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Commercial Water Heating Market Assessment: Gas Heat Pump Technology

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1 Executive Summary

The North American Gas Heat Pump Collaborative (Collaborative) is a group of 17 gas and dual fuel utilities, energy efficiency program administrators, and research organizations working to accelerate the adoption of innovative gas heat pump (GHP) technologies in North America through market transformation activities. This market assessment was conducted on behalf of the Collaborative's Commercial GHP Committee, which is focused on expanding its knowledge of the commercial GHP market in select service territories of Collaborative members across North America. This study sought to update the Collaborative's understanding of conditions in the current commercial water heater market and any challenges and opportunities that should be considered in future program development.

This research comprised four high level research activities: an assessment of baseline market conditions and technical opportunity given the market structure, interviews with supply chain contacts in manufacturing and distribution, a survey of market actors who install mechanical equipment in commercial facilities in North America, and analysis to support development of three purchase scenarios.

The section below provides a summary of findings and recommendations for the Collaborative to consider as it continues to support GHP market development in general. This market assessment focused primarily on the awareness and prevalence of GHP use for commercial water heating; however, the Collaborative is focused on expanding its knowledge of the overall GHP market, which includes space heating. While this report is focused on GHP adoption for commercial water heating, the team included discussion probes on space conditioning when appropriate. The team excluded water heating for space conditioning and industrial processes from the study's definition of commercial water heating and, where possible given the available source data, from the estimates of GHP commercial water heating technical opportunity summarized below.

1.1 Findings

1.1.1 Market Structure Assessment and Technical Opportunity

The market structure assessment estimates that it would be technically feasible to replace equipment responsible for approximately 8 percent of North American commercial natural gas consumption with GHP water heating solutions. Our analysis indicates that converting all commercial natural gas water heating systems to GHPs where technically feasible would reduce commercial water heating natural gas consumption by approximately 19 percent in the US and 17 percent in Canada. While water heating represents a modest share of total

commercial gas consumption, the analysis indicates there is opportunity within the water heating end use itself, particularly in targeted facility types and regions.

- **US regions with highest opportunity:** In the US, the greatest opportunity for GHPs exists in the southern and midwestern US. In the South Atlantic and South Central regions, new construction forecasts drive the high opportunity. In the Middle Atlantic and Great Lakes regions, the high opportunity exists largely due to high commercial gas sales. In addition, these midwestern regions have more commercial customers, and therefore more opportunities for commercial GHP installations. Hydronic heating, which heats spaces by distributing hot water to radiators, fan coils, or other terminal units, is also more prevalent in these regions, so a higher percentage of facilities are suitable for GHP solutions.
- **Canadian regions with highest opportunity:** Nearly all GHP opportunity in Canada exists within the Central, British Columbia, and Prairie regions. High opportunity in the Central and Prairie regions is driven by high commercial gas sales. In British Columbia, the high opportunity occurs due to a combination of a high percentage of gas sales being used for water heating (31%) and a higher forecast for commercial new construction.
- **Facility types with highest opportunity:** Over half of the total technical opportunity for GHPs in North America exists within four facility types: multifamily, lodging, office buildings, and retail. High opportunity for multifamily and lodging occurs because these facilities use a high share of their total natural gas consumption for water heating, and because these facilities are ideal candidates for GHPs (i.e., their applicability factors are high). The high opportunity for office buildings reflects the high portion of total commercial gas consumption driven by this facility type (20% and 24% for the US and Canada, respectively). Manufacturers focused on domestic hot water (DHW) identified ideal demand at 1,000–10,000 gallons/day, pointing to hospitals, hotels, multifamily with central DHW, K-12 cafeterias, and university dorms as key targets.

1.1.2 Market Dynamics

Awareness and inertia. Standard practice can work against specification and installation of GHPs. Among respondents to the market actor survey, 28 percent reported being completely unfamiliar with GHP solutions for water heating, and 14 percent were unfamiliar with GHP solutions for space conditioning. Among those reporting familiarity with GHP technology, 80 percent (28 of 35) had never specified or installed a GHP. To encourage selection and installation, manufacturers described prioritizing demonstration sites and providing design support for identified projects. This experience gap is compounded by the dominance of the established boiler market.

Confidence in technical viability. Market actor survey respondents generally agreed that GHP technology is appropriate for their respective climate and building stock, but confidence declines when it comes to cost and performance. Forty-two percent agreed they are confident the technology will perform as expected, and 18 percent agreed that costs are reasonable. Credible, independent project data and workforce training linked to distributors, supply houses, or manufacturers already known to design engineers and installation contractors will likely be needed to overcome this.

Emerging distribution channels. Results from in-depth interviews revealed a nascent market, as expected for an emerging product like GHPs. The limited number of distributors affiliated with GHP product lines could reflect structural gaps in market delivery channels.

High first costs. Supply chain contacts acknowledged upfront cost as a key barrier, reflecting high equipment cost and installation complexities that can include piping challenges, cranes, and/or structural modifications for roof installation. Manufacturers and market actors viewed program or utility incentives as essential for offsetting these costs. Manufacturers reported that their sales cluster in regions with active programmatic support, including demonstration projects, pilot programs, ongoing incentives, and/or outreach or design support. Market actor survey responses indicate that higher incentives for these projects could affect their recommendations.

1.1.3 Technical & Product Considerations

GHPs are gas-fired equipment that provide high efficiency heating (and, in some cases, cooling) by using thermodynamic cycles to move heat from one place to another, such as from water or air outside the building to water inside the building. With gas absorption heat pumps (GAHPs), the heat of combustion drives the necessary thermodynamic process, acting on a refrigerant and absorbent in a sealed loop inside the equipment. With engine-driven GHPs, a gas-fired engine powers a compressor, otherwise using the same thermodynamic process and refrigerants as electric heat pumps.

Both types of GHP avoid the high electricity demands of electric heat pumps, may better maintain their performance in cold weather relative to electric heat pumps, and offer rated efficiency gains of 40 percent or more over conventional gas-fired equipment.

Legionella and water temperature. Air-to-water GHPs can heat water to a maximum of 140-149° F, and engine-driven VRF GHPs max out at approximately 120° F. The commonly accepted minimum temperature to effectively destroy Legionella bacteria is 140° F, but 156-160° is often preferred for instantaneous disinfection. Concerns over water temperature may reinforce interest in a hybrid system, where the GHP preheats the water and a gas water heater boosts the temperature. Manufacturers indicate that hybrid systems can also reduce

GHP first costs by allowing designers to size the GHP to meet 60 to 80 percent of load instead of spending more to allow for the GHP to meet full load.

Avoiding electrical infrastructure investments. Limited electrical infrastructure emerged as a promising driver for GHP selection, particularly where policies also drive efficiency and decarbonization objectives. GHP products provide a viable decarbonization pathway when full electrification is constrained by economics or infrastructure. Manufacturer interviews and open responses in the market actor survey confirmed that sites where electrical upgrades for electrification are infeasible can be candidates for GHP equipment. Sites in areas with a high "spark spread" (or the difference between low natural gas costs relative to electric rates) also have greater promise.

1.2 Recommendations

The following recommendations reflect areas where the Collaborative's activities could accelerate GHP adoption.

Prioritize retrofit applications in existing buildings in near-term program design. Given the volume of existing equipment relative to commercial new construction, retrofit and replacement projects dominate the commercial mechanical market. Retrofit projects also offer practical advantages: hybrid deployments that pair new GHP equipment with existing gas equipment can reduce GHP first costs by reducing the required GHP capacity, manage performance risk, and provide demonstration opportunity for early-market program designs. GHP equipment may also help existing buildings avoid costly electrical service upgrades.

Structure incentives to address first costs directly. First costs emerged as a consistent barrier across all research activities. Manufacturer representatives discussed the gap between equipment and installation costs for GHPs relative to conventional alternatives. Manufacturers expect that equipment costs will decrease as sales increase. In the near term, incentive structures might need to consider costs associated with installation, including outdoor siting, piping, and any structural modifications. Incentive designs that specifically support hybrid deployments, where GHP equipment is sized for 60 to 80 percent of load, could lower the entry point for adoption while still delivering meaningful gas savings.

Leverage existing supply chains to build the GHP workforce. Market actors reported learning about new technologies primarily through distributors and supply houses and manufacturers. Training content should prioritize the topics that market actors ranked highest: technology basics and operation (78%), installation best practices (75%), sizing and system design (70%), and maintenance requirements (65%). Programs should connect training to the distributors and manufacturers already serving local markets to align with how market actors already access technical information.

Target high opportunity building types in regions with supportive program infrastructure. The market structure assessment and manufacturer interviews converge on a similar set of high-potential building types: multifamily, lodging, office buildings, and retail. Other facility types that emerged as good project candidates in interviews and technical review include hospitals, universities, full-service restaurants, and K-12 schools. Targeting these facility types in regions with active utility support will build on market momentum and local awareness.

Expand pilot and demonstration projects across more regions. Manufacturers see local demonstration projects driving awareness and confidence, noting their sales cluster in areas where these projects exist. Pilots in multiple regions will help demonstrate that GHPs perform well across different climates. Regional demonstration projects will also generate local performance data and build a base of experienced installers and engineers.

Develop and disseminate project-level performance and cost evidence. Programs can continue to build confidence in GHPs as technically viable, reliable, and reasonably priced. Providing credible, independent project data that promote existing case studies and available project data will help normalize the technology and overcome uncertainty. While case studies and sub-metered data reports are available in some regions, expanding these to document installed cost, energy savings, and operational experience from completed projects across North America will increase awareness and encourage installation. Energy savings calculators or standardized cost-benefit tools could further support design engineers and contractors in evaluating GHP solutions for specific applications.

Engage distributors in market development. Manufacturers are currently driving market education and project-level technical support, consistent with an emerging distribution channel. The Collaborative could amplify its efforts by facilitating connections via regional trade ally networks, supporting manufacturer participation in training programs, and helping manufacturers and their representatives build relationships with the engineering and contracting firms that drive equipment selection in the commercial market.

2 Introduction and Background

Resource Innovations and the Northwest Energy Efficiency Alliance (NEEA) contracted with Evergreen Economics and BrightLine Group to conduct research to support the North American Gas Heat Pump Collaborative[1] (the Collaborative) in its efforts to accelerate the adoption of commercial gas heat pumps (GHPs) in the market. This market assessment focused primarily on the awareness and prevalence of GHP use for commercial water heating; however, the Collaborative is focused on expanding its knowledge of the overall GHP market, which includes space heating.

This study sought to characterize the commercial water heating market to inform the efforts described above. The team designed research activities to understand the current market conditions, including existing types of water heating systems, key decision drivers and value propositions, and familiarity with existing GHP products. This research covered territories across North America, consistent with the funders of the overall study. Study funders included the following organizations:

- APGA Research Foundation, representing 150 municipal gas utilities
- Nicor Gas
- NEEA
- Center Point Energy
- Enbridge Gas
- FortisBC
- Northwest Natural
- New Jersey Natural Gas
- Peoples Gas/North Shore Gas
- Southern California Gas Company (SoCalGas)

2.1 GHPs: A Brief Description

GHPs are gas-fired equipment that provide high efficiency heating (and, in some cases, cooling) by using thermodynamic cycles to move heat from one place to another, such as from water or air outside the building to water inside the building. Unlike conventional gas-fired equipment, which approach 100 percent efficiency as an absolute ceiling, GHPs operate

[1] The Collaborative is a 501(c)3 nonprofit made up of 17 gas and dual fuel utilities across the U.S. and Canada.

with gas utilization efficiencies of 135 percent and up (commonly referred to as coefficient of performance (COP) in this context and translating to values of 1.35 to 1.8).

GHPs avoid the high electricity demands of electric heat pumps, which can require expensive electric updates in older facilities. GHPs may also better maintain their performance in cold weather relative to electric heat pumps and offer rated efficiency gains of 40 percent or more over conventional gas-fired equipment.

2.2 Study Objectives

This research centered on three primary study objectives, mapped to subtopics in Table 1.

Table 1: Study Objective Mapping

Study Objective and Subtopics	
Study Objective 1. Market Structure Assessment	
Estimate market size for the commercial sector, including both new and existing construction.	Supply chain structure by region and fuel type
	Market size by supply side actor nationally
	Existing water heaters installed in commercial buildings
Study Objective 2: Water Heater Purchase Process Assessment	
Identify the water heater system and GHP purchase process.	Challenges and barriers
	Buyer profiles
	Potential value proposition for GHP
	Information sources, buyer behavior
Study Objective 3. Supply Chain Research	
Identify key supply chain market actors to better understand perceptions and awareness of GHP and dual fuel solutions.	Manufacturer, manufacturer representative, and distributor perspectives
	Experience of installers or mechanical/electrical/ plumbing firms
	Experience of design engineers or specifiers

To inform these study objectives, the team assembled secondary data, conducted in-depth interviews, fielded a survey of market actors involved in designing or installing commercial HVAC equipment, and mapped research findings to three specific purchase scenarios.

The Evergreen team used the following set of facility types in the analysis. This list is based on the Commercial Building Stock Assessment (CBSA) building types[2] with two additions: universities and an "other" category to support analysis.

- Multifamily
- Full-service restaurants
- Lodging
- K-12 schools
- Universities
- Office buildings
- Retail
- Grocery
- Hospitals
- Long-term care facilities
- Other

2.3 Geographic Scope

The Evergreen team defined regions within the US and Canada, as shown in Figure 1. These regions guided the team's data collection activities and defined the level at which the regional market characterization results are presented. The regions are:

- **Canada:** Regions as defined by the Canadian government.[3]
- **US:** Census regions and divisions,[4] which align with regions used in the Energy Information Administration (EIA) Commercial Buildings Energy Consumption Survey (CBECS), with adjustments as needed due to study requirements (e.g., grouping Washington, Oregon, and Idaho to provide relevant results for NEEA) and to better reflect expected regional differences in commercial facilities (e.g., splitting the Mountain region into northern and southern components).

[2] https://neea.org/commercial-building-stock-assessment/
[3] https://www.canada.ca/en/immigration-refugees-citizenship/corporate/publications-manuals/discover-canada/read-online/canadas-regions.html
[4] https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

Figure 1: Regions within the US and Canada for Study Analysis and Reporting



3 Methods

This section documents the data collection approaches and analytical methods used across research activities.

3.1 Baseline Market Data Collection

Market size data, including the number of gas customers and the volumes of gas sales, are based on publicly available sources for the US and Canada, as shown in Table 2.[5]

Table 2: Market Size Data Sources

	Number of Gas Customers	Gas Sales Volumes
US	Sourced from Energy Information Administration (EIA)[6]	Sourced from EIA (from Form EIA-176)[7]
Canada	Sourced from Canadian Gas Association (CGA)[8]	Sourced from Canadian Gas Association[9]

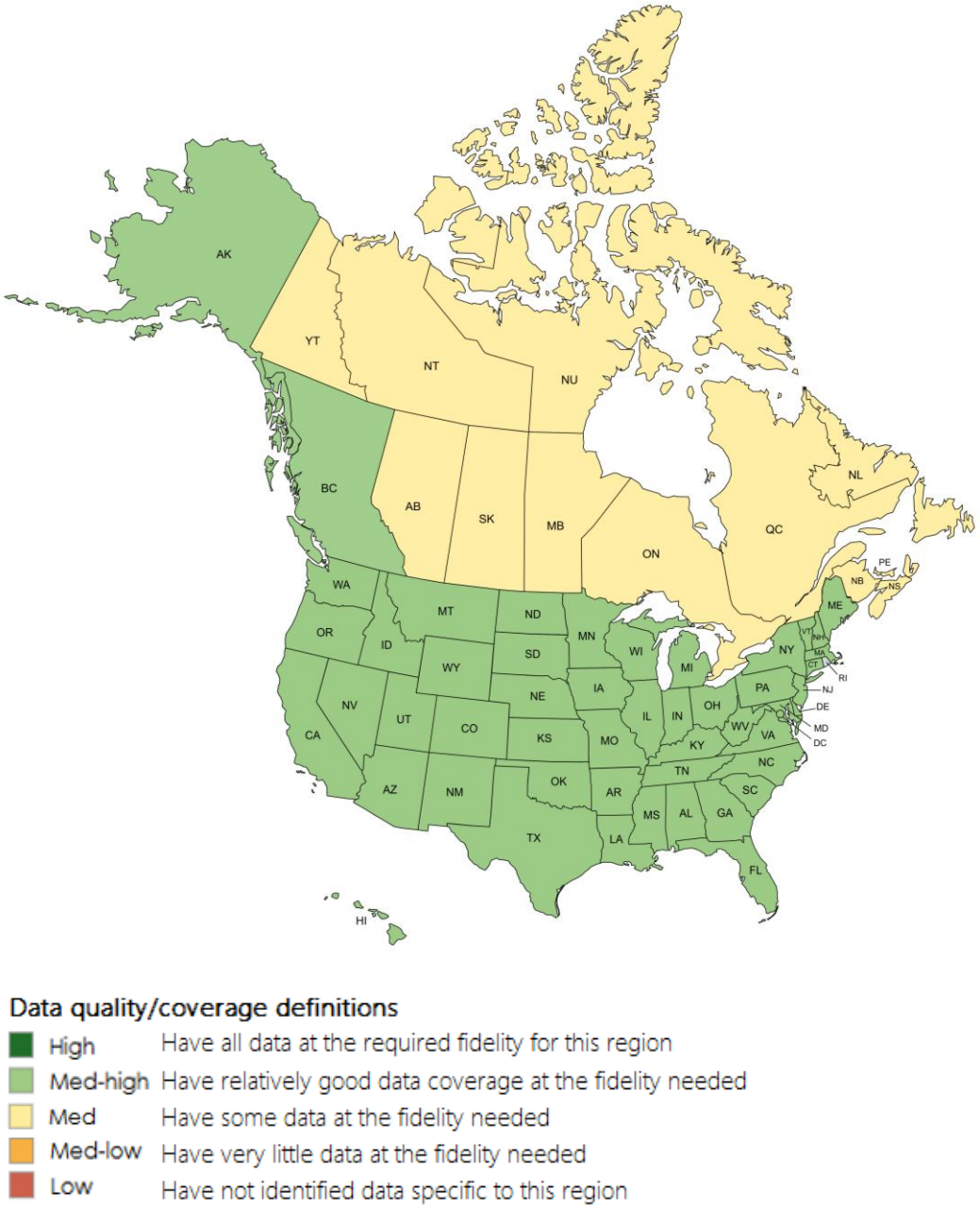
The Evergreen team also collected customer characteristic data, which provide detailed breakdowns of gas consumption and customer characteristics within the commercial market for each region. These data show the following breakdowns of natural gas consumption in the commercial sector:

- By facility type
- By end use
- Average building size by facility type
- Natural gas energy share by facility type
- Water heating and space heating saturation
- Water heating and space heating fuel shares
- Water heating and space heating equipment types

[5] The team leveraged utility-specific data to develop utility-specific results provided directly to participating utilities. The gas sales volumes for the full North American analysis relies on EIA and CGA data.
[6] https://www.eia.gov/dnav/ng/ng_cons_num_a_EPG0_VN3_Count_a.htm
[7] https://www.eia.gov/naturalgas/ngqs/#?year1=2020&year2=2023&company=Name
[8] https://www.cga.ca/resources/publications/corporate-profile/
[9] https://www.cga.ca/natural-gas-statistics/

The fidelity and coverage of these data influence the quality of the market structure assessment results. Where there is high fidelity public data available at the granularity and breakdowns needed for this analysis, the subsequent results are more accurate. Conversely, where data are unavailable or where the data do not align well with the resolution needed, there is greater uncertainty in the results. Figure 2 illustrates the data coverage across North America.

