace 1	Gas Fireplace 2	Gas Fireplace 3
Fixed glass front	☐ 1	☐ 1	☐ 1
Glass doors that open	☐ 2	☐ 2	☐ 2
No glass (open hearth)	☐ 3	☐ 3	☐ 3
Remote control	☐ 4	☐ 4	☐ 4
Standing pilot light	☐ 5	☐ 5	☐ 5

C5. How many hours are the fireplaces and heater stoves in use during a typical week in each of the following seasons? Please sum the total hours for ALL fireplaces and heater stoves used in a typical week in each season.

July – September	_____ hours per week
October – December	_____ hours per week
January – March	_____ hours per week
April – June	_____ hours per week

C6. Approximately, what share of this residence's space heating is provided by fireplaces and/or heater stoves? Please include ALL fireplaces and heater stoves at this residence in your answer.

0% (none) ☐ 0	Up to 25% ☐ 2	Up to 75% ☐ 4	Don't know ☐ 98
Up to 10% ☐ 1	Up to 50% ☐ 3	Up to 100% ☐ 5	

C7. Has a wood, electric or gas, fireplace or heater stove been installed in this residence during the last five years?

Yes ☐ 1 → **CONTINUE**
No ☐ 2
Don't know ☐ 98 } → **GO TO SECTION D**

C8. What did you install?

☐ 1 Gas fireplace or heater stove → **CONTINUE**
☐ 2 Wood heater stove
☐ 3 Electric fireplace
☐ 98 Don't know } → **GO TO SECTION D**

C9. Did this Gas fireplace or heater stove replace an existing wood, gas, or electric fireplace or was it a new installation? (select one)

☐ 1 Replaced a wood fireplace or wood heater stove
☐ 2 Replaced a gas fireplace or gas heater stove
☐ 3 Replaced an electric fireplace
☐ 4 Nothing - new installation
☐ 98 Don't know

D. Domestic water heating

D1. How many water heaters are there in this residence? If you live in an apartment, townhouse, or row house where hot water is centrally provided to all units (from outside your unit), please check "none".

☐ 1 ☐ 2 ☐ 3 ☐ None → **GO TO SECTION E**

D2. What types of water heater(s) are there in this residence? Homes with more than one water heater usually have one water heater that provides more hot water than the others. For classification purposes, consider this unit your main water heater.

	Heater 1 (main unit)	**Heater 2**	**Heater 3**
Conventional storage (tank)	☐ 1	☐ 1	☐ 1
On-demand (tankless)	☐ 2	☐ 2	☐ 2
Combined space and water heating system	☐ 3	☐ 3	☐ 3
Heat pump water heater tank	☐ 4	☐ 4	☐ 4
Don't know	☐ 98	☐ 98	☐ 98

D3. What type of fuel does your water heater(s) use?

	Heater 1 (main unit)	**Heater 2**	**Heater 3**
Electricity	☐ 1	☐ 1	☐ 1
Natural gas	☐ 2	☐ 2	☐ 2
Piped propane	☐ 3	☐ 3	☐ 3
Bottled propane	☐ 4	☐ 4	☐ 4
Oil	☐ 5	☐ 5	☐ 5
Geothermal	☐ 6	☐ 6	☐ 6
Other	☐ 96	☐ 96	☐ 96
Don't know	☐ 98	☐ 98	☐ 98

Water heater fuels

Most water heaters use gas, oil, or electricity to generate hot water. If your hot water heater has a flue or vent (metal or plastic) that exits the house, then it uses gas or oil. If you cannot see a vent. then it uses

D4. All water heaters that use gas or oil require some way to vent combustion gases. If this residence uses one or more gas or oil fired hot water heaters, please indicate the type of vent used.

	Heater 1 (main unit)	**Heater 2**	**Heater 3**
Vent through the side wall	☐ 1	☐ 1	☐ 1
Vent through the roof	☐ 2	☐ 2	☐ 2
Electric - No vent required	☐ 3	☐ 3	☐ 3
Don't know	☐ 98	☐ 98	☐ 98

D5. Is the fuel used for domestic water heating (main unit) different from what was used five years ago?

Yes ☐ 1 → **CONTINUE**
No ☐ 2 → **GO TO QUESTION D7**

D6. What was the previous water heating fuel? (Check one only)

Electricity ☐ 1 Bottled propane ☐ 4 Don't know ☐ 98
Natural gas ☐ 2 Oil ☐ 5
Piped propane ☐ 3 Other ☐ 96

D7. How old is (are) your water heater(s)?

Heater 1 (Main Unit) _____ years Don't know ☐ 98
Heater 2 _____ years Don't know ☐ 98
Heater 3 _____ years Don't know ☐ 98

D8. What is the size (volume) of the largest hot water tank in your home? The size is printed on the label attached to your tank.

- ☐ 1 Not applicable – I have an on-demand (tankless) water heater
- ☐ 2 Less than 30 imperial gallons (less than 135 litres)
- ☐ 3 30 to 39 imperial gallons (135 to 180 litres)
- ☐ 4 40 to 59 imperial gallons (181 to 270 litres)
- ☐ 5 60 or more imperial gallons (271 litres or more)
- ☐ 96 Other (please specify): _______________
- ☐ 98 Don't know

D9. Where is your water heating equipment located? (main unit only)

- ☐ 1 In the main living area of the home
- ☐ 2 In a heated basement
- ☐ 3 In an unheated basement
- ☐ 4 Inside a crawlspace
- ☐ 5 In a heated garage
- ☐ 6 In an unheated garage
- ☐ 96 Other (please specify): ____________________
- ☐ 98 Don't know

D10. Has a new water heater been installed in this residence within the past five years?

Yes ☐ 1 → **CONTINUE**
No ☐ 2 → **GO TO QUESTION D12**

D11. What was the main reason for installing a new water heater? (check one only)

- Water heater had failed ☐ 1
- Anticipated water heater failure ☐ 2
- Wanted more efficient water heater ☐ 3
- New home ☐ 4
- Wanted to switch to gas ☐ 5
- Needed more hot water ☐ 6
- Required to qualify for home insurance ☐ 7
- Other ☐ 96

D12. Please indicate the total number of the following for your residence:

	Number
Showerheads (all kinds)	______
Low flow showerheads	______
Water heater blankets	______
Instant hot water dispensers	______
Bathroom and kitchen faucets using aerators	______

D13. Please indicate the total number of the following for all members of your household:

	Number
Number of dishwasher loads per week	______
Number of baths per week	______
Number of showers per week	______

D14. Please estimate the total amount of time that shower(s) are used on a typical weekday (total for all members of this residence)

_____ minutes per day ☐ 999 No showers – take baths only

D15. Is the water used by this residence metered?

Yes ☐ 1 → **CONTINUE**
No ☐ 2 }
Don't know ☐ 98 } → **GO TO SECTION E**

D16. Does this residence receive a bill for the amount of water it uses based on the water meter reading?

☐ 1 Yes ☐ 2 No ☐ 98 Don't know

E. Swimming pools, hot tubs & saunas

E1. Does this residence have a swimming pool, hot tub, or sauna that is for the exclusive use of this residence?

Yes ☐ 1 → **CONTINUE**
No ☐ 2 → **GO TO SECTION F**

E2. Please indicate whether this residence has an indoor or outdoor swimming pool, hot tub or sauna that is for the exclusive use of this residence (for example, not shared with other residences in a townhouse or condominium complex). For each that you have, please indicate the fuel used to heat it.

	Have one that is for exclusive use of this residence?	**If yes, what is the main fuel used to heat it? (check one only)**		
a. Indoor swimming pool	☐ 1 Yes → ☐ 2 No	☐ 1 Electricity ☐ 2 Natural gas	☐ 3 Propane ☐ 4 Solar	☐ 96 Other ☐ 98 Don't know
b. Outdoor swimming pool	☐ 1 Yes → ☐ 2 No	☐ 1 Electricity ☐ 2 Natural gas ☐ 6 Check here if a solar heater is used to supplement main fuel ☐ 99 Pool not heated	☐ 3 Propane ☐ 4 Solar	☐ 96 Other ☐ 98 Don't know
c. Hot tub / Jacuzzi	☐ 1 Yes → ☐ 2 No	☐ 1 Electricity ☐ 2 Natural gas	☐ 3 Propane ☐ 96 Other	☐ 98 Don't know
d. Sauna	☐ 1 Yes → ☐ 2 No	☐ 1 Electricity ☐ 2 Natural gas	☐ 3 Propane ☐ 96 Other	☐ 98 Don't know

A Reminder

Please ensure your survey responses refer to the residence at the service address printed on the front cover of this survey.

