



Investigating Contractor Constraints to Efficient Residential Retrofits Implementation

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Disclaimer

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This project was conducted under the mentorship of Community Energy Association staff. The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of the Community Energy Association or the University of British Columbia.



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Executive Summary

CEA actively assists various communities in British Columbia through retrofit programs, aiming to achieve significant reductions in greenhouse gas emissions upon successful implementation. The primary focus revolves around transitioning buildings from fossil fuel-based heating and domestic hot water systems to electric alternatives. The most prominent challenge identified by CEA to date pertains to contractor capacity and availability. Contractors frequently report being understaffed, overwhelmed by their workload from various sources, and, may lack enthusiasm for energy efficiency initiatives and air source heat pumps. Moreover, they sometimes exhibit limited technical understanding and may hold misconceptions, such as doubting the applicability of air source heat pumps in certain British Columbia contexts.

The response to these challenges led CEA to embark on an in-depth research endeavor to identify potential solutions. This research aims to tailor programs effectively for achieving substantial greenhouse gas emission reductions within communities. To achieve this goal, the Knowledge, Attitudes, and Practices (KAP) survey method was employed.

Within the domain of Energy Efficiency Measure businesses, contractors were identified, conducted interviews, survey questions were developed, and a survey was subsequently conducted. This comprehensive survey elicited responses from 71 businesses across British Columbia, with a particular focus on their involvement in energy efficiency measures, notably heat pump installations. A significant portion of the respondents were well-established businesses, with 40% having operated successfully for 15 to 20 years. Impressively, 86% of them were well-acquainted with the Home Performance Contractor Network (HPCN). Most respondents, constituting 76%, were HVAC contractors, primarily specializing in energy efficiency measures related to HVAC systems.

Satisfaction levels regarding loan and rebate programs varied among respondents, accompanied by insightful suggestions for improvement, primarily centered around the need for improved communication and streamlined processes. While many customers applying for rebates experienced success, there were opportunities identified for enhancing success rates further. Energy Advisors emerged as valuable assets, contributing to customer education and the promotion of energy efficiency projects. Contractors expressed comfort in discussing energy efficiency with customers, yet there was a recognized need for more comprehensive training. Challenges encountered in this field encompassed technical barriers during heat pump installations, financial constraints faced by customers, and administrative hurdles demanding resolution.

ongoing efforts to reduce greenhouse gas emissions in British Columbia communities through retrofit programs are significant. The identified challenge of limited contractor availability and knowledge prompted to conduct of a comprehensive survey using the KAP method. This survey engaged with 71 businesses in British Columbia, with a particular focus on heat pump installations. The results reveal opportunities for improvement in communication with contractors and customers. Additionally, they emphasize the valuable role played by Energy Advisors and highlight the need to address technical, financial, and administrative obstacles. The survey findings will undoubtedly guide their future initiatives toward even greater success.

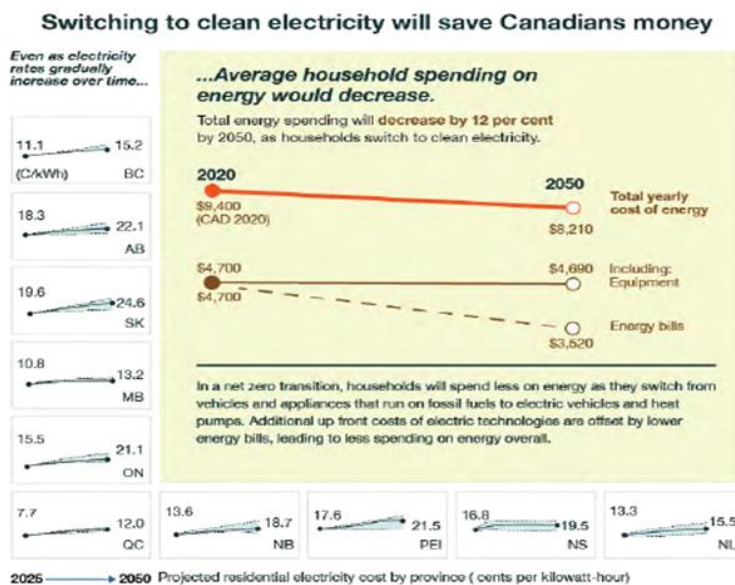
Introduction

This project is focused on comprehending the challenges faced by contractors when it comes to implementing Energy Efficiency Measures in the province of British Columbia. They emphasize the advantages of installing heat pumps but stress that the efficacy of a high-efficiency unit may be compromised in homes with poor insulation, air leaks, and inefficient windows.

The task of building net-zero electricity systems, which would surpass the size of the current grids, necessitates substantial investments, collaboration, and determination. Canada presently ranks third among developed nations in terms of having some of the lowest electricity rates for both residential and industrial use. There is growing evidence suggesting that transitioning to clean and non-emitting electricity sources could make energy consumption even more cost-effective for Canadians in the long run. However, achieving the decarbonization and expansion of the grid will require a strategic blend of investments to ensure the reliability, security, and competitiveness of the energy supply, all while keeping long-term costs for consumers at a minimum.

Furthermore, the advantages of transitioning to clean electricity extend beyond the employment opportunities generated within the electricity sector itself; industries reliant on clean power sources are also poised to experience an upswing in job opportunities.

Figure 1. Projected reduction of electricity cost by province (costs per kilowatt hour)



As an illustration, a recent study conducted by the Canadian Climate Institute (CCI) predicts that by 2050, the typical household's energy expenses will decline by 12 percent. This reduction is anticipated as Canadians make the transition from fossil fuels to more efficient technologies like electric vehicles and heat pumps.

1. Background

The Community Energy Association (CEA) is actively assisting various BC communities with retrofit programs to meet their IPCC 1.5°C targets. These targets involve reducing emissions by about 50% below 2010 levels by 2030 and ultimately achieving a 100% reduction by 2050. Emissions must be reduced across sectors such as transportation, buildings, and solid waste, and it's crucial to make reductions in all areas to have the best chance of meeting these ambitious goals.

One particularly challenging area for emissions reduction is existing buildings. Most of the buildings that will still be standing in 2030 and 2050 already exist today, and they will need extensive retrofitting to align with CleanBC and Federal Green Building targets. Retrofitting half of low-density residential buildings to be greenhouse gas neutral by 2030 and achieving this for all buildings by 2050 in any community is a monumental task. In practice, this means that communities must achieve retrofit rates of about 4-7% of the existing housing stock each year, with each of these retrofitted buildings becoming zero or very low greenhouse gas emitters.

CEA is actively engaged in helping communities implement retrofit programs that could lead to significant reductions in greenhouse gas emissions. Their primary focus is on transitioning buildings from fossil fuel heating and domestic hot water to electric heating. However, CEA has encountered a significant challenge in the form of contractor capacity and availability. Contractors often report being understaffed and overwhelmed with work from various sources, which can lead to a lack of interest in energy efficiency measures such as air source heat pumps. Some contractors may also have limited technical understanding or hold misconceptions about the applicability of air source heat pumps in different contexts within British Columbia.

Addressing these challenges in the contractor workforce is essential to achieving the ambitious emissions reduction targets set forth by local government and the broader global imperative to combat climate change. The struggle against climate change, to achieve a Net Zero status, is paramount in this century. This objective is crucial for curbing global temperature

escalation to a threshold of 1.5°C above pre-industrial levels, a commitment made by numerous nations during the Paris Agreement in December 2015, known as COP21.

Canada has made some progress in reducing emissions and pursuing its 2030 National Determined Contributions (NDC).

Projections suggest that emissions could potentially drop to an estimated 40 percent below 2005 levels by 2030 with the implementation of existing and potential measures.

To fulfill its global obligations under the Paris Agreement, Canada's federal, provincial, and territorial leaders jointly embraced the Pan-Canadian Framework on Clean Growth and Climate Change on December 9, 2016. This framework underscores collaborative efforts between the Government of Canada, provinces, territories, and Indigenous communities to combat climate change. A central component of this strategy is the Low Carbon Economy Fund, which supports plan implementation by channeling investments into projects aimed at promoting clean growth and reducing carbon emissions, to meet Canada's commitments outlined in the Paris Agreement.

Over the next five years, the Low Carbon Economy Fund will allocate resources to enhance building energy efficiency, drive innovation in emissions reduction across industries, and assist the forestry and agriculture sectors in enhancing carbon storage in forests and soils. These investments will generate long-term job opportunities for Canadians while promoting sustainable growth, innovation, and reduced energy expenses, thus benefiting the Canadian economy, and contributing to the global effort against climate change.

Ultimately, achieving net-zero emissions reduction is not only essential for safeguarding our planet but also holds the potential to create employment opportunities within the clean energy sector. British Columbia is fortunate to have access to a clean electricity mix, primarily sourced from hydroelectric power, which is celebrated as a renewable and sustainable energy source.

Contractors engaged in retrofitting existing buildings with energy-efficient measures in British Columbia often encounter several challenges. These include managing a potentially understaffed workforce and grappling with heavy workloads stemming from multiple projects, which can lead to reduced enthusiasm for energy efficiency initiatives and air source heat pumps. Furthermore, they may face challenges related to limited technical understanding and misconceptions, such as skepticism about the suitability of air source heat pumps for specific contexts within British Columbia, all of which can impact the successful implementation of energy-efficient measures in retrofitted buildings.

