# Pacific Northern Gas Residential End-Use Study 2022

**Prepared for:**

Al Kleinschmidt, P.Eng.
Manager, Energy Solutions
Pacific Northern Gas Ltd.
Vancouver, BC

**December 28, 2022**

**SAMPSON RESEARCH INC.**

1543 Park Avenue
Roberts Creek, British Columbia
V0N 2W2
1. 604.809.0382
www.sampsonresearch.com

## Disclaimer

Any opinions expressed in this report are the responsibility of the author, Sampson Research, and do not necessarily represent the views of Pacific Northern Gas Ltd.

## Printing

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

## Currency Units

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

# TABLE OF CONTENTS

# Table of Contents

Page

# Table of Contents

Page



## APPENDICES

# LIST OF TABLES

**Page**

# List of Tables

Page

# List of Tables

Page

# List of Tables

Page

# LIST OF FIGURES

**Page**

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **AFUE** | Average Fuel Utilization Efficiency |
| **APT** | Apartment |
| **ASHP** | Air Source Heat Pump |
| **CDA** | Conditional Demand Analysis |
| **CDD** | Cooling Degree Day |
| **DK** | Don't know |
| **DSM** | Demand-side management |
| **DWH** | Domestic Water Heater |
| **ERV** | Energy Recovery Ventilator |
| **FAF** | Forced Air Furnace |
| **Gas** | Natural Gas and/or piped propane |
| **GJ** | Gigajoule |
| **HDD** | Heating Degree Day |
| **HEC** | Household Energy Consumption |
| **HRV** | Heat Recovery Ventilator |
| **N/A** | Not applicable |
| **NR** | Non-response |
| **PNG** | Pacific Northern Gas Ltd. |
| **REUS** | Residential End-Use Survey |
| **SFD** | Single Family Detached |
| **SH** | Space Heating |
| **TH** | Town house |
| **UEC** | Unit Energy Consumption |

# 1 EXECUTIVE SUMMARY

This report summarizes the findings from a Residential End-Use Study (REUS) of Pacific Northern Gas Ltd. (PNG) residential customers conducted in the summer of 2022. The study included an online survey of 1,831 residential customers, randomly selected from PNG's three regions (North East, West (West), and West (East)). The survey gathered detailed information on space heating and domestic hot water equipment; fireplaces, gas cooking and other gas appliances; dwelling characteristics; household occupant characteristics; and renovations and activities directly or indirectly influencing residential consumption of natural gas. The survey also explored customer interest in energy-saving programs and services under consideration by PNG.

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). The margin of error for findings at the utility level is plus or minus 2.3%, 19 times out of 20. Margins of error for regional results varied, depending on the region, from plus or minus 3.7% to 4.3%.

A conditional demand analysis (CDA) was conducted using data from the 2022 REUS survey, gas consumption records of survey respondents, and regional weather data. The analysis produced utility and regional estimates of weather-normalized unit energy consumption (UEC or GJ/year) for major gas end-uses (primary and secondary space heating, domestic water heating, fireplaces, cooking, etc.).

## 1.1 Survey Highlights

Survey highlights from PNG's 2022 REUS are summarized below by topic area. Readers are directed to the respective section(s) of the main report for a detailed presentation and discussion of results by region, dwelling type, dwelling vintage and other criteria.

### 1.1.1 Customer Characteristics

- On average, there are 2.7 persons per residential dwelling in PNG's service area. The majority (57%) of dwellings have one or two occupants.
- One-quarter (24%) of dwellings are home to seniors (individuals aged 65 years or older). Thirty-five percent (35%) of dwellings are home to children (individuals aged 18 years or younger).
- One-quarter (25%) of dwellings have one or more persons working either part-time or full-time from home. Four-in-ten (42%) survey respondents indicated the number of days worked from home increased during the past two years.

### 1.1.2 Dwelling Characteristics & Renovations

- Single-family detached (SFD) dwellings account for the majority (81%) of residential dwelling types in PNG's service area. Mobile and other manufactured-style dwellings are the next most common dwelling type (10%), followed by semi-detached dwellings (duplexes, triplexes) (5%).
- Median home sizes (square feet) vary by dwelling type and vintage. The median size of SFDs is 2,000 $ft^2$ compared to 1,100 $ft^2$ for mobile and other manufactured dwellings.
- Ceiling heights vary by dwelling vintage. For example, 82% of SFDs constructed during 1950-1975 have eight-foot ceilings compared to just 32% of those constructed since 2015. Nine- and ten-foot ceilings are increasingly common in newly constructed homes.
- Somewhat more than eight-in-ten (83%) residential dwellings in PNG's service area have a basement or crawlspace. Of those with a basement, 55% are finished, 35% are partially finished, and 10% are unfinished.
- Double-pane (clear, no low-E) windows are the most common window type, representing 64% of all windows in residential dwellings. Double-pane windows with low-E coating represent 16% of windows. Only 7% of windows are triple pane (with or without low-E). In terms of window frame materials, windows with vinyl frames are the most common, accounting for more than one-half (54%) of all installed windows. The next most common frame materials are wood (27%) and aluminum (15%).
- Three-in-ten (29%) dwellings have had some or all of their windows (frames and glass) upgraded in the last five years. One-quarter (23%) have upgraded some or all of their exterior doors with new doors during the same period.

### 1.1.3 Energy-Related Renovation Activities – Past and Planned

- Somewhat less than half (45%) of PNG's residential customers completed one or more energy-related improvements to their residence in the last five years. The top three energy-related renovations included upgrading weather stripping / caulking, installing energy-efficient windows, and upgrading insulation in walls, attics and basements/crawlspaces.
- Four-in-ten (41%) households intend to complete one or more energy-related renovations to their home in the next two years. The most frequently intended renovations include installing energy-efficient windows, upgrading weather stripping / caulking, and installing a smart or learning-style thermostat.

### 1.1.4 Space Heating

- Natural gas is the main space heating fuel for 92% of PNG's residential customers. Four-in-ten (39%) use a secondary fuel to heat their home, most typically electricity, wood, or natural gas (i.e., natural gas is not their main fuel). Households in the North East region are less likely to use a

secondary fuel (29%) compared to those in the West (East) and West (West) regions (50% and 49% respectively).

- The large majority (88%) of residential dwellings have a gas forced air furnace. Approximately, half (47%) of gas furnaces are high-efficiency (AFUE of 90% or higher) units.
- Gas boilers are present in three percent (3%) of dwellings. A similar percentage (3%) have a gas combination space and water heating system. Gas boilers and combination systems have increased in popularity for new construction.
- One-third (35%) of dwellings have a heat pump, of which, the vast majority (90%) are ducted air source units (e.g., paired with a forced air furnace). Penetration of heat pumps is highest in the North East (41%) compared to West (East) (30%) and West (West) (27%). Newer dwellings (those constructed since 2005) are more likely than older dwellings to use a heat pump.
- Heat pumps can provide heating or cooling, depending on the season. Of those with a heat pump, eight-in-ten (82%) use it just for heating. Less than one-in-five (17%) use it for both heating and cooling.

### 1.1.5 Domestic Water Heating

- Seven-in-ten (70%) PNG residential customers use natural gas for domestic water heating (DWH). Dwellings in the North East are significantly more likely than the other regions to use natural gas for DWH requirements (78% of dwellings compared to 58% in the West (East) and 66% in the West (West)).
- The penetration rate for natural gas DWH in residential new construction in PNG's service area has been declining since the mid-2000s, from 82% of dwellings constructed between 1996 and 2005 to 57% of dwellings constructed since 2015. Declines in penetration rates have occurred in all regions.
- Conventional storage tanks (any fuel) remain the most common domestic water heating equipment type, used by 75% of residential dwellings. Newer homes (those built since 2005) are much more likely to use on-demand systems (31%). Four percent (4%) of respondents indicated their dwelling has a heat pump water heater.
- Seven percent (7%) of domestic water heaters are located in an unheated space (typically an unheated basement, crawlspace, or garage).

### 1.1.6 Fireplaces and Heating Stoves

- Slightly less than half (48%) of residential dwellings in PNG's service area have a fireplace or heater stove (any fuel). Five percent (5%) have a gas decorative fireplace, 16% have a gas heater-style fireplace, and 4% have a gas free-standing fireplace.

### 1.1.7 Appliances

- Fifteen percent (15%) of PNG customers have a gas range (gas cooktop and gas oven), 6% have a duel fuel range (gas cooktop and electric oven), 2% have a gas cooktop, and less than one percent (0.6%) have a gas wall oven.
- Gas barbeques that are connected to the home's natural gas service are present in 6% of homes. In comparison, 28% of homes have a barbeque that uses bottled propane.
- Penetration of gas cooking appliances, notably gas ranges and piped gas barbeques, tends to be higher among newer dwellings, particularly those constructed since 2015.
- Three-quarters (75%) of respondents have an automatic dishwasher, of which, two-thirds (67%) are ENERGY STAR qualified models.
- Half (49%) of homes use a front loading clothes washer and another 19% use a high efficiency top-loading machine. Nearly three-in-ten (28%) households have a standard efficiency top loading clothes washer.
- Gas clothes dryers are present in 5% of homes.

### 1.1.8 Pools and Hot Tubs

- Only two percent (2%) of PNG residential customers have either an indoor or outdoor swimming pool. One-in-ten (10%) have a hot tub.
- Natural gas is used to heat 7% of pools and 3% of hot tubs. Three-quarters (74%) of pools are not heated or heated using solar energy. The vast majority of hot tubs are heated using electricity.

### 1.1.9 Attitudes towards Natural Gas and Energy Conservation

Respondents were asked to indicate their relative agreement or disagreement with a number of statements addressing energy and energy conservation. Highlights include:

- Half (50%) of respondents feel it is cheaper to heat their home with natural gas than electricity (11% disagreed, 39% neutral).
- Four-in-ten (40%) respondents feel they have reduced their household's energy use as much as reasonably possible (17% disagreed, 42% neutral).
- More than half (54%) of respondents would like to reduce their home's energy use further but can't justify the expense to do so (10% disagreed, 36% neutral).
- Nearly one-quarter (24%) of respondents felt they were too busy to research ways to save energy (29% disagreed, 47% neutral).

### 1.1.10 Products and Services

- From a list of 11 different energy-saving products and services that might be offered by PNG to residential customers, a furnace tune-up program, a program to replace windows and frames with energy-efficient windows, and a program to replace exterior doors with energy-efficient insulated doors garnered the most interest from respondents.
- Only 6% of survey respondents were aware of PNG's rebate offer of $300 off the purchase and installation of a smart, learning-style thermostat. Only 4% were aware of PNG's $100 rebate for gas furnace and boiler tune-ups conducted by a qualified heating contractor. Awareness for both rebate offers was low across all regions.
- Asked to indicate their satisfaction with PNG's efforts to help them conserve energy, one-third (33%) of survey respondents indicated they are satisfied, 44% are neutral (neither satisfied nor unsatisfied), and 14% are dissatisfied.
- Only 6% of respondents consider themselves either *very* or *extremely knowledgeable* about renewable sources of energy such as biomethane. Seven-in-ten (69%) indicated they are *not very* or *not at all knowledgeable.*
- Asked about their willingness to pay more for natural gas if it included biomethane, one-in-four (38%) indicated they would be *somewhat, very, or extremely willing* to pay more and 58% were *not very or not at all willing* to pay more. Adjusting responses to reflect the fact that some respondents will not follow through on their stated intent if the service was offered, it is estimated that less than one-in-ten (8%) of PNG residential customers would pay more for a biomethane-enhanced natural gas service.

### 1.1.11 Customer Service Experiences

- Eighteen percent (18%) of survey respondents contacted PNG in the six-month period prior to taking the survey. The majority (86%) contacted PNG by phone. The remainder contacted PNG by email (12%) or visited a PNG office (2%). Less than one percent (<1%) used the online chat feature on PNG's website.
- Somewhat more than half (56%) contacted PNG to address a problem with their bill or to ask a question about their bill. Less frequently, the main reason was to open or close an account (18%), report a problem with their natural gas service (10%), or change their service address (8%).
- Overall, 84% of respondents who contacted PNG are satisfied with the customer service representative they communicated with and 11% are neutral (neither satisfied nor unsatisfied). Only 4% are dissatisfied.

### 1.2 Conditional Demand Analysis

A conditional demand analysis (CDA) using data from the 2022 REUS, respondent gas consumption records, and regional weather data was conducted to develop weather-normalized Unit Energy Consumption (UEC) estimates for the major gas end-uses. These major end-uses included main and secondary space heating, domestic water heaters, fireplaces, cooktops and ranges, pools, hot tubs, and piped gas barbeques.

Highlights from the CDA include:

- Weather-normalized utility-level UECs for primary and secondary space heating are 76.9 GJ/year and 30.8 GJ/year, respectively.
- Utility-level UEC estimates for other gas end-uses include domestic water heating (16.6 GJ/year), decorative fireplaces (10.6 GJ/year), and heater-type fireplaces (9.8 GJ/year).
- The utility-level conditional demand model was combined with region-specific factors (weather, mixes of different equipment types, etc.) to estimate region-specific UECs for primary space heating and domestic hot water. Weather-normalized UECs for primary space heating are highest in the North East (89.7 GJ/year) compared to the West (East) (73.2 GJ/year) and West (West) (58.7 GJ/year). Weather-normalized UECs for water heating ranged from 15.8 GJ/year for the West (West) region to 17.9 GJ/year for the West (East) region.

* * * * *

# 2 INTRODUCTION

This report presents detailed results and analyses from a comprehensive residential end-use study (REUS) of Pacific Northern Gas Ltd. (PNG) residential customers. The study is based on a large, comprehensive survey of PNG's residential customers, conducted in the summer of 2022. The survey gathered detailed information on residential dwellings, their energy-using equipment (end-uses), and the characteristics and behaviours of their occupants that influence residential natural gas consumption.

Information from this study is designed to support a broad range of activities for PNG, including:

- Preparation of revenue requirement, rate design, and other applications to the British Columbia Utilities Commission (BCUC)
- Preparation and updating of long-term resource plans and reviews of conservation potential
- Demand-side management (DSM) opportunity assessments and program designs
- Inputs for load forecasting models
- Development of marketing programs and advertising

## 2.1 Report Organization

This report is organized into 15 sections, including an executive summary.

- Executive summary
- Methodology
- Building characteristics
- Space heating
- Domestic hot water
- Fireplaces and heating stoves
- Appliances
- Pools and hot tubs
- Energy use behaviours and attitudes
- Products and services
- Customer service experiences
- Demographics
- Conditional demand analysis
- References

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

# 3 METHODOLOGY

This section provides information on the sample frame and sampling plan used for PNG's 2022 REUS, questionnaire topics, survey implementation, weighting of results, and survey accuracy. Key definitions and explanatory notes are provided at the end of this section.

## 3.1 Sample Frame and Sampling Plan

The sample frame for PNG's 2022 REUS included residential customers from the three PNG regions: North East, West (East), and West (West). Major communities served in these regions, the number of residential customers in each region, and the distribution of these customers by region are provided in Table 1. In total, the sample frame consisted of 33,417 residential customers, with half (50%) located in the North East region, 29% in the West (West) region, and the remaining 21% in the West (East) region.

**Table 1: PNG Residential Customer Counts (Sample Frame) – 2022 REUS**

| Region | Major Communities Served | Number of Residential Customers | Percent Distribution |
|---|---|---|---|
| North East | Dawson Creek, Fort St. John, Charlie Lake, Tumbler Ridge, Baldonnel | 16,700 | 50% |
| West (East) | Smithers, Houston, Vanderhoof, Fort St. James, Burns Lake | 7,160 | 21% |
| West (West) | Terrace, Kitimat, Prince Rupert, Thornhill | 9,557 | 29% |
| **Total** | | **33,417** | **100%** |

## 3.2 Sample Sizes and Preparation

An initial target of 3,000 completed surveys was set for the 2022 PNG REUS with the number of completed surveys per region set at 1,000. This target was expected to yield an overall accuracy of plus or minus 1.8% at the utility level using a 95% confidence interval, and plus or minus 3.1% in each region. To achieve this response, a sample of 9,325 randomly selected residential customers was assembled, with roughly equal numbers of customers selected from each of the three regions.

Eligibility for the sample was limited to customers that had two years of uninterrupted billing history. This criterion was required to maximize the number of survey respondents whose gas consumption data would be suitable for use in the conditional demand analysis (CDA) (Section 14, p. 97).

### 3.3 Questionnaire Topics

A comprehensive range of topics was addressed by PNG's 2022 REUS. Emphasis was placed on gathering information on space heating and domestic hot water equipment, appliances, dwelling construction and occupant characteristics, and renovation activities that directly and indirectly affect natural gas consumption. The survey also queried attitudes and behaviours that influence energy use. Demographic and socio-demographic data were collected to further inform PNG's understanding of its residential customers. Finally, the survey explored customer interest in a variety of residential energy-saving programs and services under consideration by PNG.

The 2022 PNG REUS questionnaire organized its questions into the following topic areas:

- Dwelling characteristics
- Space heating
- Domestic water heating
- Fireplaces and heater stoves
- Cooking, cleaning, and heating appliances
- Swimming pools and hot tubs
- Past and planned energy-related renovations
- Energy use behaviours and attitudes
- Interest in energy-related products and services
- Opinions on PNG customer service
- Demographics and socio-demographics

The questionnaire, hosted online with a hardcopy option available upon request, followed best practices in question wording, organization, and visual design. This is particularly important for REUS-style questionnaires as many questions are technical and the number of topics addressed makes the questionnaires lengthy (upwards of 20 pages). The questionnaire included explanatory notes to help respondents correctly categorize their equipment and household features. In situations where several different models of a particular end-use exist (e.g., domestic hot water heaters, fireplaces, etc.), descriptions of the different end-use models were provided to improve the respondent's ability to correctly classify their equipment.

The questionnaire was reviewed and approved by PNG before its release. The questionnaire, in hardcopy form, is provided in Appendix A. The order of the questions of the online version generally mirrored that of the hardcopy version.

### 3.4 Survey Invitation and Response Options

Residential customers selected to participate in the survey were either contacted by email or by letter depending upon whether an email address was linked to their account on PNG's customer information system. While all recipients of a survey request were encouraged to complete the survey online, they were provided with the option to complete a hardcopy version of the survey. This option was provided to limit

survey non-responses due to respondent preferences, the lack of access to a computer, or a suitable internet connection. Hardcopy versions of the survey included a self-addressed postage-paid return envelope. Each recipient of a survey request was provided with a response code unique to their household and a link to the Internet (online) version of the survey. Respondents were required to enter the code to access the online version of the survey or to obtain a hard copy of the questionnaire. For surveys completed online, the code was disabled once the survey was completed. The unique code was used by the marketing research firm to ensure only those receiving an invite could participate in the study, and to eliminate the possibility of duplicate survey responses (i.e., respondents completing both online and hardcopy versions of the survey).

### 3.4.1 Boosting Response Rates

As the 2022 PNG REUS survey was extensive (20 pages in hardcopy form), and technical in nature, the following steps were taken to encourage those invited to complete the survey:

**Completion incentives –** All recipients completing the REUS survey were eligible to win one of four $1,000 grand prizes of a prepaid VISA gift card. Recipients completing their survey within the first two weeks were also eligible for an early-bird prize draw of a $500 prepaid VISA gift card.

**Survey invitations** – PNG's logo and company name were clearly positioned on the email and hardcopy request invitations, and the letters were signed (electronically in the email versions) by a PNG representative. Each invitation was personalized using the recipient's name, service address and mailing address.

Each invitation clearly indicated the purpose of the survey and how information gathered through the survey would benefit PNG's residential customers.

All invitations included a name, telephone number, and email address for a PNG representative. Recipients were encouraged to contact this individual if they had questions about the survey or wished to verify the legitimacy of the survey. PNG provided an overview of the survey on their corporate website and advised their customer call centre of the survey. The name of the market research firm was provided to respondents, including the name, email address and phone number of a representative of the firm in case respondents had technical issues or questions about the survey.

**Statement of privacy –** Survey invitations and the questionnaire had a detailed statement of privacy regarding survey responses. The statement identified the marketing research firm hired to implement the survey and how information collected through the survey would be used and protected in accordance with the provisions of the *Information Protection Act* (British Columbia).

**Reminder Cards and Emails**– PNG-logoed reminder emails and cards were sent to all survey recipients approximately one week after they received their initial survey invitation. Its purpose was to remind households to complete their survey if they had not already done so.

### 3.5 Survey Implementation

The Vancouver office of Leger Research was responsible for implementing the survey, data cleaning, tabulating the results, and managing the incentives.

Survey invitations were sent out on June 27, 2022. Reminders were sent out approximately a week later. Respondents were given four weeks to complete the survey. Recipients of the survey were asked to complete the survey for the dwelling located at the service address indicated in their survey invitation. The invitation also recommended the survey be completed by the person in the household that does the majority of the maintenance and repair on the dwelling referenced in the invitation. This recommendation was provided to improve the accuracy of the responses to the technical questions in the survey.

### 3.6 Survey Response

A total of 1,831 surveys were received or completed online for an overall response rate of 20%. Regional response rates varied between 18% and 22% (Table 2). All but 18 surveys were completed online.

**Table 2: PNG 2022 REUS Response Summary (%)**

| Region | Sample Population | Survey Invitations | Valid Surveys Received | Response Rate (%) | Surveys Completed Online (%) |
|---|---|---|---|---|---|
| North East) | 16,700 | 2,992 | 524 | 18% | 99% |
| West (East) | 7,160 | 3,191 | 697 | 22% | 99% |
| West (West) | 9,557 | 3,142 | 610 | 19% | 99% |
| **PNG Total** | **33,417** | **9,325** | **1831** | **20%** | **99%** |

### 3.7 Weighting of Results

Weights were used to restore the responses by region to the regional proportions (shares) present in the sample frame. Weights were calculated using equation (1):

$$W^r = (P^r/P^{PNG}) / (S^r/S^{PNG}) \quad (1)$$

W = weight
P = population (sample frame)
S = survey returns
r = region
PNG = total of all PNG regions

Table 3 presents the weights calculated using this formula. These weights are applied when calculating utility level results. Weights are not used (or required) for presenting regional results. They only apply when calculating the overall PNG totals.

**Table 3: PNG 2022 Regional Weights**

| Region | Weight |
|---|---|
| North East | 1.74625 |
| West (East) | 0.56286 |
| West (West) | 0.85845 |

## 3.8 Accuracy of Survey Estimates

The margin of error (accuracy level) for survey estimates from PNG's 2022 REUS varies by region and the degree of consensus for each question. Table 4 summarizes the accuracy of the survey estimates at the 95% confidence level for a typical range of "yes-no" type questions for each PNG region and the utility average (PNG 2022).

**Table 4: Accuracy Levels for Proportional Responses by Region (%) – PNG 2022 REUS**
**Percent Plus or Minus at the 95% Confidence Level**

| Accuracy (%) / Proportional Response | North East +/- | West (East) +/- | West (West) +/- | PNG 2022 +/- |
|---|---|---|---|---|
| 50% | 4.3 | 3.7 | 4.0 | 2.3 |
| 40% or 60% | 4.2 | 3.6 | 3.9 | 2.2 |
| 30% or 70% | 3.9 | 3.4 | 3.6 | 2.1 |
| 20% or 80% | 3.4 | 3.0 | 3.2 | 1.8 |
| 10% or 90% | 2.6 | 2.2 | 2.4 | 1.4 |
| **Number of respondents (unweighted)** | **524** | **697** | **610** | **1,831** |

At the PNG 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 2.3%, 19 times out of 20. The margin of error varies by region, reflecting differing proportions of completed surveys to the sample population. Regardless of region, margins of error decrease as the consensus of the survey estimate increases. For example, the accuracy of a yes-no type question at the PNG utility level with 90% answering "yes" is plus or minus 1.4%, 19 times out of 20, versus plus or minus 2.3% if 50% answered "yes".

## 3.9 Using this Report

This report presents a substantial body of information and data about PNG's residential gas customers. Considerable effort has been made to ensure the data presented are accurate and statistically representative of PNG's residential customer base. The quality of the analysis and interpretation of the data is 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 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.

If not stated outright, all differences in category response percentages or averages, either at the utility level or between regions, if mentioned in the text of the report, are to be assumed statistically significant at the 95% confidence level.

The large volume of information collected by PNG's 2022 REUS means the primary purpose of this report is as a reference document. Analyses and observations made in this report are meant to further discussion and improve the understanding of factors that influence residential energy consumption.

### 3.10 Definitions & Explanatory Notes

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

**Conditional Demand Analysis (CDA) –** An econometric method for proportioning natural gas consumption for the home to 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 natural gas consumption data. It is an indirect approach to estimating end-use consumption.[1] 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.

**Heating Degree Day (HDD)** - Defined as the difference between a reference value of 18°C and the average outside temperature for that day. The number of HDDs reflects the amount by which the outside temperature falls below 18°C and the length of time below that temperature. The greater the number of HDDs in a month, the colder the month. The number of HDDs provides a good indication of the amount of space heating required to maintain a comfortable indoor temperature.

**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 non-responses. 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 PNG's residential customer base with at least 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%.

[1] As opposed to the more direct method of metering individual end-uses, a very costly and challenging method for most natural gas end-uses.

**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 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 present in the 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 end-use or appliance used by customers that have at least one of the appliance or end-use (e.g., average number of fireplaces per household with at least one fireplace).

**Significant Digit Conventions –** Except where otherwise indicated, all data placed in the text of this report have been rounded to the nearest significant digit. To facilitate analyses and calculations by PNG, data presented in tables and figures are expressed to one decimal place, and in the cases of saturation rates, two decimal places. This also allows tables to accommodate the occasional small response proportion (e.g., penetration rates of less than 1%).

**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 responded. 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 energy consumed by an end-use in a given year. UECs for gas utilities are estimated by conditional demand analysis (CDA). 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 weather dependent (i.e., vary with variations in heating degree days). Weather-dependent end-uses include, for example, space heaters and heater-style fireplaces.

**Unweighted Base** – All tables whose data and/or calculations share the same group and number of respondents will have the unweighted sample response (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., only those whose residence has a gas forced air furnace).

**Weighted Results** – All utility level results (PNG) are based on weighted data to ensure representation from the respective regions that is proportionate to that of the residential customer population. The distribution of responses within a region is unaffected by weighting.

**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.

# 4 DWELLING CHARACTERISTICS

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

- type, size, vintage (period of construction), ceiling heights, and number of floors (stories);
- 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 Types and Vintages

Single-family detached (SFD) dwellings account for the majority (81%) of dwelling types in PNG's service area, followed by mobile and other manufactured style homes (10%), and semi-detached dwellings (5%). Regionally, the North East region has a significantly lower share of single-family detached dwellings (78%) than the other two regions (83% - 84%) (Table 5).

**Table 5: Residential Dwelling Types (%)**

| Dwelling Type | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Single Family Detached | 78.4 | 84.4 | 83.4 | 81.2 |
| Semi-Detached | 5.7 | 1.6 | 5.6 | 4.8 |
| Row / Townhouse | 4.4 | 2.9 | 2.3 | 3.5 |
| Apt / Apt-Style Condo | 0.2 | 0.7 | 0.2 | 0.3 |
| Mobile & Other | 11.3 | 10.5 | 8.5 | 10.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

The distribution of residential dwellings (all types) by vintage (period of construction), shown in Table 6, shows that six-in-ten (61%) dwellings were constructed since 1975.

**Table 6: Residential Dwellings (All Types) by Period of Construction (%)**

| Period of Construction | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Before 1950 | 1.9 | 4.2 | 9.2 | 4.5 |
| 1950-1975 | 27.3 | 28.6 | 37.4 | 30.5 |
| 1976-1985 | 24.2 | 26.0 | 22.1 | 24.0 |
| 1986 -1995 | 8.0 | 17.5 | 14.8 | 12.0 |
| 1996 -2005 | 13.5 | 12.8 | 7.7 | 11.7 |
| 2006 – 2015 | 14.7 | 5.5 | 3.4 | 9.4 |
| 2016 or newer | 4.6 | 2.7 | 3.0 | 3.7 |
| Age unknown | 5.7 | 2.9 | 2.5 | 4.2 |
| **Total** | 100.0 | 100.0 | 100.0 | 100.0 |
| **1975 or older** | **29.2** | **32.8** | **46.6** | **35.0** |
| **Since 1975** | **65.0** | **64.5** | **51.0** | **60.8** |

Totals may not sum due to rounding.

Regionally, this proportion varies, with the West (West) region having a significantly larger share of older (pre-1976) dwellings compared to the North East and West (East) regions (47% versus 29% and 33% respectively). The North East region has proportionately more dwellings constructed since 2005 compared to the other two regions.

Table 7 summarizes the age distribution of the residential dwelling stock for each dwelling type. Six-in -ten (59%) SFDs, the most predominant dwelling type, were constructed since 1975. In contrast, 70% of semi-detached and 79% of mobile and other manufactured dwellings were constructed during this period.

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

| Period of Construction | Single Family Detached | Semi-Detached | Row / Town-house | Apt / Apt-Style Condo | Mobile & Other |
|---|---|---|---|---|---|
| *Unweighted base* [1] | *1,508* | *75* | *57* | *7* | *184* |
| Before 1950 | 5.4 | 1.0 | 2.7 | -- | -- |
| 1950 -1975 | 33.1 | 20.2 | 27.3 | -- | 16.8 |
| 1976 -1985 | 24.7 | 17.4 | 10.0 | 10.9 | 26.9 |
| 1986 -1995 | 12.5 | 5.2 | 5.1 | 52.7 | 12.1 |
| 1996 -2005 | 10.7 | 16.7 | 9.5 | 25.5 | 17.5 |
| 2006 - 2015 | 7.7 | 24.9 | 10.4 | 10.9 | 16.0 |
| 2016 or newer | 3.4 | 5.9 | 1.4 | -- | 6.3 |
| Age unknown | 2.6 | 8.5 | 33.6 | -- | 4.4 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Built prior to 1976** | **38.5** | **21.2** | **30.0** | **--** | **16.8** |
| **Built since 1975** | **58.9** | **70.3** | **36.3** | **100.0** | **78.8** |

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

## 4.2 Residency and Tenure

Respondents were asked to describe the relationship to their dwelling and whether some or all of the dwelling was rented to others. The results (Table 8) show that the majority (84%) of respondents own and live either part-time or full-time in the residence queried by the survey. Fifteen percent (15%) of homes are rented either in part or entirely to someone else. Regionally, the proportion of homes with renters is highest in the North East (18%) and lowest in the West (West) (11%).

**Table 8: Respondent Relationship to Dwelling (%)**

| Relationship to Dwelling | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Own the property and live in it – either part-time or full-time | 81.7 | 85.7 | 89.5 | 84.8 |
| Own the property, live in it, but also rent part of it to others | 1.5 | 3.2 | 1.5 | 1.9 |
| Own the property and use it primarily as a vacation property | 0.6 | 0.1 | 0.0 | 0.3 |
| Own the property but rent it out to others | 4.2 | 1.9 | 3.3 | 3.4 |
| Renter who lives at this property | 12.0 | 9.2 | 5.7 | 9.6 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Dwellings partially or fully rented** | **17.7** | **14.3** | **10.5** | **14.9** |

Totals may not sum due to rounding.

## 4.3 Length of Residency / Ownership

Residential customers of PNG have lived in their residences for an average (mean) of 12 years. The median is nine years (Table 9). Regionally, customers in the North East region have lived in their residences for the fewest years (average of 9.7 years) compared to those in the West (West) (14.3 years).

**Table 9: Average Length of Residence (Years)**

| Length of Residence (years) | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Mean [1] | 9.7 | 12.0 | 14.3 | 12.0 |
| Median | 8.0 | 9.0 | 10.0 | 9.0 |
| Standard Deviation | 15.1 | 9.1 | 39.6 | 25.0 |

[1] Trimmed mean, 5% of highest values removed from the calculation

## 4.4 Dwelling Size

Dwelling size is defined as the total floor area of the dwelling including the basement and any unfinished areas, but excluding garages or carports. Following an outlier analysis to remove extreme values (0.5% of the largest and smallest values for a total sample reduction of 1%), the average floor area of residential dwellings in the PNG's service area is 1,944 square feet and the median is 1,920 square feet (Table 10). The average and median values by region are influenced, in part, by the mix of dwelling types with SFDs typically having the largest floor area.

**Table 10: Dwelling Size (Square Feet)**

| Floor Space ($ft^2$) | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Mean [1] | 1,863 | 1,979 | 1,975 | 1,944 |
| Standard Deviation | 1,294 | 876 | 1,044 | 1,067 |
| Median | 1,800 | 1,960 | 2,000 | 1,920 |

[1] Mean excludes 1% of the largest and smallest values

Average (mean) and median square footage data by the five dwelling types are summarized in Table 11. These data indicate that SFDs are the largest dwellings on average (2,082 $ft^2$) and mobile and manufactured homes the smallest (1,143 $ft^2$). The median size for SFD homes is 2,000 $ft^2$, compared to 1,100 $ft^2$ for mobile and other manufactured homes.

**Table 11: Dwelling Size (Square Feet) by Type of Dwelling**

| Floor Space ($ft^2$) | Single Family Detached | Semi-Detached | Row / Town-house | Apt / Apt-Style Condo | Mobile & Other |
|---|---|---|---|---|---|
| *Unweighted base* [1] | *1,508* | *75* | *57* | *7* | *184* |
| Mean [2] | 2,082 | 1,766 | 1,216 | 1,210 | 1,143 |
| Median | 2,000 | 1,500 | 1,101 | 1,100 | 1,100 |
| Standard Deviation | 979 | 1,885 | 684 | 261 | 986 |

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

## 4.5 Ceiling Heights

Ceiling heights affect the total interior volume of the home that needs to be heated or cooled. Respondents to PNG's 2022 REUS were asked to indicate the proportions of their dwelling with 8, 9, 10 and more than 10 foot ceiling heights. These data, summarized in Table 12, show that eight 8 foot ceilings are the most common ceiling height, accounting for 72% of ceilings in stock of residential dwellings. The next most common are 9 foot ceilings and 10 foot ceilings (15% and 9% respectively). Five percent (5%) of ceilings were higher than 10 feet.