Figure 2: Data Coverage Across the US and Canada Regions



Data quality/coverage definitions

High	Have all data at the required fidelity for this region
Med-high	Have relatively good data coverage at the fidelity needed
Med	Have some data at the fidelity needed
Med-low	Have very little data at the fidelity needed
Low	Have not identified data specific to this region

The identified data sources did not align exactly with what the analysis required, so no regions received a high data coverage designation. However, all US and Canadian regions had either medium or medium-high quality, indicating some or most of the data were available at the fidelity needed for this analysis. In regions with missing data, the team used national data or data from a nearby region as a proxy.

3.1.1 Supply Chain Interviews

The Evergreen team worked with the study oversight committee to develop an interview guide for manufacturers, manufacturer representatives, and distributors. Because of the different perspectives and experience among these groups, we did not ask every question of every interviewee. The interviews were semi-structured and qualitative, designed to understand product availability, the target market, competitive product options, training programs, market support, how contacts characterized regional sales for commercial water heating, and expectations for the future. Finally, we asked contacts for referrals to knowledgeable distributors or mechanical contracting firms that we should contact to support the research effort.

Manufacturers

To develop the population frame, Resource Innovations provided contact information for GHP manufacturers operating or planning to operate in North America. Evergreen then scheduled interviews with representatives of six manufacturers, resulting in a total of six interviews with manufacturers.

Manufacturer Representatives and Distributors

Resource Innovations also provided an initial set of contacts understood to be affiliated with GHP products. To expand this manufacturer representative and distributor population frame, Evergreen collected additional contact information using Internet searches and snowball sampling through manufacturer referrals. These efforts created a preliminary list of 60 records. Evergreen conducted email and phone outreach throughout the fall of 2025. Evergreen reached out to 45 people and scheduled six interviews by December 2025, conducting a total of five interviews from this frame.

Several insights emerged from the recruitment efforts with the manufacturer representatives and distributors. Evergreen found few distributors affiliated with GHP manufacturers and also found that distributors seemed unfamiliar with GHP products, occasionally conflating the product with other types of equipment. Lastly, because of low GHP installations and market awareness for their regions, most contacts were unable to provide referrals.

3.1.2 Market Actor Survey

Evergreen developed an online survey for market actors (including HVAC and water heating professionals) to gauge awareness of and experience with GHPs in commercial settings. We distributed the survey through three channels based on study sponsor preferences.

1. Three sponsor organizations provided contact lists and allowed Evergreen to manage their survey campaigns directly. We sent invitations through Qualtrics, monitored completion rates, and managed reminder emails.
2. Eight sponsor organizations chose to distribute the survey themselves. We provided each organization with a customized anonymous link to share with their contacts. Because these organizations managed outreach independently, we do not have a complete count of invited contacts. Reminder schedules varied by organization.
3. Finally, we supplemented sponsor contact lists with additional contacts from sample vendor Data Axle to expand geographic coverage in areas with lower engagement.

The survey ran from November 12 to December 19, 2025, and received 43 completes. The lack of complete invitation counts from the eight self-distributing organizations prevents calculation of a true response rate. Table 3 provides the known survey disposition.

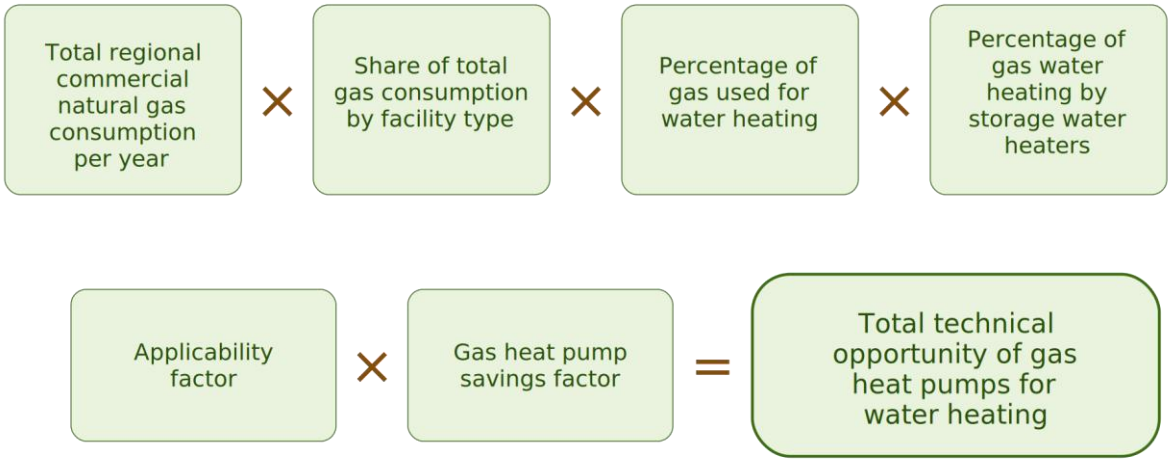
Table 3: Survey Disposition

Disposition	n
Complete	43
Qualified but Local Quota Full	37
Incomplete/Abandoned	15
Screened Out (Not Qualified)	2
Duplicate	2
Total Attempts	**99**

4 Market Structure Assessment Findings

The Evergreen team used the market size and customer characteristics datasets (described in Section 3), to estimate the potential market impacts of gas heat pumps (GHPs) in commercial water heating applications. For the purposes of the study, "technical opportunity" represents the market potential without any intervention (e.g., utility incentives, education and awareness campaigns, policy changes). Note that this study is a precursor to a larger North American Gas Heat Pump Collaborative (NAGHPC) Commercial Gas Heat Pump Savings Assessment Study, expected to be completed in 2026.[10] Figure 3 provides a graphical representation of the methodology used to estimate the technical opportunity of GHPs for commercial water heating, which is described further in the following sections.

Figure 3: Algorithm to Estimate Gas Heat Pump Technical Opportunity



4.1 Commercial Gas Consumption Baseline

Following the approach outlined above, the analysis first established annual commercial natural gas consumption for each region and facility type defined for this study. Regional natural gas consumption for existing commercial buildings sources include the Energy Information Administration and the Canadian Gas Association (Table 2). The team developed

[10] The NAGHPC Commercial Gas Heat Pump Savings Assessment Study is intended to produce defensible, jurisdiction-specific estimates of energy and demand savings for commercial GHP applications across key end uses. The results of this savings assessment study will support utility planning, program development, and regulatory processes. This work is separate, but complementary to, the Market Characterization Study.

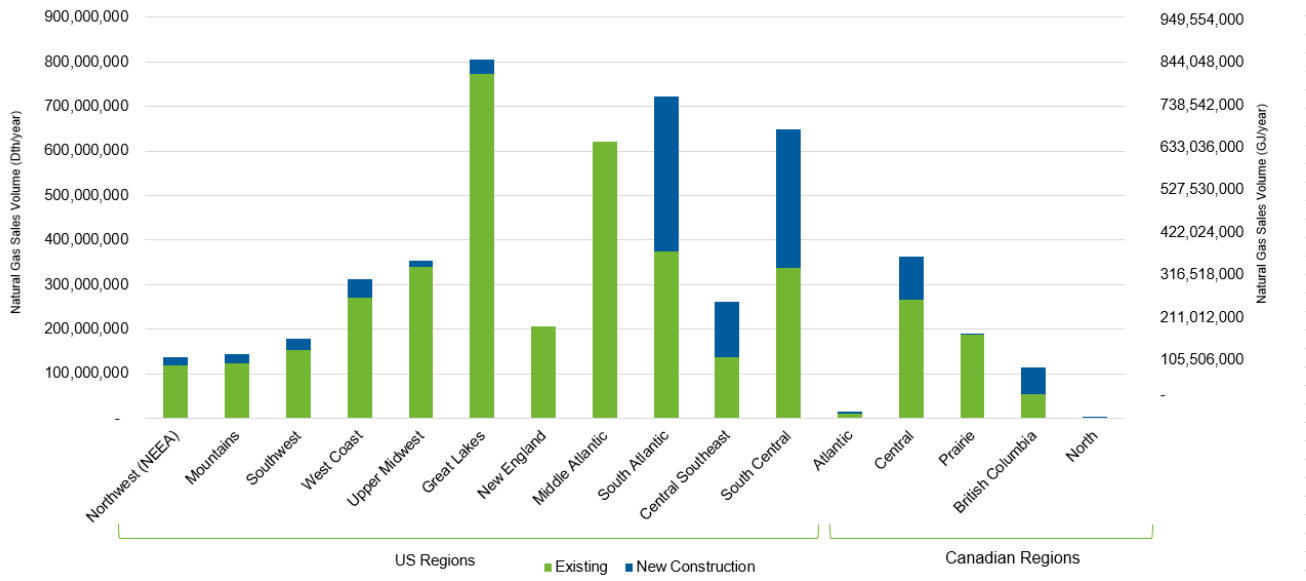
forecasted gas consumption for new construction commercial facilities using historical new construction spending in the US and Canada since 2020. The US Census Bureau[11] and Statistics Canada[12] provided data on commercial new construction spending. These data were used to develop a compound annual growth rate for the commercial new construction market, which was applied to the consumption data for existing buildings to forecast new construction gas consumption over the next 20 years. The 20-year period reflects the average effective useful life of standard (i.e., baseline) commercial natural gas water heating equipment.

New construction forecasts do not account for potential future impacts from electrification or decarbonization policies. To date, electrification has not significantly penetrated the commercial water heating market.[13, 14] At the same time, decarbonization policies may discourage installation of standard natural gas equipment while creating opportunities for high efficiency natural gas technologies, such as GHPs. However, many of these policies are currently being litigated across US jurisdictions, making it challenging to predict whether they will ultimately increase or decrease adoption of GHPs.

Figure 4 shows the commercial natural gas market in the US and Canada across both existing and new construction buildings and establishes the overall commercial gas market size by region as the starting point for the market structure assessment and subsequent technical opportunity results. Natural gas sales are highest in colder regions with a large commercial customer presence, such as the Great Lakes and Middle Atlantic regions. Regions forecasted to have high commercial new construction growth, such as the South Atlantic and South-Central regions, also have high natural gas sales.

[11] https://www.census.gov/construction/c30/historical_data.html
[12] https://www150.statcan.gc.ca
[13] https://docs.nrel.gov/docs/fy25osti/88309.pdf
[14] https://rmi.org/insight/tracking-the-heat-pump-water-heater-market-in-the-united-states/

Figure 4: North American Commercial Natural Gas Market



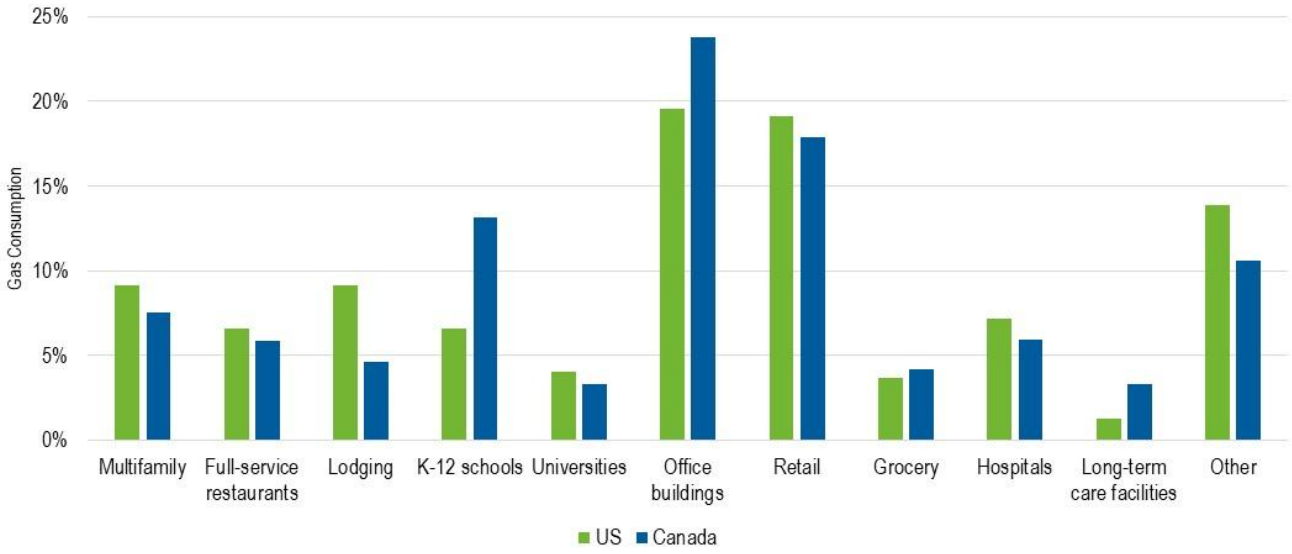
The team used data from the Commercial Buildings Energy Consumption Survey (CBECS)[15] and the Commercial Building Stock Assessment (CBSA)[16] for the US and the Survey of Commercial and Institutional Energy Use (SCIEU)[17] for Canada to distribute regional gas consumption across facility types. Figure 5 shows the percentage of natural gas used by facility type for both the US and Canada. Trends across both countries are consistent, with office buildings and retail being the highest overall natural gas consumers in the commercial market and long-term care facilities, universities, and grocery being the lowest.

[15] https://www.eia.gov/consumption/commercial/data/2018/ce/pdf/c23.pdf

[16] https://neea.org/wp-content/uploads/2025/03/CBSA-4-2019-Final-Report.pdf

[17] https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=SC&sector=aaa&juris=ca&year=2019&rn=11&page=1

Figure 5: Natural Gas Consumption by Facility Type

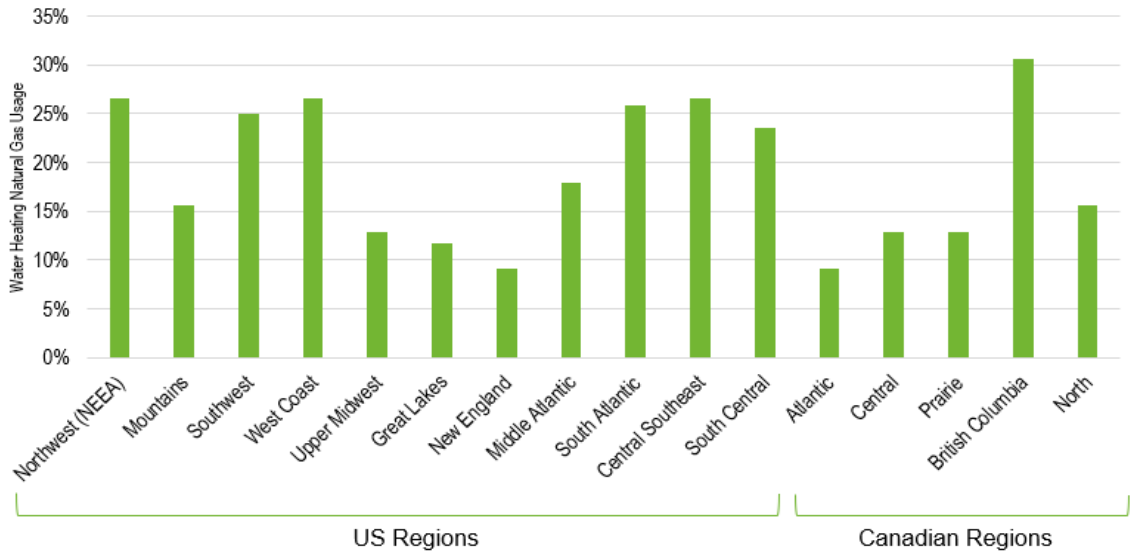


4.2 Commercial Water Heating Market

The team characterized commercial natural gas water heating consumption, isolating natural gas used for water heating and analyzing variations in water heating consumption by both region and facility type. National Renewable Energy Laboratory (NREL) ComStock reports,[18] CBECS,[19] and NAGHPC funding members were data sources used to support this analysis. Figure 6 shows the portion of natural gas used for water heating by region. Regions with warmer climates typically use a greater share of natural gas for water heating because space heating loads are lower.

[18] https://www.energycodes.gov/segmentation
[19] https://www.eia.gov/consumption/commercial/data/2018/bc/pdf/b4.pdf

Figure 6: Water Heating Natural Gas Usage by Region



Natural gas usage across facility types is more consistent, but there is variation correlated with the expected volume of hot water used. Multifamily, lodging, and long-term care facilities use a higher portion of natural gas for water heating to support showers, laundry facilities, and kitchen operations. Office buildings and retail have smaller loads because hot water is used primarily for restroom handwashing and breakroom sinks (Table 4).

Table 4: Water Heating Natural Gas Usage by Facility Type

Facility Type	Portion of Natural Gas Used for Water Heating
Multifamily	24%
Full-service restaurants	20%
Lodging	24%
K-12 schools	18%
Universities	18%
Office buildings	14%
Retail	14%
Grocery	20%
Hospitals	15%
Long-term care facilities	24%
Other	14%

The Evergreen team also identified the prevalence of storage water heaters (including central plants), as opposed to tankless or instantaneous equipment. These data were sourced from the 2023 Pennsylvania Non-Residential Baseline Study[20] and the CBSA[21] (Table 5). While there is some variation across facility types, only a small portion of water heating equipment is tankless or instantaneous in commercial facilities.

Table 5: Prevalence of Storage Water Heaters by Facility Type

Facility Type	Prevalence
Multifamily	96%
Full-service restaurants	88%
Lodging	86%
K-12 schools	94%
Universities	94%
Office buildings	96%
Retail	90%
Grocery	84%
Hospitals	96%
Long-term care facilities	96%
Other	90%

4.3 Applicability Factors

The team developed applicability factors to account for the portion of water heating equipment in existing and new buildings that could be replaced by a GHP from a *technical feasibility* perspective. This analysis accounts for the considerations listed below when developing applicability factors. These considerations emerged during manufacturer interviews as the key technical feasibility requirements.

1. Is the **hot water volume** used by the facility type suitable? Facilities requiring high hot water volumes are generally more suitable for GHPs.
2. Are **central plants** common for the facility type? Facilities with central plants are generally more suitable for certain GHP technologies.
3. Are the GHP equipment **siting requirements** suitable for the facility type? GHP equipment can be very large and heavy, making it challenging to install on rooftops or

[20] https://www.puc.pa.gov/media/2884/2023_pa_non-residential_baseline_study.pdf
[21] https://neea.org/wp-content/uploads/2025/03/CBSA-4-2019-Final-Report.pdf

within buildings, and GHPs that use ammonia cannot be installed indoors. Facilities that have flexibility for siting equipment outdoors and on the ground are generally more suitable for GHPs.

4. Are **hydronic heating systems** common within the region? GHPs are generally more suitable for facilities with existing hydronic systems.

The team developed applicability factors for each region and facility type using information gathered during manufacturer interviews and from CBECS,[22] CBSA,[23] and SCIEU[24] data.