2. Boosting Energy Efficiency Measures in British Columbia: A Provincial Retrofit Program

The Provincial program, BetterHomesBC, provides financial incentives, guidance, and assistance to households and businesses to enhance energy efficiency and decrease greenhouse gas (GHG) emissions. These programs encourage the adoption of high-efficiency heating systems and improvements to building envelopes. The initiative receives a total of \$24 million in funding of the \$ 162 million that has been allocated to British Columbia, jointly contributed by the provincial and federal governments through the Low Carbon Economy Leadership Fund (4).

Energy efficiency is all about doing things and creating things while using less energy. When homes and buildings are designed to be energy-efficient, they use less energy to keep us warm or cool, and they use less energy to run things like our appliances and machines. This is important because when we use less energy, it helps in a few big ways. First, it helps us fight against climate change, which is when our planet gets too hot because of all the stuff we put in the air. Second, it helps us save money on our energy bills, so we have more to spend on other things we like. Lastly, it makes Canadian businesses more competitive, which means they can do better in the world. Plus, using less energy is a key way to reduce the carbon dioxide we release into the air, which is good for the environment. So, energy efficiency is a win-win for everyone. (10)

2.1.1. Air Sealing Retrofit Considerations:

In British Columbia, more than a million detached and low-rise wood-frame homes have been constructed over the past century. However, older homes tend to suffer from inadequate insulation and increased air leakage compared to their newer counterparts. Upgrading insulation is particularly advantageous for older homes, especially those built before the 1980s, when insulation levels were minimal, especially in basements and crawlspaces. Surprisingly, even homes constructed in the last two decades can benefit from air sealing retrofits, as construction often overlooks airtightness. Nevertheless, new homes designed with a focus on airtightness are less likely to experience substantial gains from air-sealing measures. It's worth noting that the amount of insulation required in walls, floors, or roofs depends on the specific location within British Columbia, with colder regions necessitating more insulation and improved airtightness to ensure comfort during the winter while minimizing heating energy consumption.

2.1.2. Insulation Retrofit Considerations:

Insulation standards have evolved, and it's common for older homes to have lower insulation levels, particularly in areas like basements, crawlspaces, and attics. Many houses constructed before the 1990s also tend to have inadequate attic insulation. Recommended airtightness targets and nominal R-values for insulation vary depending on location and industry best practices, serving as valuable guidance for retrofit projects. While these values are not mandatory under the 2012 BC Building Code, they provide essential direction for homeowners considering upgrades. However, it's important to note that bringing a house up to current code requirements can be a costly endeavor. The cost-effectiveness of insulation and air sealing upgrades depends on the specific characteristics of the home, but they have the potential to significantly improve thermal comfort.

Table 1. Recommended Airtightness Targets and Insulation for Home in BC

Recommended Airtightness Targets and Insulation Levels for Homes in BC				
Wood-frame Building Enclosure Assembly	Zones 4 & 5 ≤3999 HDD	Zone 6 4000-4999 HDD	Zone 7A 5000-5999 HDD	Zone 7B & 8 ≥6000 HDD
Attic Spaces	R-40	R-50	R-60	R-60
Cathedral or Flat Roofs	R-30	R-30	R-35	R-40
Above-grade Walls	R-20	R-25	R-25	R-30
Below-grade Walls	R-20	R-20	R25	R-25
Suspended Floors	R-25	R-30	R-40	R-50
Slab-on-grade Floors	R-10	R-15	R-20	R-25
Airtightness (ACH50)	<5 ACH	<4 ACH	<3 ACH	<2 ACH

2.1.3. Window and Door

Replacing windows and doors often aims at achieving energy savings through enhanced products and improved installation. The extent of energy conservation depends on multiple factors, such as climate, existing window and door types, building airtightness, window area, orientation, and the performance of the new installations. Energy advisors can estimate these savings through computer modeling. Notably, replacing outdated single-glazed aluminum framed windows with energy-efficient alternatives can reduce heating energy consumption by as much as 30 to 40%. Key terms used to describe window, door, and skylight energy performance include U-Factor, Solar Heat Gain Coefficient (SHGC), and Energy Rating (ER). The U-Factor assesses the overall heat transfer rate, with lower values indicating better insulation. SHGC gauges the solar radiation passing through, impacting heating and cooling requirements. ER evaluates window

performance in winter conditions, with higher numbers signifying greater efficiency. In British Columbia, the Energy Efficiency Act (EEA) establishes minimum energy standards for windows and glazed doors, mandating energy performance labels. Furthermore, the voluntary ENERGY STAR® program identifies products with exceptional energy performance ratings, offering additional information through Natural Resources Canada.

2.1.4. Heat pumps

High-efficiency air source heat pumps stand out as energy-saving alternatives to electric furnaces and baseboard heaters. They achieve this by drawing heat from the surrounding air for both winter heating and summer cooling. These systems, which are electrically powered for heating and cooling, work by transferring heat between indoor and outdoor air. In winter, they efficiently extract heat from cold outside air to warm indoor spaces. Conversely, during summer, they remove heat from indoors and expel it outside to provide cooling. This dual functionality sets them apart from electric furnaces and baseboard heaters, which solely offer heating. By harnessing the ambient air as a heat source or sink, air source heat pumps offer a cost-effective and environmentally friendly means to maintain indoor comfort throughout the year.

3. Research Approach

The KAP (Knowledge, Attitude, and Practice) technique was employed for this project to formulate the survey questions. The survey was administered through Zoho Survey and segmented into four distinct parts.

The initial segment focused on examining the demographics and background information of the contractors engaged in the field of Energy Efficiency Measures installation.

The second section aimed to illuminate the availability of rebates and loans for retrofit projects. The third section delved into comprehending this context's technical and commercial obstacles.

Lastly, the survey investigated the challenges encountered by contractors involved in the installation of heat pumps.

4. Results of the Survey

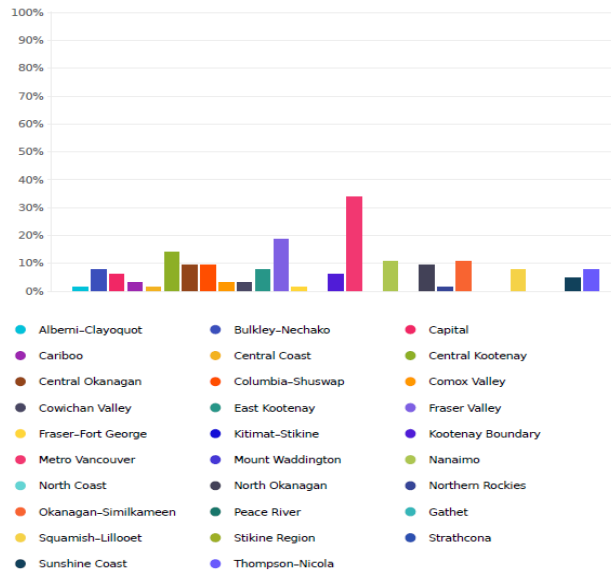
One of the greatest challenges identified for the implementation of energy retrofit programs is contractor capacity and availability. Contractor's report being short-staffed and overwhelmed with the amount of work that they have from all sources. This can result in missed opportunities for homeowners and building owners if trades aren't interested in energy efficiency or have limited technical understanding.

Contractors were surveyed to learn more about the barriers and/or challenges they are facing when they are involved in energy retrofits in different parts of British Columbia. The survey results are presented in the following sections:

4.1. Geographical Area, Business Longevity, Contractor Density, and Workforce Concentration

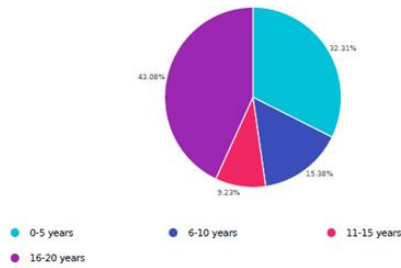
The initial set of questions revolved around two key aspects of the businesses under examination: Their domain of operation and their tenure in the industry.

Figure 2. Percentages of responses to business in various Municipalities in the Province of British Columbia



Referring to Figure 2, Out of the 71 businesses surveyed, 15% of the 116 responses about their location hailed from the Kootenay region, while 18% originated from Metro Vancouver. Many of the respondents, totaling around 43%, represented mature enterprises that have firmly established themselves in the market, having operated for a substantial period spanning 16 to 20 years. Following closely behind, approximately 9.23% were comprised of well-established businesses with a track record ranging from 11 to 15 years.

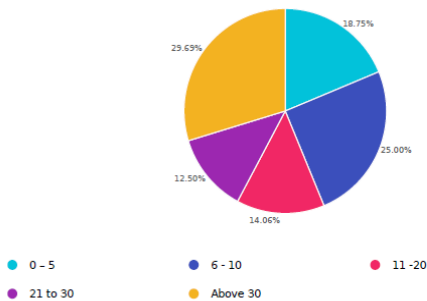
Figure 3. Business Longevity in the Province of British Columbia



Additionally, a significant portion of 32.31% of the surveyed companies fell into the startup category, with the remaining 15.38% classified as emerging contractors as shown in Figure 3. These statistics underscore the pressing need to support the growth of these startups as they progress toward the emerging phase of their business lifecycle, requiring comprehensive technical and commercial assistance.

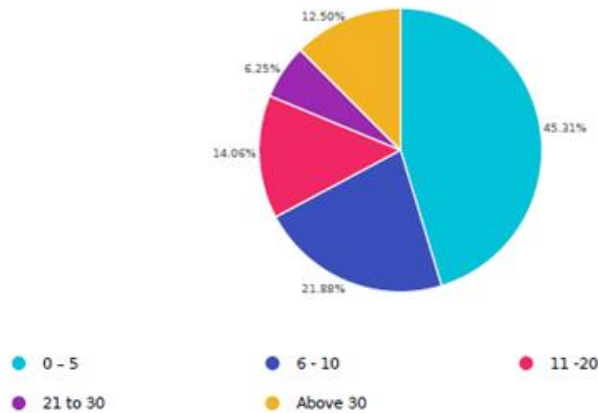
In addition to business domain and tenure, other factors explored during the survey included contractor density and workforce concentration.