**Table 12: Ceiling Heights (Mean %)**

| Ceiling Height | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| 8 feet | 69.2 | 75.4 | 72.9 | 71.6 |
| 9 feet | 16.2 | 13.3 | 14.5 | 15.1 |
| 10 feet | 9.5 | 6.8 | 8 | 8.5 |
| More than 10 feet | 5.1 | 4.4 | 4.5 | 4.8 |

Table 13 illustrates the long-term trend in ceiling heights for single-family detached dwellings. Notably, ceiling heights in new construction have increased over time, with SFDs constructed since the mid-1980s more likely to have 9 or 10 foot ceilings rather than the more traditional 8 foot ceilings of homes built in the post-war period. For example, 82% of ceilings in SFDs constructed during 1950-1975 are 8 foot compared to just 32% for dwellings constructed since 2015. Of these latter builds, one-third of ceilings, on average, are 10 feet high or higher, and another 35% are 9 feet high.

**Table 13: Ceiling Heights by Dwelling Vintage (Period of Construction) – SFDs (Mean %)**

| Ceiling Height | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* [1] | *93* | *501* | *372* | *215* | *158* | *90* | *45* | *34* |
| 8 feet | 65.7 | 81.7 | 77.9 | 73.9 | 67.6 | 38.9 | 31.7 | 76.7 |
| 9 feet | 21.9 | 11.6 | 9.5 | 8.8 | 15.9 | 32.7 | 35.0 | 11.6 |
| 10 feet | 7.4 | 4.3 | 8.4 | 9.4 | 10.2 | 17.5 | 20.4 | 4.0 |
| More than 10 feet | 5.0 | 2.4 | 4.3 | 7.8 | 6.3 | 10.9 | 12.9 | 7.8 |

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.

## 4.6 Number of Heated Floors (Stories)

Table 14 summarizes the number of heated floors, including heated basements, for residential dwellings in PNG's service area. The number of heated floors of a residential dwelling influences its space conditioning requirements. As well, multi-story dwellings have different space heating and cooling profiles than their single-story counterparts. Overall, the majority (61%) of homes in PNG's service area have two heated floors, 26% have one, and the remainder have three or more floors. Regional variations are not statistically significant.

**Table 14: Number of Heated Floors Including Basements (% of Dwellings)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| One floor | 27.7 | 23.2 | 24.0 | 25.7 |
| Two floors | 59.3 | 62.7 | 61.1 | 60.6 |
| Three floors | 11.1 | 13.2 | 13.5 | 12.2 |
| More than three floors | 1.9 | 0.9 | 1.5 | 1.6 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

## 4.7 Basements and Crawlspaces

Somewhat more than eight-in-ten (83%) residential dwellings in PNG's service area have a basement or crawlspace (Table 15). The incidence of basements and crawlspaces varies by dwelling type. Single-family detached and semi-detached dwellings are the most likely dwelling types to have a basement or crawlspace compared to townhouses and apts/condos (data not shown).

**Table 15: Incidence of Basements and Crawlspaces (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Full basement | 56.1 | 54.4 | 46.8 | 53.0 |
| Partial basement | 9.3 | 11.8 | 13.5 | 11.1 |
| Crawlspace | 18.7 | 18.1 | 19.9 | 18.9 |
| No basement or crawlspace | 15.8 | 15.8 | 19.8 | 17.0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Basement or crawlspace** | **84.2** | **84.2** | **80.2** | **83.0** |

Totals may not sum due to rounding.

Of those respondents whose dwelling has a basement (either full or partial), 55% indicated the basement was completely finished and 35% indicated it was partially finished. Ten percent (10%) have basements that were unfinished.

**Table 16: Basement Finishing (%)**
**Dwellings with Basements**

| Homes with basements | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *441* | *587* | *487* | *1,515* |
| Unfinished | 7.6 | 10.6 | 12.6 | 9.6 |
| Partially finished | 33.2 | 39.5 | 35.3 | 35.2 |
| Completely finished | 59.2 | 49.9 | 52.2 | 55.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Nine-in-ten (93%) respondents living in dwellings with either a full or partial basement indicated they heat their basement during the heating season (Table 17). In contrast, only 37% of crawlspaces are heated during the winter months. Respondents in the North East were most likely to heat their basements during the winter season.

**Table 17: Heating of Basements vs. Crawlspaces (%)**

| Basement /Crawlspace Heating | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Percent of basements heated | 95.9 | 92.4 | 88.5 | 93.1 |
| Percent of crawl spaces heated | 37.8 | 43.6 | 30.6 | 36.8 |

## 4.8 Insulation and Insulation Upgrades

Respondents to the 2022 PNG REUS were asked whether insulation was present in five areas of the home including, where applicable, attics, exterior walls, basements, crawlspaces, and garages or workshops heated using natural gas. Respondents were then asked to indicate whether insulation in these areas had been upgraded (no time period specified).

On average, 92% of attics, 93% of exterior walls, 83% of basements, 57% of crawlspaces, and 52% of garages heated with natural gas are insulated (Table 18). On average, 2% of attics are not insulated, as are 1% of exterior walls, 9% of basements, 29% of crawlspaces, and 39% of garages heated with natural gas. The remaining respondents in homes with the applicable areas indicated they were unsure if insulation was present. This uncertainty varied from 6% of respondents for attics to 14% for those with crawlspaces.

**Table 18: Insulation by Area of the Home (%)**

| Insulation present? (Where applicable) | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Attics | | | | |
| Yes | 89.7 | 92.9 | 94.7 | 91.9 |
| No | 1.4 | 1.8 | 1.7 | 1.6 |
| Don't know | 8.8 | 5.3 | 3.6 | 6.5 |
| Exterior Walls | | | | |
| Yes | 92.6 | 94.4 | 91.5 | 92.6 |
| No | 0.6 | 1.4 | 2.3 | 1.3 |
| Don't know | 6.9 | 4.2 | 6.2 | 6.1 |
| Basement | | | | |
| Yes | 83.2 | 85.1 | 80.1 | 82.8 |
| No | 8.2 | 7.1 | 12.7 | 9.2 |
| Don't know | 8.5 | 7.9 | 7.2 | 8.0 |
| Crawlspace | | | | |
| Yes | 55.3 | 57.7 | 57.7 | 56.5 |
| No | 29.2 | 27.9 | 29.5 | 29.0 |
| Don't know | 15.5 | 14.5 | 12.8 | 14.4 |
| Heated garage / workshop [1] | | | | |
| Yes | 66.2 | 42.3 | 33.3 | 52.1 |
| No | 25.8 | 48.6 | 57.0 | 39.2 |
| Don't know | 8.0 | 9.0 | 9.7 | 8.7 |

[1] Only garages / workshops heated with natural gas

Respondents indicating the presence of insulation in one or more areas were then asked whether insulation in those areas had been upgraded. On average, 31% of attics have had their insulation upgraded, 18% of exterior walls, 23% of basements, 30% of crawlspaces, and 19% of garages or workshops heated with natural gas (Table 19).

**Table 19: Insulation Upgrades by Dwelling Area (% with Upgraded Insulation)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Attics | 27.5 | 34.2 | 34.4 | 31.1 |
| Exterior walls | 16.3 | 17.8 | 21.0 | 18.0 |
| Basement | 21.4 | 24.9 | 24.2 | 23.0 |
| Crawlspace | 32.0 | 30.1 | 27.2 | 30.1 |
| Heated garage / workshop [1] | 16.8 | 22.3 | 22.9 | 18.7 |

[1] Only garages / workshops heated with natural gas

Table 20 presents data on insulation upgrades by vintage (period of construction) of the dwelling. The data show that the older the home, the more likely it has had upgrades to the insulation in one or more of the areas queried. For example, 60% of respondents living in homes constructed before 1950 indicated their attic insulation has been upgraded compared to 7% of those living in dwellings constructed between 2006 and 2015. The counterintuitive results for dwellings constructed since 2015 may be the result of some respondents interpreting the question as referring to insulation options available at the time of their home's construction.

**Table 20: Insulation Upgrades by Dwelling Vintage (Period of Construction)**

**Percent with Upgraded Insulation**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| Attics | 59.7 | 48.8 | 29.7 | 18.1 | 14.9 | 7.4 | 23.2 | 13.8 |
| Exterior walls | 41.9 | 28.5 | 16.4 | 7.6 | 10.1 | 5.4 | 20.5 | 2.6 |
| Basement | 56.5 | 36.1 | 21.7 | 11.7 | 10.2 | 6.7 | 15.1 | 7.9 |
| Crawlspace | 56.8 | 46.0 | 34.5 | 25.7 | 10.5 | 7.6 | 30.4 | 41.9 |
| Heated garage / workshop [1] | 50.7 | 43.7 | 13.8 | 13.4 | 8.5 | 1.3 | 17.2 | 29.9 |

[1] Only garages / workshops heated with natural gas

## 4.9 Draft Proofing / Air Sealing

Respondents to PNG's 2022 REUS were asked whether their home was always drafty, sometimes drafty or not at all drafty. Six-in-ten (59%) indicated their homes are "sometimes drafty" or "always drafty" (Table 21). The majority of these indicated their home was sometimes drafty. Eight percent (8%) indicated their home was always drafty. Regional variations in the proportion of homes sometimes or always drafty are not statistically significant at the 95% confidence level.

**Table 21: Draftiness of the Home (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Excellent – home is not at all drafty | 40.5 | 42.5 | 41.3 | 41.1 |
| Good – home is sometimes drafty | 51.1 | 50.3 | 51.3 | 51.0 |
| Poor – Home is always drafty | 8.4 | 7.2 | 7.4 | 7.8 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Sometimes or always drafty** | **59.5** | **57.5** | **58.7** | **58.9** |

Totals may not sum due to rounding.

The draftiness of a home is correlated with its age (Table 22). For example, half (51%) of respondents living in homes built between 1950 and 1975 indicated their homes are sometimes or always drafty compared to just 9% of respondents in homes constructed since 2015.

**Table 22: Draftiness of the Home by Dwelling Vintage (Period of Construction) (%)**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Excellent – home is not at all drafty | 37.9 | 49.1 | 52.1 | 59.2 | 68.4 | 76.8 | 91.4 | 36.4 |
| Good – home is sometimes drafty | 53.0 | 46.1 | 43.5 | 38.6 | 27.9 | 20.9 | 7.8 | 52.4 |
| Poor – Home is always drafty | 9.1 | 4.8 | 4.4 | 2.2 | 3.6 | 2.3 | 0.8 | 11.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Sometimes or always drafty** | **62.1** | **50.9** | **47.9** | **40.8** | **31.6** | **23.2** | **8.6** | **63.6** |

Totals may not sum due to rounding.

### 4.10 Windows and Window Upgrades

Respondents to PNG's 2022 REUS were asked to estimate the percentage of their windows that matched the following descriptions:

- Single pane regular (clear) glass
- Double pane regular (clear) glass
- Double pane with low-E
- Triple pane regular (clear) glass
- Triple pane with low-E
- Other (respondent to specify)

Average (mean) percentages for the five window types by region are provided in Table 23. Double pane (clear) glass windows are the most common window type, representing 64% of windows. Double pane windows with low-E coatings represent 16% of windows followed by single pane windows which account for 12% of windows.

**Table 23: Window Glazing - Mean % of Windows**

| Window Types | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Single pane (clear) glass | 13.0 | 10.9 | 10.3 | 11.8 |
| Double pane (clear) glass | 62.4 | 61.5 | 68.0 | 63.8 |
| Double pane with low-E | 14.8 | 19.2 | 16.3 | 16.2 |
| Triple pane (clear) glass | 3.5 | 3.0 | 1.8 | 2.9 |
| Triple pane with low-E | 5.2 | 4.6 | 2.4 | 4.3 |
| Other | 1.0 | 0.8 | 1.2 | 1.0 |

Respondents with double and/or triple glazed windows were asked whether these windows are ENERGY STAR® qualified. Table 24 summarizes the responses with 19% of double pane (clear) windows indicated as ENERGY STAR qualified, 55% of low-E windows, 44% of triple pane (clear), and 75% of triple pane low-E windows. Caution is advised in the interpretation of these data as the proportion of respondents unsure of the ENERGY STAR status of their windows is quite high (anywhere from 21% to 55% depending upon the window type).

**Table 24: ENERGY STAR Windows (% ENERGY STAR)**

| Windows are ENERGY STAR? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Double pane regular | | | | |
| Yes | 18.2 | 15.2 | 22.9 | 19.0 |
| No | 25.9 | 29.3 | 23.1 | 25.8 |
| Don't know | 55.9 | 55.6 | 53.9 | 55.2 |
| Double pane with low-E | | | | |
| Yes | 56.1 | 51.1 | 56.5 | 54.9 |
| No | 10.2 | 3.9 | 8.1 | 7.9 |
| Don't know | 33.7 | 44.9 | 35.5 | 37.2 |
| Triple pane regular | | | | |
| Yes | 46.7 | 41.7 | 36.8 | 43.7 |
| No | 10.0 | 11.1 | 21.1 | 12.3 |
| Don't know | 43.3 | 47.2 | 42.1 | 44.0 |
| Triple pane with low-E | | | | |
| Yes | 71.4 | 86.4 | 73.7 | 75.0 |
| No | 4.8 | 2.3 | 5.3 | 4.3 |
| Don't know | 23.8 | 11.4 | 21.1 | 20.7 |

The average (mean) shares of the six window types by dwelling vintage (period of construction) are summarized in Table 25. Of note, the percentage of single pane windows is highest in older dwellings. For example, 21% of windows in dwellings constructed before 1950 are single pane compared to only 5% of windows in dwellings constructed during the 1986-1995 period. Renovation activity among the older housing stock is clearly evident. For example, 18% of windows in homes constructed between 1950 and 1975 are now double pane with a low-E coating.

**Table 25: Window Glazing - Mean % of all Windows by Dwelling Vintage (Period of Construction)**

| Window Types | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 – 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Single pane (clear) glass | 20.6 | 13.2 | 15.4 | 5.4 | 6.2 | 3.8 | 9.6 | 24.9 |
| Double pane (clear) glass | 62.3 | 62.9 | 65.8 | 69.3 | 71.1 | 57.5 | 35.3 | 64.6 |
| Double pane with low-E | 11.4 | 17.5 | 13.4 | 18.1 | 12.1 | 25.4 | 23.8 | 6.3 |
| Triple pane (clear) glass | 2.6 | 1.5 | 2.5 | 1.7 | 3.4 | 6.7 | 14.2 | 0.0 |
| Triple pane with low-E | 3.1 | 3.4 | 2.4 | 5.4 | 7.0 | 4.2 | 17.1 | 1.1 |
| Other | -- | 1.6 | 0.5 | -- | 0.3 | 2.3 | -- | 3.0 |

### 4.10.1 Window Frames

Respondents were asked to estimate the percentage of their dwelling's windows by frame material (e.g., aluminum, wood, vinyl, fibreglass, and/or other). The results, summarized in Table 26, show that vinyl-framed windows are the most common, accounting for more than one-half (54%) of all installed windows. The next most common are wood (27%) and aluminum (15%).

**Table 26: Window Frame Material - Mean % of all Windows**

| Window Frame Material | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Vinyl | 52.6 | 53.9 | 57.4 | 54.3 |
| Wood | 27.1 | 32.5 | 22.7 | 27.0 |
| Aluminum | 15.0 | 12.0 | 17.5 | 15.1 |
| Fibreglass | 4.0 | 0.5 | 1.5 | 2.5 |
| Other | 1.3 | 1.1 | 0.9 | 1.2 |

The popularity of window frame materials varies, to some degree, with the age of the residential dwelling, notably for aluminum and wood-framed windows (Table 27). For example, the incidence of wood-framed windows is significantly lower for homes constructed since the mid-1990s, displaced by vinyl-framed windows. The popularity of vinyl framed windows as a retrofit window type for older dwellings is clearly evident.

**Table 27: Window Frame Material - Mean % of all Windows by Dwelling Vintage (Period of Construction)**

| Window Frame Material | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Vinyl | 48.7 | 54.0 | 46.1 | 49.6 | 69.3 | 67.1 | 77.6 | 31.1 |
| Wood | 30.8 | 29.5 | 34.2 | 35.4 | 15.0 | 10.2 | 7.8 | 27.8 |
| Aluminum | 15.7 | 13.8 | 16.9 | 12.3 | 13.9 | 17.8 | 4.3 | 28.4 |
| Fibreglass | 3.2 | 2.1 | 1.7 | 0.6 | 1.6 | 4.1 | 10.4 | 6.8 |
| Other | 1.6 | 0.7 | 1.0 | 2.1 | 0.3 | 0.8 | 0.0 | 5.9 |

### 4.10.2 Window Upgrades (Frames and Glass)

Three-in-ten (29%) dwellings have had some or all of their windows (frames and glass) upgraded in the last five years (Table 28).

**Table 28: Upgrades to Windows – Last Five Years (%)**

| Windows upgraded last five years? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Yes - all of them | 8.6 | 6.9 | 9.7 | 8.5 |
| Yes - some of them | 19.5 | 23.2 | 21.5 | 20.9 |
| No - none of them | 60.5 | 63.4 | 60.3 | 61.1 |
| Don't know | 11.5 | 6.4 | 8.5 | 9.5 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Some or all upgraded** | **28.1** | **30.1** | **31.1** | **29.4** |

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 highest among older dwellings, notably those constructed prior to the mid-1990s (Table 29). Respondents in homes constructed since 2016 who indicated they upgraded all of their windows may have interpreted the question as pertaining to options available to them when their home was constructed (i.e., made the decision to upgrade their window package during construction).

**Table 29: Windows Upgraded Last Five Years by Dwelling Vintage (Period of Construction) (%)**

| 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* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Yes - all of them | 7.7 | 11.8 | 9.7 | 7.1 | 4.6 | 1.0 | 19.0 | 2.2 |
| Yes - some of them | 25.2 | 27.0 | 26.1 | 26.4 | 9.4 | 6.0 | 2.5 | 6.7 |
| No - none of them | 56.5 | 53.4 | 56.8 | 59.4 | 77.1 | 82.9 | 71.3 | 48.4 |
| Don't know | 10.5 | 7.8 | 7.4 | 7.2 | 8.9 | 10.1 | 7.2 | 42.7 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Some or all upgraded** | **32.9** | **38.8** | **35.8** | **33.5** | **14.0** | **7.0** | **21.5** | **8.9** |

Totals may not sum due to rounding.

## 4.11 Exterior Door Materials and Upgrades

### 4.11.1 Exterior Door Materials

Respondents were asked to indicate how many of the following exterior door types were present at their residence:

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

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

Table 30 summarizes the percentage distribution of these six door-type combinations. Insulated steel or fibreglass doors are the most common type of exterior door, accounting for half (50%) of all exterior doors in PNG's service area. Wood doors and glass doors with either vinyl or fibreglass frames (e.g., French doors or sliding patio doors) are the next most common door types representing 16% and 11% of exterior doors respectively. Regional differences are unremarkable.

**Table 30: Exterior Door Materials (%)**

| Exterior Door Materials | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Wood doors | 15.8 | 17.4 | 16.6 | 16.4 |
| Wood doors with aluminum storm doors | 9.2 | 7.1 | 7.0 | 8.0 |
| Insulated steel or fibreglass doors | 50.8 | 47.5 | 50.4 | 49.9 |
| Glass doors with wooden frames | 7.5 | 8.7 | 5.5 | 7.1 |
| Glass doors with aluminum frames | 7.5 | 6.9 | 9.1 | 7.9 |
| Glass doors with vinyl or fibreglass frames | 9.2 | 12.4 | 11.4 | 10.6 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Table 31 summarizes the saturation rates for the six different exterior door types. The average residential dwelling has 2.8 exterior doors, of which insulated steel or fibreglass doors represent the most common type. Saturation rates for individual door types reflect the total number of that door type among the total survey population whether they have that particular door type or not. Multiplying the saturation rate by the total number of PNG residential customers generates an estimate of the total number of exterior doors, by type, across PNG's service area.

**Table 31: Exterior Door Saturation Rates by Material (Average # per Dwelling*)**

| Exterior Door Materials | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Wood doors | 0.4 | 0.5 | 0.5 | 0.4 |
| Wood doors with aluminum storm doors | 0.2 | 0.2 | 0.2 | 0.2 |
| Insulated steel or fibreglass doors | 1.3 | 1.4 | 1.5 | 1.4 |
| Glass doors with wooden frames | 0.2 | 0.2 | 0.2 | 0.2 |
| Glass doors with aluminum frames | 0.2 | 0.2 | 0.3 | 0.2 |
| Glass doors with vinyl or fibreglass frames | 0.2 | 0.3 | 0.3 | 0.3 |
| **Any Exterior Door Type** | 2.6 | 2.9 | 3.0 | 2.8 |

* Survey population

### 4.11.2 Exterior Door Upgrades Last Five Years

On average, seven percent (7%) of respondents indicated they have had all of their exterior doors upgraded with new doors during the past five years and another 16% have had some of their exterior doors upgraded (Table 32). Two-thirds (67%) made no upgrades during this period. There are no statistically significant differences between the regions.

**Table 32: Exterior Door Upgrades Last Five Years (%)**

| Exterior doors upgraded last five years? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Yes - all of them | 7.3 | 6.7 | 7.4 | 7.2 |
| Yes - some of them | 15.3 | 18.1 | 15.7 | 16.0 |
| No - None of them | 65.5 | 66.9 | 68.2 | 66.6 |
| DK | 12.0 | 8.3 | 8.7 | 10.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Some or all upgraded** | **22.5** | **24.8** | **23.1** | **23.2** |

Totals may not sum due to rounding.

The incidence of upgrades to exterior doors correlates with the age of the dwelling. Table 33 shows that upgrades to doors (either all or some of them) are more likely to occur in dwellings constructed prior to the mid-1980s. Some misinterpretation of the question is evident for dwellings constructed since 2015.

**Table 33: Exterior Door Upgrades Last Five Years by Dwelling Vintage (Period of Construction) (%)**

| 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* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Yes - all of them | 8.7 | 9.4 | 8.0 | 5.5 | 4.6 | 1.3 | 18.1 | 0.0 |
| Yes - some of them | 17.5 | 17.8 | 22.6 | 17.5 | 13.3 | 5.5 | 2.5 | 2.6 |
| No - None of them | 68.0 | 63.4 | 61.8 | 69.3 | 73.7 | 80.2 | 70.1 | 54.0 |
| Don't know | 5.8 | 9.4 | 7.6 | 7.7 | 8.5 | 13.0 | 9.3 | 43.4 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Some or all upgraded** | **26.2** | **27.2** | **30.6** | **23.0** | **17.9** | **6.8** | **20.6** | **2.6** |

Totals may not sum due to rounding.

## 4.12 Other Energy-Related Renovations Made in the Last Five Years

Respondents to PNG's 2022 REUS were provided with a list of renovations that will influence a home's use of energy and asked to indicate which ones had been completed in the past five years. They were also asked to indicate whether they had received a government or utility rebate (where available) to complete the renovation. Questions regarding renovations were asked in two groups: those related to space heating and cooling, and those addressing all other areas that influence energy use (e.g., insulation, water heating, building envelope, etc.).

### 4.12.1 Renovations Related to Heating & Cooling

Renovations related to space heating and cooling included installations (new and replacement) of air source heat pumps, central air conditioners, furnaces, and boilers. The results, summarized in Table 34, show 13% of respondents replaced a furnace or boiler in the last five years, by far the most frequently indicated renovation from the seven queried. All other changes, including adding or replacing a central air conditioner, adding or replacing a heat pump, or switching from a central air conditioner to a heat pump, each were completed by 1% or fewer respondents.

**Table 34: Space Heating and Cooling Renovations – Last Five Years**
**Percent of Respondents [1]**
**Multiple Responses Allowed**

| Type of Renovation | With or Without Rebate | With Rebate | Without Rebate | Percent Using Rebate |
|---|---|---|---|---|
| Replace a furnace or boiler | 13.1 | 0.6 | 12.5 | 5% |
| Install central air conditioner (first-time installation) | 1.3 | 0.1 | 1.2 | 7% |
| Replace an air source heat pump with a new one | 1.0 | 0.1 | 0.9 | 8% |
| Install ducted air source heat pump (first-time installation) | 0.8 | 0.2 | 0.6 | 26% |
| Install ductless (mini-split) heat pump | 0.5 | 0.1 | 0.4 | 21% |
| Replace a central air conditioner with air source heat pump | 0.3 | 0.1 | 0.2 | 33% |
| Replace central air conditioner with a new one | 0.2 | 0.1 | 0.1 | 40% |
| **At least one of the above** | **15.1** | -- | -- | **n/a** |

[1] Calculated using a weighted base of n = 1,831
n/a = not applicable

### 4.12.2 Other Energy-Related Renovations

A variety of other energy-related renovations were queried of REUS respondents including low-cost activities like improving weather stripping and chalking to more costly actions like installing an energy-efficient hot water heater or energy-efficient windows. Table 35 summarizes other energy-related renovations completed during the last five years, ordered by most frequent to least frequent.

**Table 35: Other Energy-Related Renovations – Last Five Years**
**Percent of Respondents [1]**
**Multiple Responses Allowed**

| Type of Renovation | With or Without Rebate | With Rebate | Without Rebate | Percent Using Rebate |
|---|---|---|---|---|
| Improve weather stripping or caulking | 18.2 | 1.4 | 16.8 | 7.7 |
| Install energy-efficient window(s) | 17.2 | 1.5 | 15.7 | 8.7 |
| Improve insulation in walls, attic, basement, or crawlspace | 15.1 | 0.7 | 14.3 | 4.8 |
| Install low-flow showerhead(s) | 12.5 | 0.7 | 11.7 | 5.8 |
| Install insulated exterior door(s) or storm doors | 12.0 | 0.4 | 11.6 | 3.3 |
| Install high-efficiency hot water tank | 10.8 | 1.3 | 9.5 | 11.7 |
| Install a smart or learning-style thermostat(s) | 7.3 | 0.5 | 6.8 | 6.2 |
| Install pipe wrap | 5.8 | 0.7 | 5.1 | 11.9 |
| Install on-demand (tankless or hybrid) water heater | 4.2 | 0.5 | 3.8 | 10.8 |
| Install hot tub | 3.2 | n/a | 3.2 | n/a |
| Install a wood stove | 2.1 | 0.2 | 1.9 | 9.5 |
| Install hot water heater blanket | 1.3 | 0.2 | 1.1 | 15.9 |
| Complete a whole home energy audit | 1.3 | 0.6 | 0.8 | 44.0 |
| Install heat or energy recovery ventilator (HRV or ERV) | 1.2 | 0.1 | 1.1 | 9.1 |
| Install heat pump water heater | 0.7 | 0.2 | 0.5 | 25.1 |
| Install drain pipe waste heat recovery system | 0.5 | <0.1 | 0.5 | 6.3 |
| Install heated swimming pool | 0.1 | n/a | 0.1 | n/a |
| **At least one of the above (%)** | **45.1** | -- | -- | -- |

[1] Calculated using weighted base of n = 1,831
n/a = not applicable

Somewhat less than one-half (45%) of respondents indicated they completed at least one of the renovations during the last five years. The top three renovations were improving weather stripping or caulking (18% of respondents), installing energy-efficient windows (17%), and improving insulation (15%). Installing low-flow showerheads, installing insulated exterior doors, and installing a high-efficiency hot water tank were the next most commonly completed renovations (13%, 12% and 11% respectively). The percentage of renovations completed with a rebate varied from a high of 44% for completing a whole home energy audit to 3% for installing insulated doors.

## 4.13 Planned Energy-Related Renovations – Next Two Years

Using the list of energy-related renovations from the previous section, respondents were asked which, if any, they intended to complete during the next two years. While speculative, this question provides a general indication of the types of energy-related renovations most likely to be completed in the short term.

### 4.13.1 Renovations Related to Space Heating and Cooling

Of the list of renovations provided, respondents to PNG's 2022 REUS were most likely to replace a furnace or boiler in the next two years (12%) (Table 36). The next most frequently indicated renovations included installing either a ducted air source heat pump (first time installation) or installing a central air conditioner (first time installation) (4% for each), and installing a ductless (mini-split) heat pump (2%). Of note, the incidence of respondents indicating they intended to replace their central air conditioner with a heat pump is very low (less than 1% of respondents).

**Table 36: Planned Space Heating and Cooling Renovations – Next Two Years**
**Percent of Respondents [1]**
**Multiple Responses Allowed**

| Type of Renovation | % of Respondents |
|---|---|
| *Unweighted base* | *1,831* |
| Replace a furnace or boiler | 11.6 |
| Install ducted air source heat pump (first-time installation) | 3.5 |
| Install central air conditioner (first-time installation) | 3.5 |
| Install ductless (mini-split) heat pump | 1.8 |
| Replace a central air conditioner with air source heat pump | 0.5 |
| Replace an air source heat pump with a new one | 0.4 |
| Replace central air conditioner with a new one | 0.3 |
| **At least one of the above** | **16.2** |

### 4.13.2 Other Energy-Related Renovations

Four-in-ten (41%) respondents intend to complete one or more of the seventeen other energy-related renovations to their home in the next two years (Table 37). The most frequently intended renovations include installing energy-efficient windows (19% of respondents), installing weather stripping or caulking (18%), and installing a smart or learning-style thermostat (14%).

**Table 37: Planned Other Energy-Related Renovations - Next Two Years**
**Percent of Respondents – Multiple Responses Allowed**

| Type of Renovation | % of Respondents |
|---|---|
| *Unweighted base* | *1,831* |
| Install energy-efficient window(s) | 19.0 |
| Improve weather stripping or caulking | 18.0 |
| Install a smart or learning-style thermostat(s) | 14.0 |
| Improve insulation in walls, attic, basement, or crawlspace | 13.0 |
| Install insulated exterior door(s) or storm doors | 12.0 |
| Install high-efficiency hot water tank | 7.0 |
| Install low-flow showerhead(s) | 6.0 |
| Install hot water heater blanket | 6.0 |
| Install pipe wrap | 5.0 |
| Complete a whole home energy audit | 5.0 |
| Install on-demand (tankless or hybrid) water heater | 4.0 |
| Install hot tub | 3.0 |
| Install heat pump water heater | 2.0 |
| Install a wood stove | 2.0 |
| Install heat or energy recovery ventilator (HRV or ERV) | 2.0 |
| Install drain pipe waste heat recovery system | -- |
| Install heated swimming pool | -- |
| **At least one of the above (%)** | **41.2** |

# 5 SPACE HEATING

This section presents detailed data on space heating fuels, methods (equipment), and installations; fuel switching; furnace and boiler efficiencies; and heating system maintenance behaviours.

## 5.1 Determining How Dwellings are Heated

Respondents to PNG's 2022 REUS were asked to identify the fuels used for space heating separately from the methods (equipment) used to heat their home. 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.

### 5.2.1 Main Space Heating Fuel

Natural gas serves as the main space heating fuel for nine-in-ten (92%) of PNG's residential customers. Electricity is the next most frequently indicated main space heating fuel (5% of respondents). Regionally, natural gas is the main fuel for 96% of North East customers compared to 87% of West (East) customers. Of note, wood is the main fuel for 6% of customers in the West (East) region, significantly higher than either of the two regions.

**Table 38: Main Space Heating Fuel (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Electricity | 1.7 | 5.5 | 8.5 | 4.5 |
| Natural gas | 96.2 | 86.6 | 89.0 | 92.1 |
| Piped propane | 0.4 | 0.9 | -- | 0.4 |
| Wood | 1.0 | 5.7 | 1.6 | 2.2 |
| Other | 0.6 | 1.2 | 0.7 | 0.7 |
| Don't know | 0.2 | 0.2 | 0.2 | 0.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Main space heating fuel shares by dwelling type are presented in Table 39. Natural gas is the main space heating fuel for 92% of single-family detached (SFD) homes, semi-detached, and row/townhouses. Mobile and other manufactured homes have a slightly higher penetration of natural gas for space heating at 95% of dwellings that match that description. A check of trends in the main fuel share by dwelling vintage

(period of construction) for each of the five dwelling types shows little to no difference in the share of dwellings using natural gas as their main space heating fuel based on when they were built (data not shown).

**Table 39: Main Space Heating Fuel by Dwelling Type (%)**

| | Single Family Detached | Semi-Detached | Row / Town-house | Apt / Apt-Style Condo | Mobile & Other |
|---|---|---|---|---|---|
| *Unweighted base* [1] | *1,508* | *75* | *57* | *7* | *184* |
| Electricity | 4.4 | 7.6 | 7.3 | 11.1 | 2.4 |
| Natural gas | 91.7 | 92.4 | 91.8 | 88.9 | 94.7 |
| Piped propane | 0.4 | -- | 0.9 | -- | -- |
| Wood | 2.4 | -- | -- | -- | 2.5 |
| Other | 0.9 | -- | -- | -- | -- |
| Don't know | 0.2 | -- | -- | -- | 0.3 |
| **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.

### 5.2.2 Secondary Space Heating Fuels

Four-in-ten (39%) PNG residential customers reported using a secondary fuel to heat their home. Customers in the North East region are the least likely to use a secondary fuel (29% versus 50% for the West (East) and 49% for the West (West)). The most common secondary space heating fuel is electricity (25% of respondents), followed by wood (12%) and natural gas (5%) (Table 40).

**Table 40: Secondary Space Heating Fuel(s) (%)**
**Base: Dwellings Using More than One Space Heating Fuel**
**Multiple Responses Allowed**

| Supplementary space heating fuels | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Electricity | 18.7 | 24.1 | 35.2 | 24.7 |
| Natural gas | 1.9 | 8.5 | 6.9 | 4.8 |
| Piped propane | -- | 0.2 | 0.2 | 0.1 |
| Bottled propane | -- | -- | 0.2 | <0.1 |
| Oil | -- | 0.3 | 0.5 | 0.2 |
| Wood | 9.7 | 19.8 | 11.3 | 12.3 |
| Other | 0.8 | 3.6 | 2.5 | 1.9 |
| Don't know | 0.6 | 0.6 | 0.2 | 0.5 |
| **Use secondary fuel** | **28.8** | **50.3** | **48.9** | **39.2** |

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

It is important to remember that the presence of a secondary space heating fuel does not provide any information on its overall contribution to the home's space heating load, only that it is used to some degree in heating the home.

