

A photograph of a male technician wearing a blue hard hat and a red and black plaid shirt. He is kneeling on a red step ladder, focused on using a yellow multimeter. He is holding a red probe connected to the multimeter and touching it to a white heat pump unit. A yellow tool bag is slung over his shoulder. The background is a blurred outdoor setting. The bottom half of the image has a dark red overlay with white text.

Bridging the Skills Gap for Heat Pump Proficiency

Understanding the existing skill sets and competencies of the residential HVACR workforce, and what additional knowledge may be needed to support the market transition to heat pumps and a low carbon economy.

March 2025

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Table of Contents

Executive Summary.....	3
Introduction	5
Market Development.....	7
The Impact	8
The Challenges.....	9
Why Ontario	10
Ontario’s Residential HVACR Labour Market.....	11
Opportunities and Barriers.....	12
Brief Assessment of Current Training and Certification Pathways.....	12
Experienced Mentorship.....	14
Financial.....	14
Bridging the Skills Gap for Heat Pump Proficiency Project	15
DACUM 23 Skill Sets.....	16
Stakeholder Engagement.....	18
Key Themes	20
1. Heat Pump Technology Skill Requirements.....	20
2. Aligning with Apprenticeship Training System	21
3. Support for Employers.....	23
4. Ensuring Compliance.....	24
What does the data say?	25
Critical Knowledge Deficiencies.....	27
Findings.....	28
Future Risks/Concerns	29
Industry Inertia	29
1. Industry Culture	29
2. Incentive Programs	29
3. Regulatory	30
4. Other Provinces.....	30
Bureaucratic Inertia in the Training and Apprenticeship System.....	30
Shifting Government Policy and Priorities	31
Fragmentation and Non-Alignment	31
Recommendations.....	33
Professional Development	34
Financial Supports for Residential HVACR Workers.....	34
Financial Supports for HVACR Employers.....	34
Engaging Skilled Trades Ontario	35
Recognition of Skills and Competencies	35
National Stakeholder Meeting with CCDA.....	36
Certification vs Compliance	36
Connecting Incentive Programs to Skilled Trade Proficiency.....	36
Next Steps for Bridging the Skills Gap	37
Phase II Training Development.....	37
Phase III Training Pilot	38
References.....	39

Executive Summary


In 2022, Canada's total greenhouse gas (GHG) emissions reached 708 megatonnes of carbon dioxide equivalent, with buildings contributing 88.8 megatonnes—approximately 13% of the total. Reducing emissions from buildings through the adoption of green technologies, such as heat pumps, is essential for achieving Canada's climate targets. However, the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) workforce is currently ill-prepared to support this transition due to both a workforce shortage and a lack of necessary skills and training.

Although gas technicians are not trained or licensed to install, service, or maintain electrified home heating solutions, some are performing this work regardless, often leading to substandard outcomes. Even many licensed technicians lack up-to-date training on today's heat pump technologies. This skills gap has resulted in improperly installed or serviced systems, causing heat pumps to operate inefficiently or fail to perform adequately. The consequences have been significant, with diminished consumer confidence in heat pump technology and warranty issues for manufacturers, often stemming from installation or servicing errors rather than equipment defects.

The Bridging the Skills Gap project, funded in part by NRCan and Environment and Climate Change Canada, focuses on the Ontario market as a test case to investigate these challenges. Ontario represents a significant opportunity for heat pump adoption, given its reliance on natural gas heating and the large pool of Gas Technicians (G2) and Residential Air Conditioning Mechanics (313D) who service the residential sector. The project aims to identify the knowledge and skill gaps within the workforce, as well as opportunities and barriers to addressing them.

A DACUM (Developing a Curriculum) exercise was undertaken to outline the skills and competencies required for heat pump installation, servicing and maintenance. Using the DACUM framework, a comprehensive skills technical assessment tool was created, consisting of over 200 questions, to evaluate technician confidence and knowledge across key competencies. More than 200 participants signed up for the assessment; 86 G2 and 313D technicians completing the assessment in its entirety.

The findings revealed a similarity between G2s and 313Ds in terms of the knowledge and skill sets required, alongside a need for further education and training for both groups. Notably, 313D technicians displayed confidence levels that exceeded their actual



capabilities, raising concerns about potential errors in critical tasks and adherence to safety and regulatory standards. The lack of motivation and/or mandated upskilling among certified technicians poses an additional challenge.

Significant stakeholder engagement was conducted throughout the project to gather insights from a broad range of participants, including industry representatives, educational institutions, government agencies, and regulatory authorities. These discussions revealed additional risks and concerns facing the residential HVACR industry as it transitions to a low-carbon economy. The feedback identified opportunities that informed a series of recommendations aimed at addressing workforce limitations and supporting the adoption of green technologies.

The recommendations focus on:

- Creating career pathways for G2 technicians to obtain a 313D certificate of qualification
- Mandating professional development for all HVACR technicians
- Providing financial supports for both workers and employers to offset training costs.
- Engaging Skilled Trades Ontario to support their updating of training and curriculum standards aligning with technological advances
- Developing flexible approaches to recognizing and assessing skills and competencies.
- National collaboration with organizations like the Canadian Council of Directors of Apprenticeship (CCDA) to harmonize efforts across provinces.
- The imperative that government and utility incentive programs have a requirement for work to be completed by licensed technicians.

The Bridging the Skills Gap project lays the groundwork for a second phase, which will involve developing a training curriculum based on the identified skill gaps, and a third phase, which will pilot the curriculum with a cohort of G2 and 313D technicians in Ontario. By addressing these challenges, the HVACR industry will be in a better position to play a pivotal role in Canada's transition to low-carbon, energy-efficient technologies, while ensuring the workforce is both resilient to the disruptions the transition will bring, and fully equipped to embrace the new opportunities it will also bring.

Introduction

Buildings account for 18% of Canada’s greenhouse gas emissions (GHG), and that almost all of those emissions (96%) come from space and water heating equipment reliant on fossil fuels. The Canada Green Buildings Strategy states that Canada “needs to accelerate the retrofit of approximately 11 million buildings and construct millions of greener buildings in the coming decades,” suggesting the rate of retrofits will need to quadruple over current rates if the country is to get on track towards meeting its GHG reduction goals. All the data highlights the critical need for adopting advanced HVACR technologies, especially when retrofitting or building energy-efficient homes. Equally important is ensuring a skilled and qualified workforce to install, maintain, and optimize these systems, as they are essential to transforming the market and driving lasting changes in consumer behavior.

Before focusing policies and programs on achieving results through shifting consumer demand, it is crucial to first ensure there is capacity in the workforce responsible for achieving policy goals. Without evaluating and preparing a skilled and capable workforce, Canada risks facing a significant obstacle to the widespread adoption of low-carbon, energy-efficient HVACR systems. Failure to address workforce issues may stall current efforts or create unintended consequences and will certainly hinder the HVACR industry’s ability to support Canada’s long-term emissions reduction objectives.