4.4 Gas Heat Pump Savings

The GHP savings factor estimates savings from a GHP compared to standard gas water heating equipment. Average savings for this analysis were estimated to be 41 percent, based on an engineering model developed using the following algorithm, as defined in the Illinois Technical Reference Manual, Version 13.0.[25] While a single percentage savings value is assumed here, note that the magnitude of the savings will vary by region and facility type based on gas consumption varying by region and facility type.

$$\Delta Therms_{SHW} = \frac{(T_{out} - T_{in}) * HotWaterUse_{Gallon} * \gamma_{water} * 1.0 * (\frac{1}{TE_{gasbase}} - \frac{1}{COP_{eff})}}{100{,}000}$$

T_{out}	tank temperature (˚F)
T_{in}	incoming water temperature (˚F)
$HotWaterUse_{Gallon}$	annual hot water consumption (gal)
γ_{water}	specific weight capacity of water (lb/gal)
1.0	specific heat of water (Btu/lb·˚F)
100,000	conversion from Btu to therms
$TE_{gasbase}$	rated efficiency of baseline water heater
COP_{eff}	rated efficiency of the commercial gas heat pump

[22] https://www.eia.gov/consumption/commercial/data/2018/bc/pdf/b11.pdf
[23] https://neea.org/wp-content/uploads/2025/03/CBSA-4-2019-Final-Report.pdf
[24] https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/scieu/2019/tables.cfm
[25] https://www.ilsag.info/wp-content/uploads/IL-TRM_Effective_010125_v13.0_Vol_2_C_and_I_09202024_FINAL.pdf

Additional data sources used to develop the savings factor estimate included energy.gov,[26] GHP manufacturer specification sheets, and FortisBC Gas Absorption Heat Pump Pilot information.[27, 28]

4.5 Technical Opportunity of Gas Heat Pumps

Figure 7 summarizes the process to estimate technical opportunity for GHP commercial water heating and provides context for results presented in this section. The Evergreen team began by estimating the full commercial natural gas market size in the US and Canada. Natural gas used for non-water heating end uses (83%) was omitted, along with natural gas used by water heaters that cannot be converted to GHPs (9% total). The remaining 8 percent of the overall North American commercial natural gas market, represented by the green box, is the natural gas currently consumed by equipment that could be replaced by a GHP. Finally, the GHP savings factor of 41 percent was applied to the eligible commercial natural gas water heating market to estimate the potential market impacts of GHPs.

Figure 7: North American Commercial Natural Gas Usage and Portion Eligible for GHP Conversion



[26] https://www.energy.gov/sites/default/files/2023-07/cwh-ecs-fr_2.pdf
[27] https://www.fortisbc.com/about-us/news-events/stories/what-are-gas-heat-pumps-and-how-can-they-save-money-and-energy
[28] https://www.clearesult.com/sites/default/files/2023-08/GAHP%20Best%20Practices%20Guide_V1.pdf

For the study purposes, "technical opportunity" represents the market potential without any intervention (e.g., utility incentives, education and awareness campaigns, policy changes). There are two important aspects to consider while interpreting these results:

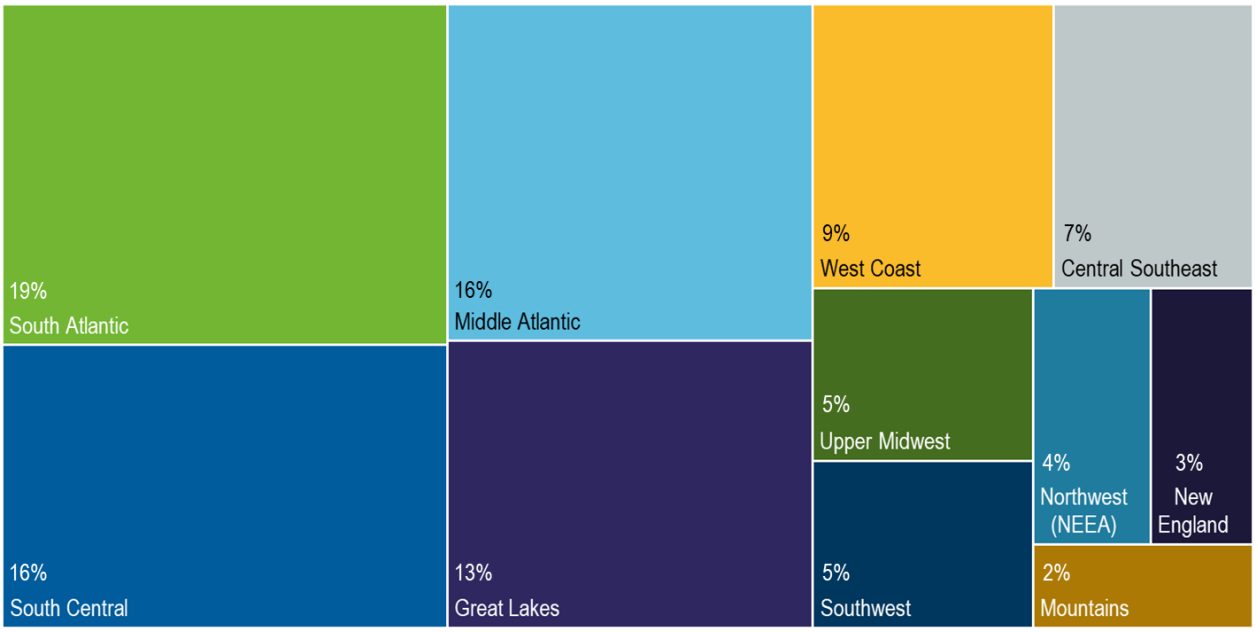
1. **Technical opportunity considers technical feasibility and omits considerations related to adoption.** This analysis accounts for site characteristics and constraints from an engineering perspective. It omits considerations related to adoption of GHPs, such as whether the facility is owned or leased, whether there is strong utility support for GHPs in the region (in the form of incentives, education, etc.), whether the region or business has a strong decarbonization focus, the region's spark spread (i.e., the price differential between natural gas and electricity), technology awareness, etc. These types of factors drive adoption of GHPs from a *customer adoption* perspective, rather than from a *technical feasibility* perspective, and are beyond the scope of this market characterization study.

2. Because customer adoption was excluded when estimating technical opportunity, the analysis assumes all equipment that can turn over or be installed from a technical feasibility perspective will be replaced or installed over a 20-year period (i.e., the estimated lifetime of baseline water heating equipment). Said differently, **the technical opportunity represents the annual energy reductions (savings) based on the entire eligible commercial water heating market converting to GHPs**, which this study assumes will occur after a 20-year period.

Topline findings indicate that approximately 19 percent of commercial water heating gas consumption in the US, and 17 percent in Canada, could be saved by the conversion of all eligible commercial gas water heaters to GHPs. This represents the total technical opportunity of GHPs in the North American commercial gas water heating market.

In the US, more than half of the total technical opportunity for GHPs exists in four regions in the US. This is illustrated in Figure 8, which shows the portion of technical opportunity that exists within each US region. That is, of the total technical opportunity in the US for GHP savings, 19 percent exists within the South Atlantic region, 16 percent each within the South Central and Middle Atlantic regions, etc.

Figure 8: Technical Opportunity in the US by Region

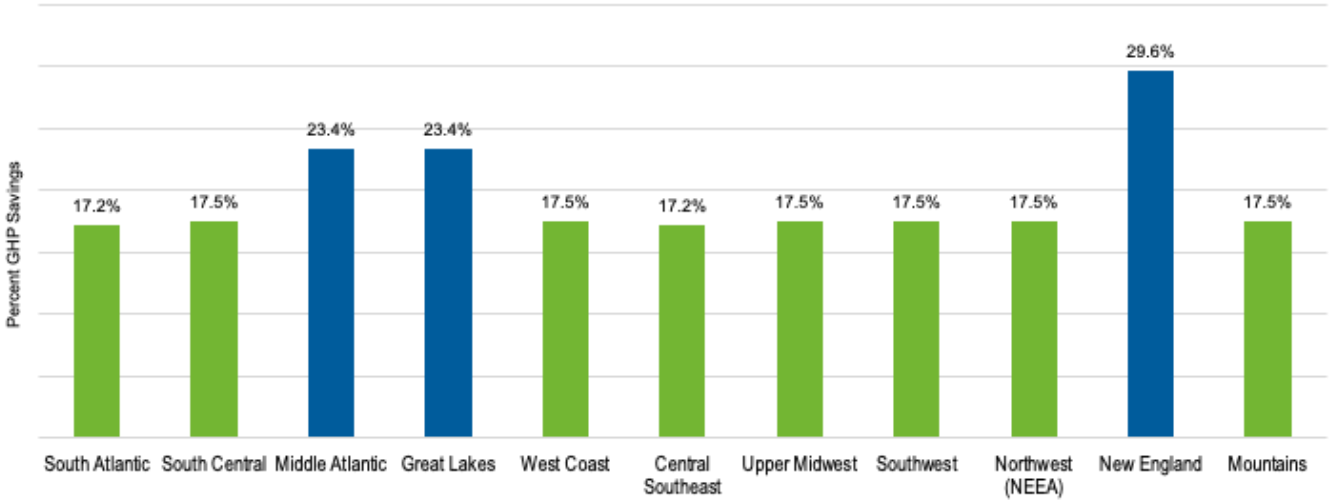


In the southern regions (South Atlantic and South Central), the high opportunity reflects high new construction forecasts. In the midwestern regions (Middle Atlantic and Great Lakes), the high opportunity is driven by high commercial gas sales. These midwestern regions also have more commercial customers compared to other regions and, therefore, more opportunities for commercial GHP installations. In addition, hydronic heating is more prevalent in these regions, so they received higher applicability factors.

Lower commercial gas sales and fewer commercial customers drive the reduced opportunity in the Southwest, Northwest, New England, and Mountains regions. Lower opportunity in the Upper Midwest is due to a lower percentage of natural gas used for water heating (13%) and a lower applicability factor given that hydronic heating systems are less common in this region.

Savings as a percentage of commercial water heating natural gas consumption range from 17 percent to 30 percent, with most regions having savings of approximately 17 percent (Figure 9). The consistency in the percentage savings values across regions occurs because several factors driving this value are similar across regions (i.e., the percentage of storage water heaters, applicability factors, and the GHP savings factor). Higher percentage savings (in blue) in the New England, Middle Atlantic, and Great Lakes regions reflect higher applicability factors because of the prevalence of hydronic heating in these regions.

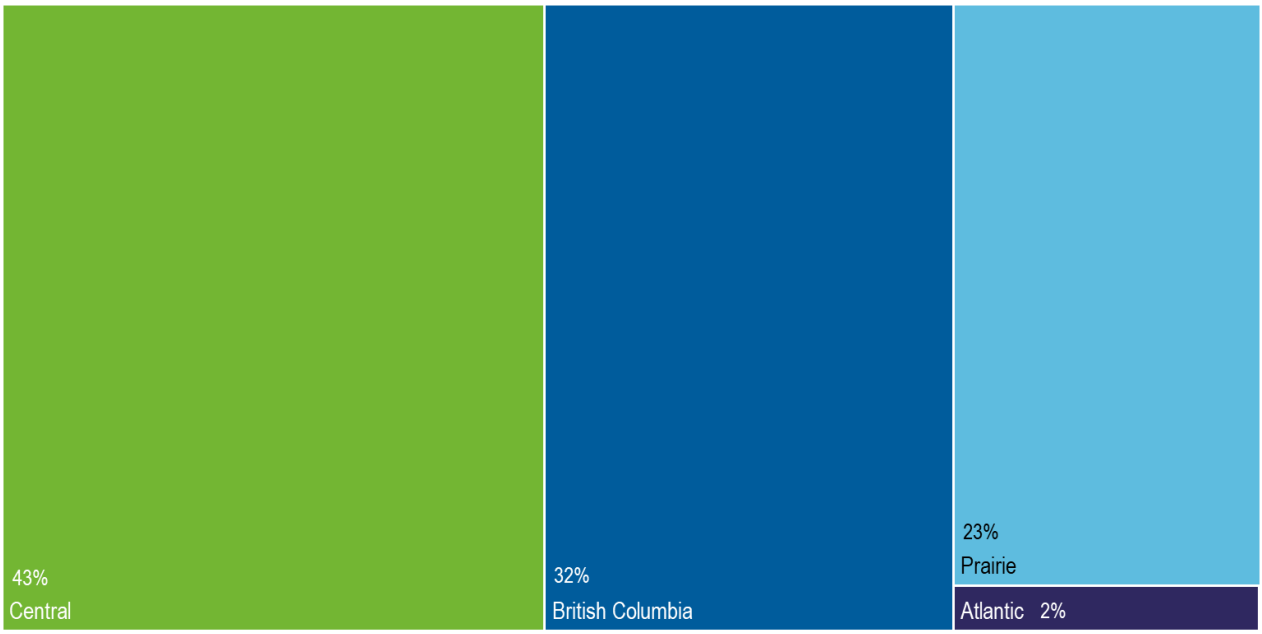
Figure 9: GHP Percentage Savings in the US



Technical opportunity varies across Canadian regions, with nearly all opportunity existing in the Central, British Columbia, and Prairie regions (Figure 10). The opportunity in the North and Atlantic regions is limited by the lack of natural gas infrastructure, and subsequently consumption, in these regions.

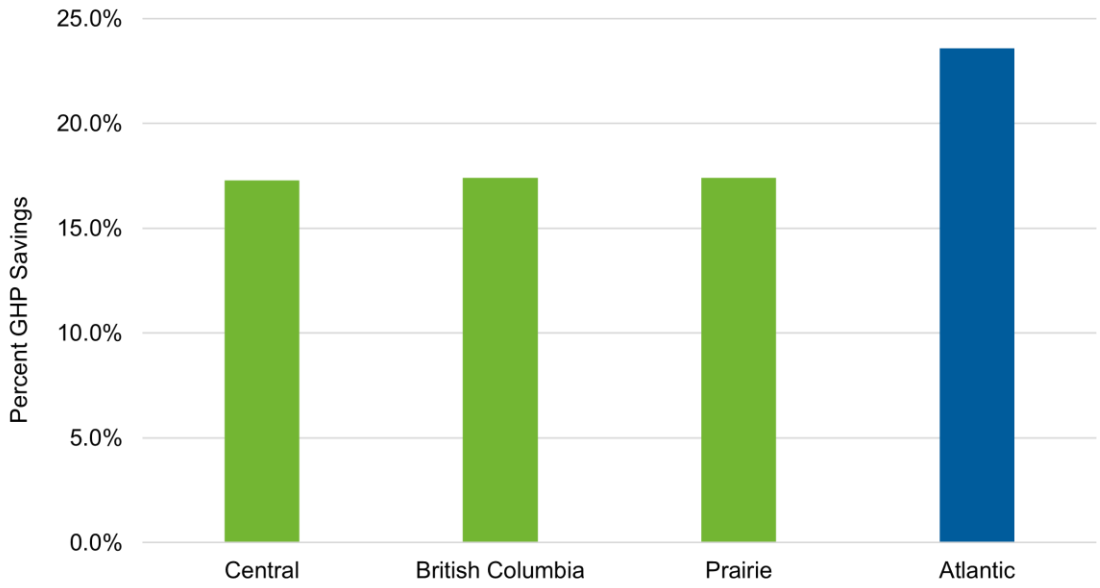
High opportunity in the Central and Prairie regions is driven by high commercial gas sales. In British Columbia, the high opportunity reflects the percentage of gas sales used for water heating (31%) and a higher new construction forecast.

Figure 10: Technical Opportunity in Canada by Region



Percentage savings across Canadian regions range from 17 percent to 24 percent (Figure 11). The higher percentage savings in the Atlantic region (in blue) are due to a higher applicability factor because of the prevalence of hydronic heating.

Figure 11: GHP Percentage Savings in Canada[29]



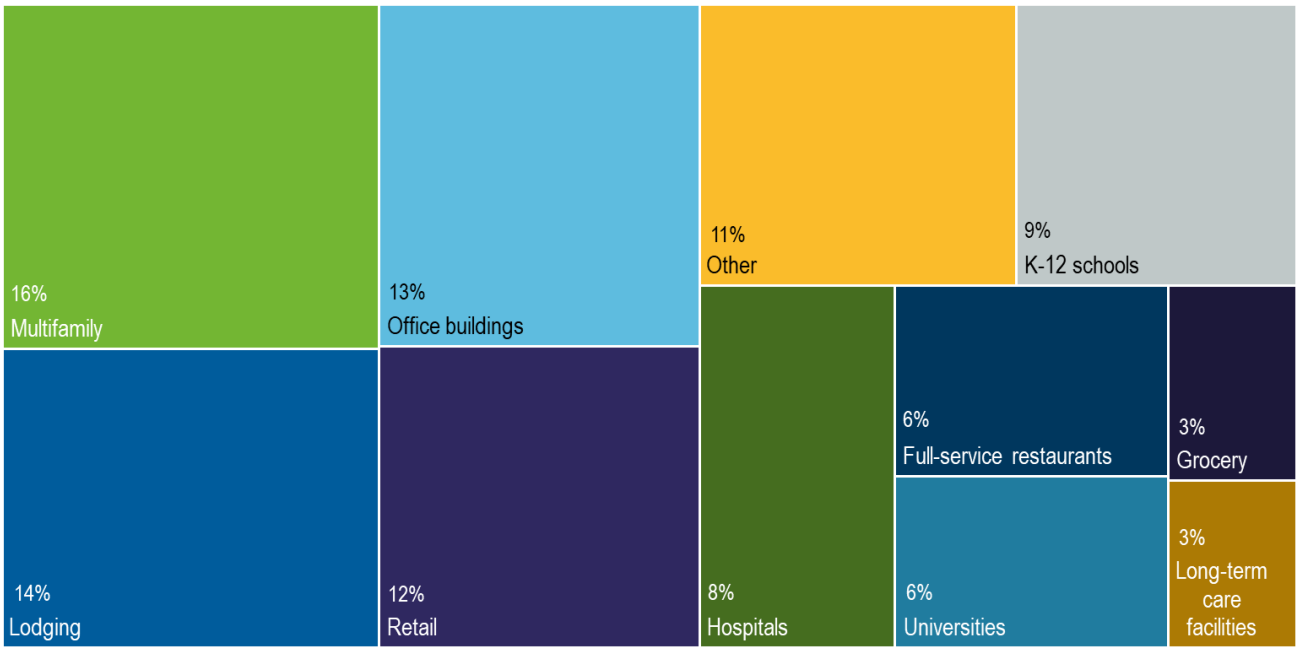
In the US and Canada, technical opportunity is variable across facility types, with about half of the opportunity existing within four facility types: multifamily, lodging, office buildings, and retail (Figure 12).

High opportunity for multifamily and lodging occurs because these facilities use a high share of their total natural gas consumption for water heating and because these facilities are ideal candidates for GHPs (i.e., their applicability factors are high). The high opportunity for office buildings reflects the high portion of total commercial gas consumption driven by this facility type (20% and 24% for the US and Canada, respectively).

There is limited opportunity within long-term care facilities because their share of total natural gas consumption in the commercial sector is low (1% and 3% for the US and Canada, respectively). Grocery is also low because the gas consumption share is low (4%) and because its applicability factor is relatively low.

[29] Note: North region excluded due to low technical opportunity.

Figure 12: Technical Opportunity in North America by Facility Type



Percentage savings range from approximately 13 percent to 26 percent across facility types (Figure 13). In general, facilities with higher applicability factors have higher percentage savings, including multifamily, lodging, K-12 schools, hospitals, universities, and long-term care facilities (in blue). These facility types are better applications for GHPs and, therefore, are predicted to have higher rates of eligible GHP installations.