### 5.2.3 Change in Main Space Heating Fuel – Last Five Years

Respondents were asked whether they changed their home's main space heating fuel in the last five years. A change in main fuel may come about because a different space heating system was installed, a decision to use one fuel-specific system more than another (for homes with more than one space heating fuel-system option), or because there is access to a fuel not previously available in the area (e.g., because of expansion in the natural gas distribution system).

Four percent (4%) of PNG residential customers changed their main space heating fuel in the last five years (Table 41). Customers in the West (West) region were significantly more likely than those in the North East) region to have switched their main space heating fuel in the last five years.

**Table 41: Change in Main Space Heating Fuel in Last Five Years (%)**

| Changed main fuel used for space heating? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Yes | 2.3 | 4.2 | 5.2 | 3.5 |

Of the small number of respondents who changed their main space heating fuel in the last five years, 35% switched from natural gas, 31 switched from electricity, and 23% switched from wood (Table 42). Caution is advised in the interpretation of regional data due to small samples.

**Table 42: Previous Main Space Heating Fuel (%)**

| Previous main space heating fuel | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *12* | *29* | *32* | *73* |
| Electricity | 16.9 | 20.7 | 47.0 | 30.6 |
| Natural gas | 33.3 | 37.8 | 34.4 | 34.9 |
| Piped propane | -- | -- | -- | -- |
| Bottled propane | -- | 3.7 | -- | 0.9 |
| Oil | -- | 3.7 | 6.1 | 3.5 |
| Wood | 33.3 | 30.5 | 9.3 | 22.5 |
| Other | 8.2 | 3.7 | -- | 3.5 |
| Don't know | 8.2 | -- | 3.2 | 4.0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

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

## 5.3 Space Heating Methods

There are a variety of methods (equipment) that can provide space heating for residential dwellings. Respondents to PNG's 2022 REUS were asked to identify their dwelling's main 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., portable electric heaters, air source heat pumps, etc.).

### 5.3.1 Number of Space Heating Methods

Ninety-five percent (95%) of respondents indicated they use two or more methods to heat their home (Table 43). Eight-in-ten (81%) use two methods. Fifteen percent (15%) use three or more methods. There are no statistically significant differences in the number of space heating methods between the three regions.

**Table 43: Number of Space Heating Methods Used (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| 1 | 5.2 | 5.0 | 3.5 | 4.7 |
| 2 | 80.3 | 79.2 | 82.8 | 80.8 |
| 3 | 10.8 | 13.2 | 12.1 | 11.7 |
| 4 | 3.3 | 2.2 | 1.5 | 2.5 |
| 5 | 0.4 | 0.3 | -- | 0.3 |
| 6 | -- | -- | 0.2 | <0.1 |
| 7 | -- | 0.2 | -- | <0.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Two or more methods** | **94.8** | **95.0** | **96.6** | **95.3** |
| **Three or more methods** | **14.5** | **15.8** | **13.7** | **14.5** |

Totals may not sum due to rounding.

### 5.3.2 Main Space Heating Methods

The main methods of space heating used by PNG's residential customers are summarized in Table 44. By far, the most common main method of heating used is a forced air furnace (83% of dwellings). Fireplaces / heater stoves, hot water baseboards, and wired-in electric baseboards are the next three most common methods; representing between 2% and 4% of households depending upon the method.

**Table 44: Main Space Heating Method (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Forced air furnace | 89.2 | 77.2 | 75.6 | 82.7 |
| Wired-in electric baseboards | 0.8 | 3.1 | 4.8 | 2.4 |
| Heat pump - air source | 0.6 | 1.4 | 2.6 | 1.4 |
| Heat pump - ground source (geothermal) | 0.2 | 0.2 | 0.5 | 0.3 |
| Hot water baseboards | 1.9 | 2.7 | 4.3 | 2.8 |
| Hot water radiant in-floor / under-floor heat | 2.9 | 1.7 | 1.5 | 2.2 |
| Fireplace or heater stove | 1.0 | 8.8 | 4.5 | 3.6 |
| Wired-in electric wall heater (fan forced) | -- | -- | 0.7 | 0.2 |
| Electric radiant heat (floors, walls, and/or ceilings) | 1.0 | 0.3 | 0.8 | 0.8 |
| Gas wall / forced air / radiant heater | 1.5 | 2.2 | 1.8 | 1.7 |
| Portable electric heaters | 0.8 | 1.9 | 3.0 | 1.6 |
| Other | 0.2 | 0.6 | -- | 0.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

While forced air furnaces dominate, dwellings in the West (East) and West (West) regions are significantly more likely than those in the North East to use either a fireplace / heater stove or wired-in electric baseboards as their main method of space heating.

Main space heating methods by dwelling type are summarized in Table 45. Forced air furnaces dominate for all dwelling types with the exception of apartments and apartment-style condominiums. The sample of this particular dwelling type is very small, so caution is advised in the interpretation of the data.

**Table 45: Main Space Heating Method by Dwelling Type (%)**

| | Single Family Detached | Semi-Detached | Row / Town-house | Apt / Apt-Style Condo | Mobile & Other |
|---|---|---|---|---|---|
| *Unweighted base* [1] | *1,508* | *75* | *57* | *7* | *184* |
| Forced air furnace | 81.7 | 80.3 | 85.4 | 68.5 | 91.4 |
| Wired-in electric baseboards | 2.2 | 5.1 | 7.5 | 11.1 | 0.9 |
| Heat pump - air source | 1.6 | -- | -- | -- | 0.8 |
| Heat pump - ground source (geothermal) | 0.3 | -- | -- | -- | -- |
| Hot water baseboards | 3.3 | 2.0 | -- | -- | -- |
| Hot water radiant in-floor / under-floor heat | 2.6 | 1.6 | -- | -- | -- |
| Fireplace or heater stove | 3.8 | -- | 1.0 | 20.4 | 4.7 |
| Wired-in electric wall heater (fan forced) | 0.2 | 1.0 | -- | -- | -- |
| Electric radiant heat (floors, walls, and/or ceilings) | 0.9 | -- | 1.0 | -- | -- |
| Gas wall / forced air / radiant heater | 1.6 | 4.0 | 3.7 | -- | 1.2 |
| Portable electric heaters | 1.5 | 6.0 | 1.5 | -- | 0.9 |
| Other | 0.3 | -- | -- | -- | -- |
| **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.

The main methods of space heating for single-family detached (SFD) dwellings, the single most common dwelling type, are explored by dwelling vintage (period of construction) in Table 46. The data show the declining incidence of forced air furnaces as the main method in newer homes (those constructed since 2005). On average, 75% of SFDs constructed since 2005 use a forced air furnaces as their main method compared to 82% of SFDs constructed before then (data not shown). Radiant in-floor / under-floor heating and air source heat pumps appear to have displaced furnaces as the main methods of space heating for these homes.[2]

[2] Data in Section 5.4, p. 39 confirm the incidence of gas-fired furnaces in newer construction has declined.

**Table 46: Main Space Heating Method by Dwelling Vintage (Period of Construction) – SFDs (%)**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* [1] | *93* | *501* | *372* | *215* | *158* | *90* | *45* | *34* |
| Forced air furnace | 77.1 | 80.8 | 84.4 | 81.4 | 86.1 | 76.5 | 72.5 | 84.7 |
| Wired-in electric baseboards | 4.0 | 2.8 | 2.4 | 1.9 | -- | 2.3 | 1.2 | 2.8 |
| Heat pump - air source | -- | 1.1 | 0.4 | 3.9 | 2.1 | 3.8 | 2.8 | -- |
| Heat pump - ground source (geothermal) | -- | 0.2 | 0.5 | 0.3 | -- | 1.5 | -- | -- |
| Hot water baseboards | 5.1 | 5.5 | 2.8 | 1.7 | 0.7 | 1.5 | -- | 4.3 |
| Hot water radiant in-floor / under-floor heat | 1.1 | 0.7 | 1.0 | 2.0 | 5.4 | 8.6 | 15.6 | 4.3 |
| Fireplace or heater stove | 2.1 | 4.3 | 4.6 | 4.1 | 2.1 | 3.5 | 1.2 | 1.5 |
| Wired-in electric wall heater (fan forced) | 1.1 | 0.2 | -- | 0.5 | -- | -- | -- | -- |
| Electric radiant heat (floors, walls, and/or ceilings) | 3.3 | 0.2 | 1.0 | 1.2 | 0.6 | 1.5 | 3.4 | -- |
| Gas wall / forced air / radiant heater | 0.8 | 1.5 | 2.0 | 1.2 | 2.9 | -- | 3.4 | -- |
| Portable electric heaters | 3.3 | 2.4 | 0.9 | 1.4 | -- | 0.8 | -- | 2.3 |
| Other | 2.1 | 0.2 | 0.2 | 0.3 | -- | -- | -- | -- |
| **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.

### 5.3.3 Secondary Space Heating Methods

Other (secondary) methods of space heating are summarized in Table 47. Two-thirds (67%) of respondents indicated they use two or more space heating methods to heat their home. Regionally, use of secondary methods is highest in the two Western regions (between 74% and 76%). The most popular secondary methods include fireplaces or heater stoves (indicated by 25% of respondents), portable electric space heaters (22%), and/or wired-in electric baseboard heaters (12%). Compared to the North East region, the Western regions are notable in the use of fireplaces or heater stoves (between 25% and 33% of respondents) and wired-in electric baseboards (14% to 18%).

**Table 47: Secondary Space Heating Methods (%)**
**Multiple Responses Allowed**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Forced air furnace | 2.9 | 7.7 | 6.4 | 4.9 |
| Wired-in electric baseboards | 7.8 | 14.3 | 18.2 | 12.2 |
| Heat pump - air source | 1.9 | 2.9 | 3.1 | 2.5 |
| Heat pump - ground source (geothermal) | 0.0 | 0.0 | 0.2 | 0.0 |
| Hot water baseboards | 0.8 | 0.1 | 0.8 | 0.6 |
| Hot water radiant in-floor / under-floor heat | 1.7 | 0.6 | 0.5 | 1.1 |
| Fireplace or heater stove | 21.6 | 32.7 | 24.8 | 24.9 |
| Wired-in electric wall heater (fan forced) | 2.3 | 2.0 | 6.1 | 3.3 |
| Electric radiant heat (floors, walls, and/or ceilings) | 2.3 | 4.2 | 4.4 | 3.3 |
| Gas wall / forced air / radiant heater | 2.3 | 2.7 | 2.3 | 2.4 |
| Portable electric heaters | 21.0 | 20.1 | 25.6 | 22.1 |
| Other | 0.0 | 1.0 | 0.2 | 0.3 |
| **No secondary method of space heating** | **41.6** | **26.4** | **23.9** | **33.2** |

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

## 5.4 Furnaces, Boilers and Combination Systems

To gather additional information on the most common methods of space heating that use natural gas, respondents to the PNG's 2022 REUS were asked whether their home has a natural gas furnace, natural gas boiler, combination space and water heater, multi-fuel furnace, or an electric furnace. Respondents with gas furnaces or boilers were asked to provide additional information on their unit's efficiency, age, whether it is an ENERGY STAR® model, and whether it was installed in the last five years.

Gas furnaces are present in 88% of residential dwellings (Table 48). Roughly equal proportions of dwellings have a gas boiler or a combination space and water heating system (3% for each). Less than one percent of dwellings have a multi-fuel furnace. Finally, 3% of respondents indicated their dwelling has an electric furnace.

**Table 48: Furnaces, Boilers, and Combination Systems (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Gas boiler | 2.1 | 2.6 | 3.1 | 2.5 |
| Gas combination system | 3.8 | 2.2 | 2.5 | 3.1 |
| Gas furnace | 90.1 | 87.2 | 85.2 | 88.1 |
| Multi-fuel furnace | 0.2 | 0.6 | 0.7 | 0.4 |
| Electric furnace | 2.3 | 2.6 | 2.8 | 2.5 |
| None of the above | 1.5 | 4.9 | 5.8 | 3.5 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Table 49 summarizes these data by dwelling vintage (period of construction). Consistent with trends highlighted earlier, homes constructed since 2005 are less likely to have a gas furnace and more likely to have a gas boiler or gas combination boiler. The shift from gas furnaces to gas boilers is consistent with the growing popularity of underfloor heating. Although the sample is small, homes constructed since 2005 also have a higher incidence of electric furnaces.

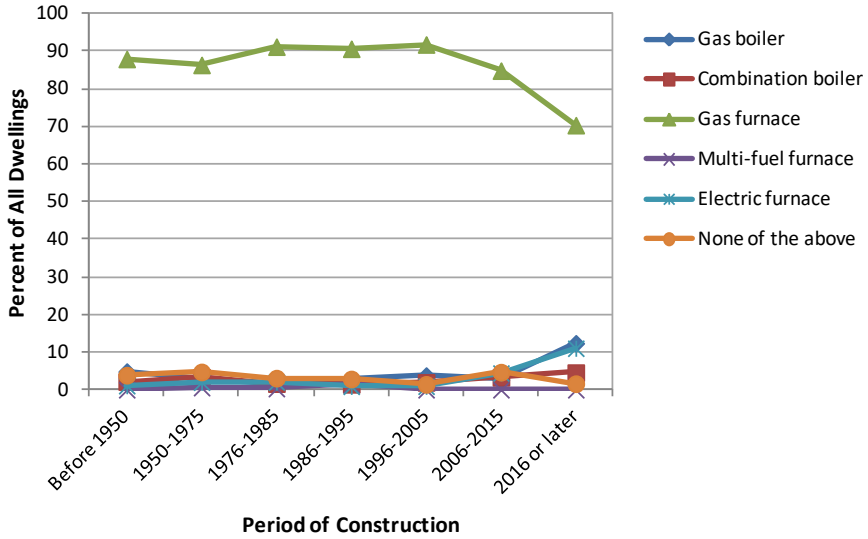
**Table 49: Furnaces and Boilers by Dwelling Vintage (%)**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *568* | *443* | *254* | *207* | *136* | *61* | *65* |
| Gas boiler | 4.8 | 2.9 | 1.6 | 2.7 | 3.8 | 2.7 | 12.4 | 2.2 |
| Gas combination system | 2.2 | 3.3 | 1.6 | 1.5 | 2.0 | 3.3 | 4.6 | 2.4 |
| Gas furnace | 88.0 | 86.4 | 91.3 | 90.7 | 91.9 | 84.9 | 70.4 | 86.0 |
| Multi-fuel furnace | -- | 0.6 | 0.3 | 1.3 | -- | -- | -- | -- |
| Electric furnace | 1.1 | 2.0 | 2.0 | 0.9 | 0.9 | 4.5 | 11.0 | 7.2 |
| None of the above | 3.9 | 4.7 | 3.1 | 2.9 | 1.4 | 4.7 | 1.6 | 2.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Figure 1 graphically illustrates the declining penetration of gas forced air furnaces in newer residential construction, offset by increases in the penetration of gas boilers, combination systems, and electric furnaces.

**Figure 1: Trends in Residential Space Heating Equipment by Dwelling Vintage (Period of Construction)**




### 5.4.1 Ages of Gas Furnaces, Boilers, and Combination Systems

The average ages of gas furnaces, gas boilers, and gas combination systems are provided in Table 50. Differences in average ages between regions are not statistically significant.

**Table 50: Average Age of Furnaces, Boilers, and Combination Systems (Years)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Gas furnaces | 14.8 | 13.6 | 14.7 | 14.5 |
| Gas boilers | 13.4 | 15.0 | 22.5 | 16.3 |
| Gas combination systems | 10.4 | 9.0 | 9.4 | 10.0 |

Table 51 provides greater insight into the age distribution of the existing stock of gas furnaces, boilers, and combination systems. One-in-four gas furnaces (39%) and gas boilers (38%) are less than 10 years old compared to six-in-ten (60%) combination systems. Approximately one-in-three gas furnaces (31%) and one-in-four gas boilers (38%) are 20 years old or older.

**Table 51: Age Distributions for Furnaces, Boilers, and Combination Systems (%)**

| Age in Years | Gas Boilers | Gas Combination Systems | Gas Furnaces |
|---|---|---|---|
| *Unweighted base* [1] | *44* | *50* | *1,598* |
| Less than 5 years | 17.9 | 39.8 | 19.7 |
| 5 – 9 | 20.5 | 20.3 | 19.0 |
| 10 – 14 | 8.4 | 12.3 | 19.9 |
| 15 – 19 | 14.9 | 3.3 | 10.3 |
| 20 – 29 | 16.9 | 22.6 | 20.1 |
| 30 years or more | 21.4 | 1.8 | 11.1 |
| **Total** | **100.0** | **100.0** | **100.0** |
| **Less than 10 years** | **38.3** | **60.0** | **38.7** |
| **20 years or older** | **38.3** | **24.4** | **31.2** |

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.

### 5.4.2 Gas Furnace Efficiencies

Respondents with a gas furnace were asked to indicate whether the furnace is a low (standard) efficiency (less than 78% efficient) unit, a mid-efficient (78% to 85% efficient) unit or a high-efficiency (90% efficient or higher) unit. Characteristics (flue type, ignition type, etc.) of the three efficiency types were provided to help respondents correctly classify their furnace's efficiency.

Nearly four-in-ten (38%) respondents indicated they have a high-efficiency furnace, 28% indicated they have a mid-efficient model, and 15% indicated their furnace is an older, low-efficiency model (Table 52). One-in-five (20%) respondents with a gas furnace were unable to classify their furnace's efficiency. This latter outcome was not unexpected as not all furnaces, especially older models, have their efficiency clearly identified.

**Table 52: Furnace Efficiency Including Don't Know Responses (%)**

| Gas furnace efficiency | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *472* | *607* | *519* | *1,598* |
| Low efficiency (< 78%) | 15.3 | 15.2 | 14.6 | 15.1 |
| Mid efficiency (78% to 85%) | 31.8 | 22.6 | 23.9 | 27.6 |
| High efficiency (90% or higher) | 32.0 | 45.6 | 42.0 | 37.7 |
| Don't know | 21.0 | 16.6 | 19.5 | 19.6 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Table 53 summarizes the efficiency mix of the furnace stock rebased to *exclude* respondents unsure of their furnace's efficiency.[3] Among those who chose one of the three efficiency categories, nearly half (47%) have a high-efficiency furnace, 34% have a mid-efficient unit, and the remaining 19% have a low efficiency unit.

[3] Rebasing by excluding "don't know" responses 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 efficiencies within the "don't know" response differs from those who indicated their furnace's efficiency.

Regionally, the North East region stands out as having a proportionately larger share of mid-efficiency units and a commensurately lower share of high-efficiency units.

**Table 53: Furnace Efficiency Excluding Don't Know Responses (%)**

| Gas furnace efficiency | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *373* | *506* | *418* | *1,297* |
| Low efficiency (< 78%) | 19.3 | 18.2 | 18.2 | 18.7 |
| Mid efficiency (78% to 85%) | 40.2 | 27.1 | 29.7 | 34.4 |
| High efficiency (90% or higher) | 40.5 | 54.7 | 52.2 | 46.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Four-in-ten (42%) respondents with a gas furnace indicated their unit is ENERGY STAR qualified, 24% indicated it was not, and the remaining 35% were unsure (Table 54). These data include those unsure of their furnace's efficiency.

**Table 54: Incidence of ENERGY STAR Gas Furnaces (%)**

| Is gas furnace ENERGY STAR qualified? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *472* | *607* | *519* | *1598* |
| Yes | 42.4 | 41.2 | 40.7 | 41.6 |
| No | 22.0 | 22.3 | 27.4 | 23.6 |
| Don't know | 35.6 | 36.6 | 32.0 | 34.8 |
| **Total** | **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 whether it is a low-efficiency (60% efficient), mid-efficient (80% to 85% efficient), or high-efficiency (90% efficient or higher) unit. Like that of furnaces, respondents were provided with additional characteristics of each efficiency type to help them correctly classify their boiler's efficiency.

One-quarter (26%) of respondents with a gas boiler indicated it is a high-efficiency unit, 27% indicated it is a mid-efficient unit, and 31% indicated it is an older, low-efficiency unit (Table 55). The proportion of respondents unsure of their boiler's efficiency is significant (17%). Regional data are provided but caution is advised as there are very few survey respondents with a gas boiler in each region.

**Table 55: Natural Gas Boiler Efficiency Including Don't Know Responses (%)**

| Boiler Efficiency | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *11* | *18* | *19* | *48* |
| Low efficiency (60%) | 27.2 | 27.7 | 36.7 | 30.9 |
| Mid efficiency (80% to 85%) | 18.3 | 16.8 | 42.2 | 26.5 |
| High efficiency (90% or higher) | 36.1 | 21.8 | 15.7 | 25.8 |
| Don't know | 18.3 | 33.7 | 5.4 | 16.8 |
| **Total** | **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.

Table 56 rebases these data by removing respondents who were unsure of their boiler's efficiency. Excluding those unsure of their boiler efficiency results in a relatively even distribution of boilers by the three efficiency groups. Again, given the small sample, caution is advised when using these data.

**Table 56: Natural Gas Boiler Efficiency Excluding Don't Know Responses (%)**

| Boiler Efficiency | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *9* | *12* | *18* | *39* |
| Low efficiency (60%) | 33.3 | 41.8 | 38.9 | 37.1 |
| Mid efficiency (80% to 85%) | 22.4 | 25.4 | 44.6 | 31.8 |
| High efficiency (90% or higher) | 44.2 | 32.8 | 16.6 | 31.1 |
| **Total** | **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 proportion of gas boilers that are ENERGY STAR qualified is summarized in Table 57. On average, 34% of respondents indicated their gas boiler is ENERGY STAR qualified, 35% indicated it is not, and the remaining 31% are unsure.

**Table 57: Incidence of ENERGY STAR Gas Boilers (%)**

| Is gas boiler ENERGY STAR qualified? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *11* | *18* | *19* | *48* |
| Yes | 54.5 | 23.2 | 12.2 | 33.9 |
| No | 18.3 | 47.4 | 50.4 | 35.1 |
| Don't know | 27.2 | 29.5 | 37.4 | 31.1 |
| **Total** | **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.

## 5.5 Heat Pumps

Respondents to PNG's 2022 REUS were asked about the presence and use of heat pumps. Four different types of heat pumps were queried:

- Air source heat pumps – ducted (e.g., integrated into the furnace ductwork)
- Air source heat pumps – ductless (mini-split)

- Air-to-water heat pumps – (e.g., paired with a boiler)
- Water-to-water heat pumps – geothermal

Of the four different heat pump types queried, ducted air source heat pumps are the most common; present in three-in-ten (31%) residential homes participating in the 2022 REUS. Regionally, penetration of ducted air source heat pumps is highest in the North East (38%) compared to West (East) (27%) and West (West) (24%).[4]

**Table 58: Incidence of Heat Pumps by Type (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Air source – ducted | 37.8 | 26.7 | 23.6 | 31.3 |
| Air source – mini-split | 0.6 | 0.7 | 1.0 | 0.7 |
| Air-to-water | 2.5 | 1.7 | 1.8 | 2.1 |
| Geothermal | 0.2 | 0.4 | 1.0 | 0.5 |
| Don't know | 15.3 | 10.9 | 10.7 | 13.0 |
| None of the above | 43.7 | 59.5 | 62.0 | 52.4 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Penetration rates for other heat pump types are very low. Two percent (2%) of homes have air-to-water systems, and less than one percent (0.7%) have a ductless mini-split air source heat pump. Of note, 13% of respondents were unsure whether their house has a heat pump.

When examined by age of the dwelling (period of construction), the data show that newer dwellings (those constructed since 2005) are more likely than older dwellings to have an air source heat pump (Table 59). Thirty-seven percent (37%) of homes constructed since 2005 have a ducted air source heat pump compared to 30% of homes constructed earlier (data not shown).

**Table 59: Incidence of Heat Pumps by Type by Dwelling Vintage (Period of Construction) (%)**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Air source – ducted | 19.9 | 28.6 | 31.5 | 31.8 | 30.7 | 37.2 | 36.8 | 43.4 |
| Air source – mini-split | 0.0 | 0.2 | 1.0 | 1.5 | 0.0 | 2.0 | 0.9 | 0.8 |
| Air-to-water | 2.1 | 1.8 | 1.9 | 1.7 | 1.4 | 3.0 | 4.7 | 4.6 |
| Geothermal | 2.1 | 0.6 | 0.4 | 0.3 | 0.5 | 0.0 | 0.0 | 0.0 |
| Don't know | 66.5 | 56.7 | 54.3 | 53.8 | 49.8 | 47.0 | 39.7 | 21.1 |
| None of the above | 9.5 | 12.0 | 10.8 | 11.0 | 17.6 | 10.8 | 17.9 | 30.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

[4] It is interesting to note that the proportion of respondents indicating a heat pump is either their main or secondary method of space heating in Section 5.3 (pp. 37-40) is considerably lower than indicated by directly asking about the presence of a heat pump. This result may be due to the somewhat indirect role that air source heat pumps play when paired with a gas furnace (the most common heat-pump arrangement suggested by the data) in cold climates. Ducted air source heat pumps may be considered part of the furnace "system" and not a separate entity when thinking of space heating methods.

### 5.5.1 Heat Pump Usage

Respondents who indicated they have a heat pump were asked how they use their systems – for heating only, for cooling only or for both heating and cooling. The results, summarized in Table 60, show the vast majority (82%) of households in PNG's service area with a heat pump use it exclusively to heat their home and not for cooling. Only 17% indicated they use it for both heating and cooling. A very small percentage (1%) indicated they use their heat pump for cooling only. Regionally, the proportions indicate that respondents in the North East region are most likely to use their system for heating only (86%) and those in the West (West) are most likely to use their systems for both heating and cooling (26%). These findings are consistent with the differences in the regional climates.

**Table 60: Heat Pump Use (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *215* | *206* | *167* | *588* |
| Heating and cooling | 13.5 | 17.6 | 25.9 | 17.1 |
| Heating only | 86.1 | 80.9 | 71.7 | 81.8 |
| Cooling only | 0.5 | 1.5 | 2.4 | 1.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Those who indicated they use their heat pumps for heating were asked to indicate the seasons in which they use their heat pump to heat their home.[5] The results, summarized in Table 61, indicate that 91% of respondents use their heat pump to heat their home, to some degree, in winter, 78% use it in the autumn months, and 59% use it in the spring months. Six percent (6%) were unsure of which months their heat pump contributed to the home's space heating. Usage in the summer was not queried.

**Table 61: Heat Pump Seasonal Use – Heating Only (%)**
**Multiple Responses Allowed**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *214* | *202* | *162* | *578* |
| Spring (Mar to May) | 61% | 64% | 50% | 59% |
| Fall (Sep to Nov) | 78% | 83% | 77% | 78% |
| Winter (Dec to Feb) | 93% | 91% | 86% | 91% |
| Don't know | 7% | 3% | 6% | 6% |

Totals will not sum to 100% due to multiple responses.

### 5.5.2 Interest in Heat Pumps

Of the survey respondents who indicated their residence does not currently use a heat pump, one-quarter (25%) have considered installing a heat pump (Table 62). Regionally, interest is highest in the West (West) (39% have considered installing a heat pump) and lowest in the North East (13%). These results are

[5] A respondent indicating they use their heat pump for heating during the winter season does not tell us how much they use the heat pump during the season, only that it is used, to some degree, during the season (e.g., during warmer periods).

consistent with current penetration levels for heat pumps in the respective regions (i.e., regions with the highest penetration of heat pumps have the lowest proportions of customers interested in installing a heat pump).

**Table 62: Have Considered Installing a Heat Pump – Households Currently Without a Heat Pump (%)**

| Considered installing a heat pump? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *309* | *491* | *443* | *1,243* |
| Yes | 13.0 | 30.7 | 38.5 | 25.3 |
| No | 87.0 | 69.3 | 61.4 | 74.7 |
| **Total** | **100%** | **100%** | **100%** | **100%** |

Totals may not sum due to rounding.

Asked why they have not installed a heat pump, respondents who have considered installing a heat pump were most likely to mention their cost (49% indicated they are too expensive), feeling uninformed (36%), and hearing that heat pumps don't work well in cold climates (28%). Skepticism that a heat pump would reduce their energy bill was indicated by 16% of respondents. Finally, 11% indicated their home's electrical system would need upgrading before a heat pump could be accommodated. Constraints on product availability or the availability of qualified contractors were indicated only by 3% of respondents.

**Table 63: Reasons for Not Installing a Heat Pump (%)**
**Respondents who have considered purchasing a heat pump**
**Multiple Responses Allowed**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *40* | *151* | *170* | *361* |
| Too expensive / Not willing to spend the money | 40.0 | 49.0 | 53.5 | 49.2 |
| Need more information / don't know much about them | 42.5 | 35.8 | 32.4 | 35.6 |
| Heard they do not work well in cold climates | 32.5 | 43.7 | 17.6 | 28.3 |
| Not convinced they would reduce our energy bill | 10.0 | 22.5 | 14.7 | 15.8 |
| Electrical wiring / system would need to be upgraded | 12.5 | 12.6 | 9.4 | 11.0 |
| Vendors are unavailable / difficult to locate | 2.5 | 2.0 | 3.5 | 2.9 |
| No need (e.g. new home, new furnace) | 2.5 | 2.0 | 2.4 | 2.3 |
| Haven't had time / Not the right time | -- | 0.7 | 2.9 | 1.6 |
| Extensive modifications needed (e.g. ducts, home renovations) | -- | 1.3 | 2.4 | 1.5 |
| Waiting to install new furnace | -- | -- | 2.9 | 1.4 |
| Already have air conditioning | 2.5 | -- | 1.2 | 1.2 |
| Heat pumps are in short supply | -- | -- | 1.8 | 0.9 |
| Lack of certified / qualified vendors | -- | 0.7 | 1.2 | 0.8 |
| Other | 2.5 | 2.6 | 1.8 | 2.2 |
| Don't know | 12.5 | 4.0 | 5.3 | 6.6 |

[1] Caution is advised in interpreting data for samples of less than 50. Results are directional only.
Columns will not sum to 100% due to multiple responses.

## 5.6 Heating System Controls

Penetration rates for manual, programmable, and smart (learning-style) thermostats are summarized in Table 64. Four-in-ten (39%) dwellings have one or more manual thermostats, nearly six-in-ten (57%) have one or more programmable thermostats, and learning-style thermostats are present in 9% of dwellings. The majority (96%) of dwellings have only one of the three thermostat types. The number of thermostats was not queried.

**Table 64: Heating System Controls (%)**
**Multiple Responses Allowed**

| Heating System Controls | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Manual thermostats | 38.7 | 38.6 | 38.0 | 38.5 |
| Programmable thermostats | 53.8 | 61.0 | 58.0 | 56.6 |
| Smart or learning-style thermostats | 9.0 | 6.2 | 10.2 | 8.7 |
| **Dwellings with more than one type** | **1.5** | **5.7** | **6.2** | **3.8** |

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

Respondents were asked whether they were aware, prior to completing the PNG survey, that PNG offers a $300 rebate on the purchase and installation of smart, learning-style thermostats. Table 65 shows that only 6% were aware of the PNG rebate offer prior to taking the survey. Awareness is low across all three regions.

**Table 65: Awareness of PNG Rebate for Smart Thermostats (%)**

| Aware of Rebate Offer? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Yes | 5.7 | 6.7 | 6.7 | 6.2 |
| No | 94.3 | 93.3 | 93.3 | 93.8 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

## 5.7 Heat Recovery Ventilators & Energy Recovery Ventilators

Respondents were asked whether their home has either a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV). The results, summarized in Table 66, show 5% of residential dwellings have an HRV and 2% have an ERV. Of note, more than half (53%) of respondents were unsure whether their home has either type of air exchange system.

**Table 66: Penetration of HRVs and ERVs (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Heat Recovery Ventilator (HRV) | 4.4 | 6.2 | 3.4 | 4.5 |
| Energy Recovery Ventilator (ERV) | 1.9 | 1.3 | 1.8 | 1.7 |
| Don't know | 48.1 | 56.0 | 59.7 | 53.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Penetration of HRVs and ERVs is highest among dwellings constructed since 2015 (24% have an HRV and 10% have an ERV) (Table 67). Of homes constructed between 2006 and 2015, 9% have an HRV and 4% have an ERV.

**Table 67: Penetration of HRVs and ERVs by Dwelling Vintage (Period of Construction) (%)**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Heat Recovery Ventilator (HRV) | 0.7 | 2.8 | 2.5 | 5.9 | 4.7 | 9.0 | 24.0 | -- |
| Energy Recovery Ventilator (ERV) | 0.7 | 1.2 | 0.5 | 1.0 | 2.9 | 4.0 | 10.2 | -- |
| Don't know | 61.8 | 57.0 | 57.3 | 54.3 | 54.2 | 43.2 | 25.0 | 32.8 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

## 5.8 Heating System Maintenance

All respondents, regardless of the type of heating system used, were asked a series of questions about the frequency of undertaking three common heating system maintenance tasks. They were asked whether they always, usually, occasionally or never complete each task. Respondents could indicate the task was not applicable to them.

The results, summarized in Table 68, show three-quarters of respondents always or usually change their heating system's filters regularly, while 15% indicated they do this occasionally or never. Three-in-ten (30%) respondents indicated they always or usually have their heating system serviced by a contractor. Only 23% of respondents indicated they usually or always service the system themselves. Of this group, half indicated they never do, suggesting either they hire a contractor or do not regularly maintain their heating systems.