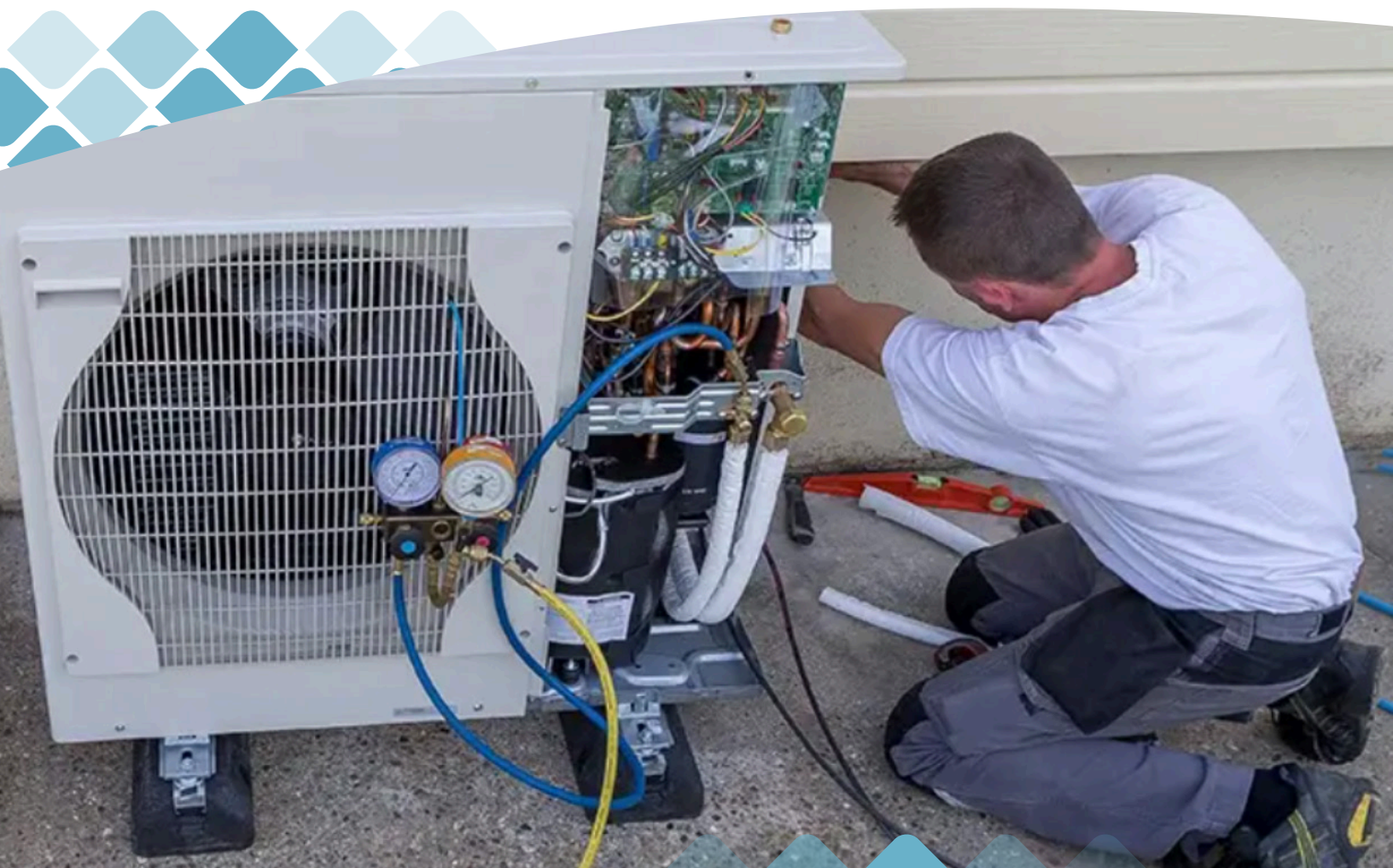
While the heating, ventilation, air conditioning and refrigeration (HVACR) workforce is rich with talented and experienced tradespeople, a critical challenge remains – much of the workforce lacks the specialized training needed to effectively install and maintain low-carbon, electric powered home comfort systems. And without urgent investment in upskilling and reskilling, this gap will persist, jeopardizing the successful adoption of current and future technologies essential for achieving climate goals. Many government and non-government organizations have conducted research and identified the need for training.

- NRCan “A market transformation roadmap for windows, space heating and water heating technologies” identifies 7 steps. Step 5 is training: ensuring a trained and certified workforce to install and maintain new products, 2018
- Environment and Climate Change Canada, A HEALTHY ENVIRONMENT AND A HEALTHY ECONOMY, 2020

- EcoCanada, Assessment of Occupational and Skills Needs and Gaps for the Energy Efficient Buildings Workforce, February 2021
- BuildForce Canada, Building a Greener Future, April 2024

Previous market analyses have recognized workforce challenges as a barrier to decarbonization, highlighting gaps in skilled training and ongoing labour shortages. However, they have not fully addressed how to overcome these challenges or accelerate the implementation of effective solutions. This technical skills assessment narrows the focus, providing clear guidance on actionable steps and identifying specific remediation efforts to ensure the workforce is properly trained to meet the increasing demand for HVACR professionals across Canada.

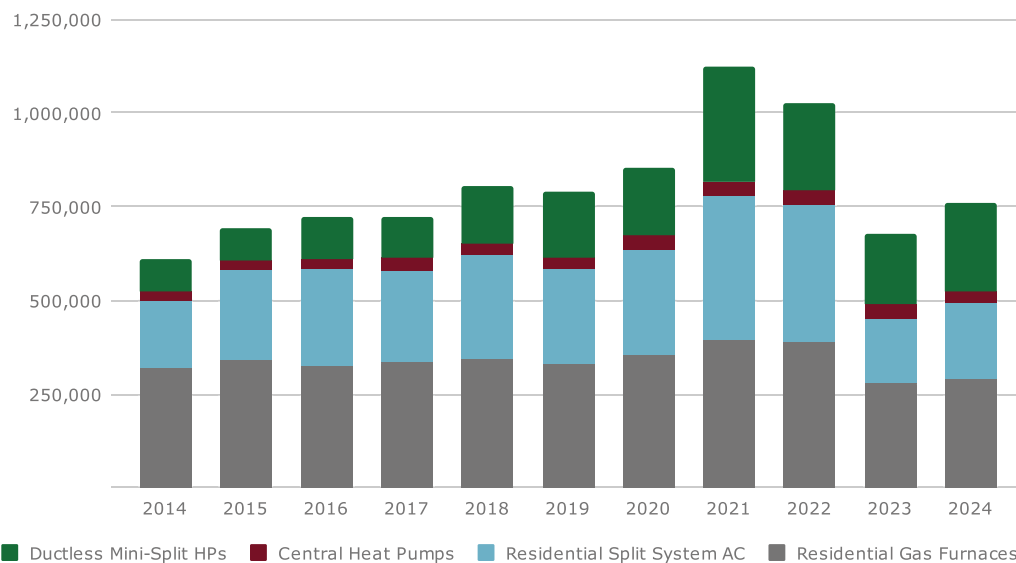
To achieve this important goal, the industry must seek out and create innovative workforce development solutions that will be both time-efficient and cost-effective, and that recognize and build on the current HVACR and Gas Technicians skills and competencies to meet the growing demand for electric heat pumps for both retrofits and new housing markets.



Market Development

Although a number of electric heating solutions exist, the most efficient and popular with homeowners is heat pump technology, with cold climate air-to-air ductless “mini-splits” and ducted heat pumps at the top of the list. According to recent reports, heat pumps are now the most common primary home heating system in New Brunswick (32 per cent) and Prince Edward Island (27 per cent), and a close second to furnaces in Nova Scotia (21 per cent vs 23 per cent). Heat pumps are also gaining popularity in Quebec (11 per cent) and British Columbia (7 per cent).² In Ontario, more than 400,000 households use electric heat pumps for heating and cooling. ongoing labour.³

Figure 1: Residential HVAC Product Shipments in Canada, 2014-2024



Programs like the Canada Greener Homes Grants and Loans and the Oil to Heat Pump Affordability Program have driven 211,697 heat pump installations across Canada since 2020, more than 40% of which have been installed in Ontario. While this sounds impressive, it represents less than 1.5% of Ontario’s six million homes.

According to the BuildForce Canada study, “The residential construction sector alone could see investments of over \$81 billion between 2023 to 2032 as the sector is tasked with installing 4.9 million cold-climate air-source heat pumps and 4.6 million electric water heaters to replace existing heating equipment powered by fossil fuels and build new homes powered by electricity.”⁴

Some analysts see this growth as the leading edge of a long-term market trend, one that will ultimately be driven by economics, not government programs.⁵ While the year-to-year changes in heat pump popularity may continue to be driven by government and utility programs, it is becoming increasingly clear that the long-term trend is sustained market growth for this technology.

The Impact

Financial supports for investing in low carbon technologies (e.g., government rebates or tax incentives) increase the demand for heat pumps, yet a bottleneck is created when there is insufficient resource capacity in the industry to deliver on the expectations of Canadians.

The previously mentioned BuildForce Canada study goes on to identify issues the demand creates for the workforce both in capacity and capability. *“These demands stem from fuel-switching in new and existing homes. These will create significant labour market challenges as the direct new employment created is nearly four times (387%) the size of the 2022 workforce for this trade.”*⁶

It is clear that existing provincial trades training and apprenticeship systems will not be able to deliver these kinds of numbers in the time required.

However, the BuildForce report astutely identifies an important pool of existing workers in the HVACR sector that can be retrained to meet the rapidly growing demands, *“Moving away from fossil fuels should limit the demand for gas fitters across the country. This presents a potential for these workers to transition to heat pump installations [...] The majority of gas fitters do not currently have the training and certification to do this work, so retraining would be required.”*⁷



The Challenges

The residential HVACR sector faces multiple challenges:

Like many trades, the HVACR workforce is ageing, and the attrition rate is not being met by the rate of incoming apprentices.

A significant portion of the current residential HVACR workforce is not licensed to work on heat pump technology.

Insufficient availability of training – limited Training Delivery Agent (TDA) seats for apprenticeship programs and a lack of professional development training.