Figure 4. Percentages of business in various municipalities in the Province of British Columbia



The options provided for the contractor density inquiries encompassed the following ranges: 0 – 5, 6 – 10, 11-20, 21 to 30, and Above 30 companies. The feedback collected revealed that 29.69% of respondents, primarily from regions characterized by low population density and minimal competition (0 to 6 companies), fell into this category. In contrast, 25% of respondents hailed from areas with high population density, where competition was robust, featuring more than 30 companies.

Figure 5. Percentage of the number of employees in a business



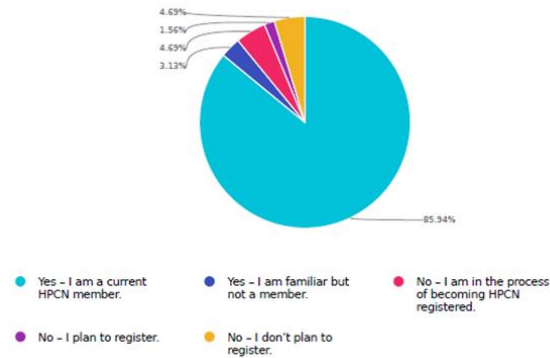
Similarly, for inquiries regarding workforce concentration, respondents were presented with the following options: 0 – 5, 6 – 10, 11-20, 21 to 30, and Beyond 30 employees. Among the respondents, smaller businesses constituted the majority, accounting for 45.31% of the responses, closely followed by enterprises with 0 to 6 employees. Furthermore, businesses with over 30 employees made up 12.50% of the responses.

The survey results have shed light on essential aspects of the businesses examined, encompassing their domain, tenure, contractor density, and workforce concentration. These findings emphasize the critical need to support startups as they transition into the emerging phase of their lifecycle, underscoring the importance of comprehensive technical and commercial assistance. Moreover, the data reveals intriguing regional variations, highlighting the contrast between low-density areas and high-density urban centers, which can inform targeted business development and support strategies.

4.2. Understanding Home Performance Contractor Network (HPCN) Engagement and Energy Efficiency Focus

This part of the survey dwelled on the familiarity of the contractors with the work of HPCN, focusing on promoting energy-efficient measures and their keenness in registering with them.

Figure 6. Percentages of contractors familiar with the work of the Home Performance Contractor Network, (HPCN)

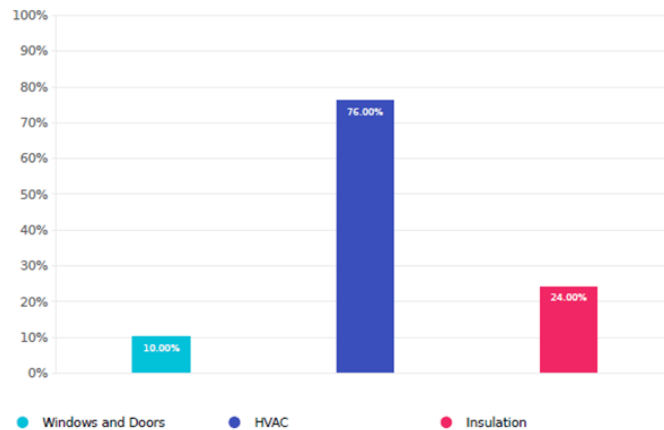


In our survey, a remarkable 86% (Note should be taken that the survey was taken by HPCN members and a few outside) of the participants demonstrated their strong familiarity with and active membership in the Home Performance Contractor Network (HPCN), highlighting their commitment to energy efficiency. Only a minimal 4.69% of the participants expressed no intention to join the HPCN registration.

4.2.1. Diverse Contractor Backgrounds

We reached out to 71 contractors, receiving responses from 50 of them, and discovered that a substantial 76% of them hailed from the HVAC sector. Within this group, 24% had expanded their services to include insulation and companies focusing on insulation separately as highlighted in Figure 7, while the remaining 10% were affiliated with the window and doors sector.

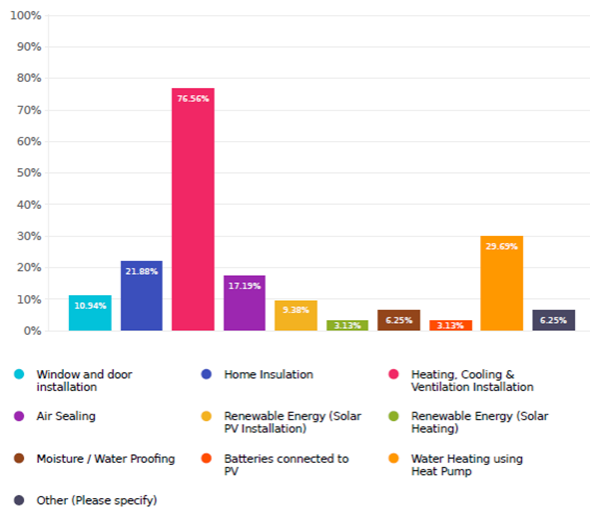
Figure 7. Percentages distribution of business (that responded) focus on Windows and Doors, HVAC, and insulation.



4.2.2. Exploring Contractor Specializations

A more in-depth exploration of the contractors' backgrounds unveiled their diverse affiliations within various sectors. Notably, the HVAC sector took the lead, representing a commanding 76.56% of the total respondents. Interestingly, 29.63% of HVAC contractors have also ventured into heat pump installation for water heating, as revealed in their responses.

Figure 8. Percentages distribution of business (that responded) focus on various Energy Efficiency Measures



4.2.3. Diverse Sector Affiliations

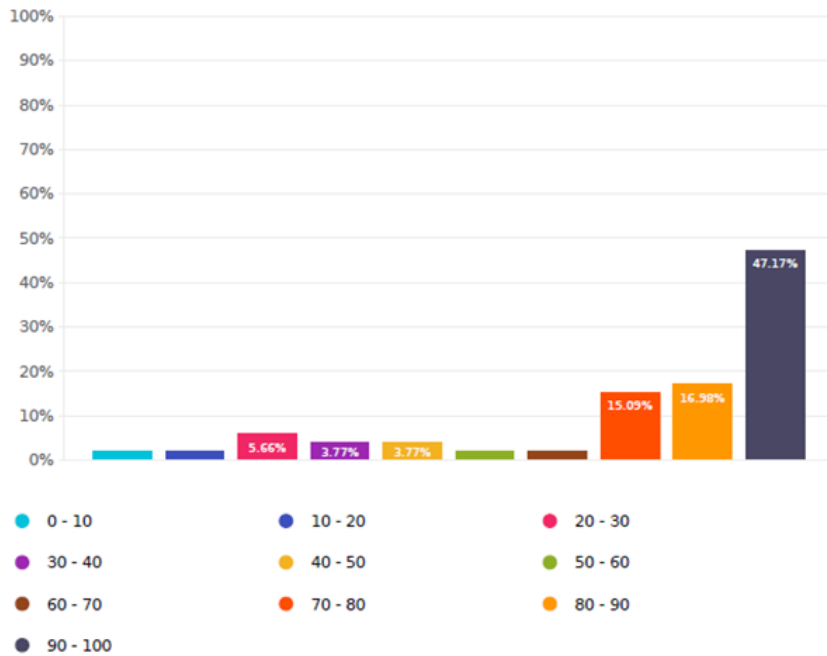
Following closely behind is the Home Insulation sector, accounting for a substantial 21.88% of the total. Additionally, we observed that Window and Door Installation and Air Sealing held portions of 10.94% and 17.19%, respectively, demonstrating the diverse interests and expertise within the contractor network when it comes to energy efficiency and home performance.

4.3. Understanding the complexity and the ease of the rebates and loan

In this segment of the survey, our focus was on evaluating the intricacies and user-friendliness of rebate and loan options. We aimed to uncover any challenges that might be associated with these financial incentives.

Regarding Rebates and Loans, it was observed that most contractors found the loan and rebate programs, which support energy-efficient initiatives, quite accessible and straightforward.

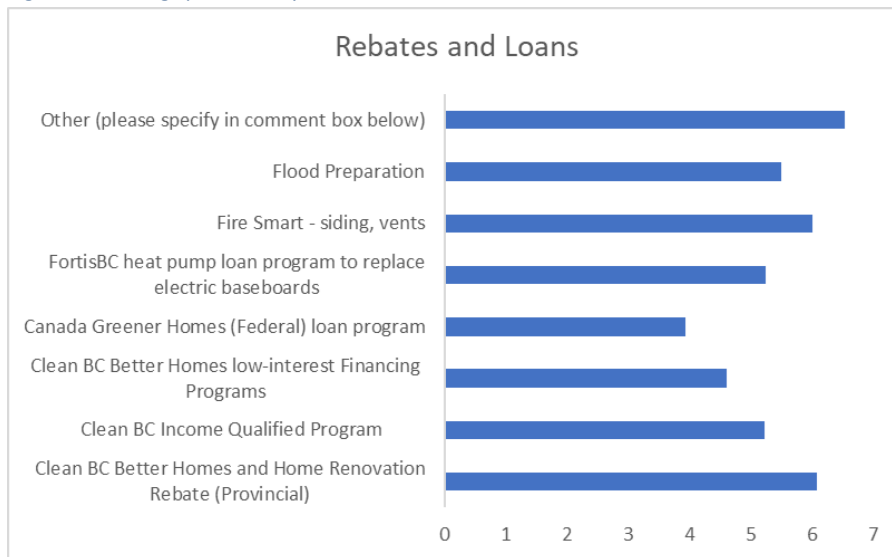
Figure 9. Percentage distribution of customers who were successful in obtaining a rebate.