**Table 68: Frequency of Heating System Maintenance (%)**
**Rows Sum Across**

| Heating System Maintenance | Always | Usually | Occasion-ally | Never | Don't Know | Not Applicable | Total | Always or Usually |
|---|---|---|---|---|---|---|---|---|
| Change heating system's filter(s) regularly | 52.8 | 23.0 | 12.9 | 2.2 | 5.9 | 3.1 | 100.0 | 75.8 |
| Service heating system annually by contractor | 14.4 | 15.3 | 32.3 | 26.8 | 4.4 | 6.7 | 100.0 | 29.8 |
| Service heating system annually themselves | 12.1 | 11.2 | 15.4 | 49.0 | 7.7 | 4.7 | 100.0 | 23.3 |

Respondents were next asked whether, prior to completing the PNG survey, they were aware that PNG offers a $100 rebate on gas furnace and boiler tune-ups conducted by a qualified heating contractor. The findings, summarized in Table 69, show that only 4% of respondents were aware of the PNG offer. Like that of the rebate for smart thermostats, awareness of the furnace tune-up offer is low in all three PNG regions.

**Table 69: Awareness of PNG Rebate for Gas Furnace and Boiler Tune-ups (%)**

| Aware of Rebate Offer? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Yes | 3.6 | 3.9 | 5.1 | 4.1 |
| No | 96.4 | 96.1 | 94.9 | 95.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

# 6 DOMESTIC HOT WATER

This chapter presents and discusses systems used for domestic water heating (DWH). These systems provide hot water for domestic activities such as clothes washing, dishwashing, showering, and bathing. The following topics are addressed:

- Penetration and saturation of DWH equipment by fuel and equipment type
- DWH equipment replacements, reasons for replacement, and fuel switching
- DWH equipment vintages
- Location of DWH equipment
- Penetration of insulating blankets, pipe wrap, and low-flow showerheads

As some dwellings can have more than one domestic water heater, the survey allowed respondents to provide information on up to three DWH systems, with the first system being the main system (i.e., the one that provides the majority of the hot water for the dwelling).

Data on the frequency of activities that use hot water, including clothes washing, dishwasher loads, and showers, are presented in Section 10.

## 6.1 Penetration and Saturation

The proportion of homes in PNG's service area with DWH equipment in the residence (i.e., not centrally provided as is the case in many apartment buildings and condominium complexes), including penetration and saturation rates for domestic water heaters, are summarized in Table 70. The majority (99%) of respondents indicated their dwelling is equipped with a domestic water heater.[6] The remaining 1% has their domestic hot water supplied via a central system.

**Table 70: Domestic Water Heater (Any Fuel) Penetration and Saturation Rates**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *507* | *677* | *576* | *1,761* |
| Penetration (%) | 99.4 | 98.5 | 99.1 | 99.1 |
| Saturation | 1.03 | 1.03 | 1.04 | 1.03 |
| Households with >1 water heater (%) | 2.8 | 2.5 | 3.5 | 2.9 |
| No hot water heater in residence (%) | 0.6 | 1.5 | 0.7 | 0.8 |

[1] Excludes non-responses and respondents living in apartments, row houses, and townhouses where hot water is centrally provided and respondents in single-family detached and semi-detached dwellings who indicated they have no domestic water heater.

Penetration and saturation rates for domestic water heaters (any fuel) by the five main dwelling types are presented in Table 71. Respondents living in apartments / apartment-style condominiums are most likely to have their domestic hot water provided via a central system (i.e., no in-dwelling water heater).

[6] A small number of respondents living in single-family detached or semi-detached dwellings indicated they had no water heater in their dwelling. This is most likely a misinterpretation of the question. The hot water heater for these dwellings may be located outside the residence (e.g., garage, outside utility shed, etc.). Data for these respondents are excluded from these calculations.

**Table 71: Domestic Water Heater (Any Fuel) Penetration and Saturation Rates by Dwelling Type**

| | Single Family Detached | Semi-Detached | Row / Town-house | Apt / Apt-Style Condo | Mobile & Other |
|---|---|---|---|---|---|
| *Unweighted base* [1,2] | *1,443* | *70* | *57* | *7* | *184* |
| Penetration (%) | 100.0 | 100.0 | 91.0 | 88.9 | 95.3 |
| Saturation | 1.03 | 1.11 | 1.06 | 1.00 | 1.02 |
| Households with >1 water heater (%) | 2.6 | 11.0 | 2.7 | -- | 2.2 |
| No hot water heater in residence (%) | -- | -- | 9.0 | 11.1 | 4.2 |

[1] Excludes non-responses and respondents living in apartments, row houses, and townhouses where hot water is centrally provided and respondents in single-family detached and semi-detached dwellings who indicated they have no domestic water heater.
[2] Caution is advised in interpreting data for samples of less than 50. Results are directional only.

Respondents indicating their hot water was centrally provided or indicated their detached or semi-detached dwelling did not have a domestic water heater in the residence, were skipped forward in the survey and not asked questions about their DWH equipment or fuels.

## 6.2 DWH Fuels

Fuels used for domestic water heating (main water heating unit only) are summarized in Table 72. Seven-in-ten (70%) dwellings use natural gas for domestic water heating. The majority of the remaining water heaters use electricity. Regionally, dwellings in the North East region are most likely to use natural gas for DWH requirements (78% of dwellings) compared to dwellings in the West (East) (58%) and West (West) regions (66%). Three percent (3%) of respondents indicated they use solar energy to supplement their water heating process (data not shown).

**Table 72: Domestic Water Heater Fuels (%)**
**Main DWH Unit**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *505* | *667* | *571* | *1,743* |
| Electricity | 21.6 | 41.7 | 34.3 | 29.5 |
| Natural gas | 78.0 | 57.7 | 65.5 | 70.1 |
| Geothermal | -- | 0.2 | 0.2 | 0.1 |
| Other | 0.4 | 0.5 | -- | 0.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Data in Table 73 show that the share of domestic water heaters using natural gas rose steadily over time, from 62% of residential dwellings constructed before 1950 to 82% of dwellings constructed between 1996 and 2005. Since then, the share has dropped significantly, with only 57% of dwellings constructed since 2016 having a gas-fired water heater. Similar declines in the penetration of natural gas water heating have occurred in all three regions (data not shown). Newly constructed dwellings are much more likely to have an electric water heater than in the past.

**Table 73: Domestic Water Heater Fuels by Dwelling Vintage (Period of Construction) (%)**
**Main DWH Unit**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base*[1] | *91* | *543* | *426* | *242* | *200* | *126* | *56* | *59* |
| Electricity | 38.2 | 31.7 | 28.3 | 25.6 | 17.9 | 34.4 | 43.5 | 33.5 |
| Natural gas | 61.8 | 67.9 | 71.5 | 74.4 | 81.6 | 64.5 | 56.5 | 65.8 |
| Geothermal | -- | -- | 0.2 | -- | 0.3 | -- | -- | -- |
| Other | -- | 0.4 | -- | -- | 0.3 | 1.0 | -- | 0.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

### 6.2.1 DWH Fuel Switching

Four percent (4.3%) of respondents indicated they switched the fuel used for domestic water heating (main unit) in the past five years (Table 74). The incidence of DWH fuel switching in the last five years is significantly higher in the West (West) region (7%) compared to the North East (3%).

**Table 74: Change in Domestic Water Heater Fuel Last Five Years (%)**

| Changed DWH fuel last five years? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *505* | *667* | *571* | *1,743* |
| Yes | 2.6 | 4.5 | 7.0 | 4.3 |

Of those who switched their DWH fuel, more than half (56%) switched from natural gas to electricity and four-in-ten (39%) switched from electricity to natural gas. Small proportions of respondents switched from other fuels (piped propane, other), typically to electricity.

**Table 75: Change in Domestic Water Heating Fuel during Past Five Years (% of All Who Switched)**

| Previous fuel ▶ / Current fuel ▼ | Electricity | Natural Gas | Piped propane | Other | Don't Know | All Previous Fuels |
|---|---|---|---|---|---|---|
| Electricity | -- | 55.6 | 1.7 | 2.2 | 1.0 | 60.5 |
| Natural gas | 38.6 | -- | -- | -- | -- | 38.6 |
| Other | -- | 1.0 | -- | -- | -- | 1.0 |
| All Current Fuels | 38.6 | 56.5 | 1.7 | 2.2 | 1.0 | **100.0** |

## 6.3 DWH Equipment

Respondents to PNG's 2022 REUS were asked to indicate the type of equipment used to provide their domestic hot water from a list of the common DWH equipment, including:

- Conventional storage tank
- On-demand (tankless)
- Hybrid on-demand (uses small storage tank)
- Combined space and water heater
- Heat pump water heater

Respondents with conventional storage (tank) water heaters (first, second and/or third units) were asked whether the units have a vent through the roof or sidewall (power vent).

### 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 76. Three-quarters (75%) of water heaters are conventional storage tanks. On-demand (either tankless or with a small tank) units represent 11% of all water heaters. Heat pump water heaters, a relatively new equipment option for water heating, represent 4% of the stock of domestic water heaters. Consistent with data on DWH fuels, customers in the Western regions are significantly more likely to have an electric hot water tank than those in the North East region. Penetration of gas on-demand water heaters is highest in the North East.

**Table 76: Domestic Water Heater Penetration Rates by Equipment Type (%)**
**Includes First, Second and Third Water Heaters**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *505* | *667* | *571* | *1,743* |
| Conventional storage tank ▾ | 70.6 | 80.5 | 77.1 | 75.3 |
| Vent through roof (gas) | 35.2 | 27.6 | 30.3 | 32.4 |
| Vent through side-wall (gas) | 7.3 | 8.7 | 7.1 | 7.7 |
| No vent (electric) | 12.1 | 28.0 | 23.9 | 19.0 |
| Don't know | 16.0 | 16.3 | 15.7 | 16.2 |
| On-demand (tankless) | 12.9 | 3.9 | 9.4 | 10.1 |
| Hybrid on-demand (small tank) | 1.5 | 1.1 | 0.3 | 1.1 |
| Combined space and water heater | 1.0 | 2.5 | 2.0 | 0.7 |
| Heat pump heater | 4.8 | 2.9 | 3.3 | 4.0 |
| Don't know [1] | 9.2 | 9.1 | 7.8 | 8.8 |
| **Total** | **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.

Of those households with a conventional storage tank, 32% are vented through the roof and 8% are vented through a side wall. This suggests that approximately one-in-five (19%) of gas-fired tanks are energy-efficient models (i.e., condensing with power vent). This estimate is approximate as 16% of respondents were unsure about their tank's venting arrangement (including if it has a vent of any kind).

Table 77 summarizes the penetration of hot water heating equipment by dwelling vintage (period of construction). Of note, approximately three-in ten dwellings constructed since 2005 use an on-demand water heater, compared to less than one-in-ten for dwellings constructed prior. On-demand units have displaced conventional storage tanks.

**Table 77: Domestic Water Heater Penetration Rates by Equipment Type and Dwelling Vintage (%)**
**Includes First, Second and Third Water Heaters**

| | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Unknown |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *91* | *543* | *426* | *242* | *200* | *126* | *56* | *59* |
| Conventional storage tank | 87.3 | 76.7 | 79.8 | 79.6 | 81.0 | 59.4 | 42.1 | 58.6 |
| On-demand (tankless) | 7.8 | 7.7 | 6.5 | 8.5 | 5.6 | 30.5 | 32.2 | 1.2 |
| Hybrid on-demand (small tank) | -- | 1.3 | 0.6 | 0.5 | 1.3 | 0.4 | 6.1 | 2.3 |
| Combined space and water heater | 2.8 | 1.0 | 0.7 | 0.6 | -- | 1.0 | 3.9 | -- |
| Heat pump heater | -- | 4.5 | 5.6 | 5.2 | 3.0 | 1.0 | -- | 5.0 |
| Don't know [1] | 2.1 | 8.8 | 6.9 | 5.6 | 9.1 | 7.7 | 15.7 | 32.9 |
| **Total** | **100.0** | **100.0** | **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.

### 6.3.2 Saturation Rates

Saturation rates for domestic water heaters, by water heater type, are summarized in Table 78. These data exclude respondents unsure of their water heater type. The saturation rate for conventional storage-style tanks is 0.81 (i.e., there are 0.81 storage tank water heaters per dwelling that have their own hot water heating equipment). Regionally, the saturation rate for conventional tanks ranges from a low of 0.75 in the North East to a high of 0.90 in the West (East). Saturation rates for on-demand (tankless and hybrid) units range from 0.07 in the West (East) to 0.20 in the North East. At the utility level, the saturation rate for on-demand units is 0.15. The saturation rate for heat pump water heaters is 0.05.

**Table 78: Domestic Water Heater Saturation Rates (Average Number per Dwelling) by Type**
**Includes First, Second and Third Water Heaters**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *377* | *498* | *436* | *1,311* |
| Conventional storage tank | 0.75 | 0.90 | 0.85 | 0.81 |
| Vent through roof | 0.48 | 0.39 | 0.42 | 0.44 |
| Vent through side-wall | 0.10 | 0.12 | 0.10 | 0.10 |
| No vent (electric) | 0.17 | 0.39 | 0.33 | 0.26 |
| On-demand [2] | 0.20 | 0.07 | 0.13 | 0.15 |
| Combined space and water heater | 0.01 | 0.03 | 0.03 | 0.01 |
| Heat pump heater | 0.07 | 0.04 | 0.05 | 0.05 |

[1] Base excludes respondents unsure of their water heater type
[2] Includes hybrid on-demand units that utilize a small tank

### 6.3.3 Water Heater Location

Respondents to PNG's 2022 REUS were asked to indicate where their domestic water heater (main unit) is located. A water heater's location, particularly whether it is located in a heated space, is relevant for conventional storage-type water heaters as the energy required to maintain the temperature of the large volume of water is dependent, in part, upon the effectiveness of the tank's insulation and the ambient temperature in the space where it is located.

The results, summarized in Table 79, show the majority of respondents have their water heater (any type) located in a heated basement (61%) or the main living area of the home (27%). It is estimated that 7% of water heaters are located in an unheated space (unheated basements, crawlspaces or garages).[7]

**Table 79: Location of Domestic Water Heater in the Home (%)**

| Location of Main Water Heater | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *505* | *667* | *571* | *1,743* |
| Main living area of the home | 25.9 | 25.3 | 29.4 | 26.8 |
| Heated basement | 63.4 | 62.7 | 56.6 | 61.3 |
| Unheated basement | 1.2 | 2.4 | 4.9 | 2.5 |
| Crawl space | 7.1 | 6.7 | 6.1 | 6.8 |
| Heated garage | 0.8 | 0.6 | 0.9 | 0.8 |
| Unheated garage | 0.2 | 0.2 | 1.2 | 0.5 |
| Other | 0.8 | 1.3 | 0.7 | 0.9 |
| Don't know | 0.6 | 0.7 | 0.2 | 0.5 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Located in an unheated space** | **5.8** | **6.4** | **10.4** | **7.3** |

Totals may not sum due to rounding.

### 6.3.4 Replacements and New Installations

Respondents to the 2022 REUS were asked whether they have installed a new domestic water heater during the past five years. If they had, they were asked to indicate the main reason for installing a new unit.

Four-in-ten (39%) households installed a new water heater in the last five years (Table 80).[8] Regionally, customers in the West (West) region were most likely to have installed a unit (45%) compared to North East (37%) and the West (East) (34%).

**Table 80: New Domestic Water Heater Installations Last Five Years (%)**

| Installed water heater last five years? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *505* | *667* | *571* | *1,743* |
| Yes | 37.4 | 33.9 | 45.4 | 38.9 |

Reasons for installing a new water heater in the past five years are summarized in Table 81. The most common reasons include water heater failure (indicated by 43% of respondents who installed a water heater in the last five years), anticipation that the water heater would fail (20%), and to qualify for home insurance (13%). Twelve percent (12%) indicated they installed a new water heater because they wanted something more energy efficient. A small percentage (<3%) indicated the water heater installation was associated with new home construction.

[7] Proportion calculated assuming 63% of crawl spaces are unheated during winter (Section 4.7, p.21).

[8] This suggests that roughly eight percent of the water heater stock is replaced every year.

**Table 81: Main Reason for Installing a New Domestic Water Heater in Last Five Years (%)**

| Reasons for Installing new water heater | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *189* | *226* | *259* | *674* |
| Water heater had failed | 46.5 | 33.9 | 43.0 | 43.0 |
| Anticipated water heater failure | 18.7 | 19.6 | 21.3 | 19.8 |
| To qualify for home insurance | 12.3 | 19.2 | 10.9 | 13.1 |
| Wanted more efficient water heater | 10.2 | 13.4 | 14.0 | 12.0 |
| Installed by previous owners | 4.8 | 5.8 | 2.7 | 4.3 |
| New home construction | 2.1 | 3.6 | 2.3 | 2.5 |
| Wanted to switch to gas | 1.1 | 0.0 | 1.9 | 1.2 |
| Part of home renovation | 1.1 | 0.4 | 1.2 | 1.0 |
| Wanted a cheaper fuel | 0.5 | 1.8 | 0.8 | 0.8 |
| Other | 2.7 | 2.2 | 1.9 | 2.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

## 6.4 Water Heater Blankets & Pipe Wrap

Slightly more than one-in-ten (11%) respondents with a conventional storage tank water heater use a water heater blanket (Table 82) One quarter (24%) of all respondents have insulating pipe wrap on their hot water pipes.

**Table 82: Water Heater Blankets and Pipe Wrap (%)**

| Percent with the following: | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Water heater blanket [1] | 11.2 | 13.7 | 7.8 | 10.8 |
| Insulating pipe wrap on hot water pipes | 24.8 | 23.5 | 23.5 | 24.1 |

[1] Base limited to those with a storage style water heater tank (n=1,312)

All respondents to the 2022 REUS were asked to indicate the number of showerheads installed in the home, and how many of these are low flow. The results, summarized in Table 83, indicate that all but a very small percentage of dwellings have at least one showerhead but only one-quarter of these households have at least one low-flow showerhead. These results should be treated with caution as many of the showerheads sold today are water efficient or low flow models but the packaging may not necessarily indicate them as such.

**Table 83: Showerhead Penetration and Saturation Rates (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| **Showerheads** | | | | |
| Penetration (%) | 99.8 | 100.0 | 99.3 | 99.7 |
| Saturation | 1.92 | 1.82 | 1.84 | 1.88 |
| **Low flow showerheads** | | | | |
| Penetration (%) | 27.0 | 26.2 | 24.7 | 26.1 |
| Saturation | 0.50 | 0.44 | 0.42 | 0.46 |

# 7 FIREPLACES & HEATER STOVES

This section summarizes data on the penetration, saturation, and use of fireplaces and heater stoves. PNG's 2022 REUS queried the presence of seven different fireplace and heater stove types:

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

Survey respondents were provided with the following descriptions to assist them in correctly classifying their fireplaces and heater stoves:

- *Decorative fireplaces* – Provide ambiance but have little or no heating ability. The firebox is typically steel or masonry, and 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 type of fireplace opening 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 84 summarizes the penetration and saturation rates for all fireplaces and heater stoves regardless of type or fuel. Overall, slightly less than half (48%) of respondents to PNG's 2022 REUS have at least one fireplace or heater stove. Penetration of fireplaces and heater stoves is highest in the West (East) and West (West) regions at 56% and 52% respectively versus 41% for the North East region. The average PNG residential customer has 0.61 fireplaces and/or heater stoves.

**Table 84: Penetration and Saturation Rates - Fireplaces and Heater Stoves**
**Any Type, Any Fuel**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Penetration (%) | 41.2 | 55.7 | 52.1 | 47.5 |
| Saturation | 0.50 | 0.73 | 0.72 | 0.61 |

Table 85 details the number of fireplaces and heating stoves per dwelling. One-third (34%) have one fireplace or heater stove, 11% have two units, and 2% have three or more units. Regionally, West (East) and West (West) regions are more likely to have dwellings with two or more units.

**Table 85: Number of Fireplaces and Heater Stoves per Dwelling (%)**
**Any Type, Any Fuel**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| None | 59.5 | 44.9 | 48.5 | 53.2 |
| 1 unit | 32.3 | 39.6 | 34.3 | 34.4 |
| 2 units | 7.3 | 12.9 | 14.4 | 10.5 |
| 3 units | 0.8 | 2.6 | 2.6 | 1.7 |
| More than 3 units | 0.2 | -- | 0.2 | 0.1 |
| **Total** | **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 fireplaces and heater stoves that use natural gas are summarized in Table 86. Five percent (5%) of dwellings have a gas decorative unit, 16% have a gas heater style, and 4% have a gas free-standing unit.

**Table 86: Gas Fireplace and Heater Stove Details**
**Base: All Households With or Without a Fireplace / Heater Stove**

| Fireplace / heater stove type | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| **Gas (decorative)** | | | | |
| Penetration (%) | 5.0 | 5.3 | 5.6 | 5.2 |
| Saturation | 0.05 | 0.06 | 0.06 | 0.06 |
| **Gas (heater type)** | | | | |
| Penetration (%) | 14.3 | 16.6 | 16.9 | 15.6 |
| Saturation | 0.16 | 0.19 | 0.20 | 0.18 |
| **Gas (free standing)** | | | | |
| Penetration (%) | 1.5 | 4.7 | 6.1 | 3.5 |
| Saturation | 0.02 | 0.05 | 0.06 | 0.04 |

Table 87 presents penetration and saturation rates of gas fireplace and heater stove types by dwelling vintage (period of construction). The data show the penetration of less-efficient decorative models is highest among dwellings constructed between 1986 and 2005. Gas heater-type fireplaces are more common in newer dwellings, notably those constructed since the mid-1990s. These data reflect trends in both new construction and retrofits for existing dwellings.

**Table 87: Gas Fireplace and Heater Stove Details by Dwelling Vintage (Period of Construction)**
**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* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| **Gas (decorative)** | | | | | | | | |
| Penetration (%) | 5.3 | 3.2 | 4.8 | 7.0 | 8.6 | 6.6 | 8.1 | 2.2 |
| Saturation | 0.05 | 0.03 | 0.05 | 0.07 | 0.10 | 0.07 | 0.09 | 0.02 |
| **Gas (heater type)** | | | | | | | | |
| Penetration (%) | 7.5 | 9.5 | 10.6 | 19.9 | 34.6 | 22.6 | 24.2 | 7.2 |
| Saturation | 0.10 | 0.11 | 0.13 | 0.24 | 0.41 | 0.24 | 0.27 | 0.07 |
| **Gas (free standing)** | | | | | | | | |
| Penetration (%) | 2.1 | 3.9 | 5.2 | 4.0 | 3.4 | 1.0 | -- | 0.8 |
| Saturation | 0.02 | 0.04 | 0.05 | 0.05 | 0.03 | 0.02 | -- | 0.01 |

### 7.1.3 Wood and Electric Fireplaces / Heater Stoves

Penetration and saturation rates for fireplaces and heater stoves that use wood, wood pellets, or electricity are summarized in Table 88. Twelve percent (12%) of dwellings have a wood burning fireplace, 9% have a wood burning stove, and 3% have a pellet stove. Penetration rates for wood burning stoves and/or pellet stoves are highest in the West (East) region (22% and 12% respectively). Electric fireplaces are found in 7% of PNG residential customer homes.

**Table 88: Fireplace and Heater Stove Details – Wood and Electric**
**Base: All Households With or Without a Fireplace / Heater Stove**

| Fireplace / Heater Stove Type | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| **Electric** | | | | |
| Penetration (%) | 6.3 | 5.9 | 9.2 | 7.1 |
| Saturation | 0.07 | 0.07 | 0.11 | 0.08 |
| **Wood burning fireplace** | | | | |
| Penetration (%) | 10.7 | 11.9 | 13.4 | 11.7 |
| Saturation | 0.11 | 0.13 | 0.15 | 0.13 |
| **Wood burning stove** | | | | |
| Penetration (%) | 6.5 | 15.0 | 8.4 | 8.9 |
| Saturation | 0.07 | 0.16 | 0.09 | 0.09 |
| **Pellet stove** | | | | |
| Penetration (%) | 1.1 | 6.8 | 3.3 | 3.0 |
| Saturation | 0.02 | 0.07 | 0.04 | 0.03 |

Penetration and saturation rates by dwelling vintage for fireplaces and heater stoves that use wood, wood pellets, or electricity are summarized in Table 89. The popularity of wood burning fireplaces is most evident in homes built during the mid-seventies to mid-eighties (21% of PNG residential customers in homes built during that period), but are considerably less common among newer dwellings. Penetration rates for wood burning stoves and pellet stoves are highest in dwellings constructed prior to the mid-1990s.

**Table 89: Fireplace and Heater Stove Details by Dwelling Vintage – Wood and Electric**
**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* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| **Electric** | | | | | | | | |
| Penetration (%) | 11.6 | 5.1 | 8.5 | 6.2 | 8.0 | 8.0 | 9.7 | 3.4 |
| Saturation | 0.15 | 0.06 | 0.09 | 0.09 | 0.10 | 0.08 | 0.10 | 0.03 |
| **Wood burning fireplace** | | | | | | | | |
| Penetration (%) | 13.0 | 10.1 | 21.4 | 10.4 | 5.8 | 4.3 | 6.3 | 8.8 |
| Saturation | 0.14 | 0.11 | 0.24 | 0.10 | 0.06 | 0.04 | 0.06 | 0.11 |
| **Wood burning stove** | | | | | | | | |
| Penetration (%) | 9.7 | 9.6 | 10.7 | 10.7 | 6.7 | 4.2 | 2.1 | 9.0 |
| Saturation | 0.10 | 0.10 | 0.12 | 0.12 | 0.07 | 0.05 | 0.02 | 0.09 |
| **Pellet stove** | | | | | | | | |
| Penetration (%) | 4.2 | 2.3 | 4.3 | 5.0 | 2.0 | 1.3 | 0.9 | 1.2 |
| Saturation | 0.06 | 0.03 | 0.05 | 0.05 | 0.02 | 0.01 | 0.01 | 0.01 |

## 7.2 Gas Fireplaces - Ages and Features

Respondents with gas fireplaces were asked to provide details on each of their gas units including age (years) and design (fixed glass front, glass doors that open, open hearth).

Data on the average age of gas fireplaces by type are summarized in Table 90. The average (mean) age of decorative-style gas fireplaces is 17 years. Heater-type fireplaces are 16 years old on average and free standing gas fireplaces / heater stoves are 19 years old on average. If the respondent had more than one of each type, only the age of the first unit is included in the calculation.

**Table 90: Age of Gas Fireplaces (Years) by Type**
**First Fireplace Only**

| Age (years) | Decorative | Heater Type | Free Standing |
|---|---|---|---|
| *Unweighted base* | *63* | *192* | *50* |
| Mean | 17.2 | 15.9 | 19.0 |
| Standard deviation | 10.5 | 8.7 | 7.2 |

Of the three gas fireplace types, heater-type fireplaces are most likely to have a fixed glass front (94% of all heater-type gas fireplaces) compared to free-standing and decorative models (81% and 76% respectively) (Table 91).

**Table 91: Gas Fireplace Characteristics by Type (%)**

| | Decorative | Heater Type | Free Standing |
|---|---|---|---|
| *Unweighted base* [1] | *97* | *294* | *78* |
| Fixed glass front | 75.7 | 93.8 | 81.3 |
| Glass doors that open | 12.3 | 5.2 | 17.3 |
| No glass (open hearth) | 12.0 | 1.1 | 1.4 |
| **Total** | **100.0** | **100.0** | **100.0** |

[1] All respondents with a gas fireplace or heater stove by type

Totals may not sum due to rounding

## 7.3 Fireplace and Heater Stoves – Operating Behaviours

### 7.3.1 Hours-of-Operation

Average weekly hours of use for fireplaces and heater stoves (all types, all fuels) by season are summarized in Table 92. Usage is highest during the fall and winter seasons (average of 13 and 28 hours per week on average, respectively) and lowest during the spring and summer (11 and 0.4 hours per week, respectively). Overall, fireplaces and heater stoves operate an average of 680 hours per year. Regionally, usage is highest in the West (East) region (1,037 hours per year) and lowest in the North East (433 hours per year).

**Table 92: Per Dwelling Weekly and Annual Average Hours of Fireplace / Heater Stove Operation**

| Season | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| Summer (Jun – Aug) | 0.3 | 0.8 | 0.3 | 0.4 |
| Fall (Sep – Nov) | 7.3 | 19.7 | 14.3 | 12.6 |
| Winter (Dec – Feb) | 18.4 | 42.8 | 30.6 | 28.4 |
| Spring (Mar – May) | 7.3 | 16.5 | 11.4 | 10.9 |
| **Annual Average Hours** [1] | **433** | **1,037** | **735** | **680** |

[1] Average hours of operation per year per dwelling with a fireplace or heater stove

Hours of use data were examined for only those households with a single fireplace or heater stove (n=229) to isolate operating behaviours by fireplace type.[9] Table 93 shows that annual usage is highest for fireplace and heater stoves whose design allows them to provide significant heat. For example, pellet stoves, gas free-standing heater stoves, and wood burning stoves have the highest annual hours of use, averaging 1,849 hours, 1,576 hours and 1,503 hours per year respectively. Electric fireplaces are used the least, averaging only 189 hours per year.

**Table 93: Average Weekly Hours of Fireplace / Heater Stove Operation by Fireplace Type Dwellings with Only One Fireplace or Heater Stove**

| Fireplace type [1] | Summer (Jun – Aug) | Fall (Sep – Nov) | Winter (Dec – Feb) | Spring (Mar – May) | Annual Average Hours |
|---|---|---|---|---|---|
| Gas (decorative) | -- | 21.2 | 32.3 | 21.2 | 970 |
| Gas (heater type) | 1.2 | 16.0 | 30.9 | 11.9 | 780 |
| Gas (free standing) | 0.6 | 35.2 | 60.7 | 24.7 | 1,576 |
| Electric | -- | 3.5 | 8.3 | 2.8 | 189 |
| Wood burning fireplace | -- | 13.3 | 38.3 | 6.3 | 753 |
| Wood burning stove | 0.6 | 26.6 | 63.2 | 25.1 | 1,503 |
| Pellet Stove | 1.4 | 35.6 | 76.8 | 28.3 | 1,849 |

[1] Dwellings with only one of any fireplace / heater stove type (n=229)

[9] Respondents with multiple fireplaces and heater stoves were not asked to provide hours-of-use for each fireplace / heater stove, only the total hours of use for all fireplaces and heater stoves in the dwelling.

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

Respondents with a fireplace or heater stove were asked to estimate their contribution to the home's space heating requirements. One-quarter (23%) of respondents with a fireplace or heater stove indicated they contribute as much as 10% of their home's space heating needs. Another 18% indicated it met up to one-quarter of their home's space heating requirements. Ten percent (10%) indicated their unit(s) met anywhere from 75% to 100% of their dwelling's entire space heating requirements. One-third (33%) of respondents indicated their fireplace unit(s) do not contribute to their home's space heating needs.

**Table 94: Fireplace and Heater Stove Contribution to Space Heating (%)**

| Contribution to space heating | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *216* | *388* | *318* | *922* |
| 0% (none) | 39.4 | 20.4 | 33.7 | 32.8 |
| Up to 10% | 23.6 | 24.5 | 21.4 | 23.1 |
| Up to 25% | 19.0 | 16.5 | 17.0 | 17.7 |
| Up to 50% | 7.9 | 14.9 | 13.8 | 11.6 |
| Up to 75% | 3.2 | 9.8 | 6.3 | 5.9 |
| Up to 100% | 1.8 | 7.2 | 3.8 | 3.8 |
| Don't know | 5.1 | 6.7 | 4.1 | 5.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **50% to 100%** | **12.9** | **32.0** | **23.9** | **21.2** |

Totals may not sum due to rounding

Regional differences of note include the higher proportion of respondents in the West (East) and West (West) regions who relied on their fireplaces and heater stoves for anywhere from 50% to 100% of their home's space heating compared to respondents in the North East (32% and 24% versus 13% of respondents respectively).

# 8 APPLIANCES

This section summarizes penetration rates for cooking, cleaning, and space heating and cooling appliances, with emphasis on appliances that use natural gas or that affect the gas consumption of a dwelling. The penetration rate for an appliance indicates the proportion of dwellings that have at least one of the appliance.

## 8.1 Gas Cooking Appliances

Penetration rates for gas cooking appliances are summarized in Table 95. Fifteen percent (15%) of customers have a gas range (gas cooktop and gas oven), 6% have a duel fuel range (gas cooktop and electric oven), 2% have a gas cooktop, and less than one percent (0.6%) have a gas wall oven. Gas barbeques connected to the home's natural gas service are present in 6% of homes compared to 28% of homes that have a barbeque that relies on bottled propane.

**Table 95: Penetration Rates for Cooking Appliances (%)**

| Cooking Appliances | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Gas range (cooktop & oven) | 14.7 | 16.1 | 14.1 | 14.8 |
| Dual fuel range (gas cooktop, electric oven) | 5.3 | 8.0 | 5.6 | 6.0 |
| Gas cooktop | 1.7 | 2.9 | 3.3 | 2.4 |
| Gas wall oven | 0.8 | 0.0 | 0.8 | 0.6 |
| Gas barbeque (piped gas) | 6.5 | 4.7 | 4.7 | 5.6 |
| Gas barbeque (bottled gas) | 26.7 | 29.8 | 28.0 | 27.8 |

When examined by dwelling vintage (period of construction), penetration of gas cooking appliances, notably gas ranges and piped gas barbeques, tends to be higher among newer dwellings, particularly those constructed since 2015 (Table 96).

**Table 96: Penetration Rates for Cooking Appliances by Dwelling Vintage (Period of Construction) (%)**

| Cooking Appliances | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Gas range (cooktop & oven) | 15.0 | 15.9 | 13.1 | 16.4 | 11.3 | 16.1 | 32.3 | 3.4 |
| Dual fuel range (gas cooktop, electric oven) | 8.7 | 4.7 | 7.3 | 8.1 | 5.8 | 3.1 | 7.7 | 4.6 |
| Gas cooktop | -- | 1.3 | 1.5 | 5.0 | 4.2 | 2.1 | 5.9 | 3.4 |
| Gas wall oven | -- | 1.1 | -- | 0.8 | 0.4 | 0.5 | 2.5 | -- |
| Gas barbeque (piped gas) | 1.7 | 4.0 | 5.8 | 3.6 | 6.0 | 9.5 | 19.9 | 3.4 |
| Gas barbeque (bottled gas) | 28.2 | 27.4 | 28.6 | 26.5 | 28.3 | 31.3 | 25.0 | 21.9 |

## 8.2 Cleaning Appliances

Penetration rates for cleaning appliances are summarized in Table 97. Dishwashers are present in three-quarters (75%) of homes. Of these, two-thirds (67%) were indicated as being ENERGY STAR qualified. Half

(49%) of homes have a front loading clothes washer and 19% have a high efficiency top loading machine. Nearly three-in-ten households have a standard efficiency top loading clothes washer. Gas clothes dryers are present in 5% of PNG customer homes.