The apprenticeship system has been slow in updating provincial training and curriculum standards to keep pace with the modern technology deployed in today's heat pumps.

Mid-career training costs – tuition costs, allocation of time, lost earned income for both employer and employee.

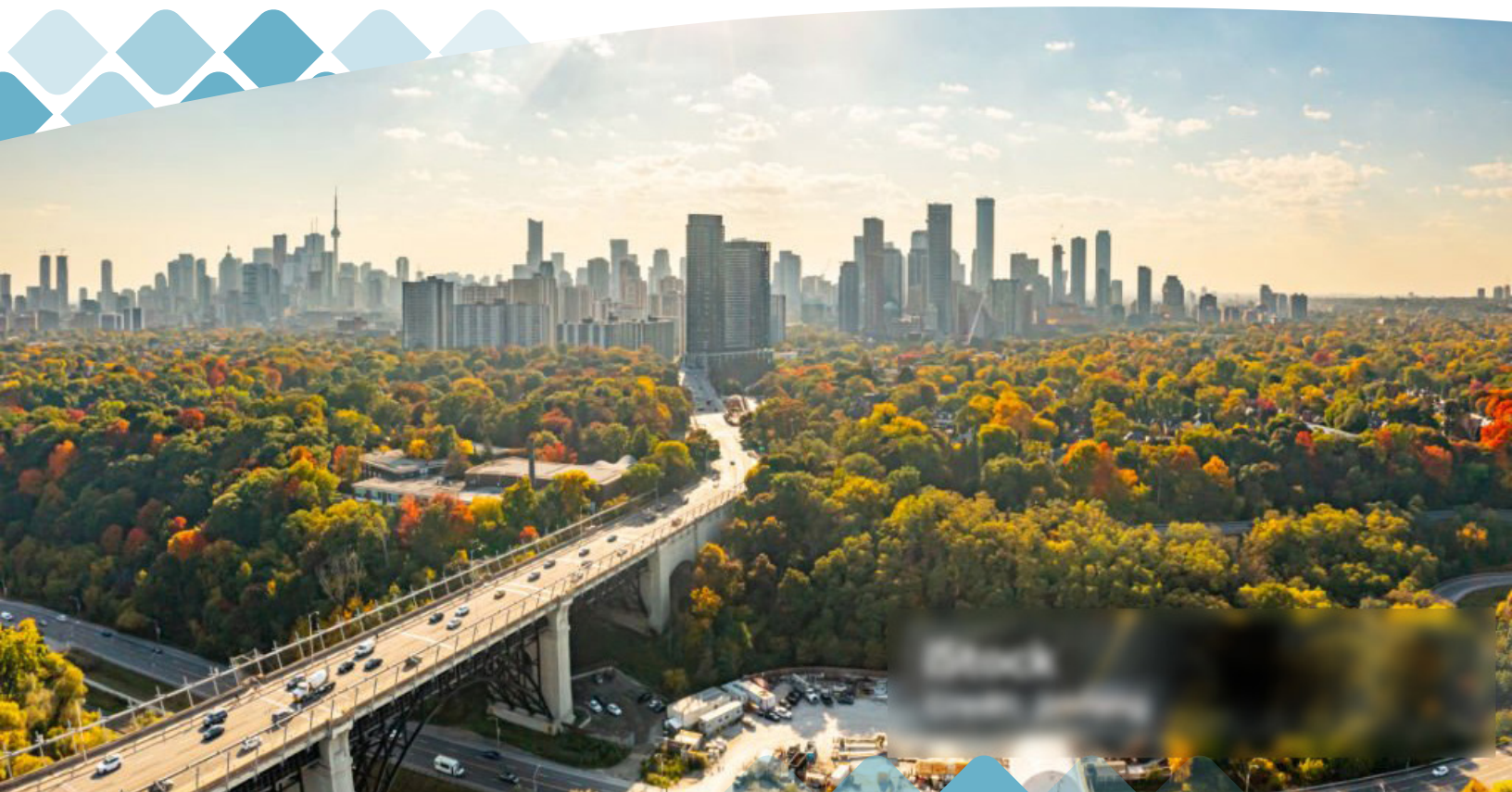
To effectively recruit, retain and develop skilled HVACR technicians capable of safely and competently installing, servicing and maintaining heat pumps, innovative workforce development strategies and solutions are essential. Training programs at all levels must evolve in tandem with advancing technology and emerging products. Moreover, strategic investments in reskilling and upskilling initiatives, along with financial incentives to encourage participation in these training opportunities, are critical to ensuring a sustainable and capable workforce.

Failure to effectively transition displaced gas technicians within the HVACR industry will lead to significant workforce capacity challenges, impacting both government and industry efforts.

Why Ontario

This project focuses on Ontario because:

- It is a significant market opportunity – Ontario houses about 40% of Canada’s population, and greater than two-thirds of the province’s homes are heated with natural gas, so the electrification opportunities (mainly involving retrofitting with heat pumps) are significant.
- The province has an established training and curriculum standards for the existing 313D Residential Air Conditioning Systems Mechanic.
- Though the 313D certification is required by law to work on heat pumps in Ontario, there has been no formal analysis of the suitability of the existing training and curriculum standards (which is mainly focused on residential air conditioning) to the unique needs and characteristics of heat pumps.
- The findings of this research will not only benefit the industry in Ontario but will be transferrable to other provinces across the country.



Ontario's Residential HVACR Labour Market

Ontario relies heavily on natural gas for space heating, particularly in urban and suburban areas. In rural and remote regions, where natural gas distribution infrastructure is unavailable, homes primarily use propane and electric baseboard heating, which is often inefficient and costly. While largely phased out, a small number of older homes still depend on heating oil for their heating needs.

Due to this dependence on combustible fossil fuels for heating, Gas Technician 2 (G2) certificate holders are responsible for the majority of installations and servicing of space heating systems across the province. The Technical Standards and Safety Authority (TSSA) oversees the training and certification of G2 technicians, ensuring they meet the necessary safety and technical standards to perform their work. TSSA also administers certifications for other technical and safety-related roles in the heating sector.⁸

In Ontario, residential cooling solutions are delivered by Residential Air Conditioning Systems Mechanics (313D – a Compulsory Provincial Trade) and Refrigeration and Air Conditioning Systems Mechanic trade (313A – a Red Seal Trade). Both trades are administered by Skilled Trades Ontario and holder of these certification (and apprentices) are licensed to install, service and maintain heat pumps. The Ontario HVACR work force employs 3,340 313D mechanics, and 9,725 313A mechanics, of which only a portion of work in the residential sector.

There are also more than 32,000 G2 technicians employed in the residential HVACR sector who are not permitted to work on heat pump systems.⁹

As Ontario transitions away from fossil fuels toward heat pump technology, this disparity highlights a looming workforce challenge. Without significantly increasing the number of qualified 313Ds and 313As, the province will face a serious shortage of licensed professionals to meet the growing demand for heat pump installations and maintenance, jeopardizing efforts to achieve climate and energy efficiency goals.



Opportunities and Barriers

No new path forward is without opportunities and barriers. Without recognizing each, the process will stumble, and success will be hampered.

Brief Assessment of Current Training and Certification Pathways

While the training needs of the sector are significant, there are avenues for training and skills development available that might make it possible to narrow the skills gap. Each of these can and will play an important role, but each also brings some drawbacks.

- *Refrigeration and Air Conditioning Systems Mechanic (313A) trade.* In many ways, this is the preferred option for the creation of fully trained HVACR technicians as it is recognized as a Red Seal trade. 313A apprentices typically train in the commercial sector to fully develop and leverage a broader skill set. The residential sector is not a normal path because it does not allow apprentices to acquire the depth of experience needed to successfully acquire the 313A trade certification.
- *Residential Air Conditioning Systems Mechanic (313D) trade.* The industry, government and interested stakeholders can and should work diligently to draw more young people and others seeking meaningful employment into this apprenticeship stream. Although, it is clear from the research done by BuildForce that the apprenticeship system today cannot deliver the number of technicians that the market will require over the next 10 or more years.
- *Ontario's TDAs.* Limited funding results in constrained number of apprenticeship seats at TDAs, leading to backlogs in apprenticeship completions. This bottleneck directly impacts the availability of a qualified workforce for the residential sector, further exacerbating the shortage of skilled technicians. Without increased investment, the province risks falling behind in workforce development critical to achieving its climate and energy goals.
- *Manufacturers Product Training.* Most major heat pump manufacturers offer training to dealers on their products. For some manufacturers, the incentive for this training is that only products installed by those that have completed the manufacturer training can be registered for warranty. This training is a valuable element in the preparation of knowledgeable and skilled technicians, but such training must be seen as an adjunct to, not a replacement for, trades certification.