The data collected from the survey questions strongly indicates that approximately 47.17% of the respondents highlighted that 90 to 100% of their customers obtained the rebates. There exists room for improvement, with the potential for a 15.09% increase in the 70 to 80% range of and a 16.98% increase in the 80-90% range.

When examining the various loans and rebates in more detail, participants were asked to rate the complexity of these offerings on a scale from 1 (very difficult) to 10 (very easy). Notably, certain options, such as Clean BC Better Homes and Home Renovations and Fire Smart–Siding Vents, scored above 6, indicating a relatively higher level of ease of use. The Fortis BC Heat Pump Loan Program, designed to replace electric baseboards, and the Clean BC Income Qualified Program, while not far behind, were rated at 5.

Figure 10. Ratings provided by contractors for various rebates and loans.



It becomes evident from the survey findings that the Canada Greener Homes (Federal) loan program and the Clean BC Better Homes Low-Interest Financing Programs may require some improvement to catch up with their counterparts. In general, there appears to be an opportunity for all rebate and loan programs to enhance their user-friendliness, as none of them received a score higher than 8.

4.3.1. Efforts to Streamline and Enhance the Rebate Experience for Contractors:

Contractors play a pivotal role in energy-efficient retrofits, and their feedback and suggestions are invaluable in optimizing the rebate process. In response to the question, "What suggestions do you have to ease the rebate process for contractors?" we received substantial feedback from over 70% of respondents. Here are the main suggestions:

1. Ductwork Rebates:

Contractors emphasize the importance of offering rebates for ductwork, as it constitutes a major retrofit requirement.

2. Regular Webinars:

Contractors suggest the implementation of regular webinars to keep them updated on the latest information regarding rebates and loans.

3. User-Friendly Reports:

There is a demand for auto-generated and user-friendly reports that clients can easily understand once the equipment is selected.

4. Centralized Rebate Platform:

Contractors recommend consolidating all rebate programs into a single application or platform, with dedicated login access for contractors.

5. Training Resources:

Contractors express the need for training materials such as videos and slides to assist them in completing rebate and loan forms effectively.

6. Expedited Approvals and Payments:

To streamline the process, there is a call to increase manpower and reduce the wait time for approvals and receiving payments.

7. Enhanced Communication:

Contractors seek improved communication channels for updates on approval and payment statuses, suggesting messaging as an effective means.

8. Pre-Approved Rebates:

Contractors propose the concept of pre-approved rebates and emphasize the need for including heat gain/heat loss evaluations, as the current HOT2000 method is deemed inadequate.

9. Certification Requirement:

Contractors advocate for making it mandatory for red-seal refrigeration professionals to install heat pumps, ensuring high-quality installations.

10. More AHRI Rebates:

Contractors highlight the need for more AHRI rebates for systems with capacities of 3 tons and greater, as many retrofits involve replacing 60-120 KBTU furnaces with 2.5-ton AC units.

11. Properly Sized Heat Pumps:

Contractors express the challenge of finding rebate-qualifying, properly sized heat pumps, especially when the AHRI rating exceeds 3 tons.

12. Equipment Sizing for Larger Spaces:

For larger homes in cold climates with significant temperature variations, contractors stress the necessity for larger equipment, particularly in winters with temperatures of -15°C or lower and hot summers.

13. Funding Models for Small Businesses:

Suggestions are made to provide better funding models to support the training of small businesses in energy-efficient retrofit practices.

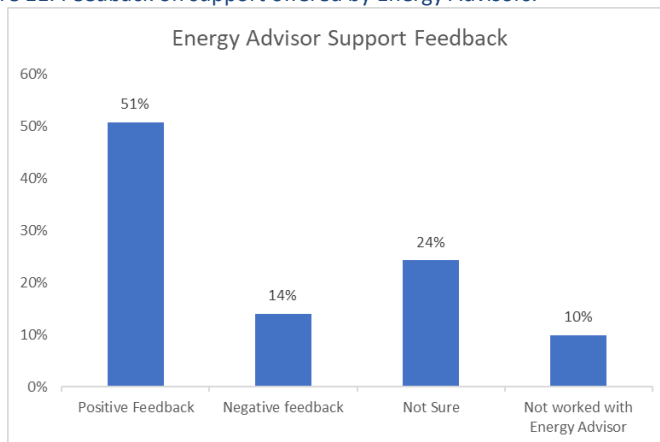
14. Streamlined Product Listings:

Contractors recommend making it easier for manufacturers to get their products on rebate lists promptly, facilitating access to energy-efficient equipment.

4.4. Facilitating Energy Efficiency Projects: The Role of Energy Advisors in Supporting Contractors

Currently, the Energy Advisor section is unavailable on the HPCN website, but it is expected to be launched soon. As part of our survey, we examined the feedback provided by contractors regarding the role of Energy Advisors. Notably, 51% of respondents shared positive feedback, while 24% remained unfamiliar with the Energy Advisor's role, and 10% did not work with one.

Figure 11. Feedback on support offered by Energy Advisors.



Positive Feedback on Energy Advisors:

1. **Guidance and Education:** Energy Advisors assist homeowners in determining rebate eligibility, educate them about home efficiency, and offer recommendations for ROI-focused upgrades.
2. **Effective Collaboration:** They collaborate with mechanical companies, offer concrete measures, and ensure proper HVAC sizing.
3. **Valuable Reports:** Energy Advisors' reports provide valuable insights, data for accurate calculations, and transparency on subsidies.
4. **Communication and Support:** Despite limited direct interaction, they effectively communicate rebate information, support contractors' recommendations, and address inquiries.
5. **Training and Improvements:** Contractors suggest more training for Energy Advisors to enhance collaboration, streamline documentation, and revise reports accurately.

Negative Feedback on Energy Advisors:

1. **Limited Impact:** Contractors note a perception of limited impact from Energy Advisors' actions, with some customers opting for direct contact with installers.
2. **Communication Challenges:** Concerns arise regarding document upload speed, unanswered emails, and unreturned calls, requiring persistent follow-up.
3. **Preferred Contractors:** Energy Advisors' preference for certain contractors can lead to lost opportunities for others, causing discrepancies in customer expectations.
4. **Cost-Benefit Analysis:** The long payback period for energy savings makes cost-benefit analysis challenging for some contractors and homeowners.

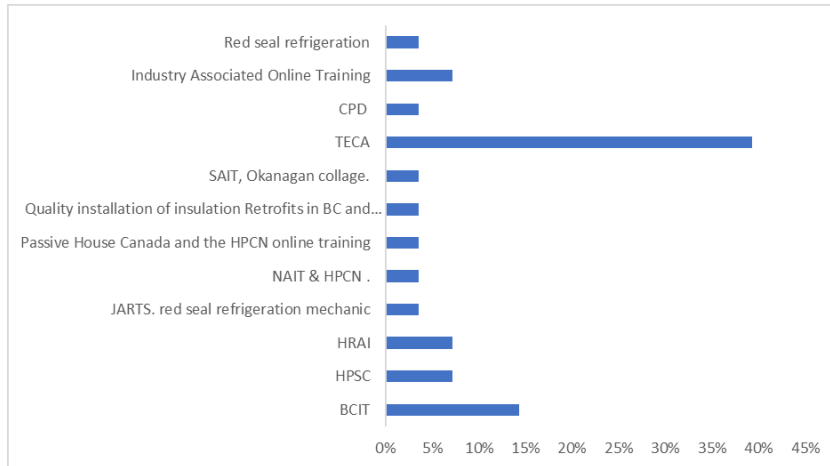
4.5. Assessment of Training in Energy Efficiency Strategies:

Current Training Landscape:

Out of the survey participants, a substantial 60% engaged with the questionnaire. Within this respondent group, a noteworthy 40% have completed training in energy efficiency strategies, primarily through the Thermal Environmental Comfort Association (TECA). This figure is followed closely by 14% who received their training from the British Columbia Institute of Technology (BCIT). Respondents have also undergone training from the Heating, Refrigeration, and Air Conditioning Institute of Canada (HRAI) and the Home Performance Stakeholder Council (HPSC).

Additionally, a smaller subset pursued their studies at the Northern Alberta Institute of Technology (NAIT) and the Southern Alberta Institute of Technology (SAIT). Notably, the survey included responses from two individuals holding Red Seal certifications, refer to Figure 12.

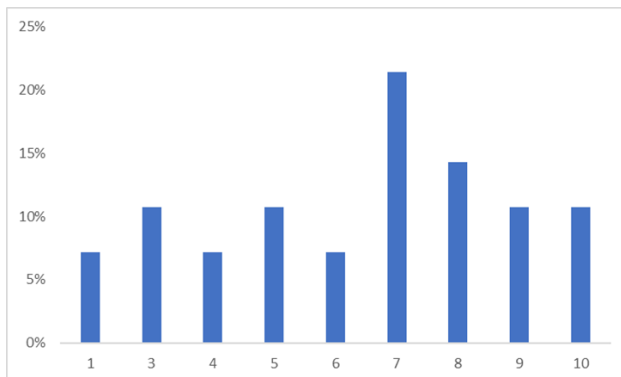
Figure 12. Overview of the training undergone by contractors.