To ensure you are eligible to win one of the four $1,000 pre-paid VISA gift cards, be sure to return your completed survey by July 31, 2022 using the enclosed self-addressed postage-paid return envelope package. Better yet, complete it online and double your chance at winning. Only one survey (paper or online) will be accepted per household.

Thank you for completing this important survey!

F. Appliances

F1. Please indicate the number of each of the following appliances in use in this residence. Where asked, please indicate the approximate age of the main appliance (your best guess is acceptable). If your home does not have the appliance, please check the "0" box.

	Number in use 0	1	2	3+	Age of main appliance (years)
COOKING					
Electric range (cook top and oven)	0	1	2	3	______
Gas range (cook top and oven)	0	1	2	3	______
Dual fuel range (gas cook top, electric oven)	0	1	2	3	______
Electric cook top	0	1	2	3	______
Gas cook top	0	1	2	3	______
Induction range	0	1	2	3	______
Electric wall oven	0	1	2	3	______
Gas wall oven	0	1	2	3	______
Microwave oven	0	1	2	3	
Toaster oven	0	1	2	3	
Gas barbeque (piped gas)	0	1	2	3	
Gas barbeque (propane tank)	0	1	2	3	
Electric barbeque	0	1	2	3	
REFRIGERATION					
Refrigerator – manual defrost	0	1	2	3	______
Refrigerator – automatic defrost	0	1	2	3	______
Compact bar fridge (include wine cooler)	0	1	2	3	______
Stand-alone freezer – upright	0	1	2	3	______
Stand-alone freezer – chest style	0	1	2	3	______
CLEANING					
Dishwasher	0	1	2	3	______
Clothes washer - top load	0	1	2	3	______
Clothes washer - front load	0	1	2	3	______
Electric clothes dryer	0	1	2	3	______
Gas clothes dryer	0	1	2	3	______
Heat pump clothes dryer	0	1	2	3	______
HEATING					
Heat recovery ventilator/make up air unit (HRV)	0	1	2	3	
Energy recovery ventilator (ERV)	0	1	2	3	
Gas outdoor heater (piped gas)	0	1	2	3	
Electric outdoor heater	0	1	2	3	
Gas outdoor heater (bottled gas)	0	1	2	3	
Gas outdoor fire pit or fireplace	0	1	2	3	

HRV/ERV

An HRV captures heat from the stale air leaving your house and uses it to preheat the fresh air coming into your house. Energy recovery ventilators (ERVs) are a type of HRV that can exchange both heat and moisture.

F2. Please indicate the number of each of the following appliances in this residence. If your home does not have the appliance, please check the "0" box.

	Number in use 0	1	2	3
Central air conditioner	0	1	2	3
Portable air conditioner	0	1	2	3
Room window air conditioner	0	1	2	3
Portable fan	0	1	2	3
Humidifier	0	1	2	3
Dehumidifier	0	1	2	3
Portable electric heater	0	1	2	3
Rotating ceiling fans without light fixtures	0	1	2	3
Rotating ceiling fans with light fixtures	0	1	2	3

F3. Some appliances and other home equipment can be monitored and controlled remotely from inside or outside the home by 'connecting' them wirelessly to a smartphone, tablet, or computer.

Does this home have any appliances or equipment 'connected' wirelessly to a smartphone, tablet or computer?

- Yes ☐ 1
- No ☐ 2 → **GO TO Section G**
- Don't know ☐ 98 → **GO TO Section G**

F4. Which of the following items does your household monitor and control via a wireless 'connection'? (check all that apply)

- ☐ 1 Clothes washer
- ☐ 2 Clothes dryer
- ☐ 3 Dishwasher
- ☐ 4 Fridge
- ☐ 5 Lighting
- ☐ 6 Security system
- ☐ 7 Stove/Oven
- ☐ 8 Smart plugs/smart electrical outlets
- ☐ 9 Smart speakers (e.g. Google Home, Alexa)
- ☐ 10 Other entertainment items (e.g. televisions, gaming consoles, etc.)
- ☐ 11 Thermostats (for heating and/or cooling equipment)
- ☐ 12 Water heating equipment
- ☐ 96 Other (please specify): ___________________________
- ☐ 98 Don't know

F5. Does this home have a smart home hub/gateway system installed?

☐ 1 Yes ☐ 2 No ☐ 98 Don't know

Smart home hub/gateway

A smart home hub/gateway system is a small, standalone box that allows all your smart products to 'speak the same wireless language' so they can be monitored and controlled from one app. (not to be confused with a modem or wi-fi router).

G. Other electrical end uses

PLEASE COMPLETE THIS SECTION IF THE ELECTRIC SERVICE FOR THIS RESIDENCE IS PROVIDED BY FORTISBC, CITY OF PENTICTON, CITY OF GRAND FORKS, DISTRICT OF SUMMERLAND, OR NELSON HYDRO.

G1. Please indicate the number of each of the following electrical appliances at this residence <u>that you use at least occasionally</u>. If your home does not have the appliance, please check the "0" box.

HOME ENTERTAINMENT	Number in use: 0	1	2	3+
LCD or LED flat screen television	☐ 0	☐ 1	☐ 2	☐ 3
Plasma flat screen television	☐ 0	☐ 1	☐ 2	☐ 3
4k ultra high-definition LED flat screen television	☐ 0	☐ 1	☐ 2	☐ 3
8k ultra high-definition QLED flat screen television	☐ 0	☐ 1	☐ 2	☐ 3
Standard CRT colour television	☐ 0	☐ 1	☐ 2	☐ 3
Front or rear projection television	☐ 0	☐ 1	☐ 2	☐ 3
Digital/cable/satellite set-top box with or without PVR	☐ 0	☐ 1	☐ 2	☐ 3
DVD / Blue Ray / VCR units	☐ 0	☐ 1	☐ 2	☐ 3
Media streaming Device (Apple TV box, Slingbox etc.)	☐ 0	☐ 1	☐ 2	☐ 3
Surround sound system connected to a TV	☐ 0	☐ 1	☐ 2	☐ 3
Traditional stereo system (amp/receiver/speakers)	☐ 0	☐ 1	☐ 2	☐ 3
Video game console	☐ 0	☐ 1	☐ 2	☐ 3
COMPUTERS				
Desktop computer	☐ 0	☐ 1	☐ 2	☐ 3
Laptop / notebook computer	☐ 0	☐ 1	☐ 2	☐ 3
Tablet computer	☐ 0	☐ 1	☐ 2	☐ 3
Computer printers – inkjet or laser	☐ 0	☐ 1	☐ 2	☐ 3
Stand-alone fax machine	☐ 0	☐ 1	☐ 2	☐ 3
Computer router/modem	☐ 0	☐ 1	☐ 2	☐ 3

G2. Please indicate which of the following ELECTRICAL devices <u>are used at least occasionally</u> at this residence and the number of the devices in use. (Check all that apply)

	Yes	Number in use
Power bars with an on-off switch	☐ 1	____
Smart power bars that automatically turn off devices (TVs, printers, etc.)	☐ 2	____
Chargers for cell phones, smart phones, tablets, etc.	☐ 3	____
Cordless hand-held vacuums/Robot vacuums/floor sweepers	☐ 4	____
Portable power banks/batteries (for electronic devices)	☐ 5	____
Electric bicycles /Electric scooters (2-wheels)	☐ 6	____
Personal mobility carts/power chairs (4-wheels)	☐ 7	____
Golf cart style vehicles	☐ 8	____
Hand-held cordless power tools	☐ 9	____
Uninterruptable power supply (UPS) units (for computer system backup)	☐ 10	____
Electric garden implements (lawn mower, hedge trimmer, leaf blower)	☐ 11	____

G3. Please indicate which of the following do you have at this residence and whether they are heated:

			If yes, is it heated?		
	Yes	**No**	**Yes**	**No**	**Don't know**
Aquarium(s)	☐ 1	☐ 2	☐ 1	☐ 2	☐ 98
Garage	☐ 1	☐ 2	☐ 1	☐ 2	☐ 98
Workshop (separate from garage)	☐ 1	☐ 2	☐ 1	☐ 2	☐ 98
Solarium	☐ 1	☐ 2	☐ 1	☐ 2	☐ 98
Personal greenhouse	☐ 1	☐ 2	☐ 1	☐ 2	☐ 98

G4. Please indicate which of the following do you have or use at this residence. If you live in an apartment or condominium, exclude common area elevators and other items accessible by all residents.