- *Third Party Training.* As heat pumps have gained popularity, many organizations have developed and rolled out training aimed for different levels: sales techniques that highlight the unique benefits of heat pumps versus other technologies, design considerations (sizing, product selection), and technical considerations involved in specific applications (e.g., ground source or air-to-water applications). Much of this training brings great additional value to the industry as it navigates its way forward; however, these programs are not homogeneous in their content or availability, nor are they a substitute for comprehensive technical training and the apprenticeship model.

A good installation can't compensate for a bad design (sales/application).

Bob McKeraghan, President, Canco ClimateCare





Experienced Mentorship

While heat pump technology is not new, until recently, its application in Canada has been limited. As a result, many of today's journeypersons who are guiding, training and mentoring today's apprentices lack appropriate experience and training with modern heat pump technology.

Journeypersons teach what they know, not what they don't.

As recently as 2023, Skilled Trades Ontario updated the 313D program to include more explicit focus on heat pumps. According to STO, "the updated skill set objects now more accurately depict the full scope of practice for 313D, which includes combined heating and cooling, as well as cooling units."¹⁰ This is a welcomed development; however, this new knowledge does not reside with journeypersons working in the field, and there is no opportunity for this education to be gained without professional development training.

Financial

Training is an expensive venture and the costs are borne by the training providers, the participants and their employers. Costs include:

- Funds to develop the curriculum, promote and recruit participants, pay the staff to deliver the training, house the training facilities and lab equipment;
- Tuition costs to the participants; and
- Lost income to the participants and their employers.

Many existing workers and stakeholders assume that government grants are readily available for trades-related training, but the process is neither direct nor well understood. For example, the 313A Refrigeration and Air Conditioning Mechanic is a recognized Red Seal trade, making it eligible for some federal funding. In contrast, the 313D Residential Air Conditioning Systems Mechanic is a compulsory trade recognized in Ontario and Manitoba but does not qualify for federal funding because it is not a Red Seal trade. As a result, the financial burden of workforce development falls largely on employers and technicians in the residential sector, creating significant barriers to reskilling and upskilling within this segment of the industry.

Bridging the Skills Gap for Heat Pump Proficiency Project

Governments have recognized the skills gap and resource challenges. The training community has shown interest in developing training to educate on the required skills. What has been missing is an assessment of the actual competencies maintained by the existing workforce in relation to the skills needed for heat pump installation, servicing and maintenance.

The Bridging the Skills Gap for Heat Pump Proficiency research project is founded in a technical skills gap assessment. The project began by developing a test standard, based on the DACUM process, to assess technicians' skills. A technical committee of heat pump subject matter experts was formed, consisting of heat pump manufacturers, accredited trainers and those with expertise in heat pump installation, servicing and maintenance. The committee documented the process of a residential heat pump installation from the first on-site conversation with the homeowner, through the step-by-step installation, trouble shooting service calls and required regular maintenance. Significant attention was given to identifying and prioritizing the skills most relevant to heat pumps.

The DACUM identified 23 essential skill sets; and specific skill sets were broken out according to technology options (specifically ducted central systems, ductless applications and several specialty heat pumps).




DACUM 23 SKILL SETS:

1. Protect Self and Others
2. Hand Tools
3. Power Tools
4. HVACR Specialty Tools
5. Specialty Products and Refrigerants
6. Job Site Preparation - New Construction
7. Job Site Preparation - Re/Re Construction
8. Sizing and Selection of Heat Pump
9. Installation of Ductless Heat Pump
10. Installation of Ducted Heat Pump
11. Installation of Specialty Heat Pumps
12. Maintenance of Ductless Heat Pump
13. Maintenance of Ducted Heat Pumps
14. Maintenance of Specialty Heat Pumps
15. Service of Ductless Heat Pump
16. Service of Ducted Heat Pump
17. Service of Specialty Heat Pumps
18. Controls/Low Voltage Electronics
19. Residential Line Voltage Electronics
20. AHJ/Codes
21. Customer Service and Relations
22. Commissioning
23. Applications and Sales for Heat Pump Technology

Using the DACUM, the committee created a technical assessment. The assessment did not include certain skill sets (categories 1, 2, 3 and 21) because of their general applicability across trades. The remaining skill sets were organized into nine modules:

- 1. Specialty Products and Tools
(Skill Sets 4–5)**
- 2. Job Site Preparation
(Skill Sets 6–7)**
- 3. Sizing and Selection
(Skill Set 8)**
- 4. Installation
(Skill Sets 9–11)**
- 5. Maintenance
(Skill Sets 12–14)**
- 6. Service
(Skill Sets 15–17)**
- 7. Controls and Line Voltage
(Skill Sets 18–19)**
- 8. Codes and Commissioning
(Skill Sets 20 & 22)**
- 9. Applications
(Skill Set 23)**



Based upon these nine modules, more than 200 questions were developed: 158 sliding scale questions to assess the participants' confidence level in completing various tasks, and 70 multiple choice questions to assess the participants' knowledge of carrying out specific tasks.

If you can install a heat pump, you can install an air conditioner, but just because you can install an air conditioner, doesn't mean you can install a heat pump.

Peter Messenger, Owner, A1 Air4

The VAMetric online platform (Valid-8), which specializes in skills and audit assessments, was programmed with the assessment questions, along with prequalification and information gathering questions, such as licenses held, years of experience and experience with heat pumps. G2s and 313Ds from all across Ontario were invited to complete the technical skills assessment. The assessment was live for a five week period.

VAMetric and HRAI assessed the results, with a view to identifying data trends and weaknesses in skills and competencies to inform future training needs. Throughout the whole process, stakeholder engagement was conducted to identify issues and challenges being faced by the industry, along with barriers incurred by technicians and employers.

This report shares the findings of this work. A copy of VAMetric's report is located in Appendix A.

Stakeholder Engagement

HRAI conducted significant stakeholder engagement with industry, government and other relevant stakeholders to gain feedback and perspective on the rationale for, and the potential implications of, the gap analysis. Discussions focused on challenges and opportunities, as well as apprenticeship and training policy issues or considerations. This engagement was also an opportunity to gain stakeholder support, to seek ideas on how to move forward with the study's findings, and to create awareness so stakeholders know what to expect in coming years and raise awareness to ensure stakeholders are informed about what to anticipate in the coming years.

HRAI established a multistakeholder committee to review and provide their perspective on the results of the DACUM exercise undertaken by the technical committee. This was followed by a second stakeholder engagement workshop to review the results from the on-line skills technical assessment and encouraged more open dialogue.

Specifically, the stakeholder committee discussed and provided feedback on the following:

- Did the DACUM accurately capture the necessary knowledge, skills and competencies, and appropriately reflect workplace needs and expectations?
- Did the DACUM exercise adequately capture the heat pump skills/tasks required to show competency?
- Has the gap analysis adequately captured the specific skills/competency deficiencies of the existing workforce (G2s and 313D)?
- How should employers and training providers be engaged in this effort?
- What employer training and apprentice incentives/support(s) are needed?
- What compliance and regulatory issues should be considered?

Feedback was received from more than 30 stakeholder representatives either through formal committee/workshop sessions or through informal one-on-one conversations. Stakeholder engagement was not restricted to the committee, but was extended to include a broad and diverse group of stakeholders, including:

- Contractors, wholesalers, and manufacturers
- Industry associations
- Labour organization
- Education and training organizations
- Regulatory authorities
- Skilled trade crown agency
- Green economy organizations
- National apprenticeship/construction skilled trade organizations
- Government representatives



Key Themes

The feedback from the stakeholder engagement process is organized into four themes:

1. HEAT PUMP TECHNOLOGY SKILL REQUIREMENTS

Manufacturer Technology Considerations

Manufacturers of heat pumps utilize proprietary technologies and processes; as such, heat pump manufacturers provide product specific training to contractors/installers. This installation and unit operations training is supplemental training and is not a replacement for the core skills training required to achieve technical proficiency in the trade.

The skills documentation developed by the technical committee through the DACUM process addresses the 80 percent of 'common' technological knowledge required for all heat pumps, regardless of manufacturer. There was recognition/acknowledgement that the remaining 20 percent, much of this being controls and electronics, is specific to the manufacturers' proprietary technology and could not be appropriately captured.

Ongoing/Continuous Professional Development


The increased demand in the marketplace for heat pumps is making it necessary for employers to find ways for skilled trade workers (G2s and 313Ds) to obtain new skills at a pace that is commensurate with the "heat pump boom." Even though the demand exists, there is a lack of professional development for active skilled tradespersons to upgrade their skills and knowledge that is consistent with modern training standards.