Satisfaction Levels and Diverse Opinions:

Among the respondents, 21% provided ratings ranging from 6 to 7, resulting in an average score of 6.08. This diverse range of responses underscores the varying levels of satisfaction with the available training. Furthermore, a significant 64% of participants evaluated their existing training experience with a rating higher than 6.0 on a scale of 1-not satisfied to 10-very satisfied. This finding highlights the potential for enhancing training programs to better align with the specific requirements of retrofit projects.

Figure 13. Evaluation of training options aimed at facilitating energy efficiency enhancements and retrofit projects.

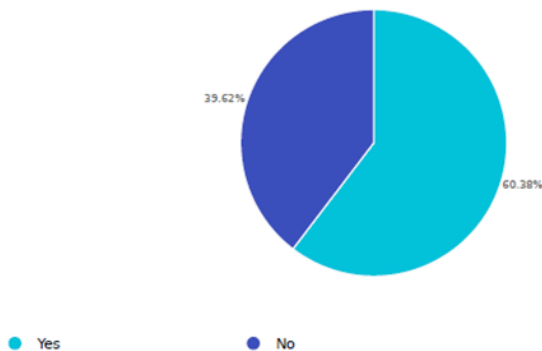


Addressing the Knowledge Gap:

The analysis of survey responses has brought to light the existence of a substantial knowledge gap within the energy efficiency measures sector. Nearly 40% of individuals engaged in this sector have not yet undergone training to bolster their proficiency in these measures. This presents an opportunity to bridge this gap, ensuring that a more comprehensive and skilled workforce is prepared to meet the demands of energy-efficient retrofit projects.

The survey results emphasize the critical role of training in enhancing energy efficiency strategies within the industry. While a significant percentage of respondents have undergone training, the diversity of satisfaction levels indicates the need for continuous improvement in training programs. Furthermore, the presence of a knowledge gap among a considerable portion of respondents highlights the importance of expanding training opportunities to equip more professionals with the expertise needed for effective energy-efficient retrofit projects. Closing this gap will not only benefit individual practitioners but also contribute to a more sustainable and energy-efficient future for the industry.

Figure 14. Evaluation of contractors undergone any training to support energy efficiency measures.



4.6. Barriers and Solutions in Energy Efficiency Projects:

In the realm of energy efficiency projects, contractors have identified several major constraints that hinder the seamless execution of these initiatives. These challenges encompass various aspects and demand strategic solutions for their mitigation.

4.6.1. Challenges in Raising Air Sealing Awareness:

One prominent obstacle is the lack of awareness among a significant number of clients regarding the importance of air sealing. A prevailing misconception tends to lean towards the belief that adding more insulation is always the optimal solution, often overlooking the fundamental principles of Building Science. Consequently, charging for the necessary attic work becomes a challenging endeavor.

1. Limited Knowledge of Energy Saving Programs:

Another constraint that arises is the limited knowledge among some customers regarding the existence of energy-saving retrofit programs. This lack of awareness restricts their ability to tap into the benefits offered by such initiatives.

2. Additional Hurdles in Energy Efficiency Projects:

In addition to the above, several other hurdles were highlighted by contractors within the energy efficiency project landscape:

3. Material Cost and Accessibility:

Contractors often face difficulties related to the cost of materials and their availability in the market, impacting the feasibility of energy-efficient retrofits.

4. Coordination Challenges in Insulation Retrofit:

Complexities emerge during the insulation retrofit process when homeowners fail to engage a contractor to coordinate work sequences. This oversight can result in suboptimal installation of air barrier tie-ins, adversely affecting airflow efficiency before insulation application.

5. Limited Remediation Options:

A significant challenge lies in the insufficient availability of companies specializing in remediation services, which is crucial for addressing issues related to energy efficiency.

Solutions to Overcome These Barriers:

To address these barriers and enhance the effectiveness of energy efficiency projects, contractors have put forward strategic suggestions:

1. Integrated Information and Process Strategy:

Implementing a cohesive strategy that harmonizes information and processes can streamline project execution and communication.

2. Early Contractor Engagement:

Increasing contractor involvement right from the project initiation stage is vital. Exploring improved incentives for homeowners to opt for contractor services from the outset can foster smoother collaboration.

3. Enhanced Contractor Training:

Promoting comprehensive training for contractors with a deep understanding of building science is essential. Providing elevated rebates to homeowners can serve as a valuable incentive. Establishing a robust system to verify the quality of contractor work ensures the delivery of high-quality energy efficiency solutions.

4. Increase Promotion of Energy-Saving Renovations:

Strengthening the publicity surrounding energy-saving renovation initiatives can raise awareness among homeowners, encouraging them to consider energy-efficient upgrades and contribute to a more sustainable future.

In summary, addressing the barriers in energy efficiency projects requires a multifaceted approach that combines education, coordination, and incentives. By implementing these strategic solutions, the industry can overcome challenges and promote the adoption of energy-efficient practices on a broader scale.

4.7. Understanding Heat Pump Contractors:

In the pursuit of comprehending the role of heat pumps within the domain of Energy Efficiency Measures, our survey delved into the insights, challenges, and recommendations offered by contractors specializing in heat pump installation.

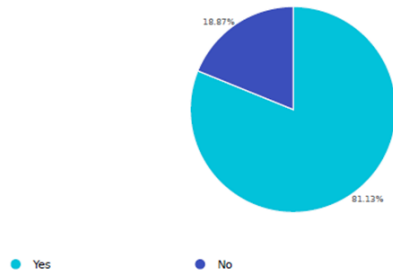
4.7.1. Contractor Demographics:

Understanding the Landscape:

An overwhelming majority, constituting 81.13% of our respondents, identified themselves as contractors primarily engaged in heat pump installation, accounting for nearly 19% of the

total. It's worth noting that within this group, we may also find contractors with expertise in areas such as window and door installation and insulation services.

Figure 15. Percentage of contractors in the heat pump installation business

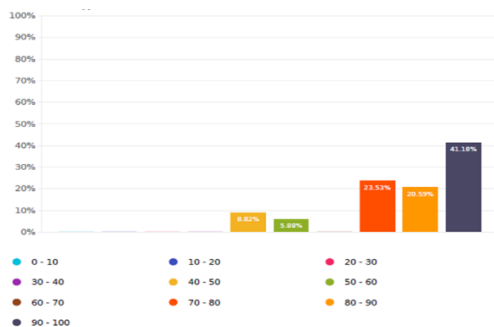


4.7.2. Sector Focus: Residential vs. Commercial:

Residential Dominance:

A substantial portion of participating businesses, totaling 41.18%, primarily directed their efforts toward the residential sector. Their focus ranged between 90% to 100%. Additionally, another 43.83% of businesses maintained a dual focus, allocating 70% to 90% of their operations to the residential HVAC sector.

Figure 16. Percentage of contractors segmented as residential (versus commercial or institutional)



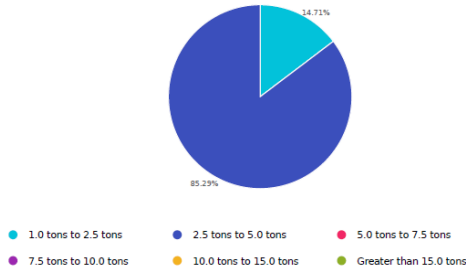
4.7.3. Unit Capacity Preferences:

Sizing It Right:

An impressive 85.23% of participants emphasized the installation of heat pumps within the tonnage range of 2.5 to 5.0 tons. A smaller yet notable proportion of 14.71% fell within the

1.0 to 2.5 tons range. These distribution patterns provide valuable insights for policymakers and manufacturers, guiding their efforts to offer tailored support to contractors operating within these specific tonnage ranges.

Figure 17. Percentage segmentation based on the capacity of the heat pump installed.



4.7.4. Heat Pump Types Installed:

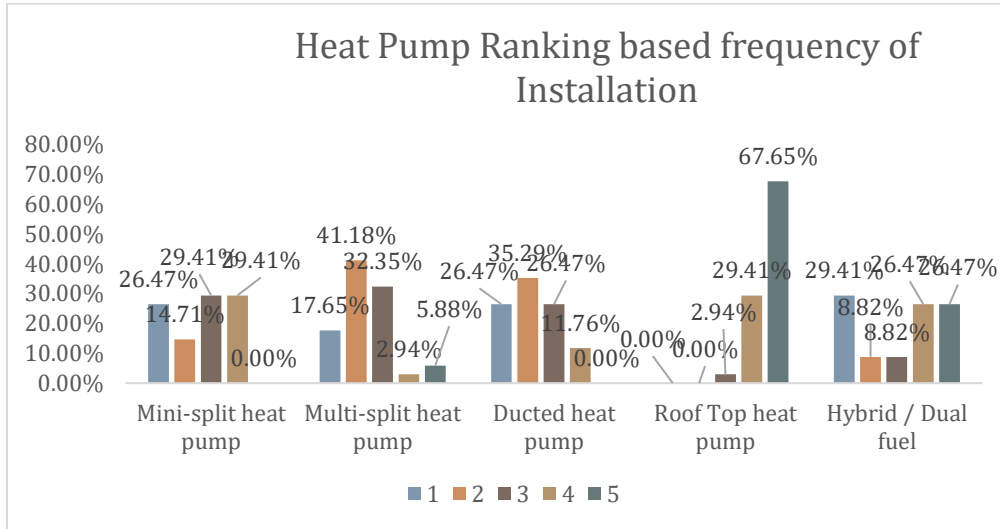
Variety of Choices:

Survey participants were presented with a range of heat pump options to gauge their preferences. Mini-split heat pumps are a popular choice at 26.47%, valued for their swift installation. Equally noteworthy, ducted heat pumps shared this percentage, showcasing a balanced preference among respondents, and the ducted heat pumps were ranked 1 as the most installed unit. Interestingly, in a few cases amongst the respondents, the dual heat pump systems took the lead with an installation rate of 26.47%, closely followed by multi-split heat pumps, which secured unanimous support at 41.18% which was ranked 2 based on the weighted average method.