	Yes
Electric elevator/lift	☐ 1
Electric car block heater/ interior car warmer (plug-in)	☐ 2
Electric water pump (well, sump, sewage, etc.)	☐ 3
Plug-in bottled water cooler	☐ 4
Home security system (hard-wired)	☐ 5
Electric towel warmer	☐ 6
Jetted bathtub	☐ 7
Exterior landscape fountain	☐ 8
Electric respiratory medical equipment	☐ 9
None of the above	☐ 99

H. Plug-in Electric Passenger Vehicles (Cars, trucks, minivans and SUVs)

PLEASE COMPLETE THIS SECTION ONLY IF THE ELECTRIC SERVICE FOR THIS RESIDENCE IS PROVIDED BY FORTISBC, CITY OF PENTICTON, CITY OF GRAND FORKS, DISTRICT OF SUMMERLAND, OR NELSON HYDRO.

Plug-in electric passenger vehicles

Battery electric vehicles: these run entirely on batteries which need to be charged by plugging into a power outlet or charging station.

Plug-in hybrid electric vehicles: these run mostly on batteries charged by plugging into a power outlet or charging station, but they are also equipped with a gas engine that can charge the battery and/or replace the electric drive train when needed.

H1. Does anyone in this household own or lease a battery electric vehicle or a plug-in hybrid electric vehicle?

If yes, please indicate the number in use.

☐1 Yes – Battery electric vehicle → Number in use ____
☐2 Yes – Plug-in electric hybrid → Number in use ____

☐3 None of the above → **GO TO SECTION I**

If your household has more than 1 plug-in electric vehicle (battery or plug-in hybrid), then complete the remaining questions for the one you drive the most.

H2. Where do you typically charge your electric vehicle? (Select the most applicable response)

☐1 At home
☐2 At locations away from the home → **GO TO H7**
☐3 Both at home and locations away from the home

H3. CHARGING AT HOME: Please estimate the average number of hours per day the vehicle is actually charging – not just plugged in – for each of the six time periods shown.

	Charging at home	Daytime 9 a.m. to 4 p.m.	Evening 4 p.m. to 9 p.m.	Overnight 9 p.m. to 9 a.m.
a.	Typical weekday	____ average hrs per day	____ average hrs per day	____ average hrs per day
b.	Typical weekend day	____ average hrs per day	____ average hrs per day	____ average hrs per day

H4. What level of electric vehicle charging do you utilize at your home? (Select all that apply)

☐1 Level 1 charging via a standard 120 volt electrical outlet
☐2 Level 2 charging via an installed 240 volt electrical charging unit
☐3 Level 3 charging via an installed 480 volt electrical charging unit (also known as a DC fast charger)
☐98 Don't know

H5. Did you receive a rebate from FortisBC when you installed your home charger?

☐1 Yes ☐2 No ☐98 Don't know

H6. If you live in a multi-unit building, is the charging of your electric vehicle at home covered by your household's own electricity account or by the building's electricity account? (Select only one.)

☐1 Household's own electricity account
☐2 Building's electricity account → **Are you required to repay the cost of charging to your building?** ☐1 Yes ☐2 No ☐98 Don't know
☐98 Don't know
☐99 Not Applicable – this service address is not in a multi-unit building

H7. CHARGING AWAY FROM HOME: Please estimate the average number of hours per day your electric vehicle is actually charging – not just plugged in – for each of the two time periods shown.

a. Typical weekday ____ average hrs per day ☐98 Don't know

b. Typical weekend day ____ average hrs per day ☐98 Don't know

H8. How many kilometers per year – on average – is your electric vehicle driven?

________ kilometers per year ☐98 Don't know

H9. What year did you buy or lease your first electric vehicle?

_____ year (YYYY) ☐98 Don't know

H10. How old is the electric vehicle you currently own or lease?

_____ years ☐98 Don't know

I. Lighting

PLEASE COMPLETE THIS SECTION ONLY IF THE ELECTRIC SERVICE FOR THIS RESIDENCE IS PROVIDED BY FORTISBC, CITY OF PENTICTON, CITY OF GRAND FORKS, DISTRICT OF SUMMERLAND OR NELSON HYDRO.

I1. For each of the major light bulb types listed in the table below, please indicate how many this residence has installed, both indoors and outdoors and how many were purchased in the last 12 months. For installed bulb counts, be sure to count all bulbs in fixtures that have more than one bulb. Do not include any holiday lighting as this is addressed in Question I3.

	Incandescent light bulbs 	Fluorescent tubes 	Compact fluorescent (CFL) 	Halogen bulbs and tubes 	LED bulbs 	Other bulb types 
Number of bulbs installed						
Number of purchased in the last 12 months						

I2. Please indicate the number of lights, if any, controlled by dimmers, timers, motion sensors and/or daylight sensors for indoor and outdoor areas. Do not include any controls that are only for holiday lighting.

	Dimmers	Timers	Motion sensors	Daylight sensors
Number of indoor light bulbs controlled				X
Number of outdoor lights controlled	X			

I3. How many of the following types of holiday lights were used during the 2021 holiday season?

	Number used in 2021 holiday season	
Strings of incandescent holiday lights	_____	☐98 Don't know
Strings of LED holiday lights	_____	☐98 Don't know

J. Renovations & energy use

J1. Please indicate renovations or actions you have completed at this residence <u>during the past five years,</u> whether you received a government or utility rebate to complete them, and the renovations you plan to undertake the <u>next two years</u>.

	Did this – past five years: With rebate	Did this – past five years: Without rebate	Plan to do this – next two years
Improve insulation	☐ 1	☐ 1	☐ 1
Install energy-efficient window(s)	☐ 2	☐ 2	☐ 2
Install insulated outside door(s) or storm doors	☐ 3	☐ 3	☐ 3
Install low-flow showerhead(s)	☐ 4	☐ 4	☐ 4
Install a smart / learning style thermostat(s)	☐ 5	☐ 5	☐ 5
Install pipe wrap	☐ 6	☐ 6	☐ 6
Install weather stripping or caulking	☐ 7	☐ 7	☐ 7
Install hot water heater blanket	☐ 8	☐ 8	☐ 8
Install drainpipe waste heat recovery system	☐ 9	☐ 9	☐ 9
Install an air source heat pump	☐ 10	☐ 10	☐ 10
Install on-demand (tankless or hybrid) water heater	☐ 11	☐ 11	☐ 11
Install high efficiency hot water tank	☐ 12	☐ 12	☐ 12
Install hot tub		☐ 13	☐ 13
Install sauna		☐ 14	☐ 14
Install heated swimming pool		☐ 15	☐ 15
Install an outdoor clothesline or clothes drying rack		☐ 16	☐ 16
None of the above	☐ 99		☐ 99

J2. In the next two years, are you planning to install a GAS FIREPLACE (insert, zero clearance or heater type stove) in this residence?

- ☐ 1 Yes → **CONTINUE**
- ☐ 2 No
- ☐ 98 Don't know

} → **GO TO SECTION K**

J3. Would this gas fireplace replace an existing wood, gas, or electric fireplace or would it be a new installation? (select one)

- ☐ 1 Replace a wood fireplace or heater stove
- ☐ 2 Replace a gas fireplace
- ☐ 3 Replace an electric fireplace
- ☐ 4 New installation
- ☐ 98 Don't know

K. Managing energy use

This section is intended to help FortisBC understand how you use / manage energy at this residence.

K1. At what temperature do you usually keep this residence during the winter (heating) season? If this residence has air conditioning (central, window, portable, or heat pump), also tell us what temperature you usually keep this residence during the summer (cooling) season.

	Winter (heating): Degrees C	or	Winter (heating): Degrees F	Summer (cooling): Degrees C	or	Summer (cooling): Degrees F	
When someone is at home	___		___	___		___	☐ 99 NA
When no one is home	___		___	___		___	☐ 99 NA
During the night	___		___	___		___	☐ 99 NA
				☐ 97 Do not have air conditioning			

Next, we would also like to understand the types of actions that you take to manage energy use at this residence. Please check the answer that best describes what you normally do.