Electrical/electronics is the part that evolves the most and the fastest. This is what requires the most training for the future.

Geoff Sharman, Residential Product Manager HVAC Division,
Mitsubishi Electric

Hybrid Systems

Refrigeration and Air Conditioning Mechanics (313A Red Seal) are licensed to complete heat pump installations, but heat pumps are often deployed in combination with an existing or new fuel-burning furnace – in "hybrid" arrangements. Many of the necessary



skills are included in the competencies of a gas technician, but additional training may be required around sizing and specification requirements for such systems, and particularly on modern electronic control systems that are designed to optimize performance for these hybrid arrangements.

Skills for All Heat Pump Approaches

Neither the 313D, nor the skill sets presented in the DACUM, capture some of the key additional skills required for ground source heat pumps. Because they require the design, installation and maintenance of a “ground loop,” ground source heat pump systems require additional unique skill sets. The availability of training on these skills is even more limited than what is available for air source heat pumps. Drilling subcontractors (often coming from the water well drilling sector) can provide supplemental skill sets to support a loop system or drilling system installation. There is also scant training on (or even awareness of) new (to Canada) applications of heat pumps such as “air-to-water” heat pumps, which allow for hydronic heating applications.

2. ALIGNING WITH APPRENTICESHIP TRAINING SYSTEM

Marketplace Gap

While the 313D provincial training apprenticeship training standard was updated in December 2023 and the curriculum standard currently being updated, the current workforce of 313D ticket holders was trained and certified under the previous 2008 standards. This represents a 15+ year gap where the training and curriculum does not align with the advent of new, more sophisticated heat pump technologies. The net impact is that the skills and competencies of the current 313D workforce may need to be augmented to capture the significant improvements in processes and changes in technologies since the last formal review.

While one explanation for the knowledge gaps exhibited by current 313D license-holders might indeed be that they were trained to a standard that did not make sufficient reference to heat pumps, another factor might also be that many of these ticket-holders acquired their certification via a challenge process, rather than at the conclusion of a full apprenticeship. Either way, the reality is that many individuals who hold the license have worked for companies that have not featured heat pumps as one of their offerings and therefore direct experience in the field may be missing.

Conversely, there are clearly also companies that have offered heat pumps for years but lack certified technicians to install them. Without endorsing this approach, that reality may mean there is a population of “field experienced” heat pump installers in the industry who acquired their skills through hands-on experience (and perhaps through informal training), and these workers may perform reasonably well despite lacking formal credentials to do the work.

Red Seal Updates

It was noted that at the national level, the 313A occupational standard is being refreshed; heat pumps are part of the refresh. This is being undertaken as part of the Canadian Council of Directors of Apprenticeship's (CCDA) Red Seal 5-year renewal process. The stakeholder committee agreed that there are potential synergies to be explored with the CCDA Red Seal Secretariat.

Informing Apprenticeship Authorities

While this gap analysis was not driven by the provincial apprenticeship agency's processes, it will have the potential to inform the apprenticeship program in Ontario as it presents industry intelligence on needed skills and competencies.

There is an opportunity to inform apprenticeship authorities of the DACUM exercise and to contribute these results into their 313D provincial training and curriculum standard reviews.

It is also an opportunity to work with provincial apprenticeship agencies (initially Skilled Trades Ontario) to design a roadmap of training that can be delivered efficiently to the industry without sacrificing the integrity of the apprenticeship education and training experience of existing workers.

Concurrently, this initiative will inform employers and training providers (TDAs) in the industry about the training needed.


Recognition of Skills and Competencies

Looking to the future, apprenticeship authorities need to establish flexible approaches to validate and formally assess the skills and competencies of G2s and 313Ds. These technicians need to know that their employer sponsor will be able to help them attain the relevant skill sets. Key elements of such an approach could include assessing skills through a variety of formats, relevant and up-to-date materials to help employers understand the journey, supporting mentors with materials and training, and an online system for monitoring and confirming progress.

Community Colleges

Colleges Ontario is extremely interested in providing 'responsive education' to meet market demands, but colleges require lead time for development. Colleges Ontario will support/contribute what it is able in terms of understanding how to meet the DACUM learning outcomes.

It was suggested that Ontario's Colleges Heads of Apprenticeship Training would most likely be supportive in terms of curriculum development and could see this as a model for other trades that are grappling with either lagging curriculum design or with emerging technologies. This includes supporting professional development requirements.



Colleges Ontario offered to work with HRAI to identify colleges that are already providing HVACR trades programs, which TDAs are delivering 313D training and how to collaborate to create/implement pilots.

Pathways and Bridging

Stakeholders commented that college HVAC and HRAC programs typically provide a gas technician certification stream within it, and training on air conditioning and heat pumps without a licensing component. Many gas technicians that completed the skills technical assessment completed HVACR courses in college.

A future opportunity is to design potential educational pathways through a trade equivalency assessment capability that would provide partial accreditation towards a 313D.

Skills Ontario

HRAI has long supported Skills Ontario with hands-on skills competitions focused on heating systems and refrigeration. HRAI and Skills Ontario should explore partnership opportunities to inform the next generation of skill trade workers about the types of careers in the HVACR industry, heat pump technology, and how the HVACR sector is taking action on climate issues.

This collaboration would provide market driven workplace/competency-based information that supports educational systems' ability to inform young people about exciting career opportunities that support the low carbon economy.

3. SUPPORT FOR EMPLOYERS

Employer Group Sponsorship Models

A significant challenge for a skilled tradesperson/apprentice (313D and G2) is finding supportive employers who are committed to guiding them through the skills upgrading/reskilling process. Many employers do not have formal human resource departments to lead such an effort.

Small to medium sized employers, particularly in smaller communities, do not have the time, resources, or capacity to provide on-the-job training. This prevents these employers from taking on apprentices and new work in the growing heat pump industry.

Currently, the highest skilled trade/apprentice completion rates come from individuals who receive significant support from structures like Union Joint Apprenticeship Training Trust Funds, and non-government organization (NGO) employment support organizations such as the Support Ontario Youth (SOY) program.

Opportunities exist for employers to partner with Union Joint Apprenticeship Training Trust Funds and SOY-like organizations to support the recruitment and apprenticeship processes.



Employer Training Incentives

As the market demands for heat pumps increase, governments need to consider financial incentives to encourage employers to reskill and/or upskill their employees so that they will be better trained and more confident to install/service/maintain today's heat pumps. The focus should be on encouraging training progression and completion through some form of milestone payments to eligible employer sponsors for taking on new or existing 313Ds and retraining/supporting G2s on a pathway to attaining their 313D license.

4. ENSURING COMPLIANCE

TSSA Regulatory Compliance

TSSA acknowledged that the training system will need to consider some type of training upgrade for G2s to meet new technology requirements. Currently, TSSA has not done any work to revise the G2 curriculum because heat pump technology installation falls outside the scope of the G2.

Municipal Bylaws

There are varying municipal regulations and bylaws that need to be considered around heat pump installations that are not uniformly applied or enforced; some of which can be quite restrictive. For example, several cities have zoning bylaws that place restrictions on where outdoor units can be installed. Some cities ban heat pumps or air conditioner units from the front yards, others have setback requirements that are quite different. Some municipal bylaws require a building permit for heat pump installations, while others do not. Adding to the complexity, approvals may depend on the discretion of municipal building officials and staff, who may lack the knowledge or experience to make informed decisions.

Understanding municipal requirements is important and, unfortunately, it appears that many of the skilled trades are not familiar with the individual municipal bylaws. Ontario recently harmonized with the National Building code, providing some synergy.

Geographic Considerations/Regional Differences

Different segments of the country have different pools of available labour. Ontario has a large pool of gas technicians. Northern rural Ontario has a number of oil burner technicians, albeit fewer in number. Given that the Oil Burner Technician (OBT2) and G2 certifications share many foundational skills, the process of reskilling and upskilling these technicians may be quite similar.

What does the data say?

More than 200 technicians expressed interest in the on-line skills technical assessment, but many were ineligible to complete the process as their qualifications fell outside the project's scope. Ineligibility was large due to being overqualified, such as holding a 313A license, or underqualified as a result of having less than five years of licensed on-the-job experience.

Of the 200 initial respondents, 86¹¹ technicians completed both the confidence-based and knowledge-based questions. Of these 86 technicians, 54 participants hold 313D licenses, and all maintain a G2 certificate.