Figure 13: GHP Percentage Savings by Facility Type

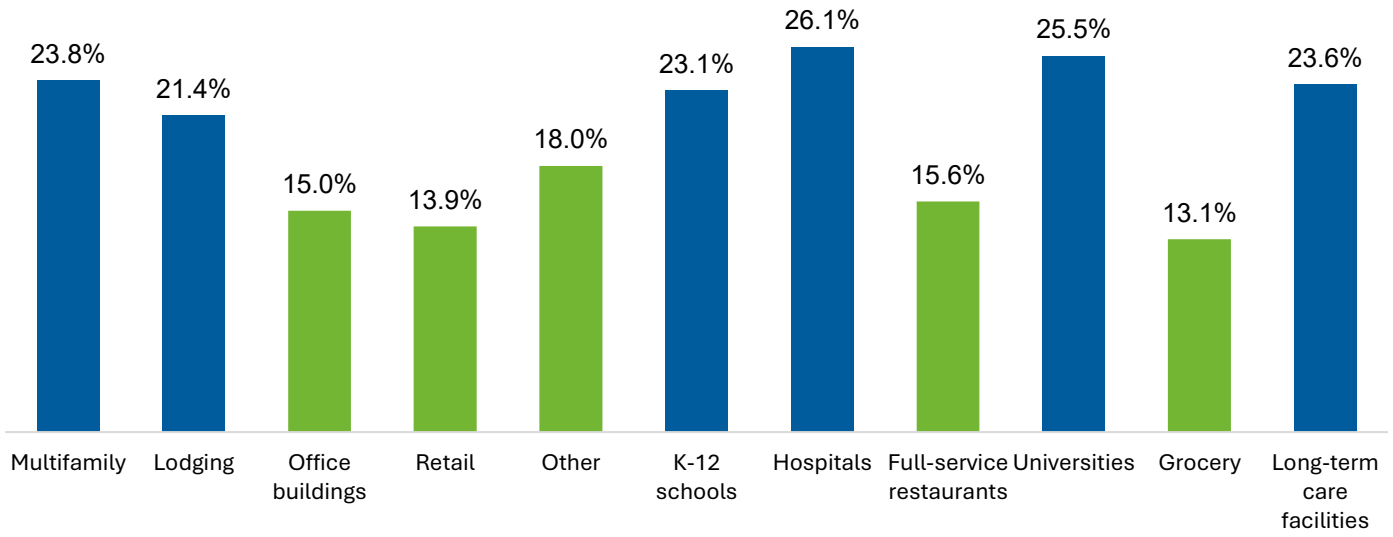


Figure 14 and Figure 15 display technical opportunity for existing buildings compared to new construction. Saving opportunities for existing buildings dwarf those for new construction in most regions. Opportunity in the new construction market is forecasted to be highest in the regions with high rates of new construction (the southern US and in British Columbia). In these regions, the technical opportunity is split almost evenly across existing and new construction facilities. New construction opportunity is small or negligible in all other regions, reflecting low new construction growth rates.

Figure 14: Technical Opportunity by Vintage in the US

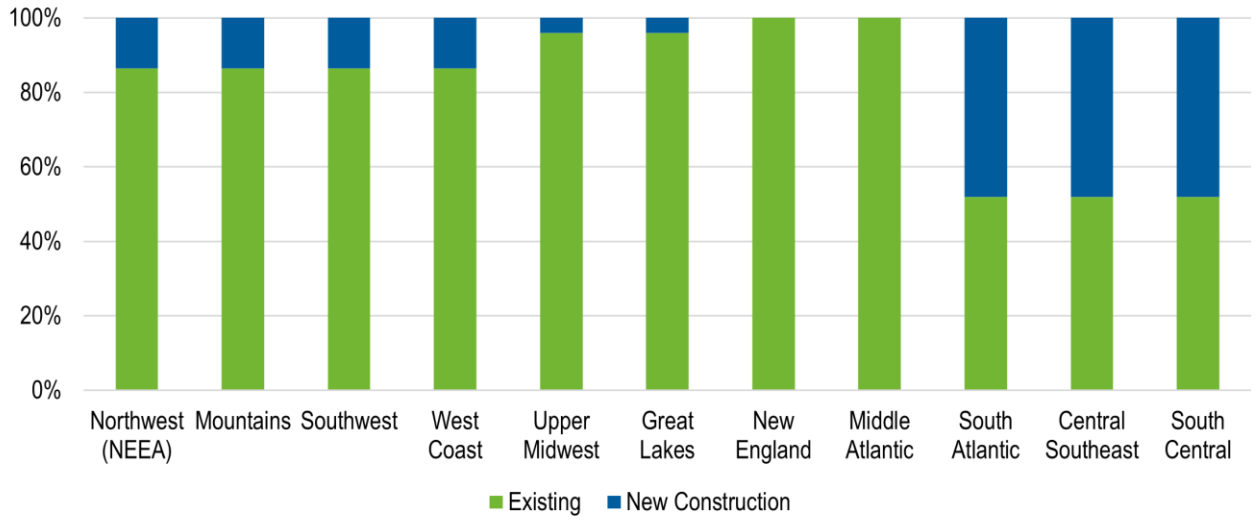
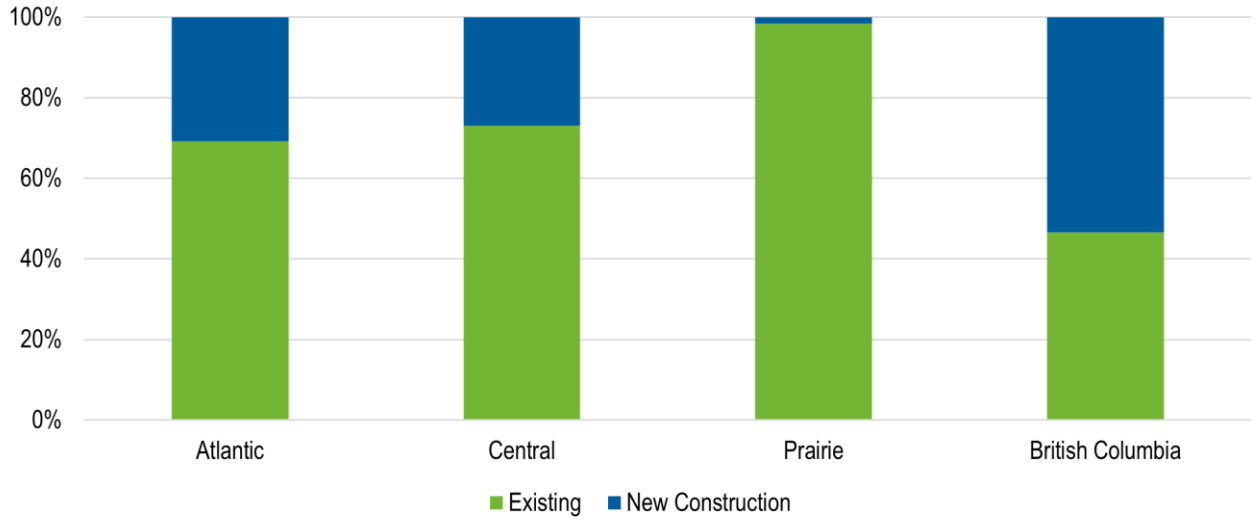


Figure 15: Technical Opportunity by Vintage in Canada[30]



[30] Note: North region excluded due to low technical opportunity.

5 Supply Chain Research Findings

This section summarizes findings from 10 interviews with contacts from six manufacturers of gas heat pumps (GHPs) available in North America and four manufacturer representatives. This section also provides an overview of the GHPs currently available in North America, drawing on interviews, information previously provided to the Collaborative, and manufacturer web sites.

5.1 Current Product Availability and Specifications

Commercial GHPs are available or forthcoming in North America from six manufacturers, with each manufacturer focusing on GHPs that fall into one of three categories:

1. Air to water, using an ammonia-water absorption cycle.
2. Water to water, using a lithium bromide-water absorption cycle.
3. Air-source variable refrigerant flow (VRF), using an engine-driven vapor compression cycle.

These systems have one attribute in common: while requiring electricity to operate, all use gas-fired combustion rather than an electrically powered compressor to drive the heat pump cycle.[31]

Air-to-water systems are available in standard factory-configured models with a range of per-unit heating capacity of 78,000 Btu/h to 123,500 Btu/h. (Vicot units have a rated capacity of 478,000 Btu/h and have been installed in pilot projects in North America but will not be certified for distribution in North America until Q3 of 2026, according to Homy Building Solutions, which represents Vicot GHPs in North America.) Air-to-water systems must be located outside, usually on the ground or roof, both because they are air-source systems and use ammonia as a refrigerant. These systems generally heat water at temperatures up to 140° F for domestic hot water, space heating, or other needs, though one manufacturer is now shipping a model capable of heating water to 149° F. Nominal heating efficiency (regardless of use) ranges from a coefficient of performance (COP) of 1.38 to 1.6, which manufacturers calculate as gas utilization efficiency for GHPs. Space cooling is available in Robur units by reversing the absorption cycle but at a lower COP of 0.67. Manufacturers may focus commercial sales efforts on domestic hot water, comfort heating (with or without cooling), or both. For many commercial facilities, providing heating (with or without cooling) would

[31] Water-to-water systems may be able to operate without heat from combustion, if sufficient waste heat is available on site.

require multiple Anesi[32] or Robur units or at least one of the Vicot units, which will provide more capacity per unit.

Water-to-water systems begin at heating capacities of 853,000 Btu/h (Thermax) and 1,200,000 Btu/h (Broad USA) and must be built to order, with lead times of four to six months. These are mammoth systems typically installed in a large central plant or boiler room. Even in gas-fired configurations, they need waste heat onsite (such as water from a manufacturing process or some other nearby source). They are rated to heat water at up to 200° F to satisfy a variety of needs, though in practice, lower temperatures are more likely. These systems require applications with large, simultaneous demand for chilled and hot water, such as hospitals, large casinos/resorts, and food processing. Domestic hot water would likely constitute part of the heating load for many applications, but economically attractive applications for these products demand higher loads, such as space heating in cold, northern climates.

Engine-driven, air-source VRF models from Yanmar are available in capacities ranging from 170,600 Btu/h to 324,100 Btu/h. These models are typically available within two to three weeks. While Yanmar is replacing the current North American product line, existing product should remain available through 2026. Weight begins at just under one ton, and these units must be installed outside, either on the ground or roof. These units typically provide space heating and cooling in conjunction with VRF terminal units, such as Daikin fan coils and air handling units. They can also be configured to provide domestic hot water through use of a Yanmar Hydrobox terminal unit with a refrigerant-to-water heat exchanger, though with a maximum water temperature of about 120° F.

Table 6 (next page) provides an at-a-glance comparison of the main GHP product lines available in North America. Information shown in the table was provided by Research Innovations at the beginning of the project, pulled from manufacturer web site and/or provided or confirmed by manufacturers during or after manufacturer interviews. Note that the capacity and efficiency ratings listed in Table 6 may not be comparable across manufacturers, which may use different assumptions to arrive at nominal ratings. For example, two manufacturers—Thermax and Vicot—represent efficiencies calculated using the Lower Heating Value (LHV) (also referred to as Net Calorific Value, or NCV) of natural gas, which results in higher rated efficiencies than with manufacturers that use Higher Heating Value (HHV) (also referred to as Gross Calorific Value, or GCV). Rated efficiencies for the same equipment may be roughly 10 percent higher when based on LHV than when based on HHV. Other differences that can have a significant impact on rated efficiency include ambient

[32] Anesi branded product availability was uncertain in April 2026 with a suspension of business operations at Stone Mountain Technologies Inc. (SMTI).

air temperature (for air-source units) or waste-heat water temperature (for water-source units), load-side water outlet and return temperatures, and load water flow rate.

Table 6: North America Gas Heat Pump Characteristics by Brand

Criteria	Brand					
	Anesi**	Broad USA	Robur	Thermax	Vicot	Yanmar
System Type	Air to water	Water to water	Air to water	Water to water	Air to water	Air-source VRF
Technology	Absorption	Absorption	Absorption	Absorption	Absorption	Engine driven
Refrigerant/Absorbent	Ammonia/Water	Water/Lithium bromide	Ammonia/Water	Water/Lithium bromide	Ammonia/Water	R-410A/Not applicable
Heating Capacity Per Unit*	78,000 Btu/h (23 kW)	1.2 to 68 MMBtu/h (350 to 20,000 kW)	123,500 Btu/h (36 kW)	853,000 Btu/h to 136 MMBtu/h (250 to 40,000 kW)	290,000 to 478,000 Btu/h (85 to 140 kW)	170,600 to 324,100 Btu/h
Heating Efficiency (COP)*	1.43 (HHV)	1.35 (HHV)	1.38 to 1.4 (HHV)	1.6 to 1.8 (LHV)	1.7 (LHV)	1.4 to 1.6 (HHV)**
Provides Cooling	No	Yes	Yes (some units)	Yes	No	Yes
Cooling Efficiency (COP)*	Not applicable	0.67 to 0.76	0.67	Not available	Not applicable	1.2 to 1.3***
Simultaneous Heating and Cooling Loads	No	Required	No	Preferred	No	Beneficial
Water Temperature Maximum	140°F	200°F (<95°C, from website)	140-149°F, depending on unit	200°F	140°F	120°F with Hydrobox
Equipment Siting	Outside	Central plant or large mechanical room	Outside	Central plant or large mechanical room	Outside	Outside
Delivery Time (Per Manufacturers)	Ships within 24 hours	~ 24 weeks	Ships within 2 to 3 days	~ 4 to 6 months	~ 3 months; 1 week once stocked in North America	~ 2 to 3 weeks

* Calculated as gas utilization efficiency. ** Anesi product availability uncertain as of April 2026. *** Yanmar does not publish COP values, because COP is not standardized for gas appliances. The project team calculated Yanmar COP values as gas utilization efficiency based on published performance data.

5.2 Distribution Channels and Regional Availability

A 2018 Northwest Energy Efficiency Alliance (NEEA) Water Heater Market Characterization Report[33] laid out primary distribution channels for water heating and included a key finding for commercial water heating: Buyers of commercial water heating systems typically purchase water heaters from installers, with most installers buying systems from distributors, retailers, or directly from manufacturers. Not surprisingly given the relative newness of the GHPs in North America, all manufacturers selling GHPs in North America reported using distribution channels that provide ample opportunity for technical assistance and installer education.

Manufacturers reported similar go-to-market strategies, relying primarily on manufacturer representatives and distributors with some customer direct marketing.

- Stone Mountain Technologies sold its Anesi GHPs primarily through manufacturer representatives, with a small number of distributors also selling and stocking units.[34] Robur also sells through manufacturer representatives, as well as to contractors when no manufacturer representative is available in that area.
- Broad USA and Thermax, which manufacture industrial-size, built-to-order water-to-water absorption heat pumps, work directly with consulting engineers and customers to specify systems and sell directly to installers (such as mechanical contractors). Homy Building Systems, which represents Vicot in North America, plans to use a direct sales model.
- Yanmar sells its engine-driven GHPs through a network of dealers trained to sell and service the systems. The company also has a contracting arm and solution provider—Controlled Air—that works directly with customers.

Table 7: North American Gas Heat Pump Distribution Channels

Brand	Manufacturer	Distribution Channels
Anesi[35]	Stone Mountain Technologies, Inc.	Manufacturer representatives, distributors
Broad USA	Broad USA	Direct sales
Robur	Robur	Manufacturer representatives, direct sales
Thermax	Thermax	Direct sales
Vicot	Vicot (sold by Homy in North America)	Direct sales through Homy Building Solutions
Yanmar	Yanmar	Dealer/distributor network

[33] https://neea.org/wp-content/uploads/2025/03/water-heater-market-characterization-report.pdf
[34] Stone Mountain Technologies Inc. (SMTI) suspended all business activities in March 2026 and is in the process of exploring new ownership opportunities.
[35] The Anesi brand was not available in April 2026 with the suspension of SMTI business activities.

All manufacturers reported that products are available throughout North America except Homy (representing Vicot), which has offices in Ontario, Canada, and plans to open an office in Chicago in 2026 to better serve the US market. Vicot will not have units certified for sale in North America until Q3 2026, though it has provided units for pilot projects in North America.

For manufacturers other than Vicot, availability differs regionally only in time required for shipping. Two of the three manufacturers that currently stock units—Robur and Yanmar—ship all units from their central distribution warehouse. Stone Mountain (SMTI)[36] reported that two distributors in Canada and three in the US stock its products and that manufacturer reps also maintain inventory.

5.3 Market Expectations and Growth Projections

When asked about the outlook for GHP sales in five to 10 years, all interviewed manufacturers expressed expectations of higher sales compared with current levels, though some also acknowledged uncertainties associated with market drivers such as utility rebates, overall program support, industry marketing efforts, and government policies regarding electrification and natural gas. The smaller sample of manufacturer representatives also saw potential for growth but focused more on the need for rebates and on uncertainties, which we address in Perceived Barriers below.

One manufacturer ventured a GHP market share forecast, predicting a commercial water heating share of 10 percent to 20 percent within 10 years. Another manufacturer mentioned the goal of doubling its current sales volume. Others underscored their conviction that North America GHP sales will increase in the future, with one predicting that “in three to five years, America will be a better market for GHP.”

Expectations for GHP market growth result in part from growing industry awareness that complete electrification is unrealistic in some locations and for some buildings because of load-related grid constraints and/or insufficient building electrical infrastructure. As one manufacturer put it, “When we go into electrification, we all know that if everything goes into electric mode … the infrastructure is not geared up to sustain electrical heat pumps in winter.” Another said, "We've got a good play to make in five to seven years here … because of how we have trended toward electricity and now several states are starting to shift back."

Two other manufacturers gave examples in which upgrading the building electrical infrastructure to support electrification was not economically feasible, making GHP solutions a more economically viable way to achieve efficiency and decarbonization gains. In one

[36] SMTI suspended business activities in Q1 2026.

example, converting an office building to a laboratory space would have required a five-year wait for electric service and millions of dollars for electrical upgrades; the GHP solution allowed the project to move forward quickly and without the electric service upgrades.

Another factor that may help tilt programs and policy to embrace GHP technology is the reality that in some areas, using GHPs at the site is a lower-carbon approach than requiring electrification while generating electricity with natural gas. One manufacturer pointed out that strict electrification does not make sense in areas where electricity is being generated by a gas turbine with 30 percent efficiency.

The expectation among manufacturers appears to be that the market will turn to GHP technology to provide decarbonization benefits in buildings for which full electrification would be economically infeasible. Expected continued increases in electricity rates, partly due to increased demand from data centers, will help GHPs better compete with electric heat pumps.

5.4 Greatest Areas of Perceived Opportunity

In the near term, perceived opportunities for GHPs vary somewhat among manufacturers, depending on the type of GHP they produce and the manufacturer's market focus. All agree that electrical grid limitations offer immediate market opportunity for GHPs. So, too, do buildings with electrical infrastructure too limited to support full electrification. GHPs can support decarbonization policies by reducing natural gas usage by 30 to 40 percent compared with natural gas boilers, based on equipment COPs shown in Table 6 and information provided by manufacturers, and they can do so without requiring grid or building electrical infrastructure improvements.