K2. Space heating	**Always**	**Usually**	**Occasionally**	**Never**	**Don't know**	**Not applicable**
a. Close window coverings to keep in heat	☐1	☐2	☐3	☐4	☐98	☐99
b. Turn down the heat at night either manually or using a programmable or smart thermostat	☐1	☐2	☐3	☐4	☐98	☐99
c. Turn down the heat either manually or using a programmable or smart thermostat *when no one is at home*	☐1	☐2	☐3	☐4	☐98	☐99
d. Reduce temperature in unused rooms by closing vents or turning down room thermostats	☐1	☐2	☐3	☐4	☐98	☐99
e. Check and re-seal air leaks in the house at least once a year (weather stripping and caulking)	☐1	☐2	☐3	☐4	☐98	☐99
f. If single pane windows, install storm windows each fall	☐1	☐2	☐3	☐4	☐98	☐99
g. Install plastic window coverings on drafty windows during winter months	☐1	☐2	☐3	☐4	☐98	☐99

K3. Are you able to reduce the temperature in unoccupied rooms at this residence? This could be done by turning down individual room thermostats, closing doors, and closing vents?

☐1 Yes ☐2 No ☐98 Don't know

K4. Air conditioning / cooling	**Always**	**Usually**	**Occasion-ally**	**Never**	**Don't know**	**Not applicable**
a. Set the thermostat at 26°C (78°F) or higher during the summer to save energy	☐1	☐2	☐3	☐4	☐98	☐99
b. Close the window coverings (drapes, blinds, etc.) during hot weather to reduce heat in the dwelling	☐1	☐2	☐3	☐4	☐98	☐99
c. Clean the air conditioner filter and coils at least once per season	☐1	☐2	☐3	☐4	☐98	☐99
d. Turn on air conditioning only when very hot and natural ventilation is insufficient	☐1	☐2	☐3	☐4	☐98	☐99
e. Use a smart/programmable thermostat or manually turn off air conditioning at night	☐1	☐2	☐3	☐4	☐98	☐99
f. Cool only rooms to be occupied rather than the whole home	☐1	☐2	☐3	☐4	☐98	☐99

K5. Water & laundry	**Always**	**Usually**	**Occasion-ally**	**Never**	**Don't know**	**Not applicable**
a. Turn off the water heater or use its "vacation setting" when no one is home for more than 2 or 3 days	☐1	☐2	☐3	☐4	☐98	☐99
b. Only do laundry with full loads	☐1	☐2	☐3	☐4	☐98	☐99
c. Clean the dryer lint filter before drying clothes	☐1	☐2	☐3	☐4	☐98	☐99
d. Use the dryer's temperature / moisture sensor to turn off the dryer rather than using timed dry	☐1	☐2	☐3	☐4	☐98	☐99
e. Hang clothes to dry rather than machine dry to save energy	☐1	☐2	☐3	☐4	☐98	☐99
f. Only run dishwasher when full	☐1	☐2	☐3	☐4	☐98	☐99
g. Air dry the dishes in the dishwasher rather than use the heated dry cycle	☐1	☐2	☐3	☐4	☐98	☐99
h. Leave water running when washing hands	☐1	☐2	☐3	☐4	☐98	☐99

K6. Please indicate the location of the laundry appliances this residence typically uses.

- ☐ 1 In my own home
- ☐ 2 In a laundry room located elsewhere in my building (e.g., laundry appliances shared with other units)
- ☐ 3 In another building or at a laundry business

K7. Does this residence have an outdoor clothesline or other means for hanging clothes to dry outdoors?

☐ 1 Yes ☐ 2 No ☐ 3 Not allowed in our building / neighbourhood

K8. How many loads of laundry does your household do per week?

Number of loads of laundry done	_____	per week
Number of loads using cold water wash and rinse only	_____	per week
Number of dryer loads	_____	per week
Number of loads dried using a clothesline or drying rack during SUMMER	_____	per week
Number of loads dried using a clothesline or drying rack during WINTER	_____	per week

K9. Lighting		**Always**	**Usually**	**Occasion-ally**	**Never**	**Don't know**	**Not applicable**
a.	Only have the minimum number of lights on in a room for what I am doing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
b.	Turn off the lights when no one is in the room	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
c.	Leave outdoor lights on at night (exclude those you do not control)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
d.	Check timers to reflect daylight savings time	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99

K10. Refrigeration		**Always**	**Usually**	**Occasion-ally**	**Never**	**Don't know**	**Not applicable**
a.	Clean the refrigerator coils at least once a year	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
b.	Check the temperature of the refrigerator to ensure food is not too cold or warm	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
c.	Check the temperature of your freezer to ensure food remains frozen, but that the freezer is not too cold	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99

K11. Other		**Always**	**Usually**	**Occasion-ally**	**Never**	**Don't know**	**Not applicable**
a.	Turn off TV / entertainment systems when no one is in the room and actively using them	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
b.	Turn off the computer and printers when not in use	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
c.	Unplug or use a power bar to turn off TVs, entertainment systems, and computers when not in use?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99
d.	Leave one or more windows open during winter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 98	☐ 99

K12. Who usually decides on which energy related repairs or renovations are made to the home? (Choose the most appropriate answer.)

☐ 1 Myself ☐ 2 Someone else in the household ☐ 3 Landlord

K13. Who makes the most effort to conserve electricity / gas in your household? (Choose the most appropriate answer.)

- ☐ 1 Myself
- ☐ 2 Someone else in the household
- ☐ 3 Most members of the household
- ☐ 4 All members of the household
- ☐ 5 None of us

K14. Overall, how much effort is your household currently making to conserve electricity / gas?

- ☐ 1 Great amount of effort
- ☐ 2 A fair amount of effort
- ☐ 3 A little effort
- ☐ 4 No effort at all
- ☐ 98 Don't know

K15. Compared to two years ago, is your household making more of an effort to conserve electricity / gas, less of an effort or about the same amount of effort?

- ☐ 1 Much more of an effort
- ☐ 2 Somewhat more of an effort
- ☐ 3 Neither more nor less effort (no change)
- ☐ 4 Somewhat less of an effort
- ☐ 5 Much less of an effort
- ☐ 98 Don't know

L. Products & services

L1. On a scale of one to four, where one is "not at all interested" and four is "very interested", how interested would you be in the following products and services?

		Not at all interested 1	2	3	Very interested 4
a.	Home energy audit to determine main energy uses in the home and identify opportunities to save energy	☐1	☐2	☐3	☐4
b.	Do-it-yourself online energy audit	☐1	☐2	☐3	☐4
c.	Furnace or heat pump tune-up to ensure they are working safely and efficiently	☐1	☐2	☐3	☐4
d.	Program to replace a lower efficiency furnace with a high-efficiency furnace	☐1	☐2	☐3	☐4
e.	Program to install high-efficiency gas fireplace	☐1	☐2	☐3	☐4
f.	Program to replace standard-efficiency clothes washer with high-efficiency clothes washer	☐1	☐2	☐3	☐4
g.	Program to replace standard-efficiency water heater with high-efficiency water heater	☐1	☐2	☐3	☐4
h.	Program to upgrade attic and wall insulation	☐1	☐2	☐3	☐4
i.	Program to improve draft proofing	☐1	☐2	☐3	☐4
j.	Program to install programmable or "smart" thermostats	☐1	☐2	☐3	☐4
k.	Program to install an in-home display that allows you to monitor your home's energy usage	☐1	☐2	☐3	☐4
l.	Program to purchase an electric automobile	☐1	☐2	☐3	☐4
m.	Program to compare your home's energy use with homes of comparable size and type	☐1	☐2	☐3	☐4
n.	Program to purchase rooftop solar panels	☐1	☐2	☐3	☐4

L2. During the last five years, did your household participate in any utility or government programs offering rebates to reduce energy use in your home? If yes, please indicate who offered the rebate.

Check all that apply

FortisBC	☐ 1
BC Hydro	☐ 2
Federal, provincial or municipal government	☐ 3
None of the above	☐ 99

M. Attitudes toward energy use

M1. In order to serve you better, we would like to understand your views on a number of energy related issues. On a scale of one to five, where one means "strongly disagree" and five means "strongly agree", please indicate how much you agree or disagree with the following statements on energy and natural gas usage.