Before completing the on-line assessment, some basic data collection questions were asked, including but not limited to:

- Types of licenses held (313D, G2, etc.)
- Years of service in the trade (from 5 to 20+)
- Number of heat pumps installed (from 0 to 21+)

No analysis was completed to correlate competency levels to the number of heat pumps installed. The vast majority of participants indicated that they had installed greater than 20 heat pumps, and thus the data for those with less experience was too small a sample to extrapolate any value.

Once vetted, eligible participants answered a series of self-assessment questions indicating their confidence in completing a specific skill set, followed by multiple-choice questions indicating their actual knowledge relevant to the application of the those skill sets. Each skill set was categorized into modules for the assessment. The skill sets and their organization into modules is outlined in the Project Methodology section.

Though the skills technical assessment did not identify a pass or failing grade, internally, a marker of 70% was identified as a minimum for required knowledge in each module; typical trade exams require 70-80% as a passing grade to attain a certificate of qualification.

HRAI conducted an analysis of the data (beyond that presented by VAMetric in Appendix A) to identify trends and specifically to provide insight that would support next steps in the research project. This additional analysis assessed confidence levels against demonstrated knowledge for each technician category (G2s only versus 313D holders) and for each of the nine modules.

Module 1: Specialty Products and Tools

Module 2: Job Site Preparation

Module 3: Sizing and Selection

Module 4: Installation

Module 5: Maintenance

Module 6: Service

Module 7: Controls and Line Voltage

Module 8: Codes and Commissioning

Module 9: Applications

Figure 2. Confidence by License and Module

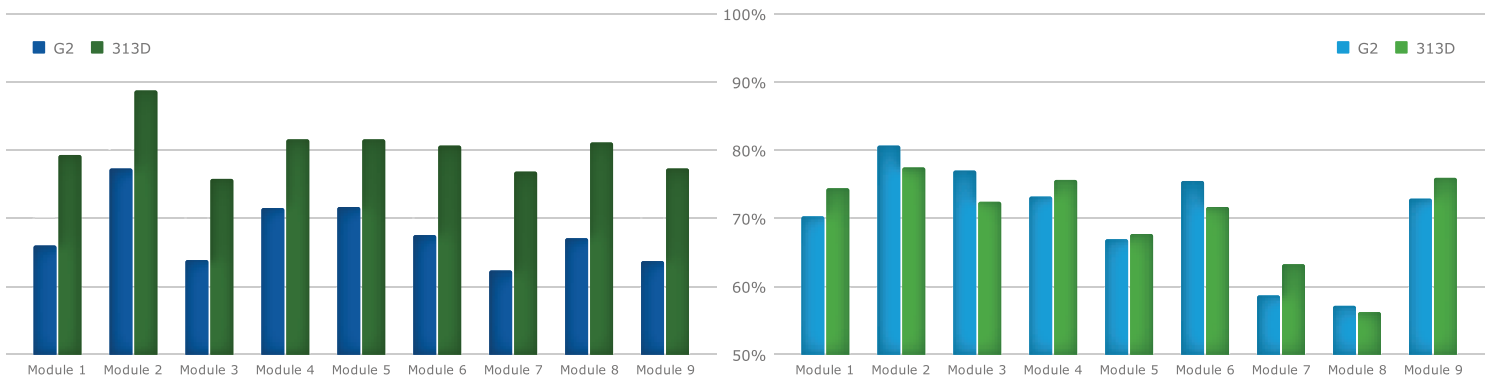


Figure 3. Knowledge by License and Module

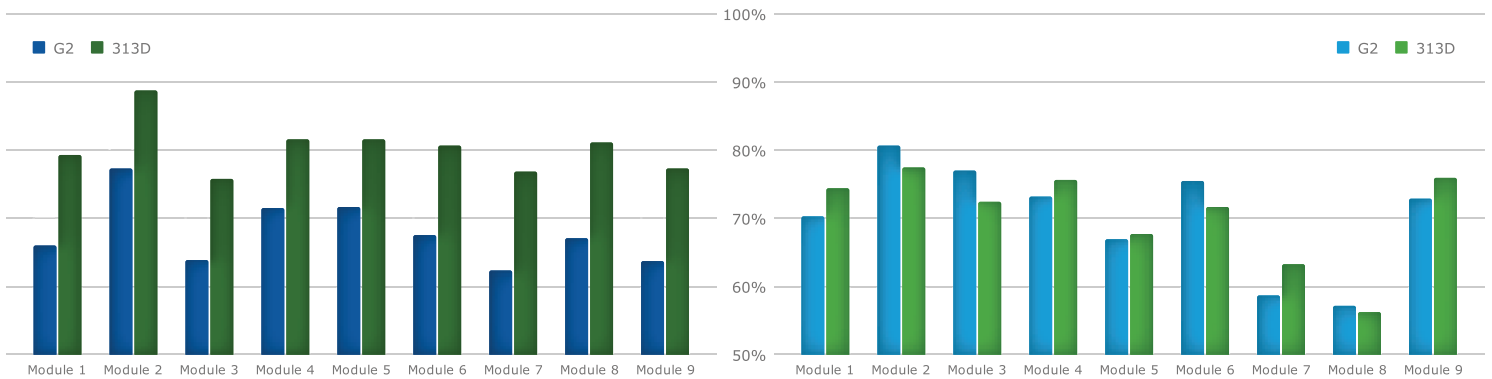
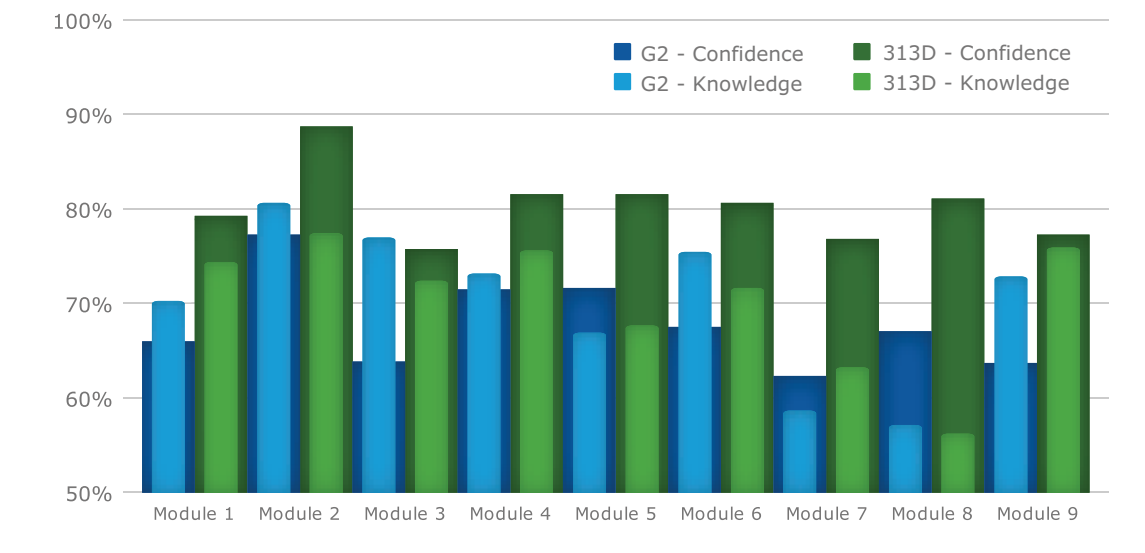


Figure 4. Confidence vs Knowledge by License and Module





Critical Knowledge Deficiencies

The data demonstrates the need for additional education and training across all assessed skill sets regardless of license. Alarming, while a majority of 313D and G2 technicians reported having installed more than 20 residential heat pumps, performance on critical modules fell significantly below the industry benchmarks for proficiency and safety. These gaps are particularly pronounced in several key technical areas.

Sizing and Selection (Module 1): This module highlighted a need for improvement, particularly in accurately applying sizing principles.

Installation (Module 4): Despite 313Ds reporting higher confidence levels (81.64%), their performance was only marginally satisfactory at 75.66%, often failing to meet the practical expectations of the field. Misalignment between confidence and knowledge was particularly evident in tasks involving ducted and specialty heat pump installations.

Maintenance (Module 5): Scores averaged below 68% for both groups, revealing significant misunderstanding of refrigerant management and preventive maintenance tasks. This is concerning given the pivotal role maintenance plays in ensuring system longevity and efficiency.

Controls and Line Voltage (Module 7): This was the weakest module overall, with G2s averaging 58.73% and 313Ds 63.17%. Questions involving thermostat wiring, Canadian Electrical Code compliance, and integration of controls into multi-zone systems proved especially challenging, with scores frequently dipping below 60%.

Codes and Commissioning (Module 8): Codes-related questions highlighted a knowledge gap.