**Table 97: Penetration Rates of Cleaning Appliances (%)**

| Cleaning Appliances | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Dishwasher | 78.2 | 68.9 | 75.2 | 75.4 |
| *Percent ENERGY STAR qualified >* | *67.1* | *68.3* | *67.3* | *67.4* |
| Top loading clothes washer – Standard efficiency | 25.0 | 28.3 | 31.2 | 27.5 |
| Top loading clothes washer – High efficiency | 16.2 | 18.5 | 25.6 | 19.4 |
| Front loading clothes washer | 54.8 | 47.6 | 38.4 | 48.5 |
| Gas clothes dryer | 5.7 | 2.7 | 5.3 | 4.9 |

## 8.3 Miscellaneous Heating and Cooling Appliances

Table 98 presents the penetration rates for a variety of gas outdoor appliances, portable electric space heaters, and air conditioners (central and portable). Penetration rates for gas outdoor appliances such as heaters, fire pits and fireplaces using either bottled or piped gas, are quite low (between 1% and 5% of dwellings). Portable electric heaters are present in one-in-five (21%) dwellings. Finally, 4% of respondents indicated their dwelling has a central air conditioner and 25% indicated it has a portable air conditioning unit.

**Table 98: Penetration Rates for Miscellaneous Heating and Cooling Appliances (%)**

| Cooking Appliances | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Gas outdoor heater (piped gas) | 2.1 | 2.0 | 2.0 | 2.0 |
| Gas outdoor heater (bottled gas) | 1.7 | 2.6 | 1.1 | 1.7 |
| Gas outdoor fire pit / fireplace (piped gas) | 1.5 | -- | 1.1 | 1.1 |
| Gas outdoor fire pit / fireplace (bottled gas) | 4.4 | 6.4 | 5.3 | 5.1 |
| Portable electric heater | 18.7 | 21.8 | 25.2 | 21.3 |
| Central air conditioner | 5.3 | 2.1 | 2.9 | 4.0 |
| Portable air conditioner | 28.4 | 20.5 | 22.1 | 24.9 |

Penetration rates for these appliances are presented in Table 99 by dwelling vintage (period of construction). While most of these end-uses do not display a relationship to when the dwelling was constructed, the penetration of portable electric space heaters generally increases with the age of the dwelling. This is consistent with older dwellings being less well insulated and more drafty.

**Table 99: Penetration Rates for Miscellaneous Heating and Cooling Appliances by Dwelling Vintage (Period of Construction) (%)**

| Cooking Appliances | Before 1950 | 1950 - 1975 | 1976 - 1985 | 1986 - 1995 | 1996 - 2005 | 2006 - 2015 | 2016 or Newer | Age Un-known |
|---|---|---|---|---|---|---|---|---|
| *Unweighted base* | *95* | *570* | *443* | *254* | *207* | *136* | *61* | *65* |
| Gas outdoor heater (piped gas) | 3.5 | 4.6 | 3.9 | 5.0 | 9.2 | 3.0 | 9.0 | 3.8 |
| Gas outdoor heater (bottled gas) | 3.2 | 1.6 | 2.8 | 2.0 | 0.8 | 1.2 | 2.5 | 4.6 |
| Gas outdoor fire pit / fireplace (piped gas) | -- | 0.6 | 0.6 | 2.0 | 1.6 | -- | 9.0 | -- |
| Gas outdoor fire pit / fireplace (bottled gas) | 5.6 | 5.0 | 4.2 | 4.5 | 6.7 | 5.3 | 8.1 | 4.2 |
| Portable electric heater | 27.6 | 22.0 | 23.8 | 23.9 | 20.0 | 9.5 | 11.8 | 25.3 |
| Central air conditioner | -- | 2.6 | 4.3 | 4.3 | 7.9 | 4.6 | 5.2 | 1.2 |
| Portable air conditioner | 26.4 | 24.2 | 25.7 | 25.1 | 24.7 | 29.2 | 21.6 | 17.4 |

### 8.3.1 Age of Central Air Conditioners

Those respondents indicating the presence of a central air conditioner were asked to indicate the age of the unit. The responses are summarized in Table 100. Overall, central air conditioners are eight years of age on average. Regional results are presented but the samples are small so caution is advised in interpreting these data.

**Table 100: Age of Central Air Conditioners (Years)**

| Years | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *28* | *15* | *18* | *61* |
| Average | 8.4 | 6.0 | 7.7 | 8.0 |
| Standard deviation | 7.4 | 4.8 | 7.0 | 7.1 |

[1] Caution is advised in interpreting data for samples of less than 50.

# 9 POOLS & HOT TUBS

This section presents the incidence of swimming pools and hot tubs among PNG's residential customer base. Questions were directed only to respondents who have exclusive access to these amenities (i.e., excludes pools and hot tubs shared with other residences in a townhouse, apartment, or condominium complex).

## 9.1 Penetration Rates

Penetration rates of exclusive-use pools and hot tubs are provided in Table 101. Saturation figures are not presented, as homes with more than one of these end-uses would be very uncommon.

**Table 101: Penetration of Pools and Hot Tubs (%)**

| Exclusive use only | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Swimming pool | 2.5 | 2.0 | 2.3 | 2.3 |
| Indoor | 0.2 | 0.2 | 0.2 | 0.2 |
| Outdoor | 2.3 | 1.9 | 2.1 | 2.2 |
| Hot tub | 8.6 | 13.3 | 9.7 | 9.9 |
| Indoor | 0.2 | 0.7 | 0.5 | 0.4 |
| Outdoor | 8.4 | 12.6 | 9.2 | 9.5 |

Only two percent (2%) of PNG residential customers surveyed indicated they have either an indoor or outdoor swimming pool for their exclusive use and one-in-ten (10%) have a hot tub. The majority of pools and hot tubs are located outdoors (92% and 96% respectively).

## 9.2 Heating Fuels

### 9.2.1 Swimming Pools

Table 102 provides additional detail on exclusive-use swimming pools, including fuels used by pools that are heated. The table does not differentiate between indoor and outdoor pools because of the very small number of respondents with either. Regional details are also not provided due to small samples. Of note, six-in-ten (60%) pools are not heated, 20% use electricity, 7% use natural gas, and the remaining 14% are heated using solar energy. Pools are heated an average of 4.2 months of the year.

**Table 102: Fuels Used to Heat Swimming Pools (%)**
**Exclusive-Use Pools Only**

| | 2022 PNG |
|---|---|
| *Unweighted base* [1] | *41* |
| Solar | 14.1 |
| Natural gas | 6.8 |
| Electricity | 19.7 |
| Pool not heated | 59.6 |
| **Total** | **100.0** |
| **Average # of months heated per year** | **4.2** |

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

### 9.2.2 Hot Tubs

The vast majority (97%) of hot tubs are heated using electricity (Table 103). Natural gas is used as the heating fuel for only 3% of hot tubs. Hot tubs are heated, on average, for 10 months of the year. The majority (99%) of hot tubs are covered when not being used.

**Table 103: Fuels Used to Heat Hot Tubs (%)**
**Exclusive-Use Hot Tubs Only**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *45* | *93* | *59* | *197* |
| Natural gas | 4.5 | 2.1 | -- | 2.5 |
| Electric | 95.5 | 97.9 | 96.7 | 96.5 |
| Other | -- | -- | 3.3 | 0.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Average # of months heated per year** | **10.2** | **10.2** | **9.9** | **10.1** |
| **Hot tub covered when not in use? (% Yes)** | **97.8** | **100.0** | **98.4** | **98.6** |

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

# 10 ENERGY USE BEHAVIOURS & ATTITUDES

PNG's 2022 REUS queried respondents about how often they undertake a variety of energy-using behaviours around the home related to hot water use (e.g., bathing, laundry, dishwashing, etc.).

## 10.1 Domestic Hot Water Use Behaviours

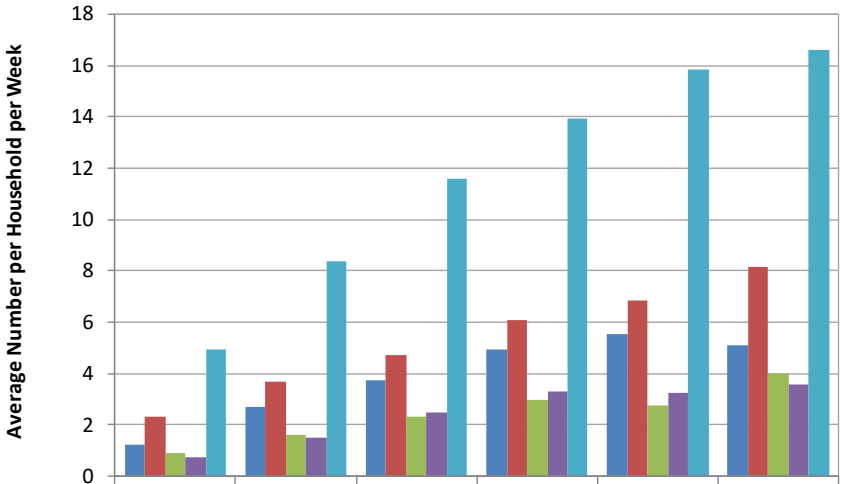
Table 104 summarizes the average number of dishwashing loads, laundry loads, baths, and showers per household indicated by respondents to the 2022 REUS. The number of these activities completed in a given week varies with household size (number of occupants) and activity in question. Some activities occur more frequently than others. For example, showers are considerably more common than baths (average of 10 showers per week versus two baths). The average shower time per household (all members of the household combined) is 21.4 minutes and the average per person is 8.6 minutes. On average, households complete 4.4 loads of laundry per week, of which 2.0 loads are done using cold water wash and rinse.

**Table 104: Hot Water Use Activities – Average per Household**

| Behaviours Impacting DWH | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Average # of people per home | 2.7 | 2.7 | 2.6 | 2.7 |
| Dishwasher loads per week | 3.4 | 3.4 | 3.4 | 3.4 |
| Laundry loads per week (any temperature) | 4.4 | 4.5 | 4.4 | 4.4 |
| Laundry loads using cold water | 2.0 | 2.0 | 1.9 | 2.0 |
| Baths per week | 2.1 | 1.8 | 2.0 | 2.0 |
| Showers per week | 9.6 | 10.0 | 10.7 | 10.0 |
| Average shower time per household (minutes) | 21.8 | 21.2 | 20.8 | 21.4 |
| Average shower time per person (minutes) | 8.9 | 8.2 | 8.5 | 8.6 |

The number of activities using hot water is correlated with the number of people in the home. Figure 2 shows the relationship between household size (number of persons in the home) 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 varies by activity. For example, a two person household will do 3.7 loads of laundry per week compared to 8.2 loads for households with six or more people. Similarly, a two person household will take 8.4 showers per week in contrast to 16.6 for homes with six or more people.

**Figure 2: Number of Hot Water Activities versus Household Size**




| | 1 | 2 | 3 | 4 | 5 | 6 or More |
|---|---|---|---|---|---|---|
| Dishwasher loads | 1.2 | 2.7 | 3.7 | 5.0 | 5.5 | 5.1 |
| Laundry loads (any temperature) | 2.3 | 3.7 | 4.7 | 6.1 | 6.8 | 8.2 |
| Laundry loads using cold water | 0.9 | 1.6 | 2.3 | 3.0 | 2.7 | 4.0 |
| Baths | 0.8 | 1.5 | 2.5 | 3.3 | 3.2 | 3.6 |
| Showers | 5.0 | 8.4 | 11.6 | 13.9 | 15.8 | 16.6 |

**Persons per Household**

## 10.2 Contribution of Household Members to Conserving 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 to the 2022 REUS were asked who in their household makes the most effort to conserve energy. The results, summarized in Table 105, show somewhat less than half (45%) of survey respondents indicated it is all of the members of their households, while another one-quarter (25%) indicated most members of their household make the effort to conserve energy. Another one-quarter (26%) indicated that only some members of their household make the effort to conserve energy. Less than one percent (<1%) indicated no one makes an effort.

**Table 105: Who Makes the Most Effort to Conserve Energy in the Home? (%)**

| Who makes the most effort? | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| All members of the household | 46.6 | 42.9 | 44.1 | 45.1 |
| Most members of the household | 24.2 | 23.8 | 26.2 | 24.7 |
| Only some members of the household | 25.2 | 28.8 | 24.8 | 25.8 |
| None of us | 0.0 | 0.3 | 0.2 | 0.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

Next, respondents were asked to rate 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". Somewhat more than

half (54%) of respondents indicated their household makes a "fair amount" of effort to conserve energy (Table 106). Seventeen percent (17%) indicated their household makes a "great amount" of effort. One quarter (25%) indicated they make only a "little effort" and 2% indicated "no effort at all". Regional differences, where they exist, are unremarkable.

**Table 106: Current Effort Made to Conserve Energy in the Home (%)**

| Effort made to conserve energy | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| No effort at all | 1.9 | 1.7 | 2.0 | 1.9 |
| A little effort | 23.5 | 28.8 | 24.6 | 24.9 |
| Fair amount of effort | 53.6 | 53.5 | 54.9 | 54.0 |
| Great amount of effort | 19.1 | 13.6 | 16.9 | 17.3 |
| Don't know | 1.9 | 2.3 | 1.6 | 1.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

## 10.3 Satisfaction with PNG's Efforts to Help Households Conserve Energy

Respondents were asked to rate their satisfaction with PNG's efforts to help them use natural gas efficiently on an eleven-point scale ranging from zero meaning "not at all satisfied" to ten meaning "extremely satisfied". Table 107 shows that one-third (33%) of respondents are satisfied with PNG's efforts to help them conserve energy and 14% are unsatisfied. Of note, 44% are neutral – neither satisfied nor unsatisfied. Nine percent (9%) chose not to answer the question.

**Table 107: Respondent Satisfaction with PNG's Efforts to Help Them Conserve Energy (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Satisfied (7 – 10) | 35.3 | 30.4 | 32.0 | 33.3 |
| Neutral (5 – 6) | 43.1 | 45.2 | 42.8 | 43.5 |
| Unsatisfied (0 – 4) | 12.6 | 16.1 | 15.7 | 14.3 |
| Prefer not to answer | 9.0 | 8.3 | 9.5 | 9.0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

## 10.4 Sources of Information for Replacing Major Energy Using Appliances

Respondents were asked to indicate the sources of information they tended to rely upon when deciding to replace a major energy-using appliance such as a furnace, boiler, or hot water heater. The results, summarized in Table 108, show that Internet research by the respondent and heating and plumbing contractors are the two most trusted sources, indicated by 61% and 51% of respondents respectively. The next most frequently indicated sources included a friend, neighbour, or family member (32%), manufacturer's websites or brochures (24%) and utility companies such as PNG or BC Hydro (19%).

**Table 108: Trusted Sources of Information when Purchasing a Major Energy Using Appliance (% of Respondents) Multiple Responses Allowed**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Internet research by the individual | 61.8 | 59.5 | 60.8 | 61.0 |
| Heating and plumbing contractor | 47.9 | 57.7 | 51.8 | 51.1 |
| Friend, neighbour, or family member | 29.4 | 33.0 | 36.2 | 32.2 |
| Manufacturer's website or brochures | 23.5 | 24.5 | 22.8 | 23.5 |
| Utility companies (e.g., PNG, BC Hydro) | 17.7 | 17.2 | 21.6 | 18.8 |
| Personal knowledge / investigation / needs | 1.7 | 1.1 | 0.7 | 1.3 |
| Property manager / Property owner | 1.3 | 1.7 | 0.5 | 1.2 |
| Other | 0.8 | 0.9 | 0.7 | 0.8 |
| Nothing | -- | -- | 0.3 | 0.1 |

Totals will not sum to 100% as multiple responses were allowed

## 10.5 Attitudes toward Energy and Energy Conservation

Table 109 summarizes the relative agreement or disagreement of respondents to a series of statements that address beliefs, attitudes, and behaviours toward energy and energy conservation. Agreement with a statement is represented by those who indicated either four or five on a five-point scale, while disagreement is represented by either one or two on the scale. Those undecided, unsure or with no strong opinion (neutral) are represented by a three. Attitudes and behaviours influence how households use energy and respond to programming designed to reduce energy consumption.

Notable observations include:

- Half (50%) of respondents feel it is cheaper to heat their home with natural gas than electricity. Only 11% disagreed with the statement and 39% were neutral.
- Six-in-ten (61%) feel believe there are many ways a person can save energy around the home and these can add up to substantial dollar savings. Nine percent (9%) disagreed and 30% were neutral.
- Four-in-ten (40%) feel they have reduced their household's energy use as much as reasonably possible, while almost one-in-five (17%) disagreed, and four-in-ten (42%) were neutral.
- Nearly one-quarter (24%) felt they were too busy to research ways to save energy.
- More than half (54%) would like to reduce their home's energy use further but can't justify the expense to do so. Ten percent (10%) disagreed and 36% were neutral.

**Table 109: Attitudes toward Energy and Energy Conservation (%)**

| Attitudes and beliefs | 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 | 2.3 | 6.2 | 30.3 | 34.6 | 26.6 | 8.5 | 61.2 |
| I will pay a little more for products or services that are environmentally friendly | 6.8 | 11.5 | 40.4 | 28.2 | 13.0 | 18.3 | 41.2 |
| It is up to each of us to reduce our impact on the environment | 3.0 | 5.1 | 19.9 | 32.0 | 39.8 | 8.1 | 71.8 |
| Members of my household regularly limit the length of their showers to save energy | 11.6 | 16.7 | 37.1 | 20.3 | 14.2 | 28.3 | 34.5 |
| I don't want to think about natural gas, I simply want it to work | 9.5 | 12.4 | 36.9 | 22.7 | 18.1 | 21.9 | 40.8 |
| I consider natural gas to be a safe energy source | 2.5 | 4.2 | 20.7 | 30.8 | 41.7 | 6.7 | 72.5 |
| When something needs to be done around the home, I usually hire someone | 18.8 | 21.7 | 28.7 | 18.3 | 12.3 | 40.5 | 30.6 |
| I almost always have a home renovation on the go | 29.4 | 18.6 | 29.2 | 14.4 | 8.3 | 48.0 | 22.7 |
| It is cheaper to heat a home with natural gas than it is with electricity | 5.0 | 6.2 | 39.1 | 21.4 | 28.2 | 11.2 | 49.6 |
| Our household has reduced its energy use by as much as reasonably possible | 4.1 | 13.1 | 42.3 | 24.8 | 15.5 | 17.2 | 40.3 |
| I am a busy person with little or no time to research ways to save energy | 10.9 | 18.5 | 46.5 | 16.1 | 7.7 | 29.4 | 23.8 |
| I conserve energy because it saves money not because it helps the environment | 8.0 | 14.8 | 41.6 | 20.8 | 14.7 | 22.8 | 35.5 |
| I would like to reduce our home's energy use further but can't justify the expense to do so | 2.8 | 7.6 | 35.8 | 27.2 | 26.6 | 10.4 | 53.8 |

# 11 PRODUCTS & SERVICES

This section summarizes interest in a range of energy-related products and services including biomethane enhanced natural gas.

## 11.1 Interest in Products and Services

Respondents to PNG's 2022 REUS were provided with a list of potential energy-related programs and services that could be offered by PNG and asked to rate their interest using a five-point scale where one meant "not at all interested" and five meant "extremely interested". The results, ranked by the proportion that indicated they are either *very interested* or *extremely interested* (i.e., 4 or 5) are summarized in Table 110. As no financial obligation or commitment is implied or required of respondents, caution is advised in interpreting these results. They are primarily directional in nature.

The three program suggestions that garnered the most interest included a furnace tune-up program (45% of respondents interested), a program to replace windows (windows and frames) with energy-efficient windows (40%), and a program to replace exterior doors with energy-efficient insulated doors or a program to improve draft-proofing (36% each). Except for a program to install an ERV, differences in the level of interest between the remaining products and services are relatively modest (between 28% and 33% of respondents interested).

**Table 110: Interest in Products and Services (%)**
**Ordered by Percent Very or Somewhat Interested**

| Product / Service | Not at all Interested (1) | Not Very Interested (2) | Somewhat Interested (3) | Very Interested (4) | Extremely Interested (5) | Interested (4 or 5) |
|---|---|---|---|---|---|---|
| Furnace tune-up program to ensure it is working safely and efficiently | 14.5 | 9.0 | 31.1 | 27.0 | 18.3 | 45.3 |
| Program to replace windows (windows and frames) with energy-efficient windows | 23.4 | 12.7 | 23.4 | 20.5 | 19.8 | 40.3 |
| Program to replace exterior doors with energy-efficient insulated doors | 21.7 | 13.9 | 28.0 | 18.6 | 17.6 | 36.2 |
| Program to improve draft-proofing | 17.5 | 14.7 | 31.4 | 19.0 | 17.1 | 36.1 |
| Program to replace manual thermostats with programmable or smart (learning-style) thermostats | 22.8 | 13.1 | 28.9 | 19.2 | 15.8 | 35.0 |
| Program to replace a low or mid-efficiency gas furnace or boiler with a high-efficiency gas furnace or boiler and high-efficiency air source heat pump | 26.5 | 14.4 | 26.2 | 17.6 | 15.2 | 32.8 |
| Program to upgrade attic and wall insulation | 25.4 | 17.3 | 27.9 | 15.2 | 14.1 | 29.3 |
| An online do-it-yourself energy audit of your home | 20.8 | 16.2 | 33.6 | 17.0 | 12.2 | 29.2 |
| Program to replace a standard efficiency natural gas water heater with a high-efficiency gas water heater | 29.4 | 15.1 | 26.4 | 15.7 | 13.1 | 28.8 |
| Program to add an energy-efficient air source heat pump to an existing gas furnace or gas boiler | 25.6 | 15.9 | 30.5 | 15.1 | 12.8 | 27.9 |
| Program to install an Energy Recovery Ventilator | 26.0 | 18.4 | 34.1 | 11.1 | 10.2 | 21.3 |

## 11.2 Interest in Bio-Methane

PNG's 2022 REUS queried respondents about their interest in renewable sources of energy to augment their natural gas supply, notably biomethane. Respondents were provided with a description of biomethane and then asked about their awareness of the product, their opinions and attitudes towards renewable energy, and their willingness to pay for adding biomethane to their natural gas supply.

### 11.2.1 Knowledge of Biomethane

Seven-in-ten (69%) respondents considered themselves either *not very knowledgeable* or *not at all knowledgeable* about renewable sources of energy such as biomethane (Table 111). Only 6% consider themselves either *very* or *extremely knowledgeable*. One-quarter (24%) were *somewhat knowledgeable.* The remaining 2% of respondents chose not to answer the question. There are no statistically significant differences in knowledge levels between the regions.

**Table 111: Knowledge of Biomethane Prior to Taking Survey (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Not at all knowledgeable | 45.6 | 46.0 | 45.3 | 45.6 |
| Not very knowledgeable | 21.0 | 24.1 | 25.4 | 22.9 |
| Somewhat knowledgeable | 25.0 | 24.1 | 23.1 | 24.3 |
| Very knowledgeable | 5.7 | 4.0 | 3.1 | 4.6 |
| Extremely knowledgeable | 1.3 | -- | 0.8 | 0.9 |
| Prefer not to answer | 1.3 | 1.7 | 2.3 | 1.7 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Not very or not at all knowledgeable** | **66.6** | **70.2** | **70.7** | **68.5** |
| **Somewhat, very, or extremely knowledgeable** | **32.1** | **28.1** | **27.1** | **29.8** |

Totals may not sum due to rounding

### 11.2.2 Opinions and Attitudes towards Biomethane

Respondents were asked to rate their level of agreement or disagreement with each of the four statements:

- PNG should promote energy efficiency and conservation before exploring new energy supplies, renewable or otherwise.
- Only PNG customers who want biomethane should pay more for it.
- All PNG customers should pay a little more on their natural gas bills to support the development of biomethane supplies.
- PNG should source its natural gas from renewable sources as much as possible, regardless of cost.

Agreement with a statement is represented by those who indicated either a four or five on a 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.

The results, summarized in Table 112, show that four-in-ten (40%) of respondents agree that PNG should promote energy efficiency and conservation before exploring new energy supplies, renewable or otherwise, compared to only 10% who disagreed. Four-in-ten (40%) respondents agreed that only PNG customers who want biomethane should pay for it (17% disagreed) and 11% felt all customers should pay for adding biomethane to PNG's natural gas supply (60% disagreed). Proportionately more respondents disagreed than agreed with the statement that PNG should source its natural gas from renewable sources as much as possible regardless of cost (31% disagreed, 23% agreed).

**Table 112: Attitudes toward Biomethane and Renewable Energy (%)**

| Attitudes and beliefs | Strongly Disagree (1) | (2) | Neither Agree or Disagree (3) | (4) | Strongly Agree (5) | Disagree (1 or 2) | Agree (4 or 5) |
|---|---|---|---|---|---|---|---|
| PNG should promote energy efficiency and conservation before exploring new energy supplies, renewable or otherwise. | 3.4 | 6.7 | 50.3 | 23.2 | 16.3 | 10.1 | 39.5 |
| Only PNG customers who want biomethane should pay more for it. | 9.8 | 7.6 | 42.8 | 16.2 | 23.5 | 17.4 | 39.7 |
| All PNG customers should pay a little more on their natural gas bills to support development of biomethane supplies. | 41.7 | 17.9 | 29.1 | 7.8 | 3.3 | 59.6 | 11.1 |
| PNG should source its natural gas from renewable sources as much as possible, regardless of cost. | 17.4 | 14 | 45.6 | 13.5 | 9.3 | 31.4 | 22.8 |

### 11.2.3 Willingness to Pay for Biomethane

All respondents were provided with the following preamble and then asked to indicate their willingness to pay a little more for their natural gas, if it was within their budget, to include biomethane with their natural gas supply.

> *PNG is purchasing biomethane to add to the supply of natural gas sold to residential customers. PNG is doing this to reduce the overall environmental impact from our consumption of natural gas. Biomethane, however, traditionally costs more than natural gas.*

The results, summarized in Table 113, show that one-in-four (38%) respondents are either *somewhat, very, or extremely willing* to pay more for natural gas if it included biomethane, while 58% were either *not very or not at all willing* to pay more for the biomethane-enhanced gas supply. Regionally, opposition to paying more for biomethane-enhanced gas was highest in the North East region (63%) and lowest in the West (East) region (52%).

**Table 113: Willingness to Pay More for Natural Gas with Biomethane (%)**

| Willingness to pay | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Not at all willing | 34.5 | 25.8 | 27.0 | 30.5 |
| Not very willing | 28.2 | 26.1 | 26.1 | 27.2 |
| Somewhat willing | 27.9 | 31.4 | 32.8 | 30.1 |
| Very willing | 4.8 | 9.3 | 7.5 | 6.5 |
| Extremely willing | 1.0 | 1.9 | 2.9 | 1.7 |
| Prefer not to answer | 3.6 | 5.5 | 3.6 | 4.0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Not very or not at all willing** | **62.8** | **51.9** | **53.1** | **57.7** |
| **Somewhat, very, or extremely willing** | **33.6** | **42.6** | **43.3** | **38.3** |

Totals may not sum due to rounding

Willingness to pay extra for biomethane-enhanced natural gas is dependent, in part, on a household's financial capacity to pay for the service. Table 114 cross-references willingness to pay with household financial stress that was queried elsewhere in the REUS survey. The level of household financial stress was based on which of the following three statements respondents felt best described their household's situation:

- We watch our pennies closely because we need to
- We are comfortable but need to watch how much we spend
- We are comfortable and don't worry too much about how much things cost

The results show the willingness to pay is lowest among households that are most financially stressed (i.e., watch their pennies closely) with only 30% somewhat, very, or extremely willing to pay more compared to 42% of households that are moderately stressed (comfortable but need to watch their spending) and 62% of households that are the least financially stressed (comfortable and don't worry too much about how much things cost).

**Table 114: Willingness to Pay More for Biomethane by Household Financial Stress Level (%)**

| Household Financial Stress Level → / Willingness to pay ↓ | Watch our pennies closely | Comfortable but watch how much we spend | Comfortable and don't worry about how much things cost |
|---|---|---|---|
| *Unweighted base* [1] | *374* | *1049* | *125* |
| Not at all willing | 42.4 | 25.3 | 15.2 |
| Not very willing | 22.8 | 30.0 | 20.9 |
| Somewhat willing | 24.1 | 32.6 | 45.6 |
| Very willing | 3.5 | 7.9 | 14.4 |
| Extremely willing | 2.3 | 1.8 | 1.7 |
| Prefer not to answer | 5.0 | 2.5 | 2.2 |
| **Total** | **100.0** | **100.0** | **100.0** |
| **Not very or not at all willing** | **65.2** | **55.3** | **36.1** |
| **Somewhat, very, or extremely willing** | **29.9** | **42.3** | **61.7** |

[1] Excludes non-responses to the financial stress question
Totals may not sum due to rounding.

As willingness to purchase questions are hypothetical, responses should be adjusted to reflect the fact that some respondents will not follow through on their stated intention if the service was offered (includes both those who indicated they would purchase and those who would not purchase). To address this, probabilities were assigned to each respondent's response to develop a more realistic "purchase intention" (Table 115). The highest probability of purchasing biomethane was given to respondents indicating they are *extremely willing* to purchase. Conversely, the lowest probability is assigned to those who indicated they were *not at all willing* to purchase the renewable energy source. Probabilities assigned to the other categories reflect the greater degree of uncertainty associated with these responses.[10]

**Table 115: Purchase Probabilities – Biomethane**

| Willingness to Purchase | Probability of Purchasing |
|---|---|
| Not at all willing | 0.02 |
| Not very willing | 0.05 |
| Somewhat willing | 0.10 |
| Very willing | 0.25 |
| Extremely willing | 0.75 |
| Don't know | 0.10 |

Adjusted using the probability assumptions in the previous table, it is estimated that eight percent (8%) of PNG residential customers would likely pay more for biomethane-enhanced natural gas service (Table 116). Regionally, residents of the North (East) region are less likely to pay for the service than their counterparts in the Western regions.

**Table 116: Predicted Purchase Intent – Natural Gas with Biomethane (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Willing to purchase | 7.2 | 9.2 | 9.6 | 8.3 |

The reader is advised to use caution when interpreting these estimates as knowledge of biomethane prior to taking the survey was low. Additionally, no information was provided on the percentage of natural gas to be displaced by bio-methane, the cost to the household, or the value of the benefit to the environment from the service. Finally, the relative success of a biomethane initiative will depend upon a variety of other factors including, but not inclusive of, program design, marketing, relative prices of competing fuels, and the state of the economy.

### 11.2.4 Barriers to Purchasing Biomethane

Respondents who indicated they were *not at all willing* or *not very willing* to pay more for having biomethane included with their natural gas supply were asked to indicate their reason(s) for their position.

[10] While the choice of probabilities can be somewhat arbitrary, the probabilities are those used by ACNeilson BASES product uptake prediction model. A good discussion of various probability options and other aspects of purchase intention surveys can be found in Chandon P, Morwitz V, Reinartz W (2005) *Do intentions really predict behavior? Self-generated validity effects in survey research.* Journal of Marketing 69:1–14.

The reasons, ordered from most frequently indicated to least frequently indicated, are summarized in Table 117. By far, respondents most frequently indicated they could not afford to pay more for a biomethane-enhanced gas service (indicated by 67% of respondents who were either *not at all willing* or *not very willing* to pay more for biomethane-enhanced natural gas). Less frequently indicated reasons included not having enough information (22%), belief that biomethane-enhanced service would not make a difference to the environment (18%), and that the service offered no benefit to the respondent personally (12%).

**Table 117: Reasons for Unwillingness to Pay for Biomethane (%)**
**Multiple Responses Allowed**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* [1] | *329* | *362* | *324* | *1,015* |
| I can't afford to pay more | 66.9 | 68.0 | 67.6 | 67.3 |
| Don't have enough information | 21.9 | 17.4 | 25.6 | 22.0 |
| Would not make a difference to the environment | 19.8 | 19.3 | 12.7 | 17.8 |
| No benefit to me | 13.1 | 10.5 | 11.1 | 12.1 |
| Price for natural gas service already too high | 2.7 | 5.0 | 3.4 | 3.3 |
| General price inflation concerns | 1.2 | 1.4 | 0.6 | 1.1 |
| Don't want to pay more for natural gas service | 0.3 | 1.1 | 0.3 | 0.5 |
| Don't believe it is needed | 0.3 | 0.8 | 0.6 | 0.5 |
| I don't pay the natural gas bill for this residence | 0.3 | 0.0 | 0.6 | 0.3 |
| Focus on energy efficiency first | 0.6 | 0.0 | 0.0 | 0.3 |
| Other | 5.2 | 4.4 | 5.2 | 5.0 |
| Don't know | 0.6 | 1.1 | 0.9 | 0.8 |

[1] Base consists of respondents who indicated they are not very willing or not at all willing to pay more for biomethane-enhanced natural gas service. Column totals will not sum to 100% as multiple responses were allowed.

# 12 CUSTOMER SERVICE EXPERIENCES

This section summarizes the findings from a series of questions that collected feedback on PNG's customer service from respondents who had contacted PNG in the six months prior to receiving the 2022 REUS survey.

## 12.1 Incidence and Method of Contact

Eighteen percent (18%) of respondents to PNG's REUS contacted PNG in the six months prior to completing their survey. Of these, the majority (86%) contacted PNG by phone, 12% contacted PNG by email, 2% visited a PNG office, and less than one percent (<1%) used the online chat feature on PNG's website (Table 118).