		Strongly disagree 1	2	Neither agree nor disagree 3	4	Strongly agree 5
a.	There are many ways that a person can save energy. When you add them up, they result in substantial savings	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b.	By making my home more energy efficient, I am helping to do my part for the environment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c.	I think natural gas is a clean and efficient energy source	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d.	Members of my household regularly limit the length of their showers to save energy	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
e.	I don't want to think about natural gas or electricity. I simply want it to work.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
f.	When something needs to be done around home, I usually hire someone	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
g.	I almost always have a home renovation on the go	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
h.	Our household has reduced its energy use by as much as reasonably possible	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
i.	I am a busy person with little or no time to research ways to save energy	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
j.	I conserve energy because it saves money, not because it helps the environment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
k.	I am knowledgeable about what affects my home's energy use	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

M2. On a scale of one to five, where one means "strongly disagree" and five means "strongly agree", please indicate how much you agree or disagree with the following statements.

		Strongly disagree 1	2	Neither agree nor disagree 3	4	Strongly agree 5
a.	I am usually the first one to try new products	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b.	I am usually willing to pay more for brand name items	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c.	I prefer dealing with British Columbia-based companies	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d.	I always look for the best price when buying products or services	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
e.	I usually take time to research issues thoroughly before making a decision	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
f.	I am the type of person to have good insurance coverage	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

N. About your household

Your responses to these final questions are strictly confidential. They will be used to assess whether this survey reached a representative sample of FortisBC's residential customers and to classify responses.

N1. Which electric utility do you receive your electricity bill from?

FortisBC Electric ☐ 1
BC Hydro ☐ 2
City of New Westminster ☐ 3
Nelson Hydro ☐ 4
City of Grand Forks ☐ 5
District of Summerland ☐ 6
City of Penticton ☐ 7
Don't know ☐ 98

N2. Into which age category do you fit?

18 years or under ☐ 1
19-24 years ☐ 2
25-34 years ☐ 3
35-44 years ☐ 4
45-54 years ☐ 5
55-64 years ☐ 6
65 years and older ☐ 7

N3. Do you identify as:

☐ 1 A woman
☐ 2 A man
☐ 96 Prefer to self-describe __________
☐ 99 Prefer not to answer

N4. Which of the following describe your current status? (check all that apply)

Employed full-time ☐ 1
Employed part-time ☐ 2
Homemaker ☐ 3
Retired ☐ 4
Unemployed ☐ 5
Student ☐ 6
Short-term or long-term disability ☐ 7

N5. How many people, including yourself, are currently living at this residence (please include any boarders or renters covered under your FortisBC account)

_____ number

N6. Please indicate the number of occupants of this residence in the following age categories:

	0	1	2	3	4	5	6+
0 - 5 years	☐	☐	☐	☐	☐	☐	☐
6 - 12 years	☐	☐	☐	☐	☐	☐	☐
13 - 18 years	☐	☐	☐	☐	☐	☐	☐
19 - 24 years	☐	☐	☐	☐	☐	☐	☐
25 - 44 years	☐	☐	☐	☐	☐	☐	☐
45 - 64 years	☐	☐	☐	☐	☐	☐	☐
65 years and older	☐	☐	☐	☐	☐	☐	☐

N7. Do any of the occupants of this residence work from home either full-time or part-time?

☐ 1 Yes ☐ 2 No → **GO TO QUESTION N10**

N8. Has the number of days these occupants worked from home increased in the past two years?

☐ 1 Yes ☐ 2 No

N9. Are the number of days these occupants work from home expected to increase, decrease, or stay about the same over the next two years?

☐ 1 Increase
☐ 2 Decrease
☐ 3 Stay about the same
☐ 98 Don't know

N10. Has the number of people living in this residence changed in the last two years?

Yes ☐ 1 No ☐ 2 → **GO TO QUESTION N12**

N11. How has the number of people in this residence changed over the past two years? (check the best answer)

☐ 1 In the past there were more people living in this residence
☐ 2 In the past there were fewer people living in this residence
☐ 3 In the past there were sometimes more people and sometimes fewer people living in this residence

N12. What is the highest level of education you have completed?

Some high school ☐ 1
Completed high school ☐ 2
Some trade/technical school ☐ 3
Completed trade/technical school ☐ 4
Some university/college ☐ 5
Completed university/college ☐ 6
Postgraduate ☐ 7

N13. What was your total household income before taxes in 2021?

Less than $20,000	☐ 1	$60,000 to $79,999	☐ 6
$20,000 to $29,999	☐ 2	$80,000 to $99,999	☐ 7
$30,000 to $39,999	☐ 3	$100,000 to $109,999	☐ 8
$40,000 to $49,999	☐ 4	$110,000 to $119,999	☐ 9
$50,000 to $59,999	☐ 5	$120,000 or more	☐ 10
		Prefer not to answer	☐ 99

N14. What are the languages spoken at this residence?

	Main language *(check one only)*	**Other languages** *(check all that apply)*
English	☐ 1	☐ 1
Mandarin	☐ 2	☐ 2
Cantonese	☐ 3	☐ 3
Hindi	☐ 4	☐ 4
Punjabi	☐ 5	☐ 5
Tagalog	☐ 6	☐ 6
Farsi (Persian)	☐ 7	☐ 7
French	☐ 8	☐ 8
German	☐ 9	☐ 9
Other (please specify):	☐ 96 ______________	☐ 96 ________________

FortisBC and Mustel Research would like to thank you for your help and assistance.

If you have any questions please contact:

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Appendix B

Conditional Demand Analysis

Detailed Equations and Results

2022 REUS Conditional Demand Analysis Detailed Methodology

Conditional Demand Analysis (CDA) was used to disaggregate total household energy consumption into UECs for several residential end-uses. CDA is based on the notion that total household consumption is directly related to the stock of end-uses present in the dwelling and the energy consumption levels associated with these end-uses (UECs). The basic conditional demand model can be represented as:

$$HEC_{ht} = \sum_{all\ a} UEC_{aht} S_{ah}$$

where HEC_{ht} is the total energy consumption by household h in month t, UEC_{aht} is the energy consumption through end-use a by household h in month t, and S_{ah} is the presence or absence of end-use a in household h.

The UECs for these end-uses are modelled as functions of appropriate exogenous variables, such as end-use features, dwelling characteristics, and household utilization patterns. In the remainder of this section, we describe the functional forms for each end-use.

B.1 Primary Electric Space Heating

The primary electric space heating usage for household h in month t is based on a balance equation:

$$UEC_{elecheat,ht} = \frac{HEATLOSS_{ht} - SECHEAT_{ht}}{EFFHEAT_h}$$

where $HEATLOSS_{ht}$ is the net heat loss, $SECHEAT_{ht}$ is the heat loss replaced by non-electric secondary heating systems, and $EFFHEAT_h$ is the system efficiency.

B.1.1 Net Heat Loss

The net heat loss of a structure can be expressed as:

$$HEATLOSS_{ht} = SURFACELOSS_{ht} - SOLARGAIN_{ht} - INTERNALGAIN_{ht}$$

where $SURFACELOSS_{ht}$ is the heat loss through envelope surfaces, $SOLARGAIN_{ht}$ is the solar gain through all surfaces during heating periods, and $INTERNALGAIN_{ht}$ is the internal gains during heating periods.

B.1.2 Heat Loss through Envelope

The heat loss through envelope surfaces is given by:

$$SURFACELOSS_h = \alpha_1 U_h AREA_h TEMPDIFF_{ht}$$

where U_h is the overall conductivity of the shell, $AREA_h$ is the total surface area, and $TEMPDIFF_{ht}$ is the differential between inside and outside temperature levels.

B.1.3 Shell Conductivity

The conductivity of the shell is assumed to depend on dwelling type, the percentage of windows and doors that are insulated, and whether the attic is insulated:[50]

$$U_h = \alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 INSULATTIC_h + \alpha_5 DOORS_h INSULDOORS_h + \alpha_6 WINDBL_h + \alpha_7 WINBEST_h$$

where MFD_h equals one if the household dwelling is a multi-family dwelling (duplex or row/townhouse), $APARTMENT_h$ equals one if the dwelling is an apartment or condominium, $INSULATTIC_h$ equals one if the attic is insulated, $DOORS_h$ equals one if outside doors are present, $INSULDOORS_h$ is the proportion of outside doors that are insulated (aluminium storm doors or insulated steel or fibreglass doors), $WINDBL_h$ is the percentage of windows with double pane glass, and $WINBEST_h$ is the percentage of windows with more insulation than double pane (double pane low-E or triple pane, regular or low-E).