Specific areas that demand immediate intervention for both groups include:

- **Multi-Zone Systems:** Scores in this area were below 60%, reflecting a lack of understanding in configuring and troubleshooting complex setups.
- **High/Low-Voltage Wiring:** Safety and technical knowledge in high/low-voltage systems remain concerning, particularly as errors in this area pose significant risks.
- **A2L Refrigerants:** Many technicians showed insufficient understanding of the safety protocols and handling requirements for newer refrigerants, highlighting a critical gap in readiness for emerging technologies.



Findings

A Potentially Dangerous Misalignment Between Confidence and Knowledge

313Ds consistently overestimated their abilities. While comfort levels for most modules were high, actual performance did not align. This gap between confidence and performance may lead to errors in critical tasks, especially in areas requiring strict adherence to codes and safety standards. It also suggests a systemic issue in self-assessment accuracy and highlights the need for further validation of skills to ensure future heat pump installations meet current and quality and safety standards.

G2's Performing Beyond Expectations in Several Key Areas

G2 technicians – despite their license not authorizing them to work with heat pumps – are working on heat pumps and outperformed 313Ds in several modules and showed promising alignment with training requirements for a 313D license, perhaps indicating they are well-positioned to transition into roles working with residential heat pumps, provided they obtain the appropriate license through the existing TEA/Certificate of Qualification framework.

Experience vs. Knowledge

Sorting the data by years of service revealed that technicians with 5–10 years of experience generally scored higher than those who have been on the job for 15 years or more. This finding underscores the importance of continuous education to address evolving industry standards, particularly with respect to electrical code updates, control systems, new refrigerants and safety protocols, as well as reviewing and identifying outdated practices.

Uniform Knowledge Gaps Across Groups

The similarity of knowledge gaps between G2s and 313Ds indicates systemic issues concerning lack of continuing education and the continued use of outdated practices. Both groups performed below expectations in modules tied to evolving technologies.

Future Risks/Concerns

The skills gap research findings result in linear recommendations; however, the explorative conversations held with multiple stakeholders brought forward additional thoughts and concerns that bear repeating.

Industry Inertia

1. INDUSTRY CULTURE


Most HVACR contractors in the residential sector today are Small and Medium Enterprises (SME) (80% have fewer than 10 employees). They are consumed with the day-to-day operations of running their business. They can be characterized as trend followers when introduced to new ways of doing business, and risk adverse when introduced to new innovations.

In part, the resistance arises from lack of time and resources needed to dedicate the effort needed to understand the benefits of new technologies. This leads to a lack of technical knowledge and experience. Overcoming that inexperience means taking risks and making investments of time and money that may or may not pay off. In a market where most end users (homeowners) also lack awareness or hold on to misconceptions about new technology, for some HVACR contractors “playing it safe” is a preferred and rewarding strategy.

It’s important to highlight that as the market increasingly adopts heat pumps as the low carbon option for home comfort, “playing it safe” is not a sustainable approach. In fact, small to medium-sized firms risk exposing themselves to greater customer dissatisfaction and potential litigation if they don’t ensure their technicians are properly trained and qualified to install these systems.

2. INCENTIVE PROGRAMS

By offsetting higher costs of new technology, government incentive programs aim to nudge the market towards products that deliver specific benefits (e.g., energy efficiency, carbon reduction) that are more societal/environmental than individual.



While such programs do indeed motivate HVACR contractors to explore product offerings like heat pumps, the effects can be temporary. The “on again, off again” nature of these programs can foster the kind of industry skepticism that works against innovation and risk-taking.

3. REGULATORY

In a regulatory system that sets (if perhaps outdated) standards for trade competence but lacks effective enforcement, some business operators will take advantage of rebate programs to boost sales and profits, often with little concern for installation quality or customer satisfaction. This behavior undermines the very market transformation that these programs aim to promote.

4. OTHER PROVINCES

Many of the organizations participating in this phase of the program recognized the varying approaches other provinces are taking—or not taking—to support proper trades training and oversight for those working with residential heat pumps. This awareness highlights the potential benefits of national harmonization to strengthen the industry as a whole.

Bureaucratic Inertia in the Training and Apprenticeship System

These are the realities/facts as provided by stakeholders:

- The apprenticeship system is complex and burdensome for Small and Medium Enterprises (SME).
- Provincial compulsory trades, e.g., 313D, are not eligible for federal funding because they are not Red Seal trades.
- The ratio of journeyman to apprentice limits SMEs’ ability to take on new staff and grow their businesses.
- Lack of apprenticeship training availability and enrollment space, and particularly in locations close to home, can be problematic.

A journeyman trains in what they know, not what they don’t. When it comes to growing a workforce with capabilities in clean technologies, the challenge not only lies in apprentices that have had limited (to no) classroom training with newer technology, but also with the journeymen mentoring the apprentices who lack formal training and experience with newer technology.



Shifting Government Policy and Priorities

Government spending provides a clear indicator of its priorities and commitments. Federally and provincially, governments are making investments in programs that support clean technology, from energy generation to electrification of transportation and home heating. These programs are designed to incentivize the uptake within the market. Unfortunately, these funding programs are time limited and don't recognize that it takes time for businesses to adapt and for consumers to change market behaviour.

To participate in and support market change, SMEs need to commit to the upfront investment in training and business adaptation for the immediate programs, but question the future, long-term return on investment as programs end and as governments or priorities change. It is a calculated risk that many SMEs are wary about taking on.

For the residential HVACR marketplace to buy-in and shift to low-carbon technologies such as heat pumps, industry players need to see clear and consistent signals from government that Canada is serious and committed to achieving its emission reduction targets.

Fragmentation and Non-Alignment

The data demonstrates that additional upskilling is required regardless of license (G2 and 313D) – the same may be true for 313A – to err on the side of caution would be prudent. With this acknowledged, training to address the knowledge/skills gap is necessary for safe and efficient heat pump installation and operation.

The costs associated with training are multiple for technicians and employers: tuition costs and 'lost time' costs. Without the impetus of mandatory professional development, there is no incentive to train. Without fear of consequence for regulatory compliance, where is the motivation?

Experience tells us that HVACR contractors will invest in training, especially technical training, when they see a clear benefit, but they will do so mainly when the timing is convenient, and the costs are manageable.

Upskilling training specific to heat pump installation, servicing and maintenance is not consistently available, nor is it designed to a specific standard.

Federal and provincial training subsidies to SMEs for the upskilling/professional development of their employees has been insufficient and inconsistent when available.



The net result is:

1. Too few licensed contractors to service rising demands;
2. Non-compliant contractors doing work;
3. Individual homeowners and manufacturers paying for failed or inefficient equipment; and
4. Government programs lacking the success that they are intending to achieve.

For governments to achieve the ambitious carbon reduction goals they have set, their policies and spending need to broaden slightly from a singular focus on the demand side of the market to a great emphasis on the supply side – from the push to shift consumer choice (through incentives or other means) to supporting initiatives that will ensure a robust supply of skilled workers capable of delivering the desired solutions. This means enforcing trade certification regulations, ensuring employers and employees have clear, uncomplicated pathways to success, and providing conditions that will motivate business owners to make the needed investments in training and growth.

Recommendations

Several recommendations have resulted from this study. However, it would be negligent to not bring forward the Energy and Mines Ministers' Conference report, August 2018, *Paving the Road to 2030 and Beyond: Market transformation road map for energy efficient equipment in the building sector*. It is specific in its declaration in the need for training and upskilling of the HVACR sector to support low carbon and energy efficiency transition. SHDEP8 – DEVELOP HEAT PUMP TRAINING AND CONTRACTOR CERTIFICATION PROGRAM with a focus for RESIDENTIAL BUILDINGS.

It goes on to say “. . . consumers rely on contractors as the main source of information for technology selection and comparing energy efficiency options. As a result, heat pumps require unique installation methods, sales strategies, as well as training and certification programs to educate Canadian contractors on the correct sizing, selection, installation, and servicing procedures. . . . These efforts would need to build on and respect existing trade training requirements in each province and territory, and may complement existing programs.”

Career Pathways for G2s

The residential HVACR workforce already employs thousands of G2 technicians. By building on their current experience, reskilling/upskilling this segment of the workforce can create a pathway that will enable them to effectively attain the skills and knowledge necessary to challenge the 313D exam or appropriately place them in the 313D apprenticeship. Without reskilling/upskilling, G2s face employment uncertainty and may eventually lack relevant skills needed in a low carbon economy.