Manufacturers also mentioned the difference between low natural gas prices and high electric rates. Referring to this difference in pricing as a "spark spread," manufacturers noted that GHP technology can look attractive compared with electric alternatives in markets with a large difference. As one manufacturer noted, *"If it's a large spark spread area—so, inexpensive gas, expensive electricity—it makes our product look better."*.

Manufacturers and manufacturer representatives emphasized that utility support and incentives are essential in creating opportunities for GHPs. *"Where gas utilities are heavily pushing this or, hopefully, putting an incentive in place is where we're able to get a manufacturer's rep excited about it … and the distributors excited about stocking it, because they know there's going to be a program [supporting] it,"* said one manufacturer. Another manufacturer mentioned that incentives get the attention of facility owners, which can drive installer interest. A manufacturer representative noted that "we've been waiting and waiting and waiting" for rebates and that they would be a "game changer" in their area. A second

manufacturer's rep said, "anywhere there's an incentive, the builder is going to look at that. The owner is going to look at that … because [interest] is driven by incentives."

Manufacturers also stressed the importance of utility-driven pilot programs and demonstration projects to help develop the commercial GHP market. One manufacturer noted that its GHP sales have been clustered in areas "where the program or gas utility has been aggressive with trying to get demonstration and pilot units out," because the projects expose engineering consultants and contractors to GHP technologies and solutions and help build confidence in GHP projects. Another manufacturer stressed the importance of having pilot/demonstration projects in multiple regions to show that GHPs can work well in various climates.

Whether serving domestic hot water needs or other heating demands, GHPs provide the best return on investment when demand is high and steady enough for savings from their greater-than-100-percent heating efficiency to offset their higher upfront cost (when compared with comparable boiler systems). The most attractive opportunities for GHP installations also vary by manufacturer and product type and how well that aligns with the end use or building type under consideration. However, the specific opportunities depend on whether a manufacturer is targeting domestic hot water or space heating (and possibly cooling) with its products.

5.4.1 Domestic Hot Water

Two of the six manufacturers interviewed described compelling commercial opportunities for GHPs in domestic water heating, and a third described pivoting from a space heating focus to a more equal balance of space and water heating. A focus on domestic hot water (DHW) makes the most sense for GHP systems with capacities on the lower end of the GHP capacity spectrum that can generate water temperatures of at least 140° F, to avoid Legionella bacteria growth. These systems can also serve space heating loads, but many commercial facilities have a large enough heating load that numerous units would be required to satisfy it, potentially leading to difficulties in siting the equipment (see Perceived Barriers).

DHW demand is a key factor in finding good candidates for GHP installations. One manufacturer cited ideal demand at between 1,000 and 10,000 gallons per day. According to this interviewee, *"If they're looking at saving energy and more specifically saving money, it really doesn't really matter what the building type is or what they do; it's how much hot water they use, because that defines how much energy they're using and how much we can save them."*

The three manufacturers with DHW as a focus named hospitals, hotels/lodging, multifamily properties with a central DHW system, K-12 schools (especially school cafeterias), university dormitories, full-service restaurants, and long-term care as key opportunities. Facility types

that typically use too little DHW to justify a GHP upgrade include standard office buildings, fast-food restaurants, and retail/grocery.

The manufacturers focused on DHW systems said installing GHPs to work in conjunction with existing gas boilers can make sense for two reasons: 1) to keep the initial cost of GHPs down by sizing them to meet only 60 to 80 percent of the load, therefore allowing for lower-capacity GHP systems, and 2) to reach the higher temperatures of 160 to 180° F preferred in some settings, such as for sanitizing. With this sort of hybrid system, the GHP acts as the primary system, pre-heating water to 120 to 140° F. The existing gas boiler boosts the temperature to the desired level. It also kicks in as necessary to meet peak loads.

5.4.2 Space Heating

For all GHPs using air-to-water or water-to-water designs—all represented here except those from Yanmar—space heating opportunities are largely limited to facilities using hydronic heating. The hydronic system will generally be served by a natural gas-fired boiler within natural gas utility service areas, though interest in electrification has led to a growing number of electric resistance boilers and air-to-water heat pumps (also referred to as electric heat pump boilers).

Manufacturers point to climate as driving the greatest opportunities for space heating with GHPs, with colder, northern climates providing the most compelling return on investment. Cold climates offer better opportunities for two reasons:

1. First, heavier heating load leads to more opportunity for GHP savings in comparison with natural gas and electric resistance boilers. For example, when the annual heating load is twice as high in one area as in another, installing a more efficient heating system reduces energy cost by twice as much, all else being equal.
2. Second, GHPs can provide superior performance in the coldest climates compared with electric heat pump alternatives, maintaining their heating capacity better at very low temperatures and providing better efficiency at certain temperatures. This can be true for all GHPs, but water-to-water absorption units with available waste heat on site should offer far better efficiency and capacity at extreme cold temperatures than air-to-water heat pump competitors.

Water-to-water absorption units also maintain the higher water temperatures needed for space heating in the coldest climates. *"At a certain temperature, [electric heat pumps] cannot [heat water to] more than, I would say, 150° F … but when in a very cold climate, you need 190 to 200° F of heating output water,"* said one manufacturer. *"A gas heat pump … can provide [those] higher temperatures."*

5.4.3 Space Heating with Cooling

GHP cooling is less efficient than GHP heating but can still be a cost-effective solution, especially for installations where the grid and/or building infrastructure would not support electric cooling and/or in areas with a large spark spread. Of the companies that manufacture air-to-water GHPs, Robur is the only one offering models in North America that can also provide cooling. With these models, the unit must be in either heating mode or cooling mode, so simultaneous heating and cooling are not possible. Water-to-water GHPs from Broad USA and Thermax can provide simultaneous heating and cooling, as can Yanmar engine-driven models.

Robur identified adding cooling to buildings that have only heating as a potential opportunity, such as with multifamily buildings, warehouses, and schools. “We can provide heating at a reduced operating cost and much more efficiently, and we can then use the reversible heat pumps to add cooling to a building that didn’t have it previously … for a negligible cost.” One example is old K-12 schools in districts that are mandating that schools add cooling.

Water-to water and engine-driven GHPs accommodate simultaneous heating and cooling loads and provide better return on investment when they do. For its units, Broad USA noted that simultaneous heating and cooling is required. Suitable water-to-water GHP applications include hospitals, universities, large resorts and casinos, industrial applications, and food processing.

5.4.4 New Construction vs. Retrofit

Manufacturers generally expect retrofit projects to provide more opportunity than new construction for commercial GHP adoption, though reasons differed:

- **Market size.** One manufacturer noted that most of their projects have been retrofit or replacement, “but that's just because it’s 80 percent of the market."
- **Lower initial investment.** Another noted less initial investment might be required for a retrofit project—for example, by installing a GHP to cover the bulk of the load while retaining the existing boiler to cover peak load, rather than obtaining new equipment to cover the full capacity needed.
- **Owner visibility into operating costs.** Yet another manufacturer noted that owners tend to drive retrofit projects and are more driven by reducing their costs. “We can help them with efficiency dramatically.”

A manufacturer with a mix of 70 percent retrofit and 30 percent new construction explained why retrofit dominates: *“Getting engineers to change their way of doing things takes longer. They have to see more of the stuff operating, and they'll slowly start to come around…most of your new construction comes from an engineering design firm.”* Another manufacturer

observed, *"The push on the new construction projects have been all electrification. I want no gas…that's just kind of the mindset."*

Still, all interviewed manufacturers and manufacturer representatives also saw opportunities in the new construction market, and some pointed to advantages with new construction. Two manufacturer representatives held that making inroads in new construction would be easier. *"Definitely easier on a new construction because everything's open,"* one said. *"You can run your pipes and everything as you please. Definitely a challenge in a retrofit."* One of the manufacturers who generally saw more opportunity in retrofits noted more success in some parts of the US because of its established relationships with new construction contractors.

5.5 Regional Variations in Program Support and GHP Awareness

All interviewed manufacturers and manufacturer representatives underscored the importance of strong utility incentives and pilot/demonstration programs in developing the market for GHPs. Participants noted regional differences in program support and the effects of policy differences in some areas.

Three manufacturers specifically mentioned FortisBC for its ongoing pilot programs and rebates, as well as activity in other parts of Canada and some US locations. *"I look at FortisBC, they've got a great rebate,"* said one manufacturer. *"I look at Nicor in Chicago, they've got a great rebate. I look at Peoples Gas … and why am I spending time in Saskatchewan? Because Saskatchewan Energy likes us and we are trying to put a rebate program there …"*

"East and West Canada, the Chicago area, and the New Jersey area are hotbeds right now," said another manufacturer. *"It's all pretty much gas utility driven because they're being aggressive about trying to put some programs in place to create some market pull."* Other manufacturers mentioned Enbridge pilot testing programs in Ontario and a Southern California Gas Company (SoCalGas) pilot in California.

Manufacturers noted that market actor awareness of GHPs is stronger in areas with strong utility support. However, one manufacturer mentioned strong ongoing awareness in Manhattan, New York, where he noted that thousands of absorption chillers provide cooling in large buildings. Awareness of gas-fired absorption equipment is strong across all market actors in this market, he said, including mechanical, electrical and plumbing (MEP) firms, possibly as the result of previous program support. More recently, New York state and local decarbonization efforts have largely focused on encouraging the use of electric systems and banning or discouraging natural gas installations.

5.6 Perceived Barriers

The manufacturers and manufacturer representatives we interviewed mentioned similar barriers to GHP adoption, but their focus differed. Whereas manufacturers focused primarily on market awareness, education, and market inertia, the manufacturer representatives emphasized high equipment and installation cost, lack of cooling, and siting and installation challenges. Both groups mentioned the lack of incentives to offset the equipment and installation costs.

Market Awareness. All agreed that market awareness for gas heat pumps is a barrier and that education is needed at every step of the supply chain. "If you just go out blindly looking for contractors and engineering firms, you're going to probably find a low hit rate on ones that even know what the heck this stuff is," said one manufacturer. "The number one hurdle I think we face right now is awareness that this technology exists and what it could do, [followed by] the number of trained technical people, both on the contractor and engineering sides, that know enough about it to start talking about it and recommending it to their customers."

Market Inertia. Contacts also mentioned market inertia as a primary barrier. "It's not easy to change the mindset of the contractors and designers to use a gas heat pump when they [have been] installing and using the common boilers for 10 years, 20 years," said one manufacturer. "Definitely that's the first challenge … They usually don't want to take the risk." Another manufacturer attributed the inertia partly to the long-sustained marketing efforts of boiler manufacturers. "There are 40 plus boiler manufacturers, and some of them are extremely large out there pushing marketing and selling their stuff, and have been since the 1940s," the spokesperson said. "So it takes a lot of time and money and effort to put a dent into that entrenched dogma."

Initial Cost. Manufacturer representatives underscored upfront cost as a key barrier to adoption, with one focusing especially on the greater installation cost of gas heat pumps for some applications compared with some alternatives. *"Everybody loves it until they learn what's involved in … the installation and how much money it costs,"* he said. For example, because ammonia-based systems must be located outside, installation requires running gas, water lines, and the electric circuit outside and possibly to the roof. The systems can weigh more than electric heat pumps, potentially requiring a support platform or modifications to the roof structure, and possibly a crane for installation. Similar challenges extend to other types of GHPs.

When discussing cost, manufacturers typically cited scenarios where gas heat pumps could cost less than alternatives, such as adding cooling or avoiding expensive electric infrastructure upgrades associated with electrification. One noted the higher cost of GHP equipment compared with some more traditional equipment: *"We compete very well against an electric heat pump. We're lower cost to buy, we're lower cost to operate. But we struggle to*

compete against conventional gas because natural gas prices are still very low, and we're competing against products that have been in the market for 100 years and have been cost optimized from a design and manufacturing point of view … So it's tough for a brand-new product at low volume to compete head on against that without some incentive help."

Placement (Siting). The size and weight of gas heat pump products compared with alternatives can also create barriers, especially for applications where multiple air-to-air GHPs or one or more water-to-water models would be needed to meet demand. Roof structures may not be capable of supporting the weight of these units without reinforcement, and there may not be adequate space outside at ground level. Water-to-water units must typically be installed at ground level inside, either in central plant buildings or large mechanical rooms. They are large enough that bringing them into mechanical rooms of existing buildings may be impractical. (These units can be delivered in two or more pieces and reassembled by factory-trained personnel at the installation site, which overcomes entry clearance challenges.)

Performance Limitations. Manufacturer representatives also noted that performance constraints can be a barrier, such as the 120 or 140° F water temperature limit for most air-source units. For space conditioning applications, the inability of most air-to-water models to provide cooling can be a disadvantage compared with electric heat pumps, and GHPs that do offer cooling provide it less efficiently than electric heat pumps.

Ammonia Safety. Manufacturers and manufacturer representatives mentioned fears over the ammonia use in some GHPs as a concern for installers but said these fears are straightforward to address, because the GHP is a sealed system and installed outside. *"The absorption cycle on the heat pump is a sealed system that doesn't really need any charging or maintenance,"* said one manufacturer. *"They realize then that it's just like any other thing [they] hook up"* and becomes less of a problem.

Natural Gas Bans. Natural gas bans (typically affecting new construction) create challenges to GHP adoption, as do utility programs reducing their support for natural gas solutions. Manufacturers mentioned US bans or *de facto* bans reducing interest in natural gas equipment in New York, Seattle, and portions of California. In Canada, restrictions are active in Montreal, Vancouver, and some other municipalities in British Columbia.

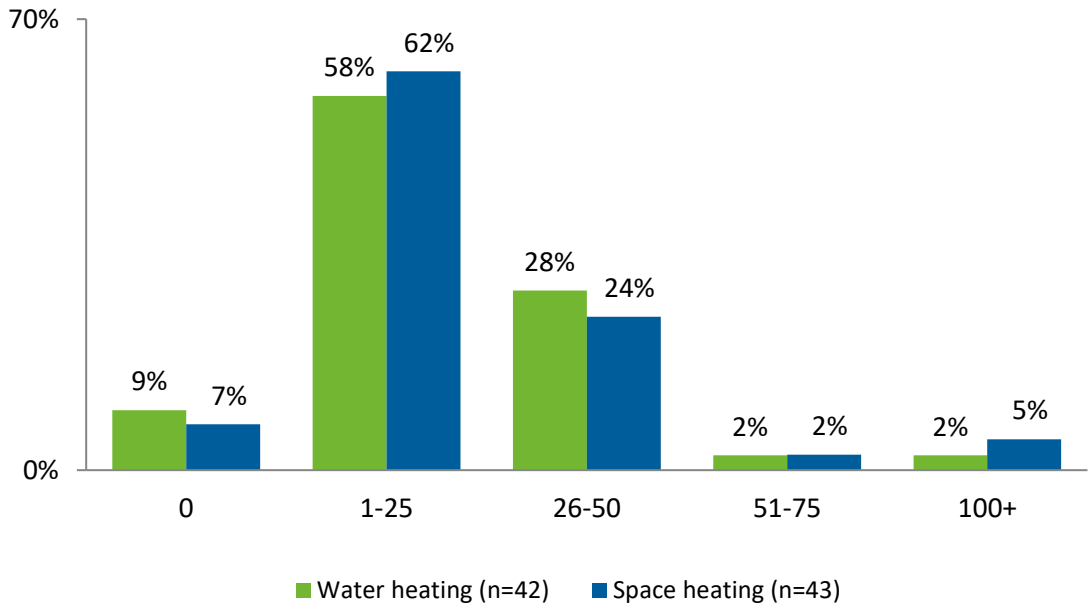
6 Market Actor Survey Findings

This section summarizes the findings from the market actor survey, which gauged overall market awareness of gas heat pumps (GHPs) for space and water heating in commercial applications. See the Methods section for the full description of the recruitment methods for the survey.

6.1 Supply Chain Structure

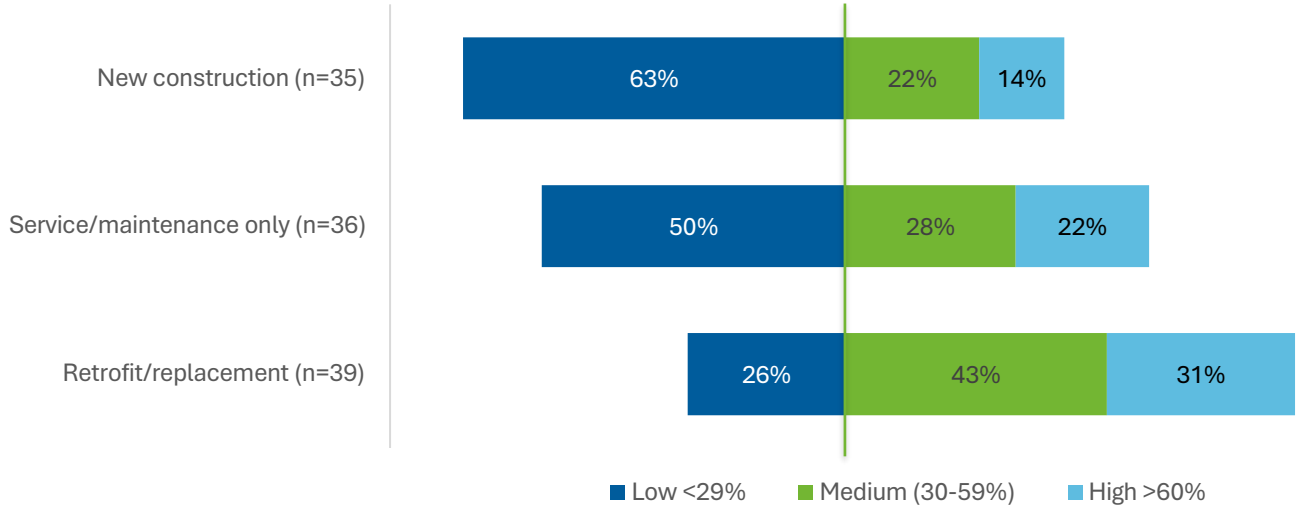
Fifty-eight percent of respondents reported their firm completes between 1 and 25 commercial water heating projects in a typical year, and 28 percent reported between 26 and 50 projects (n=42). Sixty-two percent of respondents said their firm completed between 1 and 25 commercial HVAC projects a year (n=43) (Figure 16).