B.1.4 Surface Area

The surface area of the structure is modelled as a function of the total floor area:

$$AREA_h = \alpha_1 SQFT_h^{\beta}$$

where $SQFT_h$ is the square footage of the household and β is the elasticity of surface area with respect to square footage.[51] We assumed that β equals 0.5 (i.e., the square root) because the surface area of the building shell increases less than proportionately with floor area for standard shaped buildings.

B.1.5 Temperature Differential

The differential between inside and outside temperature levels is modelled as a function of heating degree days, household heating behaviour, whether programmable thermostats or smart/learning-style

[50] An attempt was made to include variables involving the presence of insulation in the exterior walls, basement or crawl space, and heated garage/workshop. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

[51] Responses provided in square metres were converted to square feet. To reduce the effects of survey response error on the analysis, square footage values below 500 or above 5,000 were recoded as missing values (24 cases, or 1.6% of the sample used for the CDA).

thermostats are used, and whether a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV) is used at the residence:[52]

$$TEMPDIFF_{ht} = HDD_{ht}(\alpha_1 + \alpha_2 WINTER_t INSTALLWINCVR_h + \alpha_3 PROGSMARTTHM_h + \alpha_4 HRVERV_h)$$

where HDD_{ht} is heating degree days, $INSTALLWINCVR_h$ is the frequency of installing plastic window coverings on drafty windows during winter months, $PROGSMARTTHM_h$ equals one if programmable thermostats or smart/learning-style thermostats are used, and $HRVERV_h$ equals one if a heat recovery ventilator or energy recovery ventilator is used.

B.1.6 Solar Gain

The solar gain through all surfaces during heating periods is modelled as a function of the surface area of the home:

$$SOLARGAIN_{ht} = \alpha_1 AREA_h WINTER_t$$

where $WINTER_t$ equals one if t is a winter month (December, January, or February).

B.1.7 Internal Gain

The internal gain during heating periods is also modelled as a function of the surface area of the home:

$$INTERNALGAIN_{ht} = \alpha_1 AREA_h WINTER_t$$

B.1.8 Non-electric Secondary Heating System

The heat loss replaced by a non-electric secondary heating system, given that a primary electric heating system is present, can be expressed as:

$$SECHEAT_{ht} = \alpha_1 HDD_{ht} AREA_h NONELECSECHEAT_h$$

where $NONELECSECHEAT_h$ equals one if non-electric secondary space heating is present (e.g., non-electric fireplaces, woodstoves, gas wall heaters, etc.)

[52] An attempt was made to include variables involving household income, whether anyone in the residence works from home, the frequency of turning down the heat at night or when no one is at home, and the frequency of reducing the temperature in unused rooms by closing vents or turning down room thermostats. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

B.1.9 System Efficiency

The model captures the effects of using an electric furnace or heat pump (any type) for primary space heating. This was done by including exogenous variables that account for the presence of these types of equipment. As well, the model incorporates an interaction term to account for the effects of using a heat pump in conjunction with an electric furnace.

B.1.10 Overall Primary Electric Space Heating Model

Combining the preceding equations gives the overall model of primary electric space heating usage:

$$UEC_{elecheat,ht} = HDD_{ht}AREA_h(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 INSULATTIC_h + \alpha_5 DOORS_h INSULDOORS_h + \alpha_6 WINDBL_h + \alpha_7 WINBEST_h + \alpha_8 WINTER_t INSTALLWINCVR_h + \alpha_9 PROGSMARTTHM_h + \alpha_{10} HRVERV_h + \alpha_{11} ELECFURNACE_h + \alpha_{12} HEATPUMP_h + \alpha_{13} ELECFURNACE_h HEATPUMP_h + \alpha_{14} NONELECSECHEAT_h) + \alpha_{15} AREA_h WINTER_t$$

In the specification above, most of the interaction terms are not shown because they were not statistically significant or produced unreasonable results.

B.2 Secondary Electric Space Heating

Secondary electric space heating includes any additional or supplementary use of electricity to heat the residence (e.g., electric baseboards, electric fireplaces, heat pumps, portable electric heaters, etc.)

Secondary electric space heating usage is modelled as a function of heating degree days, total surface area, dwelling type, and whether a heat pump is used for secondary heating:[53]

$$UEC_{elecsecheat,ht} = HDD_{ht}AREA_h(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 HEATPUMPSEC_h)$$

where $HEATPUMPSEC_h$ equals one if a heat pump is used for secondary space heating.

B.3 Furnace Fan Motor (Gas Furnaces)

The energy usage by gas furnace fan motors is assumed to depend on heating degree days, total surface area, and whether or not a high efficiency motor is used:

$$UEC_{furnacefan,ht} = HDD_{ht}AREA_h(\alpha_1 + \alpha_2 VSM_h)$$

where VSM_h equals one if a variable speed motor or electronically controlled motor is present.

[53] An attempt was made to include a variable involving the number of portable electric heaters in use, but it was not retained in the final model because it was not statistically significant.

B.4 Central Air Conditioning

Energy usage of central air conditioning units is based on a balance equation:

$$UEC_{cac,ht} = \frac{HEATGAIN_{ht} - AUXCOOL_{ht}}{EFFCOOL_{h}}$$

where $HEATGAIN_{ht}$ is the internal gains and heat gain through the structure, $AUXCOOL_{ht}$ is the use of auxiliary cooling (evaporative cooling), and $EFFCOOL_{h}$ is the system efficiency. We assumed that $AUXCOOL_{ht}$ equals zero (no auxiliary cooling) and $EFFCOOL_{h}$ is constant across households.

B.4.1 Net Heat Gain

The net heat gain can be expressed as:

$$HEATGAIN_{ht} = SURFACEGAIN_{ht} + SOLARGAINC_{ht} + INTERNALGAINC_{ht}$$

where $SURFACEGAIN_{ht}$ is the total convection heat gain through structural surfaces, $SOLARGAINC_{ht}$ is the solar gain through all surfaces during cooling periods, and $INTERNALGAINC_{ht}$ is the internal gains during cooling periods.

B.4.2 Heat Gain through Envelope

The heat gain through envelope surfaces is given by:

$$SURFACEGAIN_{h} = \alpha_1 U_h AREA_h TEMPDIFFC_{ht}$$

where U_h is the overall conductivity of the shell, $AREA_h$ is the total surface area, and $TEMPDIFFC_{ht}$ is the differential between inside and outside temperature levels.

B.4.3 Shell Conductivity

The conductivity of the shell is assumed to depend on dwelling type:

$$U_h = \alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h$$

where MFD_h equals one if the household dwelling is a multi-family dwelling (duplex or row/townhouse) and $APARTMENT_h$ equals one if the dwelling is an apartment or condominium.

B.4.4 Temperature Differential

The differential between inside and outside temperature levels is modelled as a function of cooling degree days and household cooling behaviour:[54]

$$TEMPDIFFC_{ht} = CDD_{ht}(\alpha_1 + \alpha_2 SUMMER_h THERMSUMMER_h + \alpha_3 TURNONACHOT_h + \alpha_4 TURNOFFACNIGHTS_h)$$

where CDD_{ht} is cooling degree days, $THERMSUMMER_h$ is the frequency of setting the thermostat at 26°C (78°F) or higher during the summer to save energy, $TURNONACHOT_h$ is the frequency of turning on air conditioning only when very hot and natural ventilation is insufficient, and $TURNOFFACNIGHTS_h$ is the frequency of using a smart/programmable thermostat or manually turn off air conditioning at night.

B.4.5 Solar Gain

The solar radiant gain through all surfaces during cooling periods is modelled simply as a function of the surface area of the home:

$$SOLARGAINC_{ht} = \alpha_1 AREA_h SUMMER_t$$

where $SUMMER_t$ equals one if t is a summer month (June, July, or August).