**Table 118: Contact with PNG in the Last Six Months (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Contacted PNG | 19.7 | 16.4 | 16.1 | 17.9 |
| Method of contact: | | | | |
| Phone | 82.5 | 87.6 | 90.9 | 85.7 |
| Email | 14.6 | 9.7 | 7.1 | 11.7 |
| In person | 2.9 | 1.7 | 0.0 | 1.9 |
| Online chat | 0.0 | 0.9 | 2.0 | 0.7 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

## 12.2 Main Reason for Contacting PNG

More than half (56%) of respondents indicated the main reason for contacting PNG was to address a problem with their bill or to ask a question about their bill (Table 119). Less frequently, the main reason was to open or close an account (18%), to report a problem with their natural gas service (10%), or to change their service address (8%).

**Table 119: Main Reason for Contacting PNG in the Last Six Months (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *103* | *114* | *98* | *315* |
| Problem or question about my bill | 56.3 | 60.5 | 50.0 | 55.5 |
| Open or close an account | 19.4 | 16.7 | 14.3 | 17.5 |
| Trouble with natural gas service | 9.7 | 6.1 | 12.2 | 9.7 |
| Change of service address | 7.8 | 4.4 | 12.2 | 8.3 |
| Request gas-line information / service (e.g. locating lines, marking lines) | 1.9 | 3.5 | 4.1 | 2.8 |
| Confirm / change account information | 1.9 | 2.6 | 1.0 | 1.8 |
| Online issues (e.g. sign-in issues, problems) | -- | 1.8 | -- | 0.3 |
| Other | 1.0 | 0.9 | 3.1 | 1.5 |
| Prefer not to answer | 1.9 | 3.5 | 3.1 | 2.5 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

### 12.3 Satisfaction with PNG's Customer Service

Respondents were asked to rate their degree of agreement or disagreement with each of the following four statements addressing different aspects of their contact with PNG:

- It was easy to reach a PNG customer care representative
- PNG responded promptly to my request, question, or complaint
- The PNG representative was knowledgeable
- The PNG representative was polite and respectful

Agreement with each statement is represented by choosing either a four or five on a 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. Respondents were provided with a "not applicable" option.

The results, summarized in Table 120, show eight-in-ten (79%) respondents agreed it was easy to reach a PNG customer care representative and 9% disagreed. Similar results were recorded for the statement that PNG responded promptly to their request, question, or complaint (84% agreed, 9% disagreed). Eighty-six percent (86%) agreed the PNG representative was knowledgeable compared to only 7% who did not. Finally, nine-in-ten (91%) agreed their representative was polite and respectful compared to only 5% who disagreed.

**Table 120: Contact Experience Feedback (%)**

| Attitudes and beliefs | Strongly Disagree (1) | (2) | Neither Agree or Disagree (3) | (4) | Strongly Agree (5) | Disagree (1 or 2) | Agree (4 or 5) |
|---|---|---|---|---|---|---|---|
| It was easy to reach a PNG customer care representative | 3.2 | 6.1 | 11.4 | 21.8 | 57.5 | 9.3 | 79.3 |
| PNG responded promptly to my request, question, or complaint | 4.8 | 4.2 | 6.6 | 21.6 | 62.8 | 9.0 | 84.4 |
| The PNG representative was knowledgeable | 4.2 | 2.4 | 7.6 | 19.6 | 66.2 | 6.6 | 85.8 |
| The PNG representative was polite and respectful | 2.5 | 2.5 | 4.6 | 13.1 | 77.4 | 4.9 | 90.5 |

All respondents who contacted PNG in the six months prior to taking the survey were asked to rate their overall satisfaction with the customer service representative they dealt with using an 11-point scale ranging from a zero which meant "not at all satisfied" to a 10 which meant "extremely satisfied". Respondents were provided with the option to not respond to the question. The findings are summarized in Table 121. They show 84% of respondents are satisfied, 11% are neutral (neither satisfied nor unsatisfied) and only 4% are dissatisfied. Regional differences are not statistically significant at the 95% confidence level.

**Table 121: Satisfaction with PNG Customer Service Representative (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *103* | *114* | *98* | *315* |
| Satisfied (7 – 10) | 82.5 | 84.2 | 85.7 | 83.7 |
| Neutral (5 – 6) | 13.6 | 9.5 | 6.1 | 10.9 |
| Unsatisfied (0 – 4) | 3.9 | 3.6 | 5.1 | 4.1 |
| Prefer not to answer | -- | 2.7 | 3.0 | 1.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

Respondents who provided a score of six or less on the satisfaction scale were asked what would have made them more satisfied with their contact with PNG. The responses, ordered by frequency of mention, are summarized in Table 122. The top three most frequently made suggestions include lowering their [the respondent's] natural gas bill, offering rebates or promotions (18% of responses), better communication (16%), and having a better outcome to their problem or issue (16%). A review of verbatim comments suggests that some respondents are dissatisfied because PNG was unable, in their opinion, to explain why their gas bills are so high and/or why the price of natural gas has increased.

**Table 122: Reasons for Dissatisfaction with PNG Customer Representative (%)**
**Multiple Responses Allowed**

| | 2022 PNG |
|---|---|
| *Unweighted base* | *44* |
| Lower bills / Rebates / Promotions | 18% |
| Better communication (e.g. proactive, more empathy) | 16% |
| Better resolution / Better attempts at resolution | 16% |
| Faster service / Less wait time | 14% |
| Billing information (e.g. billing system, charges) | 12% |
| Account issues (e.g. equal billing, new accounts) | 12% |
| Fewer errors (e.g. billing, new accounts) | 8% |
| Meter issues (e.g. meter reading, installation) | 8% |
| More transparency (e.g. better reasons, inaccurate explanations) | 6% |
| Other | 6% |
| Nothing / Satisfied | 35% |
| Don't know / Prefer not to answer | 5% |

Column totals will not sum to 100% as multiple responses were allowed.

## 12.4 Preferred Method of Receiving Information from PNG

All respondents to PNG's 2022 REUS were asked to indicate how they preferred to receive information from PNG on energy efficiency initiatives, community infrastructure investments, safety, and other news. The results, summarized in Table 123, show six-in-ten (62%) respondents prefer to receive information like this by email and one-third (32%) prefer it included with their PNG bill. All other communication channels (e.g., text message, PNG's website, other) were preferred by less than 5% of respondents.

**Table 123: Preferred Method of Receiving Information from PNG (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Email | 64.7 | 61.7 | 58.4 | 62.3 |
| Included with PNG bill | 29.4 | 34.1 | 36.4 | 32.4 |
| Text message | 1.6 | 1.6 | 1.9 | 1.7 |
| PNG Website | 3.9 | 2.1 | 2.7 | 3.2 |
| Other | 0.4 | 0.5 | 0.7 | 0.5 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding

# 13 DEMOGRAPHICS

This section details the demographic and socio-demographic characteristics of respondents to PNG's 2022 REUS and the households they represent.

## 13.1 Survey Respondent Characteristics

### 13.1.1 Respondent Age

Table 124 summarizes the distribution of survey respondents by age cohort. Six-in-ten (63%) respondents to the 2022 REUS were aged 45 years or older. Regionally, respondents from the North East region are proportionately younger, with 42% under the age of 45 years compared to 32% to 33% for respondents in the Western regions.

**Table 124: REUS Respondents by Age Group (%)**

| Age cohort | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| 19 – 24 yrs | 1.1 | 0.9 | 0.7 | 0.9 |
| 25 – 34 yrs | 15.8 | 13.8 | 14.1 | 14.9 |
| 35 – 44 yrs | 25.2 | 18.3 | 17.4 | 21.4 |
| 45 – 54 yrs | 19.1 | 18.4 | 19.0 | 18.9 |
| 55 – 64 yrs | 23.5 | 22.4 | 22.1 | 22.9 |
| 65 yrs and older | 15.3 | 26.3 | 26.7 | 21.0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **44 yrs or younger** | **42.2** | **32.9** | **32.1** | **37.3** |
| **45 yrs or older** | **57.8** | **67.1** | **67.9** | **62.7** |

Totals may not sum due to rounding.

### 13.1.2 Gender

Table 125 summarizes respondents by gender. Women represent 49% of respondents to the 2022 REUS. Males represented 47% of respondents. The remainder either self-described or chose not to answer the question.

**Table 125: REUS Respondents by Gender (%)**

| Gender | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Female | 49.2 | 52.8 | 45.9 | 49.0 |
| Male | 46.4 | 44.3 | 48.5 | 46.6 |
| Self-describe | 0.2 | 0.0 | 0.0 | 0.1 |
| No answer | 4.2 | 2.9 | 5.6 | 4.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

### 13.1.3 Employment Status

Respondents to the 2022 REUS include workers (full-time, part-time, or unemployed), retirees, homemakers, students, and persons on short or long-term disability (Table 126). Overall, seven-in-ten (72%) respondents are employed either full-time or part-time and two-in-ten (22%) are retired. The remainder includes homemakers, those on short or long-term disability, unemployed or attending school (students). Regionally, respondents from the North East are more likely to be employed, and those in the Western regions are more likely to be retired.

**Table 126: Employment Status of Survey Respondents (%)**
**Multiple Responses Allowed**

| Employment status | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Employed full-time | 67.7 | 57.0 | 57.9 | 62.6 |
| Employed part-time | 8.8 | 10.9 | 7.7 | 8.9 |
| Unemployed | 2.3 | 1.3 | 1.6 | 1.9 |
| Retired | 15.3 | 26.5 | 30.5 | 22.1 |
| Homemaker | 6.3 | 4.7 | 2.6 | 4.9 |
| Student | 0.8 | 0.9 | 0.2 | 0.6 |
| Short-term or long-term disability | 3.4 | 4.3 | 2.0 | 3.2 |
| **Employed** | **76.1** | **67.1** | **65.2** | **71.1** |

Columns do not sum to 100% because multiple responses were allowed.

### 13.1.4 Educational Attainment

The distribution of survey respondents by highest level of education attained is provided in Table 127. Regional differences are unremarkable. Overall, 7% of respondents chose not to answer this question.

**Table 127: Respondent Education Status (%)**
**Highest Level of Education Achieved**

| Education | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Some high school | 3.4 | 4.2 | 2.0 | 3.2 |
| Completed high school | 16.4 | 18.4 | 13.4 | 16.0 |
| Some trade / technical school | 6.9 | 4.7 | 8.4 | 6.8 |
| Completed trade / technical school | 19.7 | 15.9 | 17.4 | 18.2 |
| Some university / college | 13.4 | 13.3 | 15.4 | 14.0 |
| Completed university / college | 25.0 | 28.1 | 27.2 | 26.3 |
| Post graduate | 8.0 | 8.6 | 9.3 | 8.5 |
| No response | 7.3 | 6.7 | 6.9 | 7.0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

## 13.2 Household Characteristics

### 13.2.1 Number of Occupants per Dwelling

Table 128 summarizes the average number of occupants per dwelling (including renters). Data are broken out to identify homes with two occupants or less, those with three to five occupants, and those with six or more. 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 10.1, p. 73 for a discussion of this relationship).

**Table 128: Number of Occupants per Dwelling**

| Number of occupants per-dwelling | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Average per home (persons) | 2.7 | 2.7 | 2.6 | 2.7 |
| Standard Deviation (persons) | 1.9 | 1.2 | 1.3 | 1.5 |
| Homes by size: | | | | |
| 2 occupants or less (%) | 55.9 | 56.9 | 59.2 | 57.1 |
| 3 - 5 occupants (%) | 40.4 | 39.2 | 37.5 | 39.3 |
| 6 occupants or more (%) | 3.6 | 3.9 | 3.3 | 3.6 |
| **Total (%)** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

On average, there are 2.7 occupants per dwelling. Somewhat fewer than six-in-ten (57%) dwellings have two occupants or less, 39% have between three and five occupants, and the remaining 4% have six or more occupants. There are no statistically significant differences in the number of occupants per dwelling between the three regions.

The distribution of household occupants by age cohort is provided in Table 129. On average, one-third (35%) of households have children at home (persons 18 years of age or younger) and one-quarter (24%) have a senior (65 years of age or older) in the home. Regionally, the Western regions are more likely than the North East region to have a senior in the home (30% to 31% versus 17% respectively).

**Table 129: Incidence of Household Members by Age Cohort (%)**
**Percent of homes with at least one**

| Age cohort of home occupants | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| 5 years or younger | 14.1 | 13.6 | 13.6 | 13.9 |
| 6 – 12 yrs | 19.3 | 18.7 | 15.9 | 18.2 |
| 13 – 18 yrs | 17.6 | 15.6 | 11.0 | 15.2 |
| 19 – 24 yrs | 9.9 | 12.5 | 10.0 | 10.5 |
| 25 – 44 yrs | 51.2 | 41.7 | 41.8 | 46.4 |
| 45 – 64 yrs | 47.7 | 47.8 | 50.3 | 48.5 |
| 65 yrs and older | 16.8 | 30.7 | 30.2 | 23.7 |
| **Households with children (<19 yrs) %** | **36.3** | **34.3** | **32.5** | **34.7** |
| **Households without children (<19 yrs) %** | **63.7** | **65.7** | **67.5** | **65.3** |

Columns do not sum to 100%

### 13.2.2 Working from Home

All respondents were asked whether anyone in the residence works either part-time or full-time from home. This question is asked as working from home compared to working outside the home tends, everything else held constant, to increase energy use in the home due to increased use of hot water and higher thermostat settings during the day. With the onset of COVID-19, there was an increase in the number of people working from home to minimize transfer of the contagion.

One quarter (25%) of respondents indicated one or more persons in their household either work part-time or full-time from home (Table 130). Of these, 42% indicated that the number of days worked from home by this person / these persons increased during the past two years. In the next two years, seven-in-ten (69%) expect the number of hours worked from home to stay the same, 15% expect the number of hours to decrease and 7% expect the number of hours to increase.

**Table 130: Persons Working from Home (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| One or more persons working from home either part-time or full-time (% yes) | 25.0 | 25.0 | 23.3 | 24.5 |
| Days working from home increased past two years (% yes) | 38.2 | 43.7 | 47.9 | 42.1 |
| Days working from home in the next two years is expected to…[1] | | | | |
| Increase | 7.6 | 5.7 | 7.7 | 7.2 |
| Decrease | 13.0 | 17.8 | 17.6 | 15.3 |
| Stay the same | 69.5 | 68.4 | 66.9 | 68.5 |
| Don't know | 9.9 | 8.0 | 7.7 | 8.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

[1] Base: only households who have one or more persons working from home.

### 13.2.3 Household Income

The distribution of respondents to the 2022 REUS by household income before taxes (2021) is provided in Table 131. The data are useful in providing context to income-driven differences between consumers in behaviours, attitudes, and equipment purchase decisions. While the proportion of respondents who chose to not answer this question is high (28%), data are not rebased to exclude these respondents primarily because there are no apparent reasons why non-responses would be distributed across the income categories with the same relative proportions as responses. Regional comparisons should be made with caution as the proportion choosing not to answer the question varies by region.

**Table 131: Annual Household Income (2021) before Taxes (%)**

| Household income (2021) | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| Less than $20,000 | 1.3 | 1.9 | 1.3 | 1.4 |
| $20,000 to $29,999 | 4.0 | 4.5 | 3.1 | 3.8 |
| $30,000 to $39,999 | 2.9 | 4.3 | 4.3 | 3.6 |
| $40,000 to $49,999 | 4.8 | 4.5 | 4.4 | 4.6 |
| $50,000 to $59,999 | 3.6 | 7.0 | 5.4 | 4.9 |
| $60,000 to $79,999 | 9.9 | 11.1 | 8.2 | 9.7 |
| $80,000 to $99,999 | 13.0 | 8.9 | 10.3 | 11.3 |
| $100,000 to $124,999 | 13.5 | 12.6 | 13.0 | 13.2 |
| $125,000 or more | 18.7 | 18.5 | 20.2 | 19.1 |
| Prefer not to answer | 28.2 | 26.8 | 29.8 | 28.4 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Less than $40,000** | **8.2** | **10.6** | **8.7** | **8.9** |
| **Less than $80,000** | **26.5** | **33.2** | **26.7** | **28.0** |
| **Less than $100,000** | **39.5** | **42.1** | **37.0** | **39.3** |
| **$100,000 or more** | **32.3** | **31.1** | **33.1** | **32.3** |

Totals may not sum due to rounding.

Household incomes by dwelling type are summarized in Table 132. Respondents living in single-family detached dwellings are the most likely to have annual household incomes exceeding $100,000 and the least likely to have incomes below $40,000 a year.

**Table 132: Annual Household Income (2021) before Taxes by Dwelling Type (%)**

| Household income (2021) | Single Family Detached | Semi-Detached | Row / Town-house | Apt / Apt-Style Condo | Mobile & Other |
|---|---|---|---|---|---|
| *Unweighted base* [1] | *1508* | *75* | *57* | *7* | *184* |
| Less than $20,000 | 1.2 | 1.9 | 1.7 | -- | 2.9 |
| $20,000 to $29,999 | 3.7 | 2.6 | 8.7 | 10.9 | 3.8 |
| $30,000 to $39,999 | 3.3 | 5.3 | 8.2 | -- | 3.8 |
| $40,000 to $49,999 | 4.1 | 4.2 | 5.1 | -- | 8.5 |
| $50,000 to $59,999 | 4.2 | 9.9 | 9.5 | -- | 6.4 |
| $60,000 to $79,999 | 8.8 | 19.1 | 6.3 | 52.7 | 12.2 |
| $80,000 to $99,999 | 11.5 | 7.9 | 18.2 | 10.9 | 9.5 |
| $100,000 to $124,999 | 13.3 | 16.4 | 17.7 | -- | 9.7 |
| $125,000 or more | 22.3 | 9.2 | 1.4 | -- | 5.0 |
| Prefer not to answer | 27.7 | 23.4 | 23.2 | 25.5 | 38.2 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| **Less than $40,000** | **8.2** | **9.8** | **18.6** | **10.9** | **10.5** |
| **Less than $80,000** | **25.3** | **43.0** | **39.5** | **63.6** | **37.6** |
| **Less than $100,000** | **36.8** | **50.9** | **57.7** | **74.5** | **47.1** |
| **$100,000 or more** | **35.6** | **25.7** | **19.1** | **--** | **14.7** |

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

To better understand the financial situation (financial stress level) of respondents participating in the 2022 REUS, each were asked to indicate which of the following three statements best describes the state of their household's finances:

- We watch our pennies closely because we need to
- We are comfortable but need to watch how much we spend
- We are comfortable and don't worry too much about how much things cost

Respondents could choose to not answer this question or to indicate that none of the statements applied to their household. Those in financial stress, everything else held constant, are less likely to opt into energy efficiency programs or to pay for extra services such as biomethane.

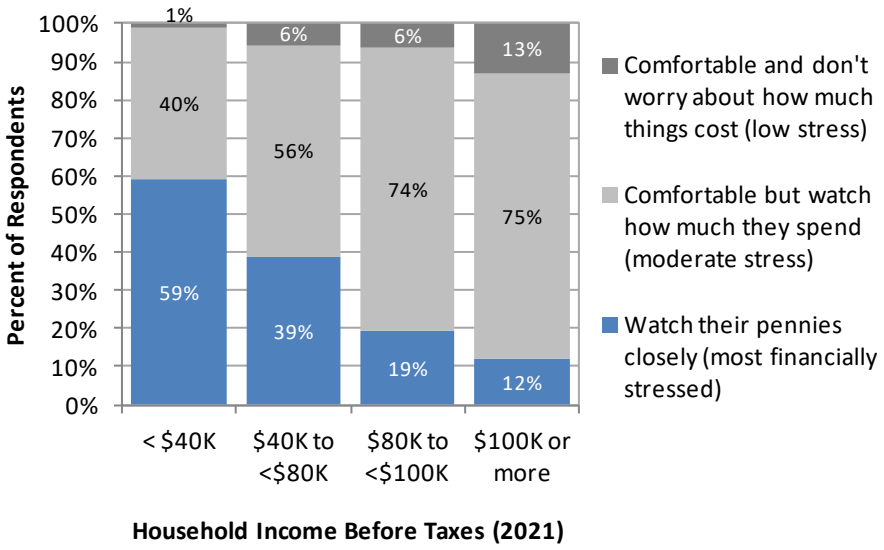
The results, summarized in Table 133, indicate that 22% closely watch what they spend (highest level of household financial stress) and 56% consider their financial situation to be comfortable but they still need to watch how much they spend (moderate stress). Seven percent (7%) indicated they are comfortable and don't worry too much about how much things cost (least financially stressed). Regionally, the proportion of respondents indicating they are the most financially stressed is highest in the North East (25%).

**Table 133: Household Financial Status (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| We watch our pennies closely because we need to | 25.4 | 20.4 | 16.2 | 21.6 |
| We are comfortable but need to watch how much we spend | 52.9 | 59.5 | 58.5 | 55.9 |
| We are comfortable and don't worry too much about how much things cost | 5.5 | 7.0 | 7.7 | 6.5 |
| None of the above | 1.1 | 1.2 | 2.5 | 1.5 |
| Prefer not to answer | 15.1 | 11.9 | 15.1 | 14.4 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Cross-tabulating these data against household income shows that financial stress levels are generally, by not exclusively, lower for households with higher incomes (Figure 3). For example, six-in-ten (59%) households with household incomes of less than $40,000 per year watch their pennies (i.e., are the most financially stressed) compared to only 12% of households with annual incomes of $100,000 or more. For those with incomes between $40,000 and $80,000, 39% feel the most financially stressed and this share declines to 19% for households whose annual household income is between $80,000 and $100,000. Of note, three-quarters (75%) of households with annual household incomes of $100,000 or more indicated that while they are financially comfortable, they still watch how much they spend. Clearly, factors other than income influence the level of financial stress felt by households.

**Figure 3: Household Income vs. Financial Stress**




### 13.2.4 Languages Spoken in the Home

Respondents 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 134).

**Table 134: Main Language Spoken in the Home (%)**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| English | 97.1 | 98.1 | 98.0 | 97.6 |
| French | 0.2 | 0.7 | 0.3 | 0.3 |
| German | 0.2 | 0.3 | 0.2 | 0.2 |
| Mandarin | 0.2 | -- | -- | 0.1 |
| Cantonese | -- | -- | 0.2 | <0.1 |
| Hindi | 0.2 | -- | 0.2 | 0.1 |
| Punjabi | 0.4 | 0.3 | 0.3 | 0.3 |
| Tagalog | 0.8 | 0.3 | 0.3 | 0.5 |
| Other | 1.0 | 0.1 | 0.3 | 0.6 |
| Don't know / Prefer not to answer | -- | 0.1 | 0.2 | 0.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Totals may not sum due to rounding.

Other languages spoken in the home are listed in Table 135. All responses are expressed as a percent of the base of all REUS respondents and may include multiple responses (i.e., two or more “other” languages spoken in the home).

**Table 135: All Other Languages Spoken in the Home (%)**
**Multiple Responses Allowed**

| | North East | West (East) | West (West) | 2022 PNG |
|---|---|---|---|---|
| *Unweighted base* | *524* | *697* | *610* | *1,831* |
| French | 5.2 | 5.7 | 7.5 | 6.0 |
| German | 2.1 | 3.2 | 2.1 | 2.3 |
| English | 2.1 | 1.6 | 1.6 | 1.9 |
| Other | 1.3 | 0.7 | 1.3 | 1.2 |
| Tagalog | 1.0 | 0.7 | 0.7 | 0.8 |
| Spanish | 0.2 | 1.1 | 0.8 | 0.6 |
| Portuguese | -- | 0.1 | 1.8 | 0.6 |
| Mandarin | 0.2 | 0.1 | 0.5 | 0.3 |
| Japanese | 0.4 | 0.1 | 0.2 | 0.3 |
| Other | 1.7 | 2.7 | 3.1 | 2.3 |

Totals will not sum to 100 as multiple responses were allowed

# 14 CONDITIONAL DEMAND ANALYSIS

This section summarizes the results of a Conditional Demand Analysis (CDA) applied to data from respondents who participated in PNG's 2022 REUS. CDA is a multivariate regression technique which combines utility billing data, weather information, and customer-specific data to estimate Unit Energy Consumption (UEC) values for major residential gas end-uses including space heating, domestic hot water heating, cooking, and fireplaces. The UEC for an end-use is defined as the quantity of energy consumed by that end-use in a given period of time. Unless stated otherwise, a UEC for an end-use is calculated based on the mix of equipment types and equipment efficiencies present in the population (e.g., the UEC for gas space heating is calculated from the base of furnaces, boilers and other gas space heating equipment in use by residential customers). Information on end-use gas consumption is used for utility planning, forecasting, marketing, and demand-side management.

A detailed presentation of the methodology, equation specifications, and equation results for the CDA are included in Appendix B.

## 14.1 Research Objectives

The objectives of the analysis were to:

- Estimate weather-normalized UEC values for major residential gas end-uses, including space heating, fireplaces, domestic water heating, cooking, as well as other specific uses.
- Estimate UEC values for each of the following regions: North East; West (East); and West (West).
- Disaggregate UECs for key end-uses by the following dwelling types: single-family detached dwellings; multi-family attached dwellings (duplexes and row/townhouses); apartments and condominiums; and mobile and manufactured homes.

The following gas end-uses were modelled:

- Primary space heating
- Secondary space heating (excluding fireplaces)
- Decorative fireplaces
- Heater type fireplaces
- Free standing fireplaces and heater stoves
- Domestic water heating
- Cooking (gas ranges, dual fuel ranges, cooktops, wall ovens)
- Barbeques (piped gas)
- Outdoor heaters (piped gas)
- Clothes dryers

An attempt was made to model gas outdoor fire pits and fireplaces (piped gas), gas heated swimming pools, and gas heated hot tubs. These end-uses were not retained in the conditional demand analysis because they produced unreasonable results, likely due to the small number of households possessing the end-uses.

Unless stated otherwise, a UEC for an end-use is calculated based on the mix of equipment types, equipment vintages, and equipment efficiencies present in the residential customer base (e.g., the UEC for gas space heating is based on the mix of furnaces, boilers and other gas space heating equipment used for space heating by residential customers).

## 14.2 Data and Sample

The sample used for the CDA consisted of households in PNG's 2022 Residential End-Use Study. The REUS survey data from these customers was used in combination with two years' worth of monthly gas consumption data for each customer, and weather data for the same period. The two-year period was from May 2020 to April 2022.

### 14.2.1 Sample Used for the CDA

For the purpose of the CDA, five customers who reported living in "other" dwelling types (e.g., basement suites or shops, as indicated in the survey) were excluded. As well, 44 customers with zero gas consumption in November, December, January, or February were excluded from the estimation of the conditional demand model. The resulting sample contained a total of 1,782 customers (Table 136).

**Table 136: Sample Used in Conditional Demand Analysis**

| Dwelling Type | North East | West (East) | West (West) | Overall |
|---|---|---|---|---|
| Single Family Detached | 407 | 568 | 499 | 1474 |
| Multi-Family Dwelling [1] | 52 | 28 | 47 | 127 |
| Apartment/Condominium | 1 | 4 | 1 | 6 |
| Mobile/Manufactured Home | 54 | 69 | 52 | 175 |
| **Total** | **514** | **669** | **599** | **1,782** |

[1] Includes duplexes, triplexes, townhouses and row houses.

## 14.3 Weather Data

Monthly weather data (heating degree days or HDDs) were obtained for seven representative weather stations and then assigned to customers in the sample based on their location (Table 137).[11] Degree days were calculated as the difference between the average daily temperature and a balance point temperature of 18° Celsius.

[11] Source: Weather Data Depot (www.weatherdatadepot.com).

**Table 137: Representative Weather Stations**

| Region | Customer Location | Weather Station |
|---|---|---|
| North East | Fort St. John, Baldonnel, Cecil Lake, Charlie Lake, Montney, North Pine, Rose Prairie, Taylor, Other | Fort St. John (YXJ) |
| | Dawson Creek, Pouce Coupe, Tumbler Ridge | Dawson Creek (YDQ) |
| West (East) | Smithers, Telkwa, Granisle, Houston, Decker Lake, Burns Lake | Smithers (YYD) |
| | Fort St. James, Fraser Lake, Fort Fraser, Vanderhoof | Prince George (YXS) |
| West (West) | Terrace, Thornhill | Terrace (YXT) |
| | Prince Rupert, Port Edward | Prince Rupert (YPR) |
| | Kitimat | Kitimat (CWKI) |

## 14.4 Overall Analysis

The conditional demand model was estimated using ordinary least squares. The regression model performed well. The adjusted R-squared value was high (0.83) and most of the regression coefficients had the correct signs 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 Unit Energy Consumption (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 heating degree days were substituted to generate weather-normalized UECs for space heating, fireplaces, and water heating.[12] Weighted average UECs were then calculated across all households possessing the end-use (weighted by region).

An overall conditional demand model was constructed to estimate UECs for PNG's service area. The weather-normalized, weighted UECs are shown in Table 138. As expected, the main end-uses are primary space heating at 76.9 GJ per year and water heating at 16.6 GJ per year. Secondary gas space heating (excluding fireplaces) is also a heavy user of natural gas (30.8 GJ per year), but it has a low penetration rate compared to other major end-uses.

Other key end-uses are decorative fireplaces (10.6 GJ per year), heater type fireplaces (9.8 GJ per year), and gas cooking appliances (6.9 GJ per year). The UEC estimates for decorative and heater type fireplaces are similar despite heater fireplaces being used more often on average (greater hours of use). This is likely due to differences in efficiency levels.

Free standing fireplaces and heater stoves, piped gas barbeques, piped gas outdoor heaters, and gas dryers are less significant users of natural gas (UECs less than 5 GJ per year). Due to low penetration rates, the UEC estimates for these end-uses should be interpreted with some caution.

[12] Normal heating degree days were calculated for each month using ten-year averages (September 2012 to August 2022).

**Table 138: Penetration Rates and Unit Energy Consumption by End-use – Overall Service Area**

| | | | | Avg. Consumption per Household | |
|---|---|---|---|---|---|
| Gas End-Use | Sample Size (unweighted) | Penetration (% presence) | Unit Energy Consumption (GJ/year) | GJ/Year | % Dist |
| Primary Space Heating | 1,631 | 93% | 76.9 | 71.8 | 81% |
| Secondary Space Heating | 71 | 3% | 30.8 | 1.0 | 1% |
| Decorative Fireplaces | 96 | 5% | 10.6 | 0.6 | 1% |
| Heater Type Fireplaces | 284 | 15% | 9.8 | 1.5 | 2% |
| Free Standing Fireplaces and Heater Stoves | 76 | 4% | 4.6 | 0.2 | <1% |
| Domestic Water Heating | 1,140 | 68% | 16.6 | 11.2 | 13% |
| Cooking | 425 | 23% | 6.9 | 1.6 | 2% |
| Barbeques | 94 | 6% | 4.6 | 0.3 | <1% |
| Outdoor Heaters | 35 | 2% | 3.0 | 0.1 | <1% |
| Dryers | 79 | 5% | 4.1 | 0.2 | <1% |
| **Household Consumption** | | | | | |
| **Estimated** | | | | **88.3** | |
| **Actual** | | | | **87.0** | |

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 average consumption for a household in PNG's service area. The weather-normalized, weighted HEC was estimated to be 88.3 GJ per year. In comparison, the actual weighted consumption for the sample was 87.0 GJ per year. The main reason why the weather normalized estimate of HEC is higher than the actual HEC is because the number of heating degree days over the two-year period used for the CDA is, on average, lower than the number of HDDs in the long-term average (i.e., the weather was warmer, on average, over the two year analysis period compared to the 10 year average) (Table 139).

**Table 139: Comparison of Actual and Normal Heating Degree Days**

| Month | Actual HDDs [1] | Normal HDDs [2] |
|---|---|---|
| January | 736 | 787 |
| February | 707 | 725 |
| March | 555 | 632 |
| April | 445 | 427 |
| May | 243 | 230 |
| June | 128 | 126 |
| July | 72 | 71 |
| August | 107 | 86 |
| September | 199 | 216 |
| October | 449 | 441 |
| November | 593 | 658 |
| December | 816 | 844 |
| **Average** | **421** | **437** |

[1] Monthly averages, calculated over the two-year period used for the CDA (weighted by region).
[2] Ten-year averages (weighted by region).

One of the objectives of the analysis was to model the influence of gas furnaces and boilers on primary space heating demand. Exogenous variables were incorporated into the conditional demand model to estimate these effects. Approximately 86% of the households in the CDA sample reported using a gas furnace as their main heating source (Table 140). Among these customers, the weather-normalized, weighted UEC for primary space heating was 73.8 GJ per year. Actual weighted consumption per household was 87.4 GJ per year.

**Table 140: Penetration Rates and Unit Energy Consumption for Select Space Heating Equipment**

| Gas End-Use | Sample Size (unweighted) | Penetration (% presence) | Unit Energy Consumption (GJ/year) |
|---|---|---|---|
| Gas Furnace | 1,495 | 86% | 73.8 |
| Gas Boiler | 40 | 2% | 109.7 |
| Gas Combination Boiler | 47 | 3% | 124.5 |

Only 2% of the sample reported using a gas boiler as their main heating source. Among these customers, the UEC estimate for primary space heating was 109.7 GJ per year. Actual weighted consumption per household was 126.3 GJ per year.

Finally, 3% of the sample reported using a combination (combi) gas boiler that provides both space heating and domestic hot water. Among these customers, the UEC estimate for primary space heating was 124.5 GJ per year. The actual weighted consumption per household was 145.4 GJ per year. Respondents with combination systems as the main heating source tended to reside in larger homes and are located in regions with colder climates. Due to low penetration rates for boilers and combination boilers, caution should be exercised in interpreting their results.

## 14.5 Regional Analysis

As part of the study, the feasibility of developing individual conditional demand models for each of the three PNG regions (North East, West (East), West (West)) as well as the combined West (East/West) region, were explored. However, sample size limitations, combined with low penetration rates for many of the end-uses, led to large variation and uncertainty in the UEC estimates derived from the regional models. To ensure more stable and robust results, it was decided to revert to the conditional demand model constructed at the utility level to estimate UECs for each region. With this approach, the overall model was able to capture some regional variation for key end-uses, such as space and water heating, but assumed constant UEC specifications for other end-uses.