4.7.5. Unit Installation Trends:

Market Penetration: In terms of the popularity of installed units, mini-split heat pumps claimed the third spot with 29.41%. Hybrid /Dual Heat pump units at 26.47.41% and Rooftop units, on the other hand, secured both the fourth and fifth positions, with installation rates of 26.47% and 67.65%, respectively based on the weighted average method. Refer to Figure 18 where the ranking is made from 1 to 5 for the most popular units based on the weighted percentage.

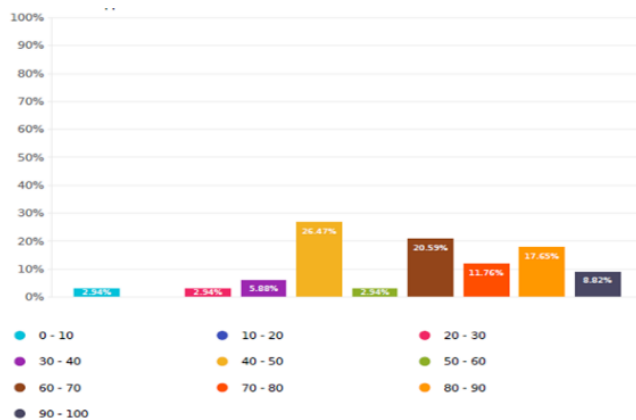
Figure 18. Percentage segmentation based on the type of heat pump installed.



4.7.6. Business Composition:

Unit Contribution: Around 26.47% of survey participants reported that ducted split heat pumps constituted 40 to 50% of their business. Approximately 20.59% noted that these units contributed significantly, making up 60 to 70% of their business operations. Slightly over 10% of respondents indicated that ducted split heat pumps accounted for a substantial 70 to 80% of their business operations.

Figure 19. Proportion of business attributed to the most installed type of heat pump.



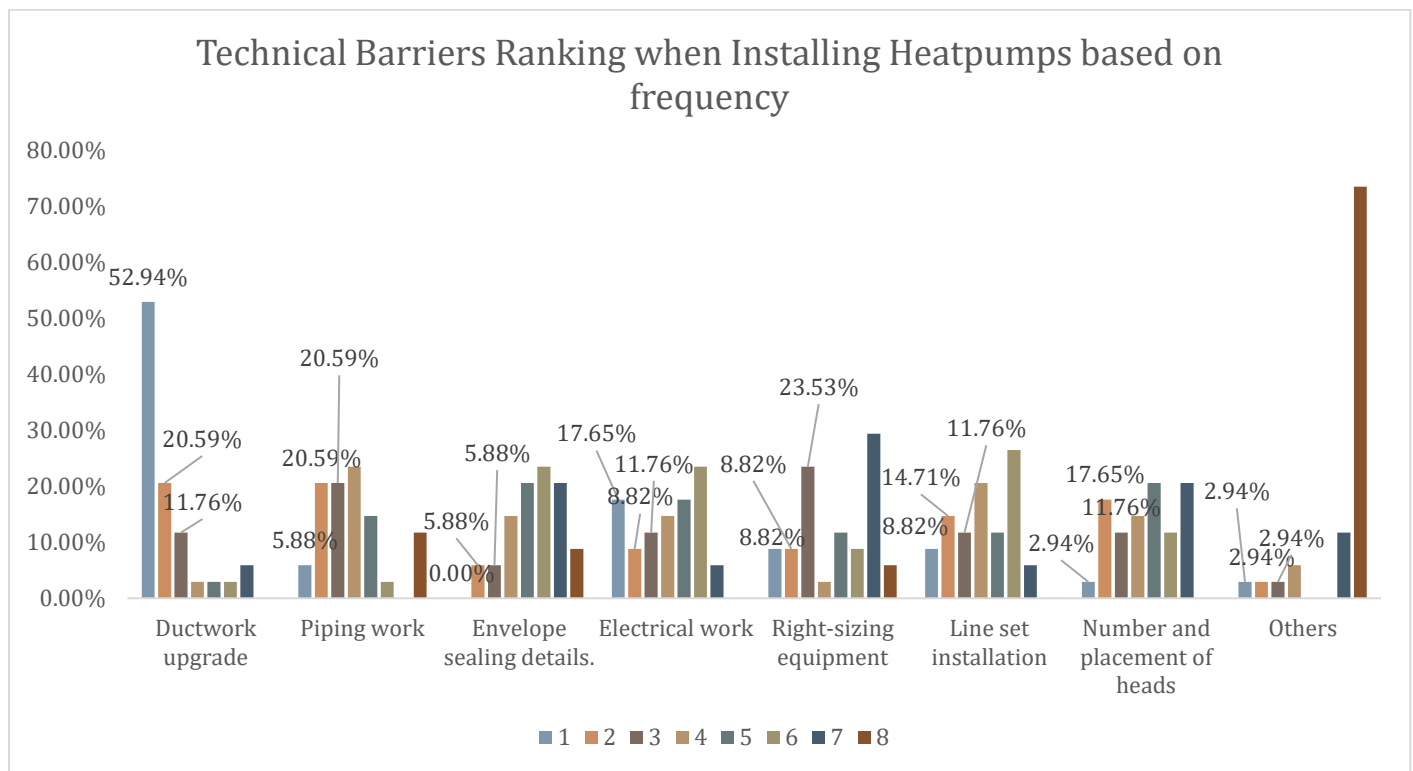
In conclusion, our survey provided valuable insights into the landscape of heat pump contractors, shedding light on their sector preferences, unit capacity choices, and heat pump installation trends. This information is crucial for stakeholders looking to support and engage with contractors in the energy efficiency sector effectively.

4.8. Technical Barriers in Heat Pump Installation:

Prioritizing Challenges:

To gain a comprehensive understanding of the technical challenges faced by contractors during heat pump installations, respondents were asked to rank these obstacles based on their frequency of occurrence. The options presented encompassed various technical aspects, each posing unique challenges and were ranked 1 to 8 based on the most frequently faced barrier as 1 and the least as 8.

Figure 20. Ranking of Technical barriers based on frequency.



Ductwork Upgrade Takes the Lead:

Among these technical hurdles, the need for ductwork upgrades emerged as the most prominent challenge, with an overwhelming 52.94% of respondents ranking it as the top barrier. This underscores the significance of addressing ductwork issues in heat pump installations.

Piping and Electrical Concerns:

Piping work and electrical work were positioned as the second and third most common challenges, with proportions of 20.59% and 23.53%, respectively. These aspects demand careful attention to ensure seamless heat pump integration.

Other Technical Considerations:

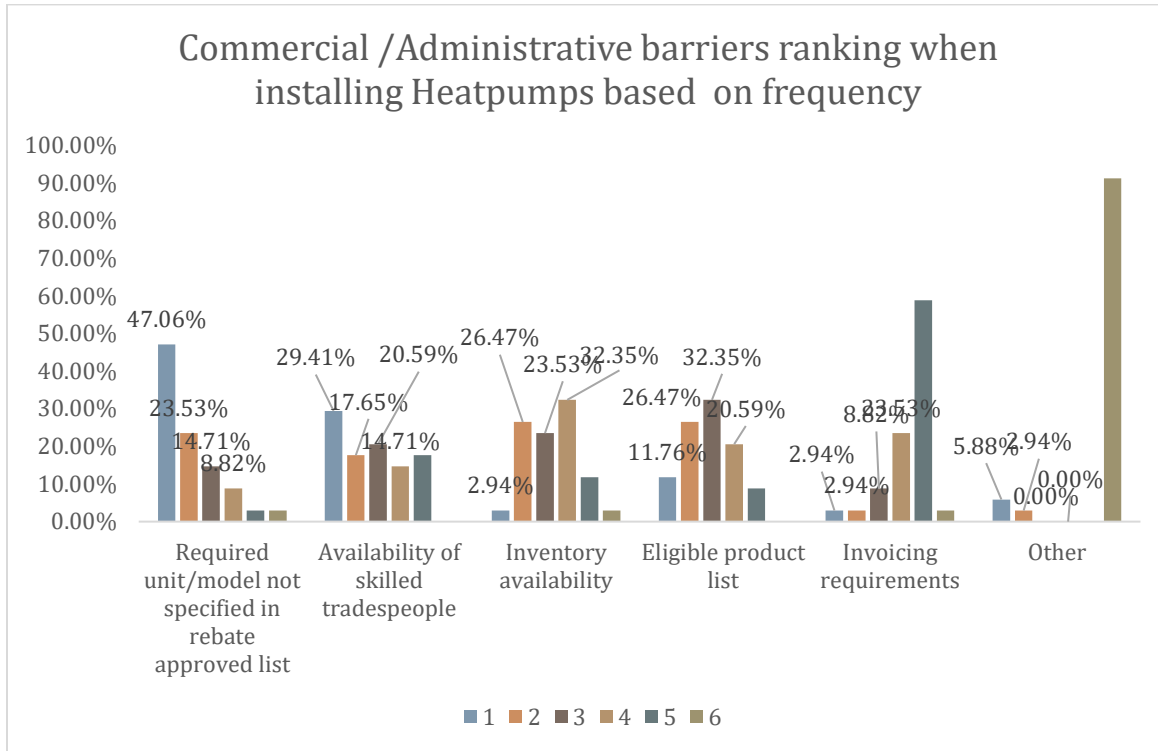
Envelop sealing details and the number and placement of heads shared the fifth rank, each receiving 20.59% of the responses, while line set installation secured the sixth position. Additionally, some contractors also highlighted challenges such as dealing with strata requirements and coping with narrow profit margins due to fierce competition.