Figure 16: Reported Volume of Commercial Projects Completed in a Typical Year



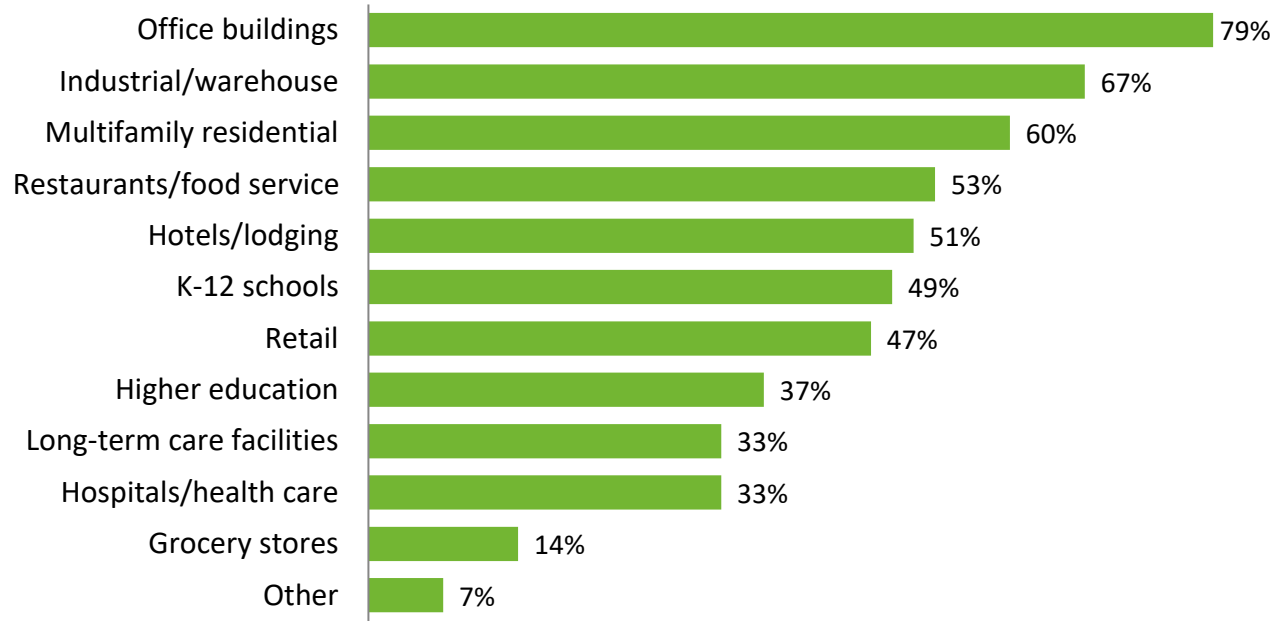
Of those commercial projects, new construction is the least common type of project, while retrofit/replacement projects are the most common (Figure 17).

Figure 17: Market Actor Portion of Work by Scenario Types (n=35)



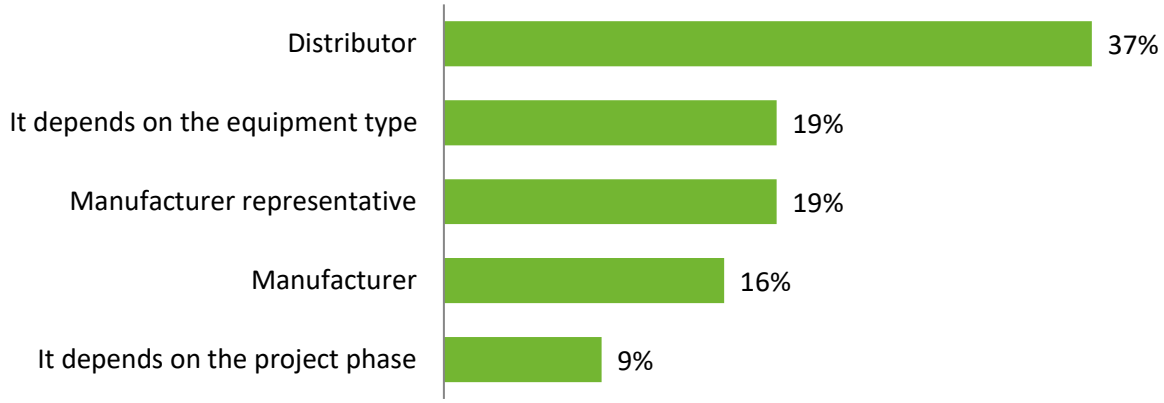
The types of commercial buildings that market actors' firms primarily serve varied, but they most commonly reported serving office buildings (79%), followed by industrial/warehouse (67%), multifamily residential (60%), restaurants/food service (53%), and hotels/lodging (51%) (Figure 18).

Figure 18: Distribution of Projects by Building Type (n=43, multiple responses allowed)



When it comes to making decisions for commercial water heating, market actors' most common primary point of contacts are distributors (37%). Twelve of the 43 respondents noted their primary contact would depend on the type of equipment or the phase of the project (28%) (Figure 19).

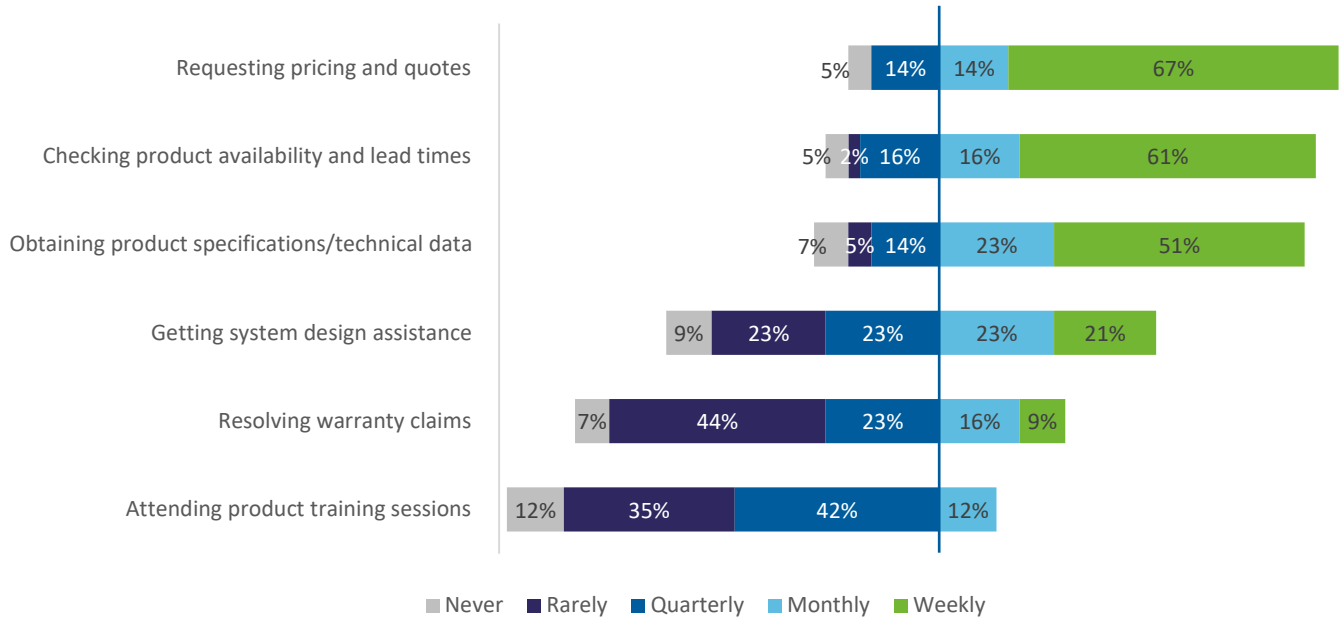
Figure 19: Most Common Primary Point of Contact for Decision-Making (n=43)



The survey asked these respondents to describe what drove their decision. They reported their point of contact depended on the size of the project, the complexity of the system, the availability of technical support, the needs of the project, or whether a project involves replacing or repairing equipment. As one market actor noted, "large jobs will be sourced through the manufacturer. One-off jobs are through our distributor."

We asked respondents the primary reasons they interact with manufacturers, manufacturer representatives, or distributors. Respondents most commonly reported weekly interaction for requesting pricing quotes (67%), checking product availability and lead times (60%), and obtaining product specifications or technical data (51%). Fewer respondents resolved warranty claims on a weekly basis (44%), and most attended product training sessions quarterly (42%). System design assistance showed the most variation across the frequency categories (Figure 20). This figure plots the less frequent interactions to the left of the line, with more frequent interactions on the right side of the line.

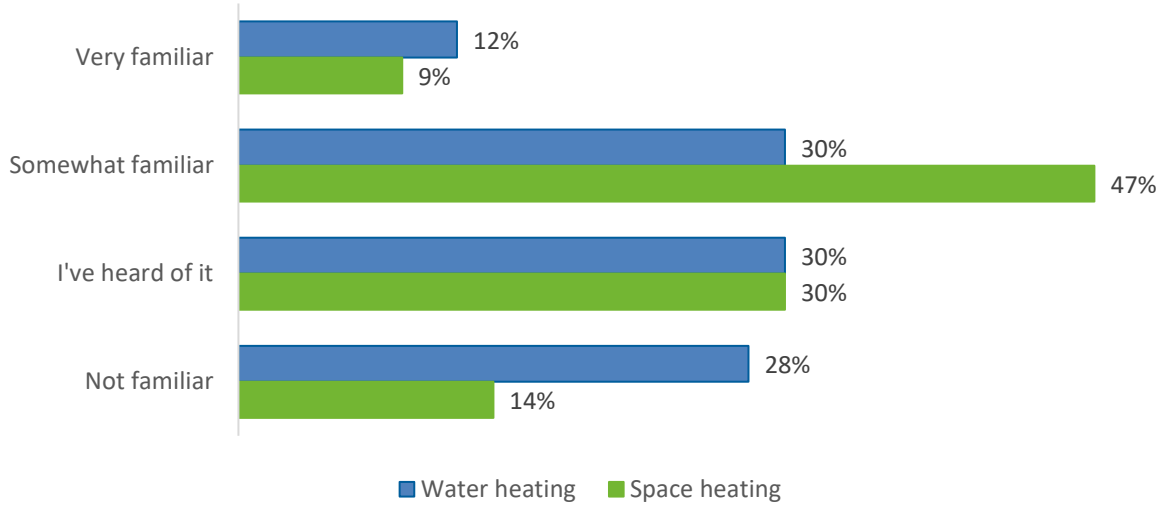
Figure 20: Interaction Frequency with Manufacturers, Manufacturer Representatives, or Distributors (n=43)



6.2 Gas Heat Pump Technology

We asked market actors about their familiarity with GHP technology for both space conditioning and water heating. For space conditioning, about half of respondents said they were "somewhat" (47%) or "very" familiar (9%) and almost another third had heard of it before (30%). When asked about familiarity with GHP technology for water heating, responses also varied, with 30 percent reporting they were somewhat familiar or they had heard of it before, and 12 percent describing themselves as very familiar. A somewhat higher portion (28%) reported being unfamiliar with GHPs for water heating than for space conditioning (14%) (Figure 21).

Figure 21: Awareness of GHP Technology for Water Heating vs. Space Conditioning (n=43)



Those with familiarity described what they had heard about using GHPs for space conditioning. The most common sentiment centered on the efficiency of the equipment (offered by 10 respondents), followed by concerns about cost (offered by five respondents). Responses revealed mixed opinions, with representative comments including:

- *"They are super-efficient but can be costly."*
- *"100%+ efficiency, expensive, [and] good rebates available"*
- *"I am familiar with the technology… and have seen field installations. I am somewhat uncomfortable with what I am seeing as far as short equipment life cycles in multifamily applications."*
- *"I have heard it is available and have looked into some manufacturers but have no hands-on experience."*
- *"That gas heat pumps are highly efficient and low maintenance… Not sure how the capital and installation costs compare to electric heat pumps."*

- *"Only the research I have done myself and a Fortis sponsored lecture. The products have not been made available."*
- *"It's a different type of heat using natural gas instead of the more traditional refrigerant. They also claim to use less energy."*

Several comments indicated respondents were confounding GHPs with electric heat pumps and/or were referring to residential applications.

- *"I know in a lot of homes it's becoming mandatory."*
- *"I have old info and training for York Triathlon."*
- *"It's 'forced to market' due to politics and code pressures by people wanting to eliminate natural gas furnaces."*

Water heating awareness is less common, with more confusion about GHPs in the water heating context. We asked those with some familiarity what they had heard about using the technology for water heating. Representative comments are provided below.

Positive comments included:

- *"It's good for energy efficiency improvements."*
- *"We have installed a few Robur GAHPs and a few air-to-water heat pumps. Good in principle…they seem to be effective. Future service on the GAHP units will be very limited due to industry knowledge and skill set."*
- *"I have lots of experience with Enbridge installs and R+D."*

Others expressed skepticism or provided a concern:

- *"I've heard that they can help close the gap on water heating, but I don't know if they can provide a full delta-T to get the water temperature where it needs to be."*
- *"It's similar to the use for AC. We have heard about it, but most owners are either going to do traditional condensing gas-fired or electric AWHP. "*
- *"It is a pseudo replacement for water heaters that doubles as a furnace."*
- *"They are high maintenance."*
- *"Honestly, it seems too much work to retrofit, having to update the electrical."*
- *"They can make the mechanical room 10° cooler."*

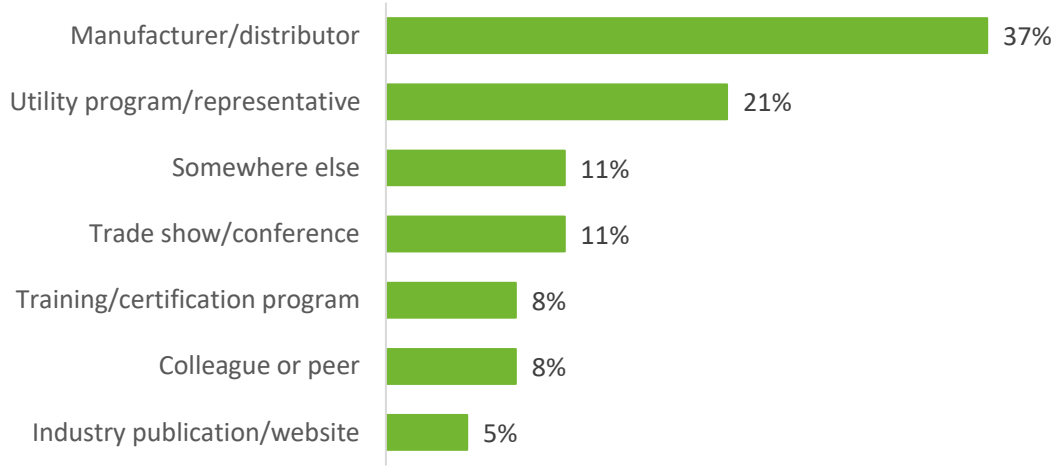
A few respondents provided vague comments or noted they had heard "things," for example:

- *"I have only heard that the systems exist."*
- *"For domestic hot water, no experience. I have quoted them."*

- *"I looked at some trial data from local manufacturers."*

The survey asked market actors with some familiarity of GHP technology where they first learned about it. The most common sources included a manufacturer or distributor (37%) and a utility program/representative (21%) (Figure 22).

Figure 22: Where Market Actors First Learn about GHP Technology (n=38)



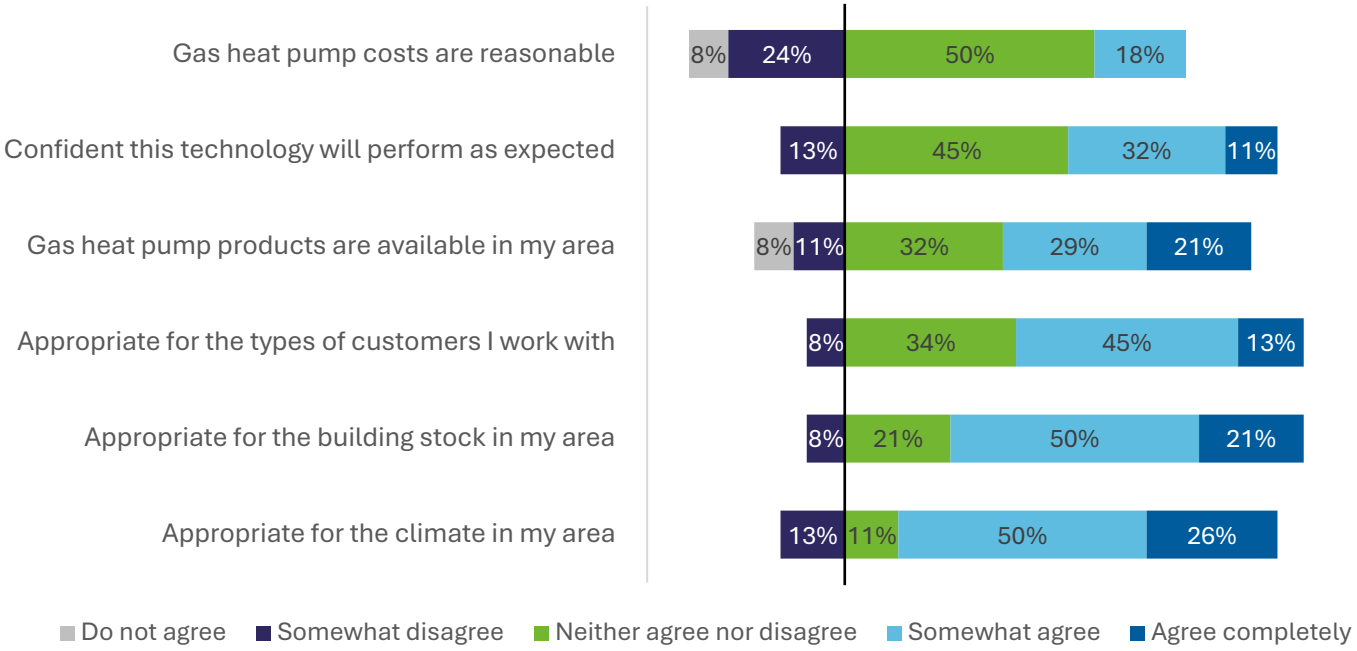
The survey asked the 35 respondents familiar with GHP technology if they had specified or installed a GHP for space conditioning or water heating in a commercial building. Most (80%, or 28 of the 35), reported they had not. Six of the seven respondents who had specified or installed GHPs provided an estimated project count and the portion of these projects in space conditioning applications, water heating applications, or both (Table 8).

Table 8: Portion of GHP Projects in Space Conditioning and Water Heating (n=6)

Respondent	Total	Respondent's State or Province	Space Conditioning Only	Water Heating Only	Both Space Conditioning and Water Heating
Respondent 1	48	California	10%	71%	19%
Respondent 2	10	Ontario	0%	0%	100%
Respondent 3	2	BC	0%	0%	100%
Respondent 4	3	BC	100%	0%	0%
Respondent 5	2	Georgia	100%	0%	0%
Respondent 6	2	BC	50%	50%	0%

We asked market actors who had some familiarity with GHP technology to rate their agreement with a series of statements about GHP technology (Figure 23), This figure plots the negative sentiment left of the line, and neutral is combined with agreement on the right side of the line. Market actors expressed confidence that GHPs are appropriate for their climate and building stock. However, confidence drops sharply when it comes to cost and performance. Forty-two percent agreed they are confident the technology will perform as expected, and just 18 percent agreed that costs are reasonable — while 45 to 50 percent remained neutral on both statements. This pattern suggests that market actors see GHPs as technically viable but remain unconvinced about the overall value proposition.

Figure 23: Agreement with GHP Technology Statements (n=38)



To understand how typical challenges in mechanical upgrade or replacement projects in mechanical buildings might differ if GHP technology were involved, we asked this same subset of market actors to indicate whether each of nine concerns was a major concern, a minor concern, or not a concern. Respondents rated these concerns twice—one for mechanical systems in general and then again assuming GHP technology is used. Interestingly, the portion rating various issues as a "major concern" is generally similar to the ratings for a general mechanical system upgrade or replacement project (Table 9).