The results presented and discussed in the next sub-sections should be interpreted with caution because of the low penetration rates, and resulting small sample sizes, for many of the end-uses. As well, applying the overall model to an individual region may produce misleading results because the overall model parameters are affected by the other regions.

### 14.5.1 North East

Table 141 shows the weather-normalized UECs for the North East region. The weather-normalized average annual energy consumption per household (HEC) was estimated to be 104.6 GJ per year. In comparison, the actual average consumption for the sample was 103.1 GJ per year. Like the overall service area, normal heating degree days are, on average, greater than actual heating degree days in the North East region, which helps to explain why the weather-normalized estimate of household consumption is greater than the actual value.

**Table 141: Penetration Rates and Unit Energy Consumption by End-Use – North East**

| | | | | Avg. Consumption per Household | |
|---|---|---|---|---|---|
| Gas End-Use | Sample Size (unweighted) | Penetration (% presence) | Unit Energy Consumption (GJ/year) | GJ/Year | % Dist |
| Primary Space Heating | 499 | 97% | 89.7 | 87.2 | 83% |
| Secondary Space Heating | 7 | 1% | 38.9* | 0.5* | 1% |
| Decorative Fireplaces | 26 | 5% | 11.4* | 0.6* | 1% |
| Heater Type Fireplaces | 74 | 14% | 10.6 | 1.5 | 1% |
| Free Standing Fireplaces and Heater Stoves | 8 | 2% | 5.7* | 0.1* | <1% |
| Domestic Water Heating | 387 | 75% | 16.6 | 12.5 | 12% |
| Cooking | 111 | 22% | 7.0 | 1.5 | 1% |
| Barbeques | 34 | 7% | 4.8 | 0.3 | <1% |
| Outdoor Heaters | 10 | 2% | 3.0* | 0.1* | <1% |
| Dryers | 29 | 6% | 4.1* | 0.2* | <1% |
| **Household Consumption** | | | | | |
| **Estimated** | | | | **104.6** | |
| **Actual** | | | | **103.1** | |

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.

### 14.5.2 West (East)

Table 142 shows the weather-normalized UECs for the West (East) region. The weather-normalized average annual energy consumption per household (HEC) was estimated to be 81.8 GJ per year. In comparison, the actual average consumption for the sample was 70.5 GJ per year. In the West (East) region, there is little difference, on average, between actual and normal heating degree days over the two-year period used for the CDA. Given that estimated total household consumption is significantly greater than actual levels, it is likely that some of the estimated UECs are overestimated for this region (specifically, space heating). Results should be interpreted with caution.

**Table 142: Penetration Rates and Unit Energy Consumption by End-Use – West (East)**

| | | | | Avg. Consumption per Household | |
|---|---|---|---|---|---|
| Gas End-Use | Sample Size (unweighted) | Penetration (% presence) | Unit Energy Consumption (GJ/year) | GJ/Year | % Dist |
| Primary Space Heating | 594 | 89% | 73.2 | 65.1 | 80% |
| Secondary Space Heating | 39 | 6% | 30.8 | 1.8 | 2% |
| Decorative Fireplaces | 37 | 6% | 11.0 | 0.6 | 1% |
| Heater Type Fireplaces | 111 | 17% | 9.7 | 1.6 | 2% |
| Free Standing Fireplaces and Heater Stoves | 31 | 5% | 5.3 | 0.2 | <1% |
| Domestic Water Heating | 380 | 57% | 17.9 | 10.2 | 12% |
| Cooking | 182 | 27% | 7.0 | 1.9 | 2% |
| Barbeques | 32 | 5% | 4.3 | 0.2 | <1% |
| Outdoor Heaters | 13 | 2% | 3.0* | 0.1* | <1% |
| Dryers | 18 | 3% | 4.1* | 0.1* | <1% |
| **Household Consumption** | | | | | |
| **Estimated** | | | | **81.8** | |
| **Actual** | | | | **70.5** | |

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.

### 14.5.3 West (West)

Table 143 shows the weather-normalized UECs for the West (West) region. The weather-normalized average annual energy consumption per household (HEC) was estimated to be 68.0 GJ per year. In comparison, the actual average consumption for the sample was 71.4 GJ per year. In contrast to the North East region and the overall service area, normal heating degree days are, on average, less than actual heating degree days for the West (West) region, which helps to explain why the weather-normalized estimate of household consumption is less than the actual value.

**Table 143: Penetration Rates and Unit Energy Consumption by End-Use – West (West)**

| | | | | Avg. Consumption per Household | |
|---|---|---|---|---|---|
| Gas End-Use | Sample Size (unweighted) | Penetration (% presence) | Unit Energy Consumption (GJ/year) | GJ/Year | % Dist |
| Primary Space Heating | 538 | 90% | 58.7 | 52.9 | 78% |
| Secondary Space Heating | 25 | 4% | 26.8* | 1.1* | 2% |
| Decorative Fireplaces | 33 | 6% | 9.2 | 0.5 | 1% |
| Heater Type Fireplaces | 99 | 17% | 8.7 | 1.4 | 2% |
| Free Standing Fireplaces and Heater Stoves | 37 | 6% | 3.9 | 0.2 | <1% |
| Domestic Water Heating | 373 | 62% | 15.8 | 9.8 | 14% |
| Cooking | 132 | 22% | 6.8 | 1.5 | 2% |
| Barbeques | 28 | 5% | 4.5* | 0.2* | <1% |
| Outdoor Heaters | 12 | 2% | 3.0* | 0.1* | <1% |
| Dryers | 32 | 5% | 4.1 | 0.2 | <1% |
| **Household Consumption** | | | | | |
| **Estimated** | | | | **68.0** | |
| **Actual** | | | | **71.4** | |

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.

### 14.5.4 West (Overall)

Table 144 shows the weather-normalized UECs for the combined West (East/West) region. The weather-normalized average annual energy consumption per household (HEC) was estimated to be 73.7 GJ per year. In comparison, the actual average consumption for the sample was 71.0 GJ per year.

**Table 144: Penetration Rates and Unit Energy Consumption by End-use – West (Overall)**

| | | | | Avg. Consumption per Household | |
|---|---|---|---|---|---|
| Gas End-Use | Sample Size (unweighted) | Penetration (% presence) | Unit Energy Consumption (GJ/year) | GJ/Year | % Dist |
| Primary Space Heating | 1,132 | 90% | 64.7 | 58.0 | 79% |
| Secondary Space Heating | 64 | 5% | 28.7 | 1.4 | 2% |
| Decorative Fireplaces | 70 | 6% | 9.9 | 0.5 | 1% |
| Heater Type Fireplaces | 210 | 17% | 9.1 | 1.5 | 2% |
| Free Standing Fireplaces and Heater Stoves | 68 | 6% | 4.4 | 0.2 | <1% |
| Domestic Water Heating | 753 | 60% | 16.6 | 10.0 | 14% |
| Cooking | 314 | 24% | 6.9 | 1.7 | 2% |
| Barbeques | 60 | 5% | 4.4 | 0.2 | <1% |
| Outdoor Heaters | 25 | 2% | 3.0* | 0.1* | <1% |
| Dryers | 50 | 4% | 4.1 | 0.2 | <1% |
| **Household Consumption** | | | | | |
| **Estimated** | | | | **73.7** | |
| **Actual** | | | | **71.0** | |

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.

## 14.6 UECs by Dwelling Type

Exogenous variables were incorporated into the CDA model for primary space heating and domestic water heating to disaggregate by the following dwelling types: single-family detached dwellings; multi-family attached dwellings (duplexes, triplexes, townhouses and row houses); apartments and condominiums; and mobile and manufactured homes.

Note that meaningful UEC estimates could not be produced for apartments/condominiums due to the small number of households residing in this dwelling type (n=6 in the CDA sample).

### 14.6.1 Primary Gas Space Heating

Table 145 shows estimated weather-normalized UECs for primary gas space heating by geographic region and dwelling type.

**Table 145: Primary Gas Space Heating UECs by Region and Dwelling Type (GJ/year)**

| | North East | West (East) | West (West) | Overall (weighted) |
|---|---|---|---|---|
| Single Family Detached | 93.6 | 75.6 | 60.9 | 79.7 |
| Multi-Family Dwelling | 59.7 | 50.3* | 42.0 | 53.1 |
| Apartment/Condominium | ** | ** | ** | ** |
| Mobile/Manufactured Home | 77.6 | 58.8 | 47.6 | 66.1 |
| **Overall** | **89.7** | **73.2** | **58.7** | **76.9** |

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.
** Insufficient sample to produce meaningful estimates.

### 14.6.2 Gas Water Heating

Table 146 shows estimated weather-normalized UECs for gas water heating by region and dwelling type. Of note, the estimated UEC for gas water heating in multi-family dwellings is significantly lower in the North East region than in the other regions. This is largely caused by the effect of the more efficient on-demand (tankless) water heater variable in the conditional demand model. In the North East region, 27% of households residing in multi-family dwellings reported using an on-demand water heater, compared to only 4% in the West (East) region and 8% in the West (West) region. This result should be interpreted with caution due to the small sample sizes involved.

**Table 146: Domestic Water Heating UECs (GJ/year)**

| | North East | West (East) | West (West) | Overall (weighted) |
|---|---|---|---|---|
| Single Family Detached | 17.8 | 18.4 | 16.2 | 17.4 |
| Multi-Family Dwelling | 8.2 | 16.2* | 13.5 | 10.3 |
| Apartment/Condominium | ** | ** | ** | ** |
| Mobile/Manufactured Home | 10.7* | 10.6* | 9.3* | 10.4 |
| **Overall** | **16.6** | **17.9** | **15.8** | **16.6** |

* Small sample size (less than 30 households with end-use present). These results should be interpreted with caution.
** Insufficient sample to produce meaningful estimates.

## 14.7 Conclusions

This section summarized the methodology and results of a Conditional Demand Analysis (CDA) used to estimate UEC values for major residential end-uses in PNG's service area. The study found considerable variation in UECs across end-uses. It also revealed that gas consumption for space heating and, to a lesser extent, water heating, varied by geographic region and dwelling type. These results provide valuable information on end-use consumption which can be used for utility planning, forecasting, marketing, and demand-side management.

## 14.8 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., primary space heating) may mask the effects of other modelled end-uses and/or capture the effects of non-modelled end-uses.

2. The effects of low-penetration end-uses (e.g., outdoor gas heaters or gas dryers) are difficult to estimate because of small sample sizes.
3. The effects of certain end-uses (e.g., gas cooking appliances and barbeques) may be confounded because of a high correlation of ownership.
4. Unit energy consumption values could not be estimated for apartments/condominiums due to small sample sizes.
5. Some information collected through the self-reported customer survey may be unreliable.
6. The rich model specifications originally developed for some end-uses had to be simplified because of unreasonable regression results.
7. Use of the conditional demand model constructed at the utility level to estimate UECs for an individual region may produce misleading results because the model parameters are affected by the other regions.

# 15 REFERENCES

Natural Resources Canada (2012), *Keeping the Heat In*, Cat. No. M144-41/2012E-PDF. Retrieved from: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/canmetenergy/pdf/housing/KeepingtheHeatIn.pdf.

Province of British Columbia, Energy Efficiency Act of British Columbia, Energy Efficiency Standards Regulation, B.C. Reg. 389/93.

# Appendix A

2022 REUS Questionnaire

**SERVICE ADDRESS:**

**SURVEY ID NUMBER:**

*Use this number to complete the online version of the survey and double chances*

Dear Customer,

At Pacific Northern Gas, we are 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 residence has been randomly selected to complete the accompanying survey. This survey is an important tool for understanding how energy is used in homes; the types of space and water heating appliances installed; how those appliances are used; the energy efficiency of homes; and attitudes about energy issues. This information is very important for:

- forecasting future demand for natural gas
- designing energy efficiency programs to help you save money on your energy bills
- protecting the environment by lowering greenhouse gas emissions

Complete and return your survey by July 27, 2022 and you will have a chance to win one of:

**Four GRAND PRIZES of a $1,000 prepaid VISA gift card**

**DOUBLE** your chances of winning one of the grand prizes by completing the survey online at: www.api.legerweb.com/PNG2022. Enter the **SURVEY ID** located at the top of this page when prompted.

Complete and return your survey by July 8, 2022 for the chance to win the **EARLY-BIRD PRIZE** of a **$500 prepaid VISA gift card** in addition to your chance at winning one of the four grand prizes.

Full contest rules can be found at the back of this survey or online at www.api.legerweb.com/PNG2022_CONTESTRULES.

If you have any questions about the survey, please contact Al Kleinschmidt at **604-691-5688** or **akleinschmidt@png.ca**. Should you encounter any technical difficulties in completing the survey, please contact Hani with Leger at **604-424-1017** or by email at **hnguyen@leger360.com**.

Yours truly,

Al Kleinschmidt
Manager, Energy Solutions
Pacific Northern Gas Ltd.

**Privacy**

The survey will tell us how you use energy in your home. To meet the goals of this survey, Pacific Northern Gas will also analyze how much natural gas your home has used over the past two years.*

To protect your privacy, Leger Research, the market research company that is conducting this survey on behalf of Pacific Northern Gas, will not have access to your account information. As well, Pacific Northern Gas 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.

** By participating in this survey, I agree that Pacific Northern Gas may use the consumption information for my home for the past two years.*

## HOW TO COMPLETE THIS PAPER SURVEY

This survey should be completed by the person most responsible for the maintenance and repair of your home. Also please ensure that the survey responses refer to the residence located at the address shown on the cover page.

1. You can complete the enclosed survey and return it in the postage paid envelope provided; or
2. You can complete the survey online at: **https://api.legerweb.com/PNG2022** by entering the **SURVEY ID** located on the front page of this survey. Completing it online doubles your chances at winning one of the four grand prizes of a $1,000 pre-paid VISA gift card.

Some questions require you to place an "X" in the appropriate box, for example:

Do you rent or own this residence? Rent ☒ Own ☐

Some questions require you to fill in a number, for example: " *23* " years

Some questions allow you to check several answers. These questions will have the instruction "check all that apply."

**The deadline for completing your survey is July 27, 2022**.

If you have mislaid the return envelope, please mail the questionnaire to:

Leger
c/o 1223 Dogwood Crescent
North Vancouver, BC
V7P 1H1

**Dear Participant:**

Throughout this questionnaire, when we ask about your home or residence, we are referring to the property located at the SERVICE ADDRESS printed on the front page of this survey**.**

## A. About This Residence

**A1. Which of the following best describes your relationship to the property at the SERVICE ADDRESS located on the front page of this questionnaire?**

- ☐ 1 I own this property and live in it – either part-time or full-time
- ☐ 2 I own this property, live in it, but also rent part of it to others
- ☐ 3 I own this property and use it primarily as a vacation property
- ☐ 4 I own this property but rent it out to others
- ☐ 5 I am a renter who lives at this property

**A2. Is this residence a…**

- ☐ 1 Single family detached dwelling
- ☐ 2 Duplex
- ☐ 3 Row/townhouse (3 or more units attached, each with separate entrance)
- ☐ 4 Apartment / Condominium
- ☐ 5 Mobile or manufactured home
- ☐ 6 Other (please specify): _____

**A3. 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

**A4. Who pays the natural gas bill for this residence?**

- ☐ 1 Owner
- ☐ 2 Renter
- ☐ 3 Property manager
- ☐ 4 Someone else

**A5. Does the natural gas bill for this residence cover any of the following, and if so, how many:**

| | Yes | No | Don't Know | Number |
|---|---|---|---|---|
| Secondary suite(s) | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 1 ☐ 2 ☐ 3 ☐ 4+ |
| Attached garage / workshop | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 1 ☐ 2 ☐ 3 ☐ 4+ |
| Detached garage / workshop | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 1 ☐ 2 ☐ 3 ☐ 4+ |
| Other buildings (e.g., sheds, farm buildings) | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 1 ☐ 2 ☐ 3 ☐ 4+ |

**A6. How many stories of heated living space does this residence have? (include basement if heated)**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+

**A7. 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

**A8. How many weeks per year is this residence occupied?**

_____ weeks ☐ 1 Always occupied

**A9. How many years have you lived in this residence?**

_____ years

**A10. What are the heights of the ceilings in this residence, excluding the basement? Please indicate the percentage of the residence with each ceiling height. Choose the closest height. Your answers should sum to 100%.**

| | |
|---|---|
| 8 feet | _____ |
| 9 feet | _____ |
| 10 feet | _____ |
| More than 10 feet | _____ |
| **TOTAL** | **100%** |

**A11. What type of basement does your residence have?**

☐ 1 Full basement
☐ 2 Partial basement
☐ 3 Crawl space → **GO TO QUESTION A13**
☐ 4 No basement → **GO TO QUESTION A14**

**A12. Is the basement area of this residence unfinished, partly finished, or completely finished?**

☐ 1 Unfinished ☐ 2 Partly finished ☐ 3 Completely finished

**A13. During the heating season, is your basement or crawl space usually heated?**

☐ 1 Yes ☐ 2 No

**A14. Please indicate which areas of this residence have insulation and whether that insulation has been upgraded.**

| Location | Has insulation? Yes | No | Don't Know | Not Applic-able | Insulation has been improved or upgraded? |
|---|---|---|---|---|---|
| In the attic | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 99 | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| In the exterior walls | ☐ 1 | ☐ 2 | ☐ 9 | | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| In the basement | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 99 | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| In the crawl space | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 99 | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| In garages/workshops heated using natural gas | ☐ 1 | ☐ 2 | ☐ 9 | ☐ 99 | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |

**A15. Which of the following best describes the draftiness of this residence?**

☐ 1 Excellent – home is not at all drafty
☐ 2 Good – home is sometimes drafty
☐ 3 Poor – home is always drafty

**A16. Please estimate what percentage of your windows are:**

| | % of Total Windows | ENERGY STAR Rated? |
|---|---|---|
| Single pane regular (clear) glass | _____% | |
| Double pane regular (clear) glass | _____% | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| Double pane low-E* | _____% | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| Triple pane regular (clear) glass | _____% | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| Triple pane low-E* | _____% | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| Other – Specify: _____ | _____% | ☐ 1 Yes ☐ 2 No ☐ 9 Don't know |
| | **Total 100%** | |

** Low-E coated glass has a slight shading or tint when compared to standard windows.*

**A17. Please estimate the percentage of your windows that have the following frames:**

| | % of Total Windows |
|---|---|
| Aluminum frames | _____% |
| Wood frames | _____% |
| Vinyl frames | _____% |
| Fiberglass frames | _____% |
| Other (please specify): _____ | _____% |
| Total | 100% |

**A18. 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

**A19. 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 | ____ 1 | Glass doors with wooden frames | ____ 4 |
| Wood doors with aluminum storm doors | ____ 2 | Glass doors with aluminum frames | ____ 5 |
| Insulated steel or fibreglass doors | ____ 3 | Glass doors with vinyl or fibreglass frames | ____ 6 |

**A20. Have any of the exterior 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

## B. Space Heating

**B1. Please indicate the MAIN fuel used to heat this residence (check one only) and then any OTHER fuel(s) used to supplement this residence's heating (check all that apply). As an example, if you primarily heat your home using a natural gas furnace but also occasionally use a wood stove, check natural gas as your MAIN fuel and wood as an OTHER fuel.**

| | MAIN Fuel *(check one only)* | OTHER 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 | ☐ 7 | ☐ 7 |
| Don't know | ☐ 9 | ☐ 9 |

**B2. Have you changed from one MAIN fuel to another to heat this residence over the past 5 years (e.g., from oil to natural gas, from natural gas to electricity, etc.)?**

Yes ☐ 1 → **CONTINUE**
No ☐ 2 → **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
☐ 7 Other
☐ 98 Don't know

**UNLESS OTHERWISE STATED, ANY REFERENCES TO "GAS" FROM THIS POINT FORWARD IN THE SURVEY REFER TO NATURAL GAS OR PIPED PROPANE**

**B4. Which of the following does this residence have?**

- ☐ 1 Gas boiler or combi boiler → **GO TO QUESTION B5**
- ☐ 2 Gas furnace → **GO TO QUESTION B7**
- ☐ 3 Multi-fuel furnace → **GO TO QUESTION B8**
- ☐ 4 Electric furnace → **GO TO QUESTION B11**
- ☐ 9 None of the above → **GO TO QUESTION B11**

**B5. GAS BOILERS ONLY: Is this boiler a combination (combi) boiler that provides both space heating and domestic hot water?**

- ☐ 1 Yes → **GO TO QUESTION B9**
- ☐ 2 No → **CONTINUE**
- ☐ 98 Don't know → **CONTINUE**

**B6. 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% efficient
- ☐ 2 Mid-efficiency – 80% to 85% efficient
- ☐ 3 High efficiency – 90% efficient or higher
- ☐ 98 Don't know

→ **GO TO QUESTION B9**

**B7. 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 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
- ☐ 2 Mid-efficiency – 78% to 85% efficient
- ☐ 3 High efficiency – 90% efficient or higher
- ☐ 98 Don't know

→ **GO TO QUESTION B9**

**B8. MULTI-FUEL FURNACES ONLY: Please indicate the MAIN fuel used by your multi-fuel furnace (check one) and the OTHER fuel(s) that can be used (check all that apply).**

| | MAIN Fuel *(check one only)* | OTHER Fuel(s) *(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 |
| Coal | ☐ 7 | ☐ 7 |
| Other | ☐ 8 | ☐ 8 |
| Don't know | ☐ 98 | ☐ 98 |

**B9. Is your furnace, boiler or combi boiler an ENERGY STAR® qualified model? If so, it should display the ENERGY STAR symbol shown at the right.**

☐ 1 Yes ☐ 2 No ☐ 98 Don't Know

**B10. How old is your furnace, boiler, or combi-boiler?**

_____ years ☐ 98 Don't know

## Gas Boiler Types

**Low Efficiency Gas Boilers:**
- 60% efficient
- uses a standing pilot light

**Mid-Efficiency Gas Boilers:**
- 80% to 85% efficient
- no pilot light, uses igniter instead
- uses induced draft fan or damper

**High Efficiency Gas Boilers:**
- 90% efficient or higher
- no pilot light, uses igniter instead
- Uses plastic exhaust pipe that exits the roof or side of house

## Combi-Boilers

Combined or combination heating systems, commonly referred to as combi-boilers, are an integrated system that supplies both heat and hot water for the home.

## Gas Furnace Types

**Low Efficiency Gas Furnaces:**
- less than 78% efficient
- typically uses a pilot light
- has metal flue that exits the roof

**Mid-Efficiency Gas Furnaces:**
- 78% to 85% efficient
- no pilot light, uses igniter instead
- has metal flue that exits the roof

**High Efficiency Gas Furnaces:**
- 90% to 98% efficient
- no pilot light, uses igniter instead
- uses plastic flue that exits the side of the house.
- ENERGY STAR qualified

**B11. Which of the following does this residence have? (check one response)**

- ☐ 1 Air source heat pump – ducted (e.g., paired with a furnace)
- ☐ 2 Air source heat pump – ductless (mini-split)
- ☐ 3 Air-to-water heat pump – (e.g., paired with a boiler)
- ☐ 4 Water-to-water heat pump – geothermal

→ **CONTINUE**

- ☐ 5 None of the above → **GO TO QUESTION B14**
- ☐ 98 Don't know → **GO TO QUESTION B14**

**B12. How do you use the heat pump at this residence? (check one response)**

- ☐ 1 For both heating and cooling → **CONTINUE**
- ☐ 2 For heating only → **CONTINUE**
- ☐ 3 For cooling only → **GO TO QUESTION B16**

**B13. Which of the following seasons is the heat pump used to HEAT this residence? (check all that apply)**

- ☐ 1 Spring (March to May)
- ☐ 2 Fall (September to November)
- ☐ 3 Winter (December to February)
- ☐ 98 Don't know

→ **GO TO QUESTION B16**

**B14. Have you considered installing a heat pump in this residence?**

- ☐ 1 Yes → **CONTINUE**
- ☐ 2 No → **GO TO QUESTION B16**

**B15. Why has a heat pump NOT been installed in this residence? (check all that apply)**

- ☐ 1 Need more information / don't know much about them
- ☐ 2 Heard they do not work well in cold climates
- ☐ 3 Too expensive / Not willing to spend the money
- ☐ 4 Electrical wiring / system would need to be upgraded
- ☐ 5 Already have air conditioning
- ☐ 6 Not convinced they would reduce our energy bill
- ☐ 7 Other (please specify): _____
- ☐ 98 Don't know

**B16. There are several methods that can be used to heat a home. Please indicate the MAIN or primary method used to heat this residence, then all OTHER methods used (if applicable). PLEASE INCLUDE ALL HEATING METHODS EVEN IF YOU HAVE ALREADY PROVIDED THIS INFORMATION.**

| Heating Methods | MAIN Space Heating Method *(check one only)* | OTHER Space Heating Methods *(check all that apply)* |
|---|---|---|
| Forced air furnace | ☐ 1 | ☐ 1 |
| Wired-in electric baseboards | ☐ 2 | ☐ 2 |
| Heat pump - air source | ☐ 3 | ☐ 3 |
| Heat pump - ground source (geothermal) | ☐ 4 | ☐ 4 |
| Hot water baseboards | ☐ 5 | ☐ 5 |
| Hot water radiant in-floor / under-floor heat | ☐ 6 | ☐ 6 |
| Fireplace or heater stove | ☐ 7 | ☐ 7 |
| Wired-in electric wall heater (fan forced) | ☐ 8 | ☐ 8 |
| Electric radiant heat (floors, walls, and/or ceilings) | ☐ 9 | ☐ 9 |
| Gas wall / forced air / radiant heater | ☐ 10 | ☐ 10 |
| Portable electric heaters | ☐ 11 | ☐ 11 |
| Other (Specify) _____ | ☐ 12 | ☐ 12 |

**Check here if no OTHER method of space heating used →** ☐ 15

## Heat Pump Types

**Air source heat pump (ducted)**

- Uses the home's existing duct work to distribute heating and cooling
- Typically paired with a forced air furnace

**Air source heat pump – ductless (mini-split)**

- Outdoor unit connected to one or more wall mounted "heads" inside the home
- Typically used in homes with electric baseboard heating

**Air-to-water heat pump**

- Used with boilers to supply hot water to radiators or under floor systems.

**Water-to-water (geothermal)**

- For use with hydronic systems using earth energy to heat and cool water.

**B17. What types of thermostats are used in this residence? (check all that apply)**

- ☐ 1 Manual thermostat(s)
- ☐ 2 Programmable thermostat(s)
- ☐ 3 Smart or learning-style thermostat(s) (e.g., Nest, ecobee, etc.)

**B18. PNG offers a $300 rebate on the purchase and installation of smart (learning-style) thermostats. Were you aware of this rebate before taking this survey?**

☐ 1 Yes ☐ 2 No

**B19. Does this residence have either a heat recovery ventilator (HRV) or energy recovery ventilator (ERV)? HRVs and ERVs provide a continuous supply fresh air from the outside that is warmed by stale air they exhaust from the home. ERVs are similar to HRVs but also provide moisture control.**

- ☐ 1 Yes – Heat recovery ventilator (HRV)
- ☐ 2 Yes – Energy recovery ventilator (ERV)
- ☐ 3 No
- ☐ 98 Don't know

**B20. 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 system's filter(s) 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 |

**B21. PNG offers a $100 rebate on gas furnace and boiler tune-ups conducted by a qualified heating contractor. Were you aware of this rebate before taking this survey?**

☐ 1 Yes ☐ 2 No

## C. Domestic Water Heating

**C1. 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, please check "none".**

1 ☐ 2 ☐ 3 ☐ None ☐ **GO TO QUESTION C13**

**C2. What type of fuel does your water heater(s) use? 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 |
|---|---|---|---|
| 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 | ☐ 7 | ☐ 7 | ☐ 7 |

**Water Heater Fuels: Hint**

Most water heaters use gas, oil or electricity to produce hot water. If your water heater does not have a vent or flue then it uses electricity

**C3. Does your water heater(s) use solar energy to pre-warm or supplement the water heating process?**

| | Heater 1 (Main Unit) | Heater 2 | Heater 3 |
|---|---|---|---|
| Yes | ☐ 1 | ☐ 1 | ☐ 1 |
| No | ☐ 2 | ☐ 2 | ☐ 2 |

**C4. Have you changed the fuel used for water heating (Main Unit) at this residence within the past five years (e.g., from oil to natural gas, from natural gas to electricity, etc.)?**

☐ 1 Yes → **CONTINUE** ☐ 2 No → **GO TO QUESTION C6**

**C5. What was the previous water heater fuel?**

| | Heater 1 (Main Unit) |
|---|---|
| Electricity | ☐ 1 |
| Natural gas | ☐ 2 |
| Piped propane | ☐ 3 |
| Bottled propane | ☐ 4 |
| Oil | ☐ 5 |
| Geothermal | ☐ 6 |
| Other | ☐ 7 |

**Water Heater Types**

**On-demand (tankless)**
- Compact units that provide hot water on demand.

**Hybrid on-demand**
- Uses a small storage tank to reduce temperature fluctuations during use.

**Heat pump water heater**
- Combines a heat pump with an electric hot water tank to improve energy efficiency

**C6. What type(s) of water heater(s) is used by this residence?**

| | Heater 1 (Main Unit) | Heater 2 | Heater 3 |
|---|---|---|---|
| Conventional storage tank | ☐ 1 | ☐ 1 | ☐ 1 |
| On-demand (tankless) | ☐ 2 | ☐ 2 | ☐ 2 |
| Hybrid on-demand (uses small storage tank) | ☐ 3 | ☐ 3 | ☐ 3 |
| Combined space and water heater | ☐ 4 | ☐ 4 | ☐ 4 |
| Heat pump water heater | ☐ 5 | ☐ 5 | ☐ 5 |
| Don't know | ☐ 98 | ☐ 98 | ☐ 98 |

**C7. CONVENTIONAL STORAGE TANK HEATERS ONLY: Does the water heater tank have a:**

| | Heater 1 (Main Unit) | Heater 2 | Heater 3 |
|---|---|---|---|
| Metal vent through the roof | ☐ 1 | ☐ 1 | ☐ 1 |
| Metal vent through the side wall (power vent) | ☐ 2 | ☐ 2 | ☐ 2 |
| Plastic vent through the side wall | ☐ 3 | ☐ 3 | ☐ 3 |
| No vent (electric tank) | ☐ 4 | ☐ 4 | ☐ 4 |
| Don't know | ☐ 98 | ☐ 98 | ☐ 98 |

**C8. 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 |

**C9. Where is your water heater (main unit) located?**

| | | | |
|---|---|---|---|
| ☐ 1 | Main living area of the home | ☐ 5 | Heated garage |
| ☐ 2 | Heated basement | ☐ 6 | Unheated garage |
| ☐ 3 | Unheated basement | ☐ 7 | Other (please specify): _____ |
| ☐ 4 | Crawl space | ☐ 98 | Don't know |

**C10. Has a new water heater been installed in this residence during the past 5 years**?

Yes ☐ 1 → **CONTINUE**
No ☐ 2 → **GO TO QUESTION C12**

**C11. What was the main reason a new water heater was installed? (Check one response)**

| | |
|---|---|
| Anticipated water heater failure | ☐ 1 |
| Wanted to switch to gas | ☐ 2 |
| Wanted more efficient water heater | ☐ 3 |
| Water heater had failed | ☐ 4 |
| New home construction | ☐ 5 |
| Wanted a cheaper fuel | ☐ 6 |
| To qualify for home insurance | ☐ 7 |
| Other (specify) _____ | ☐ 8 |

**C12. Does this residence have any of the following:**

| | Yes | No | Don't Know | Not Applicable |
|---|---|---|---|---|
| An insulating blanket installed on the hot water tank | ☐ 1 | ☐ 2 | ☐ 98 | ☐ 99 |
| Pipe wrap (insulation) on the hot water pipes | ☐ 1 | ☐ 2 | ☐ 98 | |

**C13. Please indicate the total number of the following installed in this residence:**

| | Number |
|---|---|
| Showerheads (all kinds) | _____ |
| Low flow showerheads | _____ |

**C14. Please indicate the total number of the following for all members of this residence:**

| | Number |
|---|---|
| Dishwasher loads per week | _____ |
| Baths per week | _____ |
| Showers per week | _____ |

**C15. 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 ☐ 1 No showers – take baths only

**C16. How many loads of laundry does your household do per week?**

| | | |
|---|---|---|
| Number of loads done in cold, warm or hot water | _____ | per week |
| Number of loads using cold water wash and rinse only | _____ | per week |

## D. 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.**

**D1. Does this residence have a fireplace or heater stove?**

Yes ☐ 1 → **CONTINUE**
No ☐ 2 → **GO TO SECTION E**

### Gas Fireplace and Stove Types

**Decorative fireplaces** – Provide ambiance but have little or no heating ability. The firebox is typically steel or masonry, and 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.