◆ ***HRAI recommends establishing a task force comprised of HVACR industry, Union representatives, Colleges Ontario, TSSA, STO, MLITSD, and Skills Ontario to lead the development of career educational/apprenticeship pathways that move G2s toward the 313D license.***

◆ ***HRAI recommends that the governments commit the needed funding to subsidize the costs of reskilling workers in the residential HVACR sector.***

Professional Development

The research revealed that many 313D technicians who have the appropriate qualifications (per regulation), still lack critical skills and knowledge needed to work effectively with emerging technologies. While some employers are committed to continuous learning, many more are not or cite financial barriers to upskilling their workforce. A regulatory commitment of continuing education would be transformative and of significant benefit for tradespersons, employers and consumers, as it would compel the industry to keep up with evolving technologies.

◆ ***HRAI recommends that Skilled Trades Ontario mandate continuous education requirements for the residential HVACR sector, and, if demand warrants, perhaps for all skilled trades under its purview.***

◆ ***HRAI recommends establishing a task group comprised of representatives from the HVACR industry, union training representatives, Colleges Ontario, Future Skills Centre, TSSA, and Skilled Trades Ontario to develop a heat pump specific professional development course(s) consistent with today's technological needs. The DACUM exercise can be leveraged as a first step to determining the skills need to be upgraded and how best to do the upgrading.***

Financial Supports for Residential HVACR Workers

Financial assistance is available for individuals entering a Red Seal trade, but not for Provincial Compulsory trades or mid-level tradespeople. Given the critical role skilled trades professionals will play in meeting the growing demand for clean technologies like heat pumps, the government should allocate financial resources and offer direct incentives to both prospective and current tradespeople.

◆ ***To encourage the existing G2 and 313D workforce to upgrade their skills, HRAI recommends that the federal government commit to a program of financial incentives to support non-Red Seal apprenticeship training (like the Apprenticeship Incentive Grant and the Apprenticeship Completion Grant) and upskilling, especially where such training and upskilling supports the government's a low carbon economy goals.***

Financial Supports for HVACR Employers

The residential HVACR industry is dominated by Small and Medium Enterprises (the vast majority with fewer than 10 employees). Particularly in smaller communities, these small business owners do not have easy access to approved institutional training facilities, nor do they have formal human resource or training departments to manage on-the-job

training and/or apprenticeship programs. Specific government supports and incentives investment in training, not only recognizing tuition and 'lost time' costs, but also travel and accommodation hardships for rural employers.

HRAI recommends that the provincial government develop a “skilled trade low carbon economy incentive grant program” that helps residential HVACR employers to train skilled trade workers/apprentices on residential heat pump technologies. The goal is to provide employers with grant payments based on worker completion milestones.

Engaging Skilled Trades Ontario

One of the priority objectives in Skilled Trades Ontario Strategic Plan 2023-2026 is to “Support an Innovative Apprenticeship and Certification Model.” In meeting this objective, STO is responsible for revising training and curriculum standards to keep pace with the changing needs of skilled trades (including heat pump technology advancements). In support of this objective, Skilled Trades Ontario (STO) announced its new Standards Industry Advisory Committees, which are inviting trades professionals to contribute their expertise and provide support as the agency develops and updates standards and examinations.

To help address the skills gap for Ontario’s heat pump industry, HRAI recommends that Skill Trades Ontario leverage the DACUM analysis to support their work in upgrading the provincial training (upgraded December 2023) and curriculum standards (pending) for the 313D. In addition, we recommend that STO undertake this work through the recently announced Standards Industry Advisory Committees initiative.

Recognition of Skills and Competencies

The Trade Equivalency Assessment process is designed for experienced tradespeople who have not completed an apprenticeship but have the experience and qualifications in a trade and want to challenge the Red Seal or provincial exam to obtain a Certificate of Qualification.

HRAI recommends that Skilled Trades Ontario establish flexible approaches to assessing/validating 313D and G2 skills and competencies. Key elements of such a system include assessing skills through a variety of formats, modern materials to help workers and employers understand the training/upgrading journey, supporting mentors with materials and training, online system for monitoring and confirming progress.

National Stakeholder Meeting with CCDA

HRAI recommends hosting a national industry meeting with the Canadian Council of Directors of Apprenticeship (CCDA). The objective would be to unite the industry with all provincial apprenticeship authorities to discuss skilled trade issues affecting the residential heat pump industry across Canada and to share the outcomes of this initiative. This would help HRAI and CCDA prioritize issues and future initiatives.

Certification vs Compliance

Certification can enhance the reputation and credibility of successfully completing the training and testing that meets heat pump requirements. It provides credible and objective proof of a worker's skills, competencies, safety and reliability. Compliance typically involves attestation or demonstration of skills and competencies in meeting specific requirements. Compliance can enhance both quality and safety.

HRAI recommends that an industry consultation be undertaken to consider both certification and compliance as part of a holistic approach to meeting the expectations and needs of the residential HVACR industry and regulatory requirements through the Ministry of Labour, Immigration, Training and Skills Development and Skilled Trades Ontario.

Connecting Incentive Programs to Skilled Trade Proficiency

In recognizing the role that heat pumps can play in reducing building carbon emissions, government grants programs have incentivized technology adoption. However, if not properly installed, serviced and maintained, the expected benefits (energy savings, carbon reductions and even basic comfort) are compromised. There is currently no compliance enforcement for this equipment to be purchased or installed by appropriately licensed and skilled technicians, nor are homeowners educated to ask for such credentials.

HRAI recommends to all levels of government that future grant, incentive, and rebate programs eligibility include a requirement that installation and servicing can only be undertaken by qualified contractors who employ certified and licensed skilled tradespersons.

Next Steps for Bridging the Skills Gap

1

This report culminates the first phase in the three phase research project, Bridging the Skills Gap for Heat Pump Proficiency. Phase II is the development of curriculum to address the knowledge and skills gaps identified in Phase I. Phase III is pilot testing of the curriculum delivery to a cohort of G2 and 313D technicians across the Province of Ontario. Stakeholder engagement, initiated in Phase I, will continue throughout the life of the research project.

2

PHASE II TRAINING DEVELOPMENT

When this project was first conceived, it was anticipated that the training needs would parlay into two different training needs: upskilling and reskilling; believing that the G2s would require additional training and the 313Ds would need refresher training. However, the research identified that this is not the case. As a result of the research findings in Phase I, the training curriculum will support a single course regardless of license.

Multiple TDAs are involved in the curriculum development so that no one group is overly burdened with the creation of training materials. The collaborative approach encourages innovation and pulls upon the expertise of several individuals. The peer reviews will ensure consistency in the content and delivery.

The training will cover the full range of skills necessary to install/service/maintain a heat pump, with more time/focus being directed to skills that were identified as weak in the Phase I technical assessment.

The 8-week program will include theoretical teaching, comprised of a combination of synchronous and asynchronous tools that will be delivered on-line to maximize flexibility for the participants, and hands-on labs that will allow participants to practice their learnings in a real environment.

3

PHASE III TRAINING PILOT

The goal of Phase III is to have 60 technicians complete the training curriculum developed in Phase II. To accomplish this, we need to recruit technicians and employers who would be interested in committing to the training. The funding ensures that the training is available at no cost to the technician or the employer.

HRAI is looking to deliver the program in strategic areas throughout Ontario. The common curriculum means that regardless of geographic location, the training will be the same – critical baseline for research.

The training will be sandwiched with the skills technical assessment completed in Phase I, to initially assess the specific individual's knowledge and again upon completion of the training to assess the success of the knowledge transfer. The global results of the Phase III assessments will also be used to evaluate the success of the learning objectives through an equitable assessment of the training implementation.

The training will be delivered during the 'down' time (March/April) between furnace season and air conditioning season. Participants will receive a Record of Completion.

A Lessons Learned will be conducted upon conclusion of the pilot training to assess the training materials and delivery mechanisms, and identify areas of success and where improvements can be made.

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- ⁴ <https://www.buildforce.ca/wp-content/uploads/2024/10/Building-a-Greener-Future.pdf>, p. 86.
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- ⁶ <https://www.buildforce.ca/wp-content/uploads/2024/10/Building-a-Greener-Future.pdf> p. 10.
- ⁷ Ibid., p.86
- ⁸ <https://www.tssa.org/sites/default/files/TSSADoc/AD-Gas-and-Oil-Burner-Technician-Procedures-and-Policies.pdf>
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- ¹⁰ <https://www.skilledtradesontario.ca/wp-content/uploads/1970/01/Notice-of-change-Residential-Air-Conditioning-Systems-Mechanic-313D-ATS-Dec-4th-2023-EN.pdf>
- ¹¹ The VAMetric report includes technicians that completed the confidence questions, but not the knowledge questions. HRAI's analysis removed those assessments from the data analysis for better representation of the data.



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