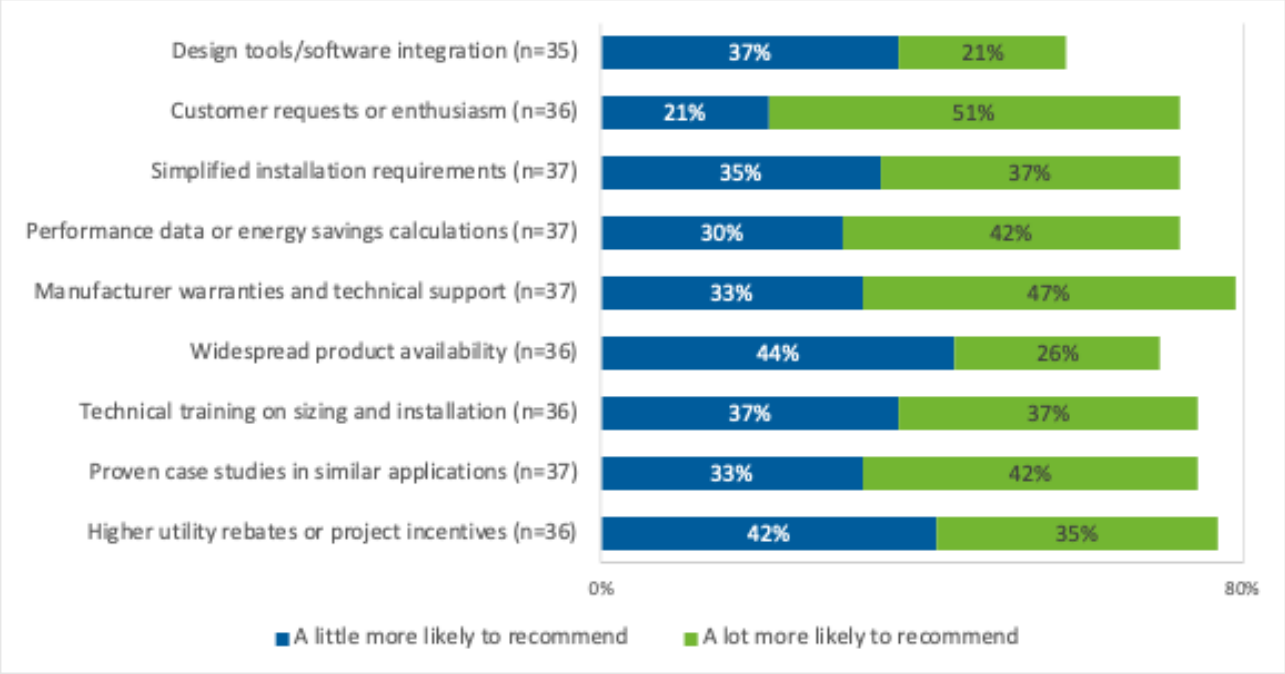
Table 9: Portion Rating Each Challenge a "Major Concern" in General Mechanical System Upgrades Compared to GHP Technology

Statement	General %	General N	GHP %	GHP N
Finding reasonably priced solution	70%	41	67%	36
Confidence in reliability	63%	42	58%	37
Product fits the space	63%	42	54%	36
Minimizing installation costs	60%	41	56%	37
Reducing installation complexity	47%	41	47%	37
Selecting product firm has experience with	30%	41	28%	37
Overcoming customer unfamiliarity	33%	40	37%	36
Avoiding permitting issues	26%	40	28%	35
Managing product availability	21%	38	23%	34

The survey asked market actors with familiarity with GHPs to consider a few solutions and rate the likelihood that each might change their recommendation. Over half of respondents indicated that customer requests or enthusiasm would make them "a lot more likely" to recommend GHP technology. Figure 24 indicates that manufacturer warranties and technical support could meaningfully change respondent recommendations, followed by higher utility rebates or project incentives.[37]

[37] The survey provided the list of considerations but did not gather follow-up information to gather more details about the reasonings for or specific details about their selected responses for this question.

Figure 24: Likelihood of Considerations to Change their Recommendations



Finally, respondents were asked to describe scenarios that would offer the best opportunities for GHP technology. The open-ended responses are described below.

Situations where there is limited electrical infrastructure. This emerged as the most frequently cited scenario, as buildings with electrical capacity constraints are likely to make electric heat pumps impractical.

- *"Existing buildings with limited electrical capacity."*
- *"Where a heat pump is desired, but the available power is not sufficient for a typical heat pump."*
- *"Any location where the existing electrical service is too small can add GHP."*

Specific building types. These include schools and municipal buildings with consistent heating or cooling loads.

- *"The best opportunities [are] in places with high year-round heating and cooling demand—especially schools, municipal buildings, new housing developments and commercial sites."*
- *"Government and public sector. Private sector requires comfort, performance, and longevity above all else."*

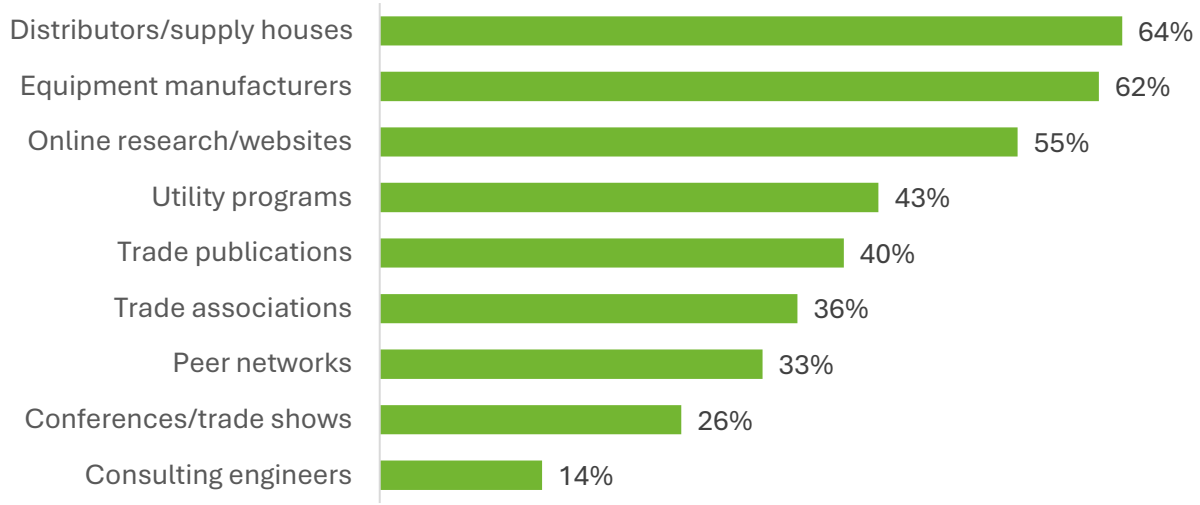
Retrofit vs. new construction. Responses indicated mixed opinions on whether retrofit or new construction projects are likely entry points.

- *"Businesses with aging buildings, due for mechanical upgrades and low on cash. Also, those who want to say they are 'green.'"*
- *"When existing equipment is at end of life… [and] natural gas is available on-site."*
- *"Commercial buildings that are in the rough-in phase and are looking to optimize both plumbing and HVAC systems."*
- *"I'd probably first start recommending GHP for retrofit projects, so I could see how they get installed and how well they perform, before recommending for new construction projects."*

6.3 Information Sources & Training

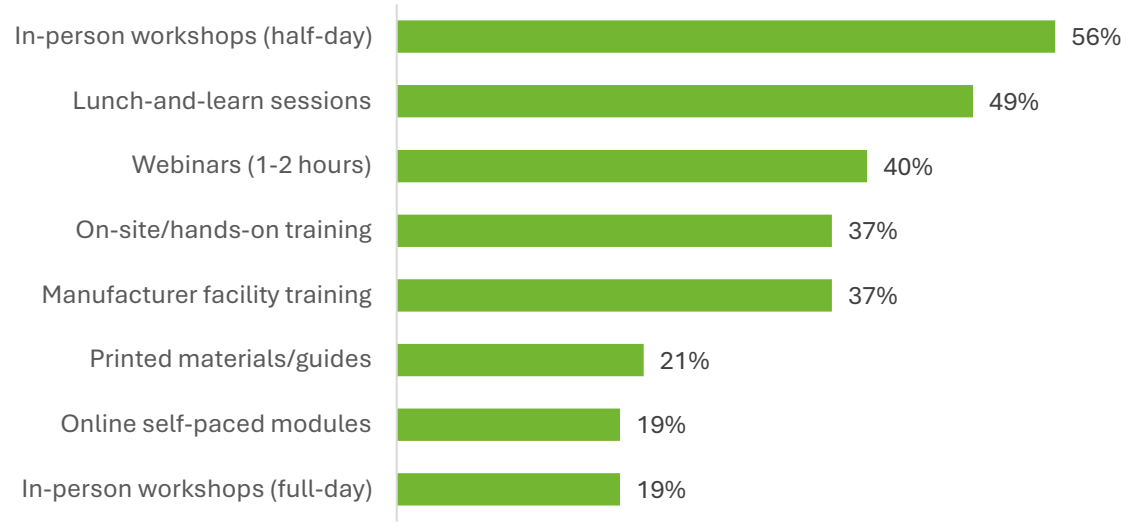
Market actors turn first to their existing supply chain when learning about new commercial water heating technologies, such as distributors or supply houses (64%) and manufacturers (62%). Over half (55%) also conduct their own online research, while utility programs and trade publications serve as secondary sources (Figure 25).

Figure 25: Sources of Information for New Commercial Water Heating Technologies (n=42, multiple responses allowed)



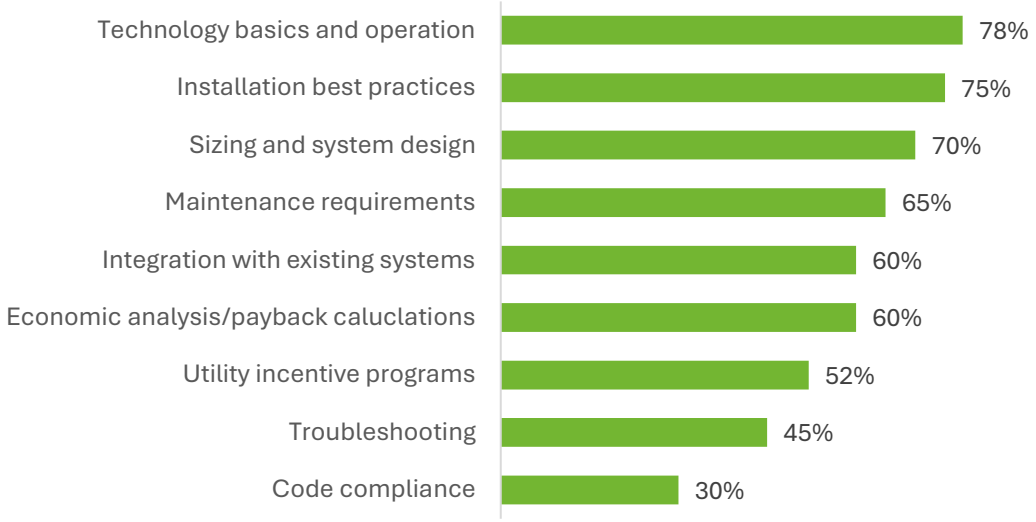
When asked about training, market actors indicated they prefer to receive technical training through half-day in-person workshops (56%), lunch and learn sessions (49%), and one to two-hour long webinars (40%) (Figure 26). Market actors also appeared to be more interested in training specifically for space conditioning applications compared to water heater applications (51% vs. 44%).

Figure 26: Training Method Preferences (n=43, multiple responses allowed)



Eighty-six percent of market actors reported they were "very" (18 of 43 or 42%) or "somewhat" (19 of 43 or 44%) interested in training specifically on commercial GHP water heater applications. Market actors interested in training reported that the most valuable training topics would be technology basics and operation (78%), installation best practices (75%), sizing and system design (70%), and maintenance requirements (65%). Market actors perceived code compliance training as least valuable (30%) (Figure 27).

Figure 27: Training Topic Preferences (n=40, multiple responses allowed)



6.4 Firmographics

This section provides a summary of the firmographics associated with the survey respondents. The 43 market actors most commonly represented commercial HVAC contractor firms (30%), followed by mechanical contractors (19%) and 12 percent each for plumbing contractors, design/consulting engineers, and "other" (Table 10).

Table 10: Market Actors' Firm Types (n=43)

Firm Type	Count	%
Commercial HVAC contractor	13	30%
Mechanical contractor	8	19%
Plumbing contractor	5	12%
Design/consulting engineer	5	12%
Other	5	12%
MEP (Mechanical, Electrical, Plumbing) firm	4	9%
Manufacturer's representative	3	7%

Market actors reported working throughout North America. Organizations in states or provinces with robust trade ally networks and those that distributed the invitation broadly are more represented (Table 11).

Table 11: State or Province of Respondent Work (n=43)

Response	n	%
Illinois	9	21%
British Columbia	8	19%
Northwest Region (WA, OR)	8	19%
California	3	7%
Georgia	3	7%
Ohio	3	7%
New Jersey	2	5%
Ontario	2	5%
Western Canada	2	5%
Colorado	1	2%

Response	n	%
Midwest US	1	2%
National	1	2%

Market actors most commonly classified their firm as regional, with national being the least common (Table 12).

Table 12: Scope of Market Actor Firms (n=43)

Firm Area	n	%
Regional	23	53%
State- or province-wide	17	40%
National	3	7%

Two-thirds of market actors worked in smaller firms (66%), reporting that they work in firms with fewer than 40 employees (Table 13).

Table 13: Number of Employees (n=43)

Employee Range	n	%
1-10	17	40%
11-40	11	26%
41-70	4	9%
71-100	4	9%
101-200	3	7%
Over 200	4	9%

7 Purchase Process Scenarios

This section presents three purchase scenarios for gas heat pump (GHP) equipment installation. It is informed by a review of recent studies exploring the purchase drivers for commercial HVAC and water heating projects. [38, 39, 40, 41, 42] The scenarios incorporate insights from the supply chain interviews, market structure assessment, and market actor survey. To develop these scenarios, the research team discussed cross cutting findings and identified three scenarios where GHP products provide technically and economically viable solutions for a given building, market, or upgrade objective. Across the scenarios, GHP products provide a viable decarbonization pathway when full electrification is economically or infrastructurally constrained.

7.1 Insights from Prior Research

While the purchase scenarios presented below draw primarily on the supply chain interviews, market actor survey, and market structure assessment completed as part of this study, the Evergreen team considered several prior studies that explored commercial water heating purchase behavior, GHP field performance, and purchaser expectations. This section summarizes findings from those studies that illuminate market conditions, decision-making dynamics, and system design considerations relevant to GHP adoption.

The purchase context. Prior research by Russel Research and Lieberman Research indicates that like-for-like replacement is a default outcome for commercial water heating decisions, particularly in urgent replacement situations. Russel Research found water heater selection to be a low-involvement purchase for commercial customers, and Lieberman Research's 2025 study confirmed that reliability, product availability, and cost are primary considerations. Efficiency can be influential if tied explicitly to cost savings. Both studies also confirmed that installers and tradespeople are the most influential actors in commercial water heater selection. In a 2023 Dual Fuel and Gas Heat Pump Market Research study,

[38] Russel Research. 2018. *Water Heater Market Characterization Report*. Prepared for NEEA. Report #E18-305
[39] Lieberman Research. 2025. *Market Research on Existing Water Heaters in Select Commercial Buildings*. Prepared for NEEA. Report #E25-489.
[40] GTI. White Paper: *Commercial Gas Heat Pumps for Hot Water and AC*. Demonstration in Restaurant Applications, Technical Summary of CEC PIR 16-001.
[41] Lieberman Research. 2023. *Dual Fuel and Gas Heat Pump Market Research*. Prepared for NEEA. Report #E23-466.
[42] Heller, Jon. Ecotope. "Commercial Heat Pump Water Heaters: Ready for Prime Time." Presentation at ACEEE's Hot Air Hot Water Forum. March 4, 2025.

Lieberman found that contractors who lack familiarity with or confidence in a given technology will not offer it to buyers.

Fuel source perceptions. The scenarios assume a technically and economically rational evaluation process, but buyer perceptions of fuel can vary. Lieberman's 2023 study found that commercial buyers tend to view natural gas as more efficient than electricity for heating, but some buyers will also perceive electric systems as more sustainable. Regional policy that encourages decarbonization can shift the operating cost calculus in favor of higher-efficiency gas equipment, strengthening the economic case for GHP adoption in Scenarios 1 and 2, even where electrification preferences exist.[43]

7.2 Purchase Scenarios

These scenarios reflect the different use cases and strengths of each type of GHP product and integrate building characteristics, domestic hot water (DHW) demand, and space heating system requirements. The overall context for the purchase scenarios is important to keep in mind:

1. This study did not include research with building owners, managers, or facility staff, who are typically involved in the discussion, scoping, and selection of mechanical system upgrades. Their perspectives are largely absent, emerging only from prior studies focused on that segment of the market.
2. These scenarios are illustrative pathways, not prescriptive projects informed by site-level engineering. There are myriad factors that could be present in any building or market that could improve or reduce the viability of a GHP project/upgrade.
3. These scenarios reflect the market dynamics at the beginning of 2026. Policy and market changes, technological advancement, or dramatic shifts in the cost of electricity or natural gas could affect the economics or feasibility of projects.
4. The scenarios reflect the expectation that GHP technology can provide a viable decarbonization pathway where full electrification is constrained by infrastructure or economics.

7.2.1 Scenario 1: Domestic Hot Water Retrofit (Air-to-Water Absorption GHP)

Building Profile and Purchase Trigger

This scenario involves buildings with moderate to high, consistent DHW demand (1,000-10,000 gallons per day) with existing gas infrastructure but constrained electrical capacity.

[43] CLEAResult Canada Inc. 2023. *Gas Absorption Heat Pumps Best Practices Guide, Version 1*. Prepared for FortisBC.

Facility types most appropriate for this scenario include full-service restaurants, hotels/lodging, multifamily with central DHW, long-term care, K-12 cafeterias, or university dormitories. The purchase triggers in this scenario include aging boilers, policy or other pressure to decarbonize the building, and electrical infrastructure unable to support electrification without expensive upgrades.

Technology and Deployment

Air-to-water GHP systems from Stone Mountain (Anesi),[44] Robur, and Vicot (the latter of which will be available in Q3 2026 and distributed by Homy Building Solutions in North America) can provide a cost-effective solution for moderate to high-volume DHW demand. All can heat water at up to 140° F in ideal conditions (149° F for Robur GAHP-A Plus and GAHP-AR Plus units), but a hybrid solution that adds one or more GHPs to an existing natural gas boiler system often makes sense. With this approach, providing only enough GHP units to meet 60 to 80 percent of the DHW load helps keep initial costs down. The GHP units pre-heat water to 120 to 140° F, and the natural gas boiler(s) boost the temperature to exceed customary Legionella risk thresholds and/or to support applications that require sanitizing hot water. The legacy natural gas boiler system also kicks in as necessary to handle peak demand.

For sites with hydronic space heating, the GHP system may also be able to support heating needs, though multiple units may be needed to meet space heating loads. As of early 2026, only Robur offers air-to-water GHPs that can also provide cooling, but even these cannot provide both hot and chilled water at the same time. Space heating and cooling could be provided seasonally with one or more units installed in addition to the GHP(s) installed to provide domestic hot water. With this approach, the DHW GHP(s) would provide DHW year-round, and one or more additional GHPs would provide heating in winter and cooling in summer.