**D2. How many of the following types of fireplaces and heater stoves does this residence have? For each type, please indicate whether they are used primarily for heating, ambiance or both.**

| | Number | | | Used primarily for: | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3+ | Heating | Ambiance | Both |
| Gas (decorative) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (heater type) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (free standing) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Electric | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Wood burning fireplace | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Wood burning stove | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Pellet stove | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Other: _____ | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 1 | ☐ 2 | ☐ 3 |

**IF THIS RESIDENCE DOES NOT HAVE A GAS FIREPLACE OR GAS HEATER STOVE, GO TO D5**

**D3. GAS FIREPLACES ONLY: How old is (are) your gas fireplace(s)?**

| | | |
|---|---|---|
| Gas (decorative) – 1 | _____ years | Don't know ☐ 98 |
| Gas (decorative) – 2 | _____ years | Don't know ☐ 98 |
| Gas (decorative) – 3 | _____ years | Don't know ☐ 98 |
| Gas (heater type) – 1 | _____ years | Don't know ☐ 98 |
| Gas (heater type) – 2 | _____ years | Don't know ☐ 98 |
| Gas (heater type) – 3 | _____ years | Don't know ☐ 98 |
| Gas (free standing) – 1 | _____ years | Don't know ☐ 98 |
| Gas (free standing) – 2 | _____ years | Don't know ☐ 98 |
| Gas (free standing) – 3 | _____ years | Don't know ☐ 98 |

**D4. GAS FIREPLACES ONLY: For each gas fireplace you have, please indicate whether it has a fixed glass front, glass doors that open, or an open hearth design (no glass) by checking the appropriate box.**

| | Fixed Glass Front | Glass doors that open | No glass (open hearth) |
|---|---|---|---|
| Gas (decorative) - 1 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (decorative) - 2 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (decorative) - 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (heater type) – 1 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (heater type) – 2 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (heater type) – 3 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (free standing) – 1 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (free standing) – 2 | ☐ 1 | ☐ 2 | ☐ 3 |
| Gas (free standing) – 3 | ☐ 1 | ☐ 2 | ☐ 3 |

**D5. 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.**

Summer (June – August) _____ hours per week
Fall (September – November) _____ hours per week
Winter (December – February) _____ hours per week
Spring (March – May) _____ hours per week

**D6. Approximately, what share of this residence's space heating needs are provided by fireplaces or heater stoves? Please include all fireplaces and heater stoves at this residence in your answer.**

0% (none) ☐ 0
Up to 10% ☐ 1
Up to 25% ☐ 2
Up to 50% ☐ 3
Up to 75% ☐ 4
Up to 100% ☐ 5
Don't know ☐ 98

## E. Swimming Pools & Hot Tubs

**E1. Do you have a swimming pool at this residence that is for the exclusive use of your household (i.e., not shared with other residences)?**

Yes, indoor ☐ 1
Yes, outdoor ☐ 2
→ **CONTINUE**

No ☐ 3 → **GO TO QUESTION E4**

**E2. What fuel do you use to heat the water in your pool and do you use solar energy to help heat the water?**

| | MAIN heater fuel | Supplemented with solar heating |
|---|---|---|
| Solar | ☐ 1 | ☐ 2 |
| Natural gas | ☐ 2 | ☐ 3 |
| Electricity | ☐ 3 | ☐ 4 |
| Propane | ☐ 4 | ☐ 5 |
| Other | ☐ 5 | |

Pool not heated ☐ 6 → **GO TO QUESTION E4**

**E3. How many months per-year is your pool heated?** _____ months per-year

**E4. Do you have a HOT TUB at this residence that is for the exclusive use of this residence (i.e., not shared with other residences)?**

Yes, indoor ☐ 1
Yes, outdoor ☐ 2
→ **CONTINUE**

No ☐ 3 → **GO TO SECTION F**

**E5. What fuel is used to heat the hot tub?**

Natural gas ☐ 1
Propane ☐ 2
Solar ☐ 3
Electricity ☐ 4
Other ☐ 5

**E6. How many months per-year is your hot tub heated?** _____ months per-year

**E7. During the months when you heat your hot tub, do you cover it when not in use?** Yes ☐ 1 No ☐ 2

## F. Appliances

**F1. Please indicate which of the following appliances are used in this residence.**

| COOKING | Yes |
|---|---|
| Gas range (cooktop and oven) | ☐ 1 |
| Dual fuel range (gas cooktop, electric oven) | ☐ 1 |
| Gas cooktop | ☐ 1 |
| Gas wall oven | ☐ 1 |
| Gas barbeque (piped gas) | ☐ 1 |
| Gas barbeque (bottled gas) | ☐ 1 |

| CLEANING | Yes |
|---|---|
| Dishwasher | ☐ 1 |
| Top load clothes washer – Standard efficiency | ☐ 1 |
| Top load clothes washer – High efficiency | ☐ 1 |
| Front load clothes washer | ☐ 1 |
| Gas clothes dryer | ☐ 1 |

→ **ENERGY STAR® qualified?**
☐ 1 Yes
☐ 2 No
☐ 98 Don't know

| HEATING & COOLING | Yes |
|---|---|
| Gas outdoor heater (piped gas) | ☐ 1 |
| Gas outdoor heater (bottled gas) | ☐ 1 |
| Gas outdoor fire pit or fireplace (piped gas) | ☐ 1 |
| Gas outdoor fire pit or fireplace (bottled gas) | ☐ 1 |
| Portable electric heater | ☐ 1 |
| Central air conditioner | ☐ 1 |
| Portable or window air conditioner | ☐ 1 |

→ **How old is your air conditioner?** ____ years
☐ 98 Don't know

### *A FRIENDLY REMINDER*

Please ensure your survey responses refer to the residence at the SERVICE ADDRESS identified on the front page of this survey.

To ensure you are eligible to win one of the **four grand prizes** of a **$1,000** prepaid VISA gift card, make sure to complete and return this survey by **July 27, 2022**.

Submit your completed survey by **July 8, 2022** for the chance to win the **early-bird prize draw** of a $500 prepaid

## G. Energy-Related Renovations

**G1. Please indicate the renovations or actions you have undertaken at this residence during the past 5 years, whether you received a government or utility rebate to complete them, and the renovations you plan to undertake within the next 2 years.**

| | Did this – past 5 years | | Plan to do this – next 2 years |
|---|---|---|---|
| | With rebate | Without rebate | |
| Improve insulation in walls, attic, basement, or crawlspace | ☐ 1 | ☐ 1 | ☐ 1 |
| Install energy efficient window(s) | ☐ 2 | ☐ 2 | ☐ 2 |
| Install insulated exterior door(s) or storm doors | ☐ 3 | ☐ 3 | ☐ 3 |
| Install low flow showerhead(s) | ☐ 4 | ☐ 4 | ☐ 4 |
| Install a smart or learning-style thermostat(s) | ☐ 5 | ☐ 5 | ☐ 5 |
| Install pipe wrap | ☐ 6 | ☐ 6 | ☐ 6 |
| Improve weather stripping or caulking | ☐ 7 | ☐ 7 | ☐ 7 |
| Install hot water heater blanket | ☐ 8 | ☐ 8 | ☐ 8 |
| Install drain pipe waste heat recovery system | ☐ 9 | ☐ 9 | ☐ 9 |
| Install on-demand (tankless or hybrid) water heater | ☐ 10 | ☐ 10 | ☐ 10 |
| Install high efficiency hot water tank | ☐ 11 | ☐ 11 | ☐ 11 |
| Install heat pump water heater | ☐ 12 | ☐ 12 | ☐ 12 |
| Complete a whole home energy audit | ☐ 13 | ☐ 13 | ☐ 13 |
| Install a wood stove | ☐ 14 | ☐ 14 | ☐ 14 |
| Install heat or energy recovery ventilator (HRV or ERV) | ☐ 15 | ☐ 15 | ☐ 15 |
| Install heated swimming pool | | ☐ 16 | ☐ 16 |
| Install hot tub | | ☐ 17 | ☐ 17 |
| **None of the above →** | ☐ 0 | | ☐ 0 |

**G2. Which sources of information do you rely upon when deciding to replace a major energy-using appliance like a furnace, boiler or hot water heater? (check all that apply)**

☐ 1 Friend, neighbour, or family member
☐ 2 Manufacturer's website or brochures
☐ 3 Heating and plumbing contractor
☐ 4 Utility companies (e.g., PNG, BC Hydro)
☐ 5 My own Internet research
☐ 6 Other (please specify): _____

**G3. Please indicate which of the following changes to this residence's heating or cooling systems were made during the past 5 years, whether you received a government or utility rebate to complete them, and the changes you plan to undertake within the next 2 years.**

| | Did this – past 5 years | | Plan to do this – next 2 years |
|---|---|---|---|
| | With rebate | Without rebate | |
| Install ducted air source heat pump (first time installation) | ☐ 1 | ☐ 1 | ☐ 1 |
| Replace an air source heat pump with a new one | ☐ 2 | ☐ 2 | ☐ 2 |
| Replace central air conditioner with air source heat pump | ☐ 3 | ☐ 3 | ☐ 3 |
| Install central air conditioner (first time installation) | ☐ 4 | ☐ 4 | ☐ 4 |
| Install ductless (mini-split) heat pump | ☐ 5 | ☐ 5 | ☐ 5 |
| Replace central air conditioner with a new one | ☐ 6 | ☐ 6 | ☐ 6 |
| Replace a furnace or boiler | ☐ 7 | ☐ 7 | ☐ 7 |
| **None of the above →** | ☐ 0 | | ☐ 0 |

## H. Attitudes Towards Energy Use

**H1. In order to serve you better, we would like to understand your views on a number of energy and environmental issues. Please indicate how much you agree or disagree with each of the following statements about energy and natural gas use.**

| | | Strongly Disagree 1 | 2 | Neither Agree or 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. | I will pay a little more for products or services that are environmentally friendly | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| c. | It is up to each of us to reduce our impact on the environment | ☐ 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, I simply want it to work | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| f. | I consider natural gas to be a safe energy source | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| g. | When something needs to be done around home, I usually hire someone | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| h. | I almost always have a home renovation on the go | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| i. | It is cheaper to heat a home with natural gas than it is with electricity | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| j. | Our household has reduced its energy use by as much as reasonably possible | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| k. | I am a busy person with little or no time to research ways to save energy | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| l. | I conserve energy because it saves money not because it helps the environment | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| m. | I would like to reduce our home's energy use further but can't justify the expense to do so | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**H2. Who makes the most effort to conserve energy in your household? (check one response)**

- ☐ 1 All members of the household
- ☐ 2 Most members of the household
- ☐ 3 Only some members of the household
- ☐ 4 None of us

**H3. Overall, how much effort is your household currently making to conserve electricity / gas?**

- ☐ 1 No effort at all
- ☐ 2 A little effort
- ☐ 3 Fair amount of effort
- ☐ 4 Great amount of effort
- ☐ 98 Don't know

**H4. How satisfied are you with PNG's efforts to help you use natural gas efficiently?**

| Not at all satisfied 0 | 1 | 2 | 3 | 4 | Neither Satisfied or Dissatisfied 5 | 6 | 7 | 8 | 9 | Extremely Satisfied 10 | Prefer not to answer |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ 8 | ☐ 9 | ☐ 10 | ☐ 99 |

# I. Products & Services

**I1. How interested would you be in the following products and services?**

| | | Not at all Interested 1 | Not very interested 2 | Somewhat interested 3 | Very interested 4 | Extremely interested 5 |
|---|---|---|---|---|---|---|
| a. | An online do-it-yourself energy audit of your home | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| b. | Furnace tune-up program to ensure it is working safely and efficiently | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| c. | Program to add an energy efficient air source heat pump to an existing gas furnace or gas boiler | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| d. | Program to replace a low or mid-efficiency gas furnace or boiler with a high efficiency gas furnace or boiler and high efficiency air source heat pump | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| e. | Program to upgrade attic and wall insulation | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| f. | Program to install an Energy Recovery Ventilator | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| g. | Program to replace a standard-efficiency natural gas water heater with a high-efficiency gas water heater | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| h. | Program to improve draft proofing | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| i. | Program to replace manual thermostats with programmable or smart (learning-style) thermostats | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| j. | Program to replace windows (windows and frames) with energy-efficient windows | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| k. | Program to replace exterior doors with energy efficient insulated doors | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**I2. Biomethane is a naturally-occurring gas emitted from the decomposition of organic matter, notably from landfills and agricultural waste. Biomethane is considered a clean, renewable source of energy and is chemically identical to natural gas. Before taking this survey, how knowledgeable were you about renewable sources of energy such as bio-methane? (check one response)**

☐ 1 Not at all knowledgeable
☐ 2 Not very knowledgeable
☐ 3 Somewhat knowledgeable
☐ 4 Very knowledgeable
☐ 5 Extremely knowledgeable
☐ 99 Prefer not to answer

**I3. Please indicate how much you agree or disagree with the following statements? (check one response for each statement)**

| | | Strongly Disagree 1 | 2 | Neither Agree or Disagree 3 | 4 | Strongly Agree 5 |
|---|---|---|---|---|---|---|
| a. | PNG should promote energy efficiency and conservation before exploring new energy supplies, renewable or otherwise. | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| b. | Only PNG customers who want biomethane should pay more for it. | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| c. | All PNG customers should pay a little more on their natural gas bills to support development of biomethane supplies. | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| d. | PNG should source its natural gas from renewable sources as much as possible, regardless of cost. | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

**I4. PNG is purchasing biomethane to add to the supply of natural gas sold to residential customers. PNG is doing this to reduce the overall environmental impact from our consumption of natural gas. Biomethane, however, traditionally costs more than natural gas.**

**If it was within your budget, how willing would you be to pay a little more for your natural gas if it included biomethane? (check one response)**

- ☐ 1 Not at all willing → **CONTINUE**
- ☐ 2 Not very willing → **CONTINUE**
- ☐ 3 Somewhat willing
- ☐ 4 Very willing
- ☐ 5 Extremely willing
- ☐ 99 Prefer not to answer

→ **GO TO SECTION J**

**I5. What are your reasons for saying this? (select all that apply)**

- ☐ 1 Don't have enough information
- ☐ 2 Don't believe it would make a difference to the environment
- ☐ 3 No benefit to me
- ☐ 4 I can't afford to pay more
- ☐ 5 I don't pay the natural gas bill for this residence
- ☐ 6 Other (please specify): _____
- ☐ 98 Don't know

## J. OPINIONS ABOUT YOUR SERVICE FROM PNG

**J1. Did you contact PNG in the past 6 months, via online, phone, email or in-person? (check one response)**

- ☐ 1 Yes
- ☐ 2 No → **GO TO SECTION K**
- ☐ 99 Prefer not to answer → **GO TO SECTION K**

**J2. How did you contact PNG? (check one response)**

- ☐ 1 Phone
- ☐ 2 Email
- ☐ 3 Online chat
- ☐ 4 In-person

**J3. What was the main reason you contacted PNG? (check one response)**

- ☐ 1 Trouble with my natural gas service
- ☐ 2 Problem or question about my bill
- ☐ 3 Change of service address
- ☐ 4 Open or close an account
- ☐ 5 To register a complaint
- ☐ 6 Other (specify) _____
- ☐ 99 Prefer not to answer

**J4. On a scale of one to five, where one means that you strongly disagree and five means that you strongly agree, how much do you agree or disagree with each of the following statements about your contact with PNG?**

| | | Strongly Disagree 1 | 2 | Neither Agree or Disagree 3 | 4 | Strongly Agree 5 | Not Applicable |
|---|---|---|---|---|---|---|---|
| a. | It was easy to reach a PNG customer care representative | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. | PNG responded promptly to my request, question, or complaint | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| c. | The PNG representative was knowledgeable | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| d. | The PNG representative was polite and respectful | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |

**J5. Overall, how satisfied are you with the PNG representative you dealt with?**

| Not at all satisfied | | | | | Neither Satisfied or Dissatisfied | | | | | Extremely Satisfied | Prefer not to answer |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ 8 | ☐ 9 | ☐ 10 | ☐ 99 |

**J6. IF YOU GAVE A SATISFACTION SCORE OF 6 OR LESS TO THE PREVIOUS QUESTION: What would have made you more satisfied with your contact with PNG?**

Enter your response here:

## K. About Your Household

**These last questions are for classification purposes only and are completely confidential, as are all your answers to this survey.**

**K1. Into which of the following age categories do you fit?**

- ☐ 1 18 years or under
- ☐ 2 19-24 years
- ☐ 3 25-34 years
- ☐ 4 35-44 years
- ☐ 5 45-54 years
- ☐ 6 55-64 years
- ☐ 7 65 years and older

**K2. Do you identify as a:**

- ☐ 1 Woman
- ☐ 2 Man
- ☐ 3 Prefer to self-describe: _____
- ☐ 99 Prefer not to answer

**K3. Which of the following describes your current status? (check all that apply)**

- ☐ 1 Employed full-time
- ☐ 2 Employed part-time
- ☐ 3 Homemaker
- ☐ 4 Retired
- ☐ 5 Unemployed
- ☐ 6 Student
- ☐ 7 Short-term or long-term disability

**K4. How many people, including yourself, are currently living at this residence (please include any boarders or renters covered under your Pacific Northern Gas account)**

_____ people

**K5. Please indicate the number of occupants in each of 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 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**K6. Has the number of people living at this residence increased, decreased, or stayed the same over the last two years?**

☐ 1 Increased ☐ 2 Decreased ☐ 3 Stayed the same

**K7. Does anyone in this residence work from home either full-time or part-time?**

- ☐ 1 Yes
- ☐ 2 No ☐ **GO TO QUESTION K10**

**K8. Have the number of days worked at home by this person or persons increased in the past two years?**

- ☐ 1 Yes
- ☐ 2 No
- ☐ 98 Don't know

**K9. Are the number of days working 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

**K10. 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 |
| Post graduate | ☐ 7 |
| Prefer not to answer | ☐ 99 |

**K11. 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 $124,999 | ☐ 8 |
| $40,000 to $49,999 | ☐ 4 | $125,000 or more | ☐ 9 |
| $50,000 to $59,999 | ☐ 5 | Prefer not to answer | ☐ 99 |

**K12. Which of the following statements best describes your household's financial situation?**

- ☐ 1 We watch our pennies closely because we need to
- ☐ 2 We are comfortable but need to watch how much we spend
- ☐ 3 We are comfortable and don't worry too much about how much things cost
- ☐ 4 None of the above
- ☐ 99 Prefer not to answer

**K13. What are the languages spoken at this residence?**

| | **Main language** *(check one only)* | **Other languages** *(check all that apply)* |
|---|---|---|
| English | ☐ 1 | ☐ 1 |
| French | ☐ 2 | ☐ 2 |
| German | ☐ 3 | ☐ 3 |
| Mandarin | ☐ 4 | ☐ 4 |
| Cantonese | ☐ 5 | ☐ 5 |
| Hindi | ☐ 6 | ☐ 6 |
| Punjabi | ☐ 7 | ☐ 7 |
| Tagalog | ☐ 8 | ☐ 8 |
| Farsi (Persian) | ☐ 9 | ☐ 9 |
| Other (please specify): | ☐ 10 _____ | ☐ 10 _____ |

**K14. What is your preferred method of receiving information from PNG on topics such as energy efficiency programs, community infrastructure investments, safety, and other news? Information from this question is for research purposes only. PNG will not contact you without your prior permission. (check one response)**

- ☐ 1 Email
- ☐ 2 Included with your PNG bill
- ☐ 3 Text message
- ☐ 4 PNG website
- ☐ 5 Other (specify) _____
- ☐ 99 Prefer not to answer

**Pacific Northern Gas Ltd. and Leger would like to thank you for your help and assistance.**

**If you have any questions please contact Al Kleinschmidt at 604-691-5688 or akleinschmidt@png.ca**

# Appendix B

Conditional Demand Analysis
Detailed Equations and Results

# PNG 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.

## B1. Primary Gas Space Heating

The primary gas space heating usage for household *h* in month *t* is based on a balance equation:

$$UEC_{gasheat,ht} = \frac{HEATLOSS_{ht} - SECHEAT_{ht}}{EFFHEAT_h}$$

where $HEATLOSS_{ht}$ is the net heat loss, $SECHEAT_{ht}$ is the heat loss replaced by non-gas secondary heating systems, and $EFFHEAT_h$ is the system efficiency.

### *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.

### *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.

### *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 basement, attic, and walls are insulated:[13]

$$U_h = \alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 MOBILEMANUFACTURED_h + \alpha_5 INSULATTIC_h + \alpha_6 INSULWALLS_h + \alpha_7 BASEMENT_h INSULBASEMENT_h + \alpha_8 DOORS_h INSULDOORS_h + \alpha_9 WINDBL_h + \alpha_{10} WINBEST_h$$

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, $MOBILEMANUFACTURED_h$ equals one if the dwelling is a mobile or manufactured home, $INSULATTIC_h$ equals one if the attic is insulated, $INSULWALLS_h$ equals one if the exterior walls are insulated, $BASEMENT_h$ equals one if a basement or crawl space is present, $INSULBASEMENT_h$ equals one if the basement or crawl space 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).

### *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.[14] 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.

[13] An attempt was made to include a variable representing whether a heated garage/workshop is insulated, but it was not retained in the final model because its regression coefficient was the wrong sign.

[14] 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 (41 cases, or 2.3% of the sample used for the CDA).

### *Temperature Differential*

The differential between inside and outside temperature levels is modelled as a function of heating degree days, and whether programmable thermostats or smart/learning-style thermostats are used in the residence: [15]

$$TEMPDIFF_{ht} = HDD_{ht}(\alpha_1 + \alpha_2 PROGSMARTTHM_h)$$

where $HDD_{ht}$ is heating degree days, and $PROGSMARTTHM_h$ equals one if programmable thermostats or smart/learning-style thermostats are used.

### *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).

### *Internal Gain*

The internal gain during heating periods is also modelled as a function of the surface area of the home:

$$INTERNALGAIN_{ht} = \alpha_1 AREA_h WINTER_t$$

### *Non-gas Secondary Heating System*

The heat loss replaced by a non-gas secondary heating system, given that a primary gas heating system is present, can be expressed as:

$$SECHEAT_{ht} = \alpha_1 HDD_{ht} AREA_h NONGASSECHEAT_h$$

where $NONGASSECHEAT_h$ equals one if non-gas secondary space heating is present (e.g., non-gas fireplace, woodstove, electric baseboards, etc.)

[15] An attempt was made to include variables involving household income, whether anyone in the residence works from home, and the presence of a heat recovery ventilator or energy recovery ventilator. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results. Note: the model does not incorporate behavioural factors, such as the frequency of turning down the heat at night or when no one is at home, because the customer survey did not include questions about household heating behaviours.

### *System Efficiency*

The model captures the effects of using a gas furnace, gas boiler, combination (combi) boiler, or multi-fuel furnace (which uses gas as the main fuel) 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 interaction terms to account for the effects of pairing an air source heat pump (ducted) with a furnace, or an air-to-water heat pump with a boiler or combination boiler.

An attempt was also made to model system efficiencies in terms of the efficiency level of the gas furnace or boiler, or whether this equipment is an ENERGY STAR® qualified model. However, these variables were 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).

### *Overall Primary Gas Space Heating Model*

Combining the preceding equations gives the overall model of primary gas space heating usage:

$$UEC_{gasheat,ht} = HDD_{ht}AREA_h(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 MOBILEMANUFACTURED_h + \alpha 5INSULATTICh + \alpha 6INSULWALLSh + \alpha 7BASEMENThINSULBASEMENTh + \alpha 8DOORShINSULDOORSh + \alpha 9WINDBLh + \alpha 10WINBESTh + \alpha 11PROGSMARTTHMh + \alpha 12FURNACEh + \alpha 13FURNACEhHEATPUMPDUCTEDh + \alpha 14BOILERh + \alpha 15BOILERhHEATPUMPAIRTOWATERh + \alpha 16COMBIBOILERh + \alpha 17COMBIBOILERhHEATPUMPAIRTOWATERh + \alpha 18MULTIFUELFURNACEh + \alpha 19NONGASSECHEATh + \alpha 20AREAhWINTERt$$

In the specification above, most of the interaction terms are not shown because they were not statistically significant or produced unreasonable results.

## B2. Secondary Gas Space Heating

Secondary gas space heating includes any additional or supplementary use of gas to heat the residence (e.g., furnaces, gas wall heaters, etc.) The use of gas fireplaces and heater stoves is modelled separately.

Secondary gas space heating usage is modelled simply as a function of heating degree days, total surface area, and dwelling type:

$$UEC_{gassecheat,ht} = HDD_{ht}AREA_h(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 MOBILEMANUFACTURED_h)$$

### B3. Gas Fireplaces and Heater Stoves

The energy usage by gas fireplaces and heater stoves (decorative, heater type, and free standing) is assumed to depend on the number in use and heating degree days:[16]

$$UEC_{gasfireplacedec,ht} = GASFIREPLACEDEC_h(\alpha_1 + \alpha_2 HDD_{ht})$$

$$UEC_{gasfireplaceheater,ht} = GASFIREPLACEHEATER_h(\alpha_1 + \alpha_2 HDD_{ht})$$

$$UEC_{gasfireplacefree,ht} = GASFIREPLACEFREE_h(\alpha_1 + \alpha_2 HDD_{ht})$$

where *GASFIREPLACEDEC*$_h$ is the number of declarative fireplaces in use, *GASFIREPLACEHEATER*$_h$ is the number of heater type fireplaces in use, and *GASFIREPLACEFREE*$_h$ is the number of free standing fireplaces and heater stoves in use.

### B4. Gas Water Heating

Gas water heating energy usage can be expressed as:

$$UEC_{gaswheat,ht} = \frac{WHEATLOSS_{ht} + VUSE_{ht}}{EFFWHEAT_h}$$

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.

#### *Standby Losses*

The heat losses associated with standby losses is assumed to depend on dwelling type, whether the home is new, and the temperature differential between the tank temperature and the inlet temperature:[17]

$$WHEATLOSS_{ht} = WHEATDIFF_{ht}(\alpha_1 + \alpha 2MFDh + \alpha 3APARTMENTh + \alpha 4MOBILEMANUFACTUREDh + \alpha 5NEWHOMEh$$

where *NEWHOME*$_h$ equals one if the residence is built in 2006 or later.

[16] An attempt was made to include variables representing the average number of hours in use, as well as the percentage of space heating requirements provided by fireplaces or heater stoves. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

[17] An attempt was made to include variables involving whether a water heater blanket is used on the hot water tank, and whether pipe wrap (insulation) is used on the hot water pipes. These variables were not retained in the final model because there were too many missing values.

The differential between tank temperature and inlet temperature is modelled simply as a function of heating degree days:

$$WHEATDIFF_{ht} = \alpha_1 HDD_{ht}$$

### *Water Usage*

The heat losses tied to water usage is assumed to depend on the number of household members, the amount of time that showers are used, and the number of laundry loads done at the residence:[18]

$$VUSE_{ht} = \alpha_1 PEOPLE_h + \alpha_2 TIMESHOWERS_h + \alpha_3 LAUNDRYLOADS_h$$

where $PEOPLE_h$ is equal to the log of household size plus one[19], $TIMESHOWERS_h$ is the total amount of time that showers are used on a typical weekday, and $LAUNDRYLOADS_h$ is the number of loads of laundry per week.

### *System Efficiency*

The model captures the effects of using an on-demand (tankless) water heater, a hybrid on-demand water heater, or a combined space and water heater.[20] This was done by including exogenous variables that account for the presence of these types of equipment.

An attempt was also 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).

### *Overall Gas Water Heating Model*

Combining the preceding equations gives the overall model for gas water heating energy usage:

$$UEC_{gaswheat,ht} = HDD_{ht}(\alpha_1 + \alpha_2 MFD_h + \alpha_3 APARTMENT_h + \alpha_4 MOBILEMANUFACTURED_h + \alpha 5NEWHOMEh + \alpha 6ONDEMANDh + \alpha 7HYBRIDh + \alpha 8COMBINEDh + \alpha 9PEOPLEh + \alpha 10TIMESHOWERSh + \alpha 11LAUNDRYLOADSh$$

[18] An attempt was made to include variables involving the average number of baths taken, the average number of dishwasher loads, whether an ENERGY STAR® qualified dishwasher is present, whether a high efficiency top loading clothes washer or a front-loading clothes washer is present, and the proportion of low-flow showerheads installed in the residence. These variables were not retained in the final model because they were not statistically significant or produced unreasonable results.

[19] 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.)

[20] An attempt was made to include a variable representing whether a heat pump water heater is present, but it was not retained in the final model because its regression coefficient was the wrong sign.

### B5. Gas Cooking

Energy consumption of gas cooking appliances (gas ranges, dual fuel ranges, cooktops, and wall ovens) is assumed to depend on the number of household members:[21]

$$UEC_{gascook,ht} = \alpha_1 PEOPLE_h$$

where $PEOPLE_h$ is equal to the log of household size plus one.

### B6. Gas Barbeques

Energy consumption of piped gas barbeques is also assumed to depend on the number of household members:

$$UEC_{gasbbq,ht} = \alpha_1 PEOPLE_h$$

where $PEOPLE_h$ is equal to the log of household size plus one.

### B7. Gas Outdoor Heaters

Energy consumption of piped gas outdoor heaters is assumed to be constant for those households possessing this end-use:

$$UEC_{gasoutdoorheater,ht} = \alpha_1$$

### B8. Gas Dryers

Energy consumption of gas dryers is assumed to be constant for those households possessing this end-use:

$$UEC_{gasdryer,ht} = \alpha_1$$

[21] An attempt was made to include household income, but the variable was not retained in the final model because it was not statistically significant.

## B9. Regression Model – Overall Service Area

**Model Fit**
Adjusted R-squared: 0.830
F statistic: 4,044.4

| Variable | Coefficient | SE | t-value | P-value |
|---|---|---|---|---|
| HDDxAREAxS_GASHEAT | 0.000640 | 0.000013 | 48.5 | 0.000 |
| HDDxAREAxMFDxS_GASHEAT | -0.000101 | 0.000008 | -13.0 | 0.000 |
| HDDxAREAxAPARTMENTxS_GASHEAT | -0.000047 | 0.000024 | -1.9 | 0.054 |
| HDDxAREAxMOBILEMANUFACTUREDxS_GASHEAT | -0.000014 | 0.000006 | -2.5 | 0.014 |
| HDDxAREAxINSULATTICxS_GASHEAT | -0.000017 | 0.000004 | -3.9 | 0.000 |
| HDDxAREAxINSULWALLSxS_GASHEAT | -0.000077 | 0.000011 | -6.7 | 0.000 |
| HDDxAREAxBASEMENTxINSULBASEMENTxS_GASHEAT | -0.000043 | 0.000003 | -14.2 | 0.000 |
| HDDxAREAxDOORSxINSULDOORSxS_GASHEAT | -0.000026 | 0.000003 | -9.8 | 0.000 |
| HDDxAREAxWINDBLxS_GASHEAT | -0.000030 | 0.000004 | -8.3 | 0.000 |
| HDDxAREAxWINBESTxS_GASHEAT | -0.000041 | 0.000004 | -10.0 | 0.000 |
| HDDxAREAxPROGSMARTTHMxS_GASHEAT | -0.000026 | 0.000002 | -11.4 | 0.000 |
| HDDxAREAxFURNACExS_GASHEAT | -0.000120 | 0.000007 | -17.7 | 0.000 |
| HDDxAREAxFURNACExHEATPUMPDUCTEDxS_GASHEAT | -0.000010 | 0.000002 | -4.4 | 0.000 |
| HDDxAREAxBOILERxS_GASHEAT | 0.000018 | 0.000010 | 1.9 | 0.060 |
| HDDxAREAxBOILERxHEATPUMPAIRTOWATERxS_GASHEAT | -0.000125 | 0.000016 | -7.6 | 0.000 |
| HDDxAREAxCOMBIBOILERxS_GASHEAT | 0.000050 | 0.000010 | 4.8 | 0.000 |
| HDDxAREAxCOMBIBOILERxHEATPUMPAIRTOWATERxS_GASHEAT | -0.000038 | 0.000011 | -3.4 | 0.001 |
| HDDxAREAxMULTIFUELFURNACExS_GASHEAT | -0.000121 | 0.000024 | -5.0 | 0.000 |
| HDDxAREAxNONGASSECHEATxS_GASHEAT | -0.000022 | 0.000002 | -10.6 | 0.000 |
| AREAxWINTERxS_GASHEAT | 0.001515 | 0.000092 | 16.4 | 0.000 |
| HDDxAREAxS_GASSECHEAT | 0.000146 | 0.000006 | 22.9 | 0.000 |
| HDDxAREAxMFDxS_GASSECHEAT | 0.000028 | 0.000027 | 1.1 | 0.292 |
| HDDxAREAxMOBILEMANUFACTUREDxS_GASSECHEAT | -0.000049 | 0.000022 | -2.2 | 0.028 |
| GASFIREPLACEDECxS_GASFIREPLACEDEC | 0.365823 | 0.156462 | 2.3 | 0.019 |
| GASFIREPLACEHEATERxS_GASFIREPLACEHEATER | 0.361524 | 0.084948 | 4.3 | 0.000 |
| GASFIREPLACEFREExS_GASFIREPLACEFREE | -0.015559 | 0.193421 | -0.1 | 0.936 |
| HDDxGASFIREPLACEDECxS_GASFIREPLACEDEC | 0.001073 | 0.000317 | 3.4 | 0.001 |
| HDDxGASFIREPLACEHEATERxS_GASFIREPLACEHEATER | 0.000803 | 0.000175 | 4.6 | 0.000 |
| HDDxGASFIREPLACEFREExS_GASFIREPLACEFREE | 0.000979 | 0.000425 | 2.3 | 0.021 |
| HDDxS_GASWHEATER | 0.002422 | 0.000133 | 18.2 | 0.000 |
| HDDxMFDxS_GASWHEATER | -0.000311 | 0.000338 | -0.9 | 0.357 |
| HDDxMOBILEMANUFACTUREDxS_GASWHEATER | -0.000848 | 0.000290 | -2.9 | 0.003 |
| HDDxNEWHOMExS_GASWHEATER | -0.003272 | 0.000166 | -19.7 | 0.000 |
| HDDxONDEMANDxS_GASWHEATER | -0.001654 | 0.000166 | -10.0 | 0.000 |
| HDDxHYBRIDxS_GASWHEATER | -0.002851 | 0.000442 | -6.5 | 0.000 |
| HDDxCOMBINEDxS_GASWHEATER | -0.002974 | 0.000523 | -5.7 | 0.000 |
| PEOPLExS_GASWHEATER | 0.523438 | 0.120808 | 4.3 | 0.000 |
| TIMESHOWERSxS_GASWHEATER | 0.004579 | 0.000940 | 4.9 | 0.000 |
| LAUNDRYLOADSxS_GASWHEATER | 0.061181 | 0.008791 | 7.0 | 0.000 |
| PEOPLExS_GASCOOK | 1.064198 | 0.090690 | 11.7 | 0.000 |
| PEOPLExS_GASBBQ | 0.684736 | 0.164442 | 4.2 | 0.000 |
| S_GASOUTDOORHEATER | 0.247233 | 0.155313 | 1.6 | 0.111 |
| S_GASDRYER | 0.344879 | 0.099281 | 3.5 | 0.001 |

**Sampson Research Inc.**

Economic research that matters to communities and business

☎ 604.809.0382

✉ jsampson@sampsonresearch.com

www.sampsonresearch.com