B.4.6 Internal Gain

The internal gain during cooling periods is also modelled as a function of the surface area of the home:

$$INTERNALGAINC_{ht} = \alpha_1 AREA_h SUMMER_t$$

B.4.7 Overall Central Air Conditioning Model

Combining the preceding equations gives the overall model for central air conditioning energy usage:

$$UEC_{cac,ht} = CDD_{ht} AREA_h(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 SUMMER_h THERMSUMMER_h + \alpha_5 TURNONACHOT_h + \alpha_6 TURNOFFACNIGHTS_h) + \alpha_7 AREA_h SUMMER_t$$

In the specification above, most of the interaction terms are not shown because they were not statistically significant or produced unreasonable results.

[54] An attempt was made to include variables involving the frequency of closing the window coverings during hot weather to reduce heat in the dwelling and the frequency of cooling only rooms to be occupied rather than the whole home. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

B.5 Room and Portable Air Conditioning

Energy usage of room and portable air conditioning units is modelled as a function of cooling degree days, total surface area, and the number of room and portable air conditioning units in use:

$$UEC_{rpac,ht} = \alpha_1 CDD_{ht} AREA_h RPAC_h$$

where $RPAC_h$ is the total number of room and portable air conditioning units in use.

B.6 Electric Water Heating

Electric water heating energy usage can be expressed as:

$$UEC_{elecwheat,ht} = \frac{WHEATLOSS_{ht} + VUSE_{ht}}{EFFWHEAT_h}$$

where $WHEATLOSS_{ht}$ is the heat losses associated with standby losses from the heating unit, $VUSE_{ht}$ is the heat losses tied to water usage, and $EFFWHEAT_h$ is the efficiency of the unit.

B.6.1 Standby Losses

The heat losses associated with standby losses are assumed to depend on dwelling type, whether the home is new, the frequency of turning off the water heater when no one is home, and the temperature differential between the tank temperature and the inlet temperature:[55]

$$WHEATLOSS_{ht} = WHEATDIFF_{ht}(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 NEWHOME_h + \alpha_5 TURNOFFWHEATER_h)$$

where $NEWHOME_h$ equals one if the residence is built in 2006 or later, and $TURNOFFWHEATER_h$ is the frequency of turning off the water heater or using its “vacation setting” when no one is home for more than two or three days.

The differential between tank temperature and inlet temperature is modelled simply as a function of heating degree days:

$$WHEATDIFF_{ht} = \alpha_1 HDD_{ht}$$

[55] An attempt was made to include variables involving the size of the largest hot water tank, as well as whether a water heater blanket is used on the hot water tank. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

B.6.2 Water Usage

The heat losses tied to water usage are assumed to depend on the number of household members, the number of dishwasher and clothes washer loads done, the number of baths taken, and the proportion of low-flow showerheads in use in the residence:[56]

$$VUSE_{ht} = \alpha_1 PEOPLE_h + \alpha_2 DISHWASHERLOADS_h + \alpha_3 LAUNDRYLOADS_h + \alpha_4 BATHS_h + \alpha_5 PROPLOWFLOW_h$$

where $PEOPLE_h$ is equal to the log of household size plus one[57], $DISHWASHERLOADS_h$ is the number of dishwasher loads per week, $LAUNDRYLOADS_h$ is the number of loads of laundry per week, $BATHS_h$ is the number of baths taken per week, and $PROPLOWFLOW_h$ is the proportion of low-flow showerheads.

B.6.3 System Efficiency

An attempt was made to model system efficiencies in terms of the age of the main water heater. However, this variable was not retained in the final model because there were too many missing values (which results in the loss of degrees of freedom in the analysis). Therefore, we assumed that $EFFWHEAT_h$ is constant across households except for those with a heat pump water heater tank. The model captures the efficiency gains from using this type of tank by including an exogenous variable that accounts for its presence. In the same way, we attempted to model the efficiency gains from using an on-demand (tankless) water heater or a combined space and water heating system. However, the relevant variables were not retained in the final model because they were not statistically significant, likely due to the small number of households using these types of equipment for electric water heating.

B.6.4 Overall Electric Water Heating Model

Combining the preceding equations gives the overall model for electric water heating energy usage:

$$UEC_{elecwheat,ht} = HDD_{ht}(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 NEWHOME_h + \alpha_5 TURNOFFWHEATER_h + \alpha_6 HEATPUMPWHEATER_h) + \alpha_7 PEOPLE_h + \alpha_8 DISHWASHERLOADS_h + + \alpha_9 LAUNDRYLOADS_h + \alpha_{10} BATHS_h + \alpha_{11} PROPLOWFLOW_h$$

[56] An attempt was made to include variables involving the amount of time that showers are used, whether a front-loading clothes washer is present, and whether instant hot water dispensers or faucet aerators are present. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

[57] A log function is used because water heating demand typically increases less than proportionately with household size (i.e., hot water usage for a two-person household is usually not twice that of a one-person household, etc.)

B.7 Refrigerators

Energy consumption of refrigerators (manual or automatic) is modelled as a function of whether these appliances are present:[58]

$$UEC_{ref,ht} = \alpha_1 REFMANUAL_h + \alpha_2 REFAUTO_h$$

where $REFMANUAL_h$ equals one if a manual defrost refrigerator is used and $REFAUTO_h$ equals one if an automatic defrost refrigerator is used.

B.8 Freezers

Energy consumption of stand-alone freezers (upright or chest style) is modelled as a function of whether these appliances are present:

$$UEC_{freezer,ht} = \alpha_1 FREEZERUPRIGHT_h + \alpha_2 FREEZERCHEST_h$$

where $FREEZERUPRIGHT_h$ equals one if an upright freezer is used and $FREEZERCHEST_h$ equals one if a chest style freezer is used.

B.9 Electric Cooking

Energy consumption of electric cooking appliances (electric ranges, dual fuel ranges, cook tops, induction ranges, and wall ovens) is assumed to be constant for those households using these appliances:[59]

$$UEC_{eleccook,ht} = \alpha_1$$

B.10 Dishwashers

Energy consumption of dishwashers is assumed to be constant for those households using a dishwasher:[60]

$$UEC_{dishwasher,ht} = \alpha_1$$

[58] An attempt was made to include a variable involving whether a compact bar fridge is present, but it was not retained in the final model because it produced unreasonable results.

[59] An attempt was made to include variables involving the number of cooking appliances in use, household size, income, and the presence of a microwave. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

[60] An attempt was made to include variables involving the number of dishwashers in use, as well as the number of dishwasher loads done per week. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

B.11 Clothes Washers and Electric Dryers

Energy consumption of clothes washers and electric dryers is assumed to be constant for those households using these appliances:[61]

$$UEC_{cwasherdryer,ht} = \alpha_1$$

B.12 Lighting

Energy consumption of lighting is modelled as a function of the number of bulbs in use in the household:[62]

$$UEC_{lighting,ht} = \alpha_1 INCAND_h + \alpha_2 FLUO_h + \alpha_3 CFL_h + \alpha_4 HALOGEN_h + \alpha_5 LED_h + \alpha_6 OTHERBULB_h$$

where $INCAND_h$ is the number of incandescent light bulbs in use, $FLUO_h$ is the number of fluorescent light bulbs in use, CFL_h is the number of compact fluorescent light bulbs in use, $HALOGEN_h$ is the number of halogen light bulbs in use, LED_h is the number of LED light bulbs in use, and $OTHERBULB_h$ is the number of other types of light bulbs in use.

Some survey respondents did not complete the lighting inventory in the REUS questionnaire. For these households, we assumed an average number for each type of light bulb based on their dwelling type. This assumes the penetration rate for the lighting end-use is 100 percent.

Furthermore, due to a systematic underreporting of all lighting types in the 2022 REUS survey, we factored up the number of light bulbs for every household in the sample using the same methodology described in Section 10.1.[63] This increases the number of light bulbs in each household but maintains the distribution of bulb types as reported in the survey.

B.13 Home Entertainment Equipment

Energy usage for home entertainment equipment is assumed to depend on the number of devices in use:[64]

$$UEC_{homeentertainment,ht} = \alpha_1 HOMEENTERTAINMENT_h$$

[61] An attempt was made to include variables involving the number of clothes washers and electric dryers in use, as well as the number of washer and dryer loads done per week. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

[62] An attempt was made to include a variable involving the proportion of lights controlled by dimmers, timers, motion sensors, or daylight sensors, but it was not retained in the final model because it produced unreasonable results.