Air-to-water GHPs must be installed outdoors—typically on the roof or on the ground—both because they are air-source units and because they use ammonia as a refrigerant. Particularly for installations requiring more than one GHP unit, appropriate sites must have adequate space for ground-level installation or adequate space and structural support to install the equipment on the roof.

Market Context

This scenario is most likely a retrofit or major renovation project, as the constrained electrical service is part of the purchase trigger, although grid constraints can also limit options for new construction. Grid constrained buildings emerged as a strong near-term use case in supply chain interviews and the market actor survey. This product has the shortest delivery timelines

[44] Stone Mountain suspended all business activities in Q1 2026.

(estimated at 24 hours to three months), which makes it an option for urgent replacement scenarios as well.

Key Barriers and Considerations

Interviews also revealed several project level considerations that could create barriers for this purchase scenario. In addition to documented market awareness and familiarity barriers, several product-specific technical barriers could affect recommendations and acceptance. First, concerns about ammonia safety might need to be addressed through training and education, as the systems are sited outdoors and the ammonia is in a sealed, outdoor unit. The outdoor installation can create siting challenges with weight limiting rooftop installations and clearance requirements limiting outdoor siting options.

7.2.2 Scenario 2: Simultaneous Load Central Plant (Water-to-Water Absorption GHP)

Building Profile and Purchase Trigger

This scenario involves installation of water-to-water absorption GHP equipment able to serve large facilities with massive year-round simultaneous heating and cooling demand, including many that operate 24 hours a day. These facility types include hospitals, university campuses, large resorts/casinos, food processing facilities, and some industrial sites. The primary purchase triggers for this scenario would be central plant modernization efforts, sustainability policies, or campus-level master plans that support investment in efficient dual fuel options, allowing facility managers to choose between natural gas or electric systems depending on the comparative energy cost, weather, or other considerations. The purchase decision process would primarily be driven by consulting engineers and mechanical contractors engaged to support the facility. Manufacturers are likely to sell this product directly once it is selected.

Technology and Deployment

Water-to-water GHP systems offered in North America by Broad USA and Thermax are capable of capacities ranging from 853 Btu/h to 136 MMBtu/h—easily enough for central plant needs. These built-to-order, custom-configured units operate most efficiently and make the most sense financially where there are large simultaneous heating and cooling loads: the GHPs boost heating efficiency by capturing waste heat from the cooling process that would normally be rejected to a cooling tower. Water temperatures can be as high as 200° F, easily supporting hydronic space heating in cold climates as well as DHW.

With their mammoth size and weight—for example, Broad USA performance data show a range of operating weights of 4.7 to 56.5 tons, depending on the capacity of the unit—these systems fit most naturally in a central plant or large machine room environment, typically at ground level. Installation in rooftop/penthouse machine rooms engineered for heavy

equipment can also be workable. Both Broad USA and Thermax can ship the units in two or more pieces to solve clearance problems and make the equipment easier to maneuver into place.

Market Context

These large facilities with continuous load represent an inherently small market driven by custom configuration and bespoke engineering sales, not commodity products. The systems must be custom-configured and are built to order. Accordingly, the delivery time for this equipment is four to six months. Cold northern climates are likely to provide the best return on investment, as the heating load will provide an opportunity to capture savings from efficient heating. These projects require more than DHW load.

Key Barriers and Considerations

The primary barriers for this scenario include long lead times (up to six months) and inertia and risk avoidance in the design engineering community that reduce the likelihood of recommendation. Electrification policies might reduce viability in new construction. However, the most challenging barriers are likely associated with the site characteristics overall: finding sites with simultaneous loads sufficient to justify the investment and the size of the equipment, which typically requires ground level installation in a central plant or large mechanical room.

7.2.3 Scenario 3: High Spark Spread Space Conditioning (Engine-Driven Air-Source VRF GHP)

Building Profile and Purchase Trigger

The third scenario involves installing an engine-driven VRF GHP. This equipment is suitable for a range of mid-sized commercial facilities, including offices or municipal buildings, hospitals, hotels/lodging, long-term care, and K-12 schools. The most attractive scenario is a location with a high electricity-to-gas price ratio and the need for VRF zoned heating and cooling. Purchase triggers could include high electrical demand charges, a mandate to add cooling (for example in older school buildings), and electrical infrastructure unable to support electrification without expensive upgrades.

Technology and Deployment

Yanmar's GHPs use the same vapor compression cycle as electric heat pumps, but the compressor is driven by a gas-fired engine instead of an electric motor. Yanmar GHPs use a VRF architecture to drive Daikin VRF terminal units, such as fan coils and air handling units, providing good flexibility in delivering heating and cooling to a variety of spaces. The system can be a strong alternative for any application suitable for electric VRF heat pumps, but without the high electricity demand of those systems (or the need for costly electrical infrastructure upgrades). The relatively low electricity demand can also help in installations

where the system is needed during power outages, to help minimize drain on battery energy storage systems or on-site backup power generation.

Yanmar VRF GHPs can provide DHW through connection of a Hydrobox terminal unit, though the unit can heat water only to 120° F, which is well below the 140° F often considered as the minimum necessary to effectively kill Legionella bacteria. A Hydrobox could be paired with an indirect tank with integrated electric resistance heating so that the VRF system would heat water efficiently to 120° F and have the tank's heating boost the temperature to the desired level. For applications that involve high-demand DHW, Yanmar recommends its combined heat and power (CHP) solutions.

As engine-drive, air-source systems, the Yanmar VRF GHPs must be located outdoors, typically on the ground or roof. Yanmar was updating its product line during this project. Available products at the time used R-410A refrigerant, and regulatory changes involving flammable refrigerants may affect future configurations and installation requirements.

Market Context

The strongest market for these products may be in regions where natural gas is substantially cheaper than electricity. In interviews, suppliers indicated that these products could be delivered within two to three weeks.

Key Barriers and Considerations

There are several product- and market-level barriers likely to affect adoption in this scenario. Concerns about refrigerant changes and potential flammability are creating headwinds for VRF adoption, and HVAC contractors may not be familiar with maintaining engine-driven equipment. For installations where water heating for domestic use is needed, the system's maximum water supply temperature of 120° F is insufficient to destroy Legionella bacteria, though this can be addressed by pairing the system with an indirect tank that includes electric resistance auxiliary heating. Finally, the product line transitions and any accompanying uncertainty with product availability could create short-term confusion.

7.3 Scenario Comparison Table

Table 14 summarizes the three purchase scenarios discussed above. Each scenario reflects a distinct combination of building characteristics, hot water demand profiles, and heating system requirements that favor a particular GHP technology. The scenarios are informed by manufacturer and distributor interviews, market actor survey findings, the purchase scenario literature review, and the market structure assessment. These scenarios are intended as illustrative pathways rather than prescriptive recommendations. Individual buildings will vary in their specific technical requirements, and site-level engineering assessment is necessary to confirm GHP suitability for any given application.

Table 14: Scenario Comparison

Criteria	Scenario 1 Moderate to High DHW Retrofit Air-to-Water Absorption	Scenario 2 Simultaneous Load Central Plant Water-to-Water Absorption	Scenario 3 High Spark Spread Engine-Driven VRF
Technology	Ammonia-water absorption cycle	Lithium bromide-water absorption cycle	Engine-driven vapor compression cycle
Target Buildings	Full-service restaurants, hotels/lodging, multifamily (central DHW), long-term care, K-12 cafeterias, university dorms	Hospitals, university campuses, large resorts/casinos, food processing, industrial facilities	Mid-sized offices, K-12 schools, municipal buildings, hospitals, hotels/lodging, long-term care
Heating Capacity	78,000–478,000 Btu/h per unit	853K–136M Btu/h (built to order)	170,600–324,100 Btu/h
Heating COP	1.38–1.6	1.35–1.64	1.4–1.6
Max DHW Temp	140–149°F	200°F	~120°F
Space Heating	Hydronic opportunity where applicable. May require multiple units for larger loads; higher-capacity models (e.g., Vicot, 478K Btu/h) extend feasibility. Not the primary driver for this scenario.	Can address simultaneous high heating and cooling loads. May augment other heating systems, allowing the facility to respond to different economic or load conditions.	Space heating and cooling primary driver for this scenario. VRF system delivers zoned space heating and cooling via refrigerant distribution to indoor terminal units.
Cooling Capability	Robur only (COP 0.67); heating or cooling mode, not simultaneous	Yes: Simultaneous required (Broad) or preferred (Thermax)	Yes: Simultaneous zone heating/cooling are beneficial
Typical Deployment	Hybrid: GHP handles 60–80% baseload DHW (120–140°F); existing boiler covers peaks and boosts temp to 160–180°F for sanitation.	Central plant installation replacing or augmenting large chillers and boilers. Large 24-hour loads allow the system to operate under favorable conditions.	Outdoor engine-driven units power VRF loop for zoned fan coils. Hydrobox provides supplemental DHW pre-heat (~120°F); DHW is not the primary application.
Delivery Timeline	24 hours to 3 months	24 weeks to 6 months (custom-configured)	2–3 weeks

Criteria	**Scenario 1** Moderate to High DHW Retrofit Air-to-Water Absorption	**Scenario 2** Simultaneous Load Central Plant Water-to-Water Absorption	**Scenario 3** High Spark Spread Engine-Driven VRF
Siting	Outdoors (roof or ground)	Central plant / large mechanical room (ground level or roof if engineered for the load)	Outdoors (roof or ground)
Distribution Channel	Manufacturer reps, distributors	Direct sales to consulting engineers/ customers	Dealer network
Total North American Technical Opportunity	Multifamily: 16% Lodging: 14% Restaurants: 6%	Hospitals: 8% Universities: 6%	Office: 13% K-12: 9%
Key Barriers	Ammonia safety perception (sealed outdoor system); siting (weight, outdoor-only); workforce gap; "guinea pig" fear. Water temp at 140°F is at the lower bound of standard engineering practice.	Long lead times (4–6 mo., custom); physical size and weight; requires simultaneous loads; engineering mindset inertia	DHW temp limited (~120°F); product line transition (avail. through 2026); refrigerant regulatory changes
Best Fit Summary	Buildings with 1,000–10,000 gal/day DHW, existing gas infrastructure, constrained electrical capacity. Retrofit = ~80% of opportunity. Hybrid deployment with existing boiler reduces first cost and risk.	Large facilities with massive simultaneous heating and cooling demand. Cold climates provide strongest return on investment. DHW is part of load, not sole justification.	High spark spread, constrained electrical capacity, buildings without hydronic infrastructure that need heating and cooling. Space conditioning is primary; DHW is supplemental.

8 Summary Findings and Recommendations

This study sought to inform the North American Gas Heat Pump Collaborative's (Collaborative's) efforts to accelerate adoption of gas heat pump (GHP) technology. The findings below synthesize results across the four research streams, followed by recommendations for the Collaborative's consideration.

8.1 Conclusions

8.1.1 Market Structure Assessment and Technical Opportunity

The market structure assessment estimates that it would be technically feasible to replace equipment responsible for approximately 8 percent of North American commercial natural gas consumption with GHP water heating solutions. Our analysis indicates that converting all commercial natural gas water heating systems to GHPs where technically feasible would reduce commercial water heating natural gas consumption by approximately 19 percent in the US and 17 percent in Canada. While water heating represents a modest share of total commercial gas consumption, the analysis indicates there is opportunity within the water heating end use itself, particularly in targeted facility types and regions.

US regions with highest opportunity: In the US, the greatest opportunity for GHPs exists in the southern and midwestern US. In the South Atlantic and South Central regions, new construction forecasts drive the high opportunity. In the Middle Atlantic and Great Lakes regions, the high opportunity exists largely due to high commercial gas sales. In addition, these midwestern regions have more commercial customers, and therefore more opportunities for commercial GHP installations. Hydronic heating, which heats spaces by distributing hot water to radiators, fan coils, or other terminal units, is also more prevalent in these regions, so a higher percentage of facilities are suitable for GHP solutions.

Canadian regions with highest opportunity: Nearly all GHP opportunity in Canada exists within the Central, British Columbia, and Prairie regions. High opportunity in the Central and Prairie regions is driven by high commercial gas sales. In British Columbia, the high opportunity occurs due to a combination of a high percentage of gas sales being used for water heating (31%) and a higher forecast for commercial new construction.

Facility types with highest opportunity: Over half of the total technical opportunity for GHPs in North America exists within four facility types: multifamily, lodging, office buildings, and retail. High opportunity for multifamily and lodging occurs because these facilities use a high share of their total natural gas consumption for water heating, and because these facilities are ideal candidates for GHPs (i.e., their applicability factors are high). The high opportunity

for office buildings reflects the high portion of total commercial gas consumption driven by this facility type (20% and 24% for the US and Canada, respectively). Manufacturers focused on domestic hot water (DHW) identified ideal demand at 1,000–10,000 gallons/day, pointing to hospitals, hotels, multifamily with central DHW, K-12 cafeterias, and university dorms as key targets.

8.1.2 Market Dynamics

Awareness and inertia. Standard practice can work against specification and installation of GHPs. Among respondents to the market actor survey, 28 percent reported being completely unfamiliar with GHP solutions for water heating, and 14 percent were unfamiliar with GHP solutions for space conditioning. Among those reporting familiarity with GHP technology, 80 percent (28 of 35) had never specified or installed a GHP. To encourage selection and installation, manufacturers described prioritizing demonstration sites and providing design support for identified projects. This experience gap is compounded by the dominance of the established boiler market.

Confidence in technical viability. Market actor survey respondents generally agreed that GHP technology is appropriate for their respective climate and building stock, but confidence declines when it comes to cost and performance. Forty-two percent agreed they are confident the technology will perform as expected, and 18 percent agreed that costs are reasonable. Credible, independent project data and workforce training linked to distributors, supply houses, or manufacturers already known to design engineers and installation contractors will likely be needed to overcome this.

Emerging distribution channels. The team's experience recruiting for supply chain interviews and the results of those interviews revealed a nascent market, as expected for an emerging product like GHPs. The limited number of distributors affiliated with GHP product lines could reflect structural gaps in market delivery channels.

High first costs. Supply chain contacts acknowledged upfront cost as a key barrier, reflecting high equipment cost and installation complexities that can include piping challenges, cranes, and/or structural modifications for roof installation. Manufacturers and market actors viewed program or utility incentives as essential for offsetting these costs. Manufacturers reported that their sales cluster in regions with active programmatic support, including demonstration projects, pilot programs, ongoing incentives, and/or outreach or design support. Market actor survey responses indicate that higher incentives for these projects could affect their recommendations.

8.1.3 Technical & Product Considerations

GHPs are gas-fired equipment that provide high efficiency heating (and, in some cases, cooling) by using thermodynamic cycles to move heat from one place to another, such as

from water or air outside the building to water inside the building. With gas absorption heat pumps (GAHPs), the heat of combustion drives the necessary thermodynamic process, acting on a refrigerant and absorbent in a sealed loop inside the equipment. With engine-driven GHPs, a gas-fired engine powers a compressor, otherwise using the same thermodynamic process and refrigerants as electric heat pumps.

Both types of GHP avoid the high electricity demands of electric heat pumps, may better maintain their performance in cold weather relative to electric heat pumps, and offer rated efficiency gains of 40 percent or more over conventional gas-fired equipment.

- **Legionella and water temperature.** Air-to-water GHPs can heat water to a maximum of 140-149° F, and engine-driven VRF GHPs max out at approximately 120° F. The commonly accepted minimum temperature to effectively destroy Legionella bacteria is 140° F, but 156-160° is often preferred for instantaneous disinfection. Concerns over water temperature may reinforce interest in a hybrid system, where the GHP preheats the water and a boiler boosts the temperature. Manufacturers indicate that hybrid systems can also reduce GHP first costs by allowing designers to size the GHP to meet 60 to 80 percent of load instead of spending more to allow for the GHP to meet full load.
- **Avoiding electrical infrastructure investments.** Limited electrical infrastructure emerged as a promising driver for GHP selection, particularly where policies also drive efficiency and decarbonization objectives. GHP products provide a viable decarbonization pathway when full electrification is constrained by economics or infrastructure. Manufacturer interviews and open responses in the market actor survey confirmed that sites where electrical upgrades for electrification are infeasible can be candidates for GHP equipment. Sites in areas with a high “spark spread” (or the difference between low natural gas costs relative to electric rates) also have greater promise.

8.2 Recommendations

The following recommendations reflect areas where the Collaborative’s activities could accelerate GHP adoption.

Prioritize retrofit applications in existing buildings in near-term program design. Given the volume of existing equipment relative to commercial new construction, retrofit and replacement projects dominate the commercial mechanical market. Retrofit projects also offer practical advantages: hybrid deployments that pair new GHP equipment with existing boilers can reduce GHP first costs by reducing the required GHP capacity, manage performance risk, and provide demonstration opportunity for early-market program designs. GHP equipment may also help existing buildings avoid costly electrical service upgrades.

Structure incentives to address first costs directly. First costs emerged as a consistent barrier across all research activities. Manufacturer representatives discussed the gap between equipment and installation costs for GHPs relative to conventional alternatives. Manufacturers expect that equipment costs will decrease as sales increase. In the near term, incentive structures might need to consider costs associated with installation, including outdoor siting, piping, and any structural modifications. Incentive designs that specifically support hybrid deployments, where GHP equipment is sized for 60 to 80 percent of load, could lower the entry point for adoption while still delivering meaningful gas savings.

Leverage existing supply chains to build the GHP workforce. Market actors reported learning about new technologies primarily through distributors and supply houses and manufacturers. Training content should prioritize the topics that market actors ranked highest: technology basics and operation (78%), installation best practices (75%), sizing and system design (70%), and maintenance requirements (65%). Programs should connect training to the distributors and manufacturers already serving local markets to align with how market actors already access technical information.

Target high opportunity building types in regions with supportive program infrastructure. The market structure assessment and manufacturer interviews converge on a similar set of high-potential building types: multifamily, lodging, office buildings, and retail. Other facility types that emerged as good project candidates in interviews and technical review include hospitals, universities, full-service restaurants, and K-12 schools. Targeting these facility types in regions with active utility support will build on market momentum and local awareness.

Expand pilot and demonstration projects across more regions. Manufacturers see local demonstration projects driving awareness and confidence, noting their sales cluster in areas where these projects exist. Pilots in multiple regions will help demonstrate that GHPs perform well across different climates. Regional demonstration projects will also generate local performance data and build a base of experienced installers and engineers.

Develop and disseminate project-level performance and cost evidence. Programs can continue to build confidence in GHPs as technically viable, reliable, and reasonably priced. Providing credible, independent project data that promote existing case studies and available project data will help normalize the technology and overcome uncertainty. While case studies and sub-metered data reports are available in some regions, expanding these to document installed cost, energy savings, and operational experience from completed projects across North America will increase awareness and encourage installation. Energy savings calculators or standardized cost-benefit tools could further support design engineers and contractors in evaluating GHP solutions for specific applications.

Engage distributors in market development. Manufacturers are currently driving market education and project-level technical support, consistent with an emerging distribution channel. The Collaborative could amplify their efforts by facilitating connections via regional trade ally networks, supporting manufacturer participation in training programs, and helping manufacturers and their representatives build relationships with the engineering and contracting firms that drive equipment selection in the commercial market.