4.9 Commercial and Administrative Barriers:

Identifying Common Obstacles:

In the realm of commercial and administrative barriers encountered during heat pump installations, contractors were asked to rank these challenges based on their frequency of occurrence. This segment focuses on the administrative and logistical aspects that can impede the smooth execution of projects.

Figure 21. Ranking of Commercial barriers based on frequency.



Absence of Approved Models:

The foremost barrier, as indicated by 47.06% of respondents, was the absence of a specified unit or model on the approved rebate list. This challenge underscores the importance of aligning available heat pump models with rebate programs to facilitate adoption.

Skilled Labor Shortages:

Challenges related to the shortage of proficient tradespeople closely followed, underscoring the significance of having an adequately skilled workforce available for heat pump installations.

Navigating Invoicing Requirements:

Invoicing requisites were also identified as a significant concern, emphasizing the need for clarity and efficiency in financial processes.

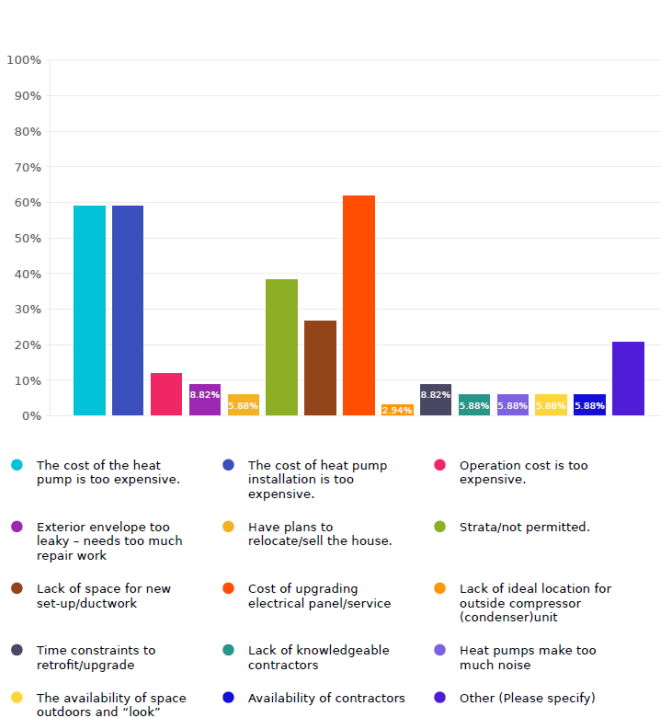
Understanding Customer Obstacles:

Approximately 60% of survey participants highlighted the cost-related barriers faced by their customers when considering heat pump installations. These cost-related concerns encompass both the initial cost of the heat pump unit and the expenses associated with its installation.

Electrical Panel/Service Upgrades:

Notably, the expense linked to upgrading the electrical panel or service took precedence, securing slightly over 60% of the total responses. This highlights the importance of addressing the financial aspects of heat pump adoption from both the contractor and customer perspectives.

Figure 22. Segmentation based on obstacles faced by customers when installing a heat pump.



In summary, this comprehensive analysis offers valuable insights into the technical, commercial, administrative, and customer-facing challenges faced by contractors in the heat pump installation landscape. Addressing these obstacles effectively is essential to promote the adoption of heat pumps and advance energy-efficient solutions in the industry.

4.10. Most common Obstacle with retrofitting heat pump projects shared by Contractors.

4.10.1. Emphasizing Customer Education:

Central to our approach is ensuring customers possess a comprehensive grasp of their systems and energy-efficient practices. We propose a mandatory video tailored to eligible rebate recipients. This video would encompass critical aspects like heat pump operations, air-handler filter changes, outdoor unit maintenance, winter defrost mechanisms, reversing valve sounds, and thermostat adjustments. This strategy aims to heighten customer awareness while optimizing energy usage.

4.10.2. Electrical Panel Enhancement:

Additionally, addressing electrical system capacity assumes significance, particularly since retrofit projects often grapple with existing electrical loads nearing maximum capacity. The enhancement of electrical panels and careful consideration of amperage play a pivotal role in facilitating seamless system transitions.

4.10.3. Streamlining Retrofit Challenges:

Strategies aimed at streamlining retrofit projects hold paramount importance in surmounting common challenges. Ensuring installers are well-acquainted with qualifying equipment stands as a primary concern, especially given suppliers' occasional model number alterations that impact AHRI ratings while the equipment itself remains consistent. This understanding greatly diminishes inconsistencies. Furthermore, adeptly managing installations within completed spaces assumes significance in effectively addressing the complexities and constraints associated with retrofits.

4.10.4. Mitigating Costs and Bolstering Training Initiatives:

Strategies to mitigate cost-related apprehensions and nurture skilled professionals emerge as pivotal priorities. Addressing the perception of elevated costs, particularly during the shift from gas heating, stands as a critical driver of change. Introducing gradual rebates based on enhancements in energy efficiency can serve as an encouraging incentive. Additionally, maintaining a proficient workforce is key to delivering quality installations and ensuring customer satisfaction. We can uphold the industry's expertise and standards by fostering ongoing training programs and incentivizing staff retention.

4.10.5. Enhancing Rebate Programs and Ensuring Clarity:

Strategic improvements to rebate programs that align more closely with industry requisites and the provision of transparent explanations for eligibility criteria are crucial measures. Coordinated efforts between federal and provincial entities for simplified applications can alleviate administrative burdens. Ensuring that both customers and contractors are well-versed in eligibility details and the application process remains fundamental in promoting active participation and transparency.

4.10.6. Promoting Precise Design and Installation:

Accentuating precise system design and installation endeavors resonates with both optimal energy efficiency and bolstering industry credibility. Implementation of routine audits to ensure accurate calculations, proper sizing, and adherence to elevated standards amplifies the overall caliber of installations. By upholding meticulous approaches, the transition to heat pumps can effectively balance environmental impact with energy efficiency. In summary, an all-encompassing strategy that underscores customer education, adept electrical load management, addressing retrofit complexities, cost mitigation, reinforcing rebate programs, and prioritizing meticulous design and installation collectively form a comprehensive framework for propelling the heat pump industry forward and realizing energy-efficient solutions for residential settings.

4.11. Suggestions to Overcome Technical Constraints:

4.11.1. Aligning Clean BC and Greener Home Programs:

To optimize program effectiveness, consider aligning the Clean BC program with the Greener Home program. This alignment can capitalize on established standards and incorporate their rebate initiatives. Such synergy would streamline the process and provide homeowners with clear participation guidelines, alleviating confusion when navigating Clean BC independently.

4.11.2. Equipment Eligibility Awareness:

Empower contractors with a comprehensive understanding of equipment eligibility. Ensuring they are well-informed about supplier-induced changes in model numbers, which may affect AHRI ratings without altering specifications, can prevent equipment from falling off approved lists. This knowledge ensures smoother operations and more accurate expectations.

4.11.3. Prioritize Rightsizing Training:

Prioritize training for heat pump contractors in the art of rightsizing for retrofit projects. This skill is pivotal for ensuring optimal performance and energy efficiency, directly contributing to installation success. By honing these skills, contractors can navigate projects effectively and with a higher level of expertise.

4.12. Suggestions to Overcome Commercial Constraints:

4.12.1. Streamline Permitting and Improve Rebates:

Optimize permitting procedures and enhance electrical rebates for upgrades. Streamlining administrative processes reduces hassles and encourages more contractors to engage in energy-efficient projects. Implementing graduated rebates, where minor efficiency improvements yield substantial rewards, can motivate homeowners to adopt eco-friendly technology.

4.12.2. Leveraging Smart Meters and Equivalency Measures:

Leverage Fortis's smart meters for heat loss calculations, reducing paperwork and improving data collection efficiency. Introduce equivalency measures to incentivize combining new heat pumps with existing furnaces, opening opportunities for broader energy-efficient upgrades.

4.13. Suggestions to Overcome Administrative Constraints:

4.13.1. Address Repetitive Training and Paperwork:

Elevate industry efficiency by addressing repetitive training and the administrative load associated with paperwork. Simplify and expedite these aspects to significantly improve workflow, allowing professionals to allocate more time to meaningful work.

4.13.2. Access to Financial Aid for Middle-Income Individuals:

Make financial aid accessible to middle-income individuals, eliminating restrictions solely on low-income groups. Merging federal and provincial components of the grant process can streamline the approach, reducing complexities.

4.13.3. Accommodate Growing Demand:

For new home construction, advocate for larger electrical services and invest in existing infrastructure to accommodate the growing demand for energy-efficient systems. Reimagine the Greener Homes Loan process to include preapproved rebates, reducing uncertainty for homeowners.

4.14. Quality Assurance and Industry Professionalism:

4.14.1. Vigilant Oversight of Contractor Installations:

Maintain the technology's reputation by implementing regular audits and inspections to ensure installations adhere to high standards, reflecting the industry's commitment to excellence.