[63] A factor was calculated for each dwelling type such that the average number of total light bulbs is the same as in the 2017 analysis.

[64] An attempt was made to separately model televisions, set-top boxes, DVD/Blue Ray/VCR units, media streaming devices, surround sound systems, traditional stereo systems, and video game consoles. These individual end-uses were not retained in the conditional demand analysis because they produced unreasonable results. Accordingly, their electricity usage is captured as part of this aggregate “home entertainment equipment” end-use.

where *HOMEENTERTAINMENT*$_h$ is the total number of televisions (any type), set-top boxes, DVD/Blue Ray/VCR units, media streaming devices, surround sound systems, traditional stereo systems, and video game consoles in use in the household.

B.14 Swimming Pools

Energy consumption through the operation of swimming pools is assumed to be constant for those households with electric-heated pools:

$$UEC_{elecheatpool,ht} = \alpha_1$$

B.15 Hot Tubs

Energy consumption through the operation of hot tubs is assumed to be constant for those households with electric-heated hot tubs:

$$UEC_{elechottub,ht} = \alpha_1$$

B.16 Saunas

Energy consumption through the operation of saunas is assumed to be constant for those households with electric-heated saunas:

$$UEC_{elecsauna,ht} = \alpha_1$$

B.17 Battery Electric Vehicles

Energy usage for charging battery electric vehicles is assumed to be constant for those households using these automobiles:[65]

$$UEC_{elecvehicle,ht} = \alpha_1$$

B.18 Car Block Heaters

Energy usage for electric car block heaters is assumed to be constant:

$$UEC_{carblockheater,ht} = \alpha_1$$

[65] An attempt was made to include plug-in hybrid electric vehicles in this end-use; however, the relevant variable was not retained in the final model because its coefficient was negative. As a result, the end-use and its associated UEC value correspond to battery electric vehicles only.

B.19 Water Pumps

Energy usage for water pumps (e.g., well, sump, sewage, etc.) is assumed to be constant:

$$UEC_{waterpump,ht} = \alpha_1$$

B.18 Baseload

The baseload is an aggregate end-use that represents the combined consumption of all miscellaneous plug loads and other end-uses not individually accounted for in the model. Baseload consumption is modelled simply as a function of dwelling type:

$$UEC_{baseload,ht} = \alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h$$

B.19 Regression Model

Table 238: Regression Model – FBC's Overall Service Area

Model Fit
Adjusted R-squared: 0.350
F statistic: 283.2

Variable	Coefficient	SE	t-value	P-value
Constant	131.142136	23.339840	5.6	0.000
MFD	-140.738359	14.461107	-9.7	0.000
APARTMENT	-158.050478	12.035190	-13.1	0.000
HDDxAREAxS_ELECHEAT	0.059603	0.002120	28.1	0.000
HDDxAREAxMFDxS_ELECHEAT	0.005182	0.002237	2.3	0.021
HDDxAREAxAPARTMENTxS_ELECHEAT	-0.034754	0.001569	-22.1	0.000
HDDxAREAxINSULATTICxS_ELECHEAT	-0.003336	0.001409	-2.4	0.018
HDDxAREAxDOORSxINSULDOORSxS_ELECHEAT	-0.006862	0.001016	-6.8	0.000
HDDxAREAxWINDBLxS_ELECHEAT	-0.005668	0.001319	-4.3	0.000
HDDxAREAxWINBESTxS_ELECHEAT	-0.006161	0.001492	-4.1	0.000
HDDxAREAxWINTERxINSTALLWINCVRxS_ELECHEAT	-0.006793	0.002040	-3.3	0.001
HDDxAREAxPROGSMARTTHMxS_ELECHEAT	-0.000591	0.000875	-0.7	0.499
HDDxAREAxHRVERVxS_ELECHEAT	0.005020	0.001328	3.8	0.000
HDDxAREAxELECFURNACExS_ELECHEAT	-0.005086	0.001260	-4.0	0.000
HDDxAREAxELECFURNACExHEATPUMPxS_ELECHEAT	0.007995	0.001624	4.9	0.000
HDDxAREAxHEATPUMPxS_ELECHEAT	-0.014946	0.001049	-14.2	0.000
HDDxAREAxNONELECSECHEATxS_ELECHEAT	-0.013207	0.000874	-15.1	0.000
AREAxWINTERxS_ELECHEAT	2.436286	0.447986	5.4	0.000
HDDxAREAxS_ELECSECHEAT	0.008464	0.000487	17.4	0.000
HDDxAREAxMFDxS_ELECSECHEAT	-0.003166	0.001836	-1.7	0.085
HDDxAREAxAPARTMENTxS_ELECSECHEAT	-0.012967	0.001838	-7.1	0.000
HDDxAREAxHEATPUMPSECxS_ELECSECHEAT	0.001923	0.001142	1.7	0.092
CDDxAREAxS_CAC	0.057915	0.004929	11.8	0.000
CDDxAREAxMFDxS_CAC	-0.001305	0.005715	-0.2	0.819
CDDxAREAxAPARTMENTxS_CAC	-0.014060	0.005785	-2.4	0.015
CDDxAREAxSUMMERxTHERMSUMMERxS_CAC	-0.011570	0.004122	-2.8	0.005
CDDxAREAxTURNONACHOTxS_CAC	-0.016865	0.004762	-3.5	0.000
CDDxAREAxTURNOFFACNIGHTxS_CAC	-0.010405	0.003467	-3.0	0.003
AREAxSUMMERxS_CAC	0.375678	0.399380	0.9	0.347
CDDxAREAxRPACxS_RPAC	0.015933	0.001508	10.6	0.000
HDDxS_ELECWHEAT	0.345750	0.030092	11.5	0.000
HDDxMFDxS_ELECWHEAT	-0.257950	0.077040	-3.3	0.001
HDDxAPARTMENTxS_ELECWHEAT	0.031670	0.050135	0.6	0.528
HDDxNEWHOMExS_ELECWHEAT	-0.118730	0.037491	-3.2	0.002
HDDxTURNOFFWHEATERxS_ELECWHEAT	-0.280440	0.036972	-7.6	0.000
HDDxHEATPUMPWHEATERxS_ELECWHEAT	-0.435850	0.109672	-4.0	0.000
PEOPLExS_ELECWHEAT	140.231288	25.203626	5.6	0.000
DISHWASHERLOADSxS_ELECWHEAT	12.131291	2.363870	5.1	0.000
LAUNDRYLOADSxS_ELECWHEAT	15.169899	2.343507	6.5	0.000
BATHSxS_ELECWHEAT	5.061289	1.956865	2.6	0.010
PROPLOWFLOWxS_ELECWHEAT	-135.313614	12.167424	-11.1	0.000
S_REFMANUAL	77.904210	12.862700	6.1	0.000
S_REFAUTO	51.566944	14.131934	3.6	0.000
S_FREEZERUPRIGHT	70.877251	7.618709	9.3	0.000

…continued on next page

Variable	Coefficient	SE	t-value	P-value
S_FREEZERCHEST	53.127747	6.972182	7.6	0.000
S_ELECCOOK	63.817289	10.300461	6.2	0.000
S_DISHWASHER	67.340841	9.483956	7.1	0.000
S_CWASHERDRYER	69.087321	15.449238	4.5	0.000
INCANDxS_LIGHTING	1.456210	0.231841	6.3	0.000
FLUOxS_LIGHTING	1.418492	0.505899	2.8	0.005
CFLxS_LIGHTING	0.340734	0.374392	0.9	0.363
HALOGENxS_LIGHTING	1.736712	0.372049	4.7	0.000
LEDxS_LIGHTING	2.447751	0.141930	17.2	0.000
OTHERBULBxS_LIGHTING	1.968998	0.371617	5.3	0.000
HOMEENTERTAINMENTxS_HOMEENTERTAINMENT	20.943293	1.116934	18.8	0.000
S_ELECHEATPOOL	169.727649	33.822378	5.0	0.000
S_ELECHOTTUB	274.512371	9.962674	27.6	0.000
S_ELECSAUNA	48.955874	22.402732	2.2	0.029
S_ELECVEHICLE	54.538679	21.952378	2.5	0.013
S_WATERPUMP	133.407279	9.956153	13.4	0.000

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