4.14.2. Address Scarcity Issues:

Address the scarcity of heat pumps to ensure their widespread availability, meeting the increasing demand for these efficient systems.

4.14.3. Enhance Professionalism:

Foster professionalism within the industry by mandating accurate calculations by salespeople and designers and conducting regular audits to verify the quality of heat pump installations. These measures enhance credibility and performance.

4.15. Administrative Efficiency and Clarity:

4.15.1. Integrated Rebate Management:

Consider integrating rebate management between federal and provincial bodies and homeowners to simplify the process for contractors. Additionally, email notifications as a more convenient alternative to mandatory webinars, offering professionals flexibility in accessing crucial information.

4.15.2. Clarity in Program Explanations:

Enhance the clarity of rebate program explanations and institute mandatory consultations with rebate support teams to mitigate confusion and elevate application quality. Amalgamate federal and provincial requirements to streamline processes and create a more coherent framework that promotes a smoother journey for all stakeholders involved.

Summary

The survey involved 71 businesses, primarily focusing on their engagement in energy efficiency measures, particularly heat pump installations. Most businesses were established, with 86% being part of the Home Performance Contractor Network (HPCN). HVAC contractors dominated the field, emphasizing energy efficiency measures related to HVAC systems. While satisfaction with loan and rebate programs varied, recommendations for improvement included streamlined processes and better communication. Most customers who applied for rebates were successful, but there was room for improvement. Energy Advisors played a crucial role in educating customers and promoting energy efficiency projects. Contractors were generally comfortable discussing energy efficiency but identified the need for more training. Challenges included technical barriers during heat pump installations, cost constraints for customers, and administrative complexities.

Recommendations

- Unified Rebate Programs: Collaborate to harmonize Clean BC and Greener Home programs, simplifying participation for homeowners and providing consistent guidelines.
- Ductwork rebates: Extending a rebate for the necessary re-ducting and electrical panel upgrades demands meticulous deliberation, as underscored by the contractors.
- Contractor Education: Equip contractors with in-depth knowledge about equipment eligibility and AHRI ratings to ensure accurate submissions and smoother operations.

- **Right-Sizing Training:** Prioritize training on right-sizing equipment to enhance energy efficiency and performance in retrofit projects.
- **Process Optimization:** Streamline permitting procedures, enhance electrical rebates, and introduce graduated rebate tiers to encourage greater adoption.
- **Innovative Solutions:** Explore the use of Fortis's smart meters for heat loss calculation and promote equivalency measures for combined furnace and heat pump systems.
- **Industry-Wide Enhancements:** Advocate for measures such as banning flare nuts, enforcing stricter refrigerant leak prevention standards, and supporting advanced technology development.
- **Efficiency Improvement:** Simplify training and administrative tasks to optimize workflow and allow professionals to focus on meaningful work.
- **Middle-Income Accessibility:** Ensure financial aid accessibility for middle-income individuals and merge federal and provincial grant components for a seamless application process.
- **Professionalism Focus:** Mandate accurate calculations, conduct regular audits, and maintain high standards in installations to uphold the industry's credibility.
- **Heat Pump Availability:** Address heat pump scarcity to meet the growing demand for these efficient systems.
- **Contractor Oversight:** Implement regular audits and inspections to ensure quality heat pump installations and maintain industry credibility.
- **Rebate Program Enhancement:** Improve rebate program clarity through explanations and consultations with rebate support teams, while streamlining federal and provincial requirements.
- By implementing these recommendations, the energy efficiency measures industry can overcome challenges, enhance customer satisfaction, and contribute to a more sustainable future.

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Research to understand barriers to implementing efficient residential retrofits (contractor constraints) | Husain.

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Appendices



Residential Building Survey – Retrofits

* What areas does your business service?

* How long has your company been in business?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years

What is your company's name?

* Are you familiar with the Home Performance Contractor Network (HPCN)?

- Yes – I am a current HPCN member.
- Yes – I am familiar but not a member.
- No – I am in the process of becoming HPCN registered.
- No – I plan to register.
- No – I don't plan to register.

* Select your organization's focus area in the energy efficiency measures

- Window and door installation
- Home Insulation
- Heating, Cooling & Ventilation Installation
- Air Sealing
- Renewable Energy (Solar PV Installation)
- Renewable Energy (Solar Heating)
- Moisture / Water Proofing
- Batteries connected to PV
- Water Heating using Heat Pump

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Please rate the loan and rebate programs offered to support energy efficiency measures based on their level of complexity, with 1 indicating "Very Difficult" and 10 indicating "Very Easy":

* Clean BC Better Homes and Home Renovation Rebate (Provincial)

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

* Clean BC Income Qualified Program

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

* Clean BC Better Homes low-interest Financing Programs

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

* Canada Greener Homes (Federal) loan program

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

* FortisBC heat pump loan program to replace electric baseboards

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

* Fire Smart - siding, vents

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

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* Flood Preparation

Very Difficult Very Easy Not applicable

1 2 3 4 5 6 7 8 9 10

Other (please specify in comment box below)

Very Difficult Very Easy

1 2 3 4 5 6 7 8 9 10

Program Name

0 / 5000

* Typically, of the customers who applied for rebates, what percentage of customers were successful in obtaining a rebate?

0 100

* What suggestions do you have to ease the rebate process for contractors?

0 / 20000

* How do the Energy Advisors help the contractors in promoting the Energy Efficiency Measure projects?

0 / 20000

* How comfortable are you discussing energy efficiency and retrofit projects with customers?

- Completely comfortable
- Somewhat comfortable
- Not at all comfortable

* Did you undergo any training to support energy efficiency measures?

- Yes
- No

* How satisfied are you with the training available to support energy efficiency and retrofits? On a scale of 1 (not at all satisfied) to 10 (completely satisfied).

Not at all satisfied Completely satisfied

1 2 3 4 5 6 7 8 9 10

* How satisfied are you with the training available to support energy efficiency and retrofits? On a scale of 1 (not at all satisfied) to 10 (completely satisfied).

Not at all satisfied Completely satisfied

1 2 3 4 5 6 7 8 9 10

* Does your company provide services related to heat pump installations?

- Yes
- No

Residential Building Survey - Heat Pumps

* What percentage of your work is residential (versus commercial or institutional)?

0 100

* What is the average capacity of heat pumps you have installed in residential retrofit projects?

- 1.0 tons to 2.5 tons
- 2.5 tons to 5.0 tons
- 5.0 tons to 7.5 tons
- 7.5 tons to 10.0 tons
- 10.0 tons to 15.0 tons
- Greater than 15.0 tons

* Please rank the following types of heat pumps based on how many you install with 1 being the most common.

<input type="text" value="--- Select ---"/>	▼	Mini-split heat pump
<input type="text" value="--- Select ---"/>	▼	Multi-split heat pump
<input type="text" value="--- Select ---"/>	▼	Ducted heat pump
<input type="text" value="--- Select ---"/>	▼	Roof Top heat pump
<input type="text" value="--- Select ---"/>	▼	Hybrid / Dual fuel

* What is the percentage of the most common heat pump installed in residential retrofit projects?

0 100

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* Please rank the following technical barriers/challenges that you commonly encounter when installing heat pumps, based on their frequency of occurrence, with 1 being the most frequent.

- Ductwork upgrade
- Piping work
- Envelope sealing details.
- Electrical work
- Right-sizing equipment
- Line set installation
- Number and placement of heads
- Others

If Others, please specify

0 / 5000

* Please rank the following commercial/administrative barriers/challenges commonly encountered during the installation of heat pumps, based on their frequency of occurrence, with 1 being the most frequent.

- Required unit/model not specified in rebate approved list
- Availability of skilled tradespeople
- Inventory availability
- Eligible product list
- Invoicing requirements
- Other

If Other, please specify

0 / 5000

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* What are the top 3 barriers/obstacles your customers face to installing a heat pump? (select only three)

- The cost of the heat pump is too expensive.
- The cost of heat pump installation is too expensive.
- Operation cost is too expensive.
- Exterior envelope too leaky – needs too much repair work
- Have plans to relocate/sell the house.
- Strata/not permitted.
- Lack of space for new set-up/ductwork
- Cost of upgrading electrical panel/service
- Lack of ideal location for outside compressor (condenser)unit
- Time constraints to retrofit/upgrade
- Lack of knowledgeable contractors
- Heat pumps make too much noise
- The availability of space outdoors and "look"
- Availability of contractors
- Other (Please specify)

Please rank the training topics that are most relevant and important for enhancing the development of your team currently, taking into consideration the needs of retrofitting and the industry, with 1 being the most relevant/important.

- Residential Ventilation systems.
- Residential Commissioning systems.
- Electricity basics for HVAC contractors.
- Refrigerant Handling Training.
- Retrofitting with "House as a system approach".
- Technician field practices for quality Installation.
- Quality Installation of Air Sourced Heat pumps.
- Quality installation of water source heat pumps.
- Quality installation of ground source heat pumps.
- Residential Heat Loss and Heat Gain Calculations.
- Other

If Other, please specify

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* To what extent do you think the low cost of utility natural gas / high cost of electricity is hindering the promotion of heat pumps? 1 being "Low impact ", and 10 being "High impact".

Low Impact High Impact Not applicable

1 2 3 4 5 6 7 8 9 10

* Could you highlight/mention one major constraint with retrofitting heat pump projects?

0 / 20000

* What suggestions do you have to overcome the technical /commercial /administrative constraints while installing heat pumps?

