TRADING UP
How Alberta’s Trades Can Build a Zero Carbon Future
ACKNOWLEDGMENTS

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Canada’s goal to decrease greenhouse gas emissions (GHGs) by 30 per cent below 2005 levels by 2030 requires a significant change, especially among carbon-intensive industries.

The building industry has the opportunity to be a leading contributor to this change, as over a quarter of all emissions come from the materials, construction, and operation of buildings.

The entire building industry must transition to zero carbon buildings if Canada is to meet its GHG obligations. New buildings designed today must set zero carbon emissions as their target and retrofits of existing buildings must likewise emphasize deep emission reductions. However, high-performance buildings demand new skill sets and knowledge; further, they require an integrated approach to ensure new technologies and systems work seamlessly together.

Following Canada Green Building Council (CaGBC) reports including Trading Up: Equipping Ontario Trades with the Skills of the Future and Accelerating to Zero: Upskilling for Engineers, Architects, and Renewable Energy Specialists, this report focuses on Alberta’s trades workforce.

While all of Canada must transition to zero carbon building construction, the approach in each province will differ due to its construction marketplace, labour force, and the systems in place for training the construction trades. Alberta has a comparative advantage to other provinces, given its well-established apprenticeship training system, which provides an ideal platform for facilitating the uptake of zero carbon skills.

This study explores the following questions: What are the zero carbon skills Alberta’s construction trades need, and how can this workforce be upskilled to meet the design, construction and retrofitting of zero carbon buildings?

The purpose of the research is to:
1. Identify gaps in the knowledge and skills training that will be required for Alberta tradespeople to meet the demands of the construction of zero carbon buildings.
2. Describe the barriers Alberta tradespeople face when accessing zero carbon building training.
3. Recommend future education planning, program approaches, and training resources for tradespeople in Alberta.
RECOMMENDATIONS

To address these knowledge gaps and encourage skill uptake in this sector, CaGBC recommends actions designed to incentivize the adoption of zero carbon building expertise within the Alberta trades and to ensure that zero carbon training is relevant and accessible. The recommendations are structured to reflect the suggested lead organizations and bodies, including policy decision-makers, accreditation and professional bodies, and education and training providers.

**Provide Incentives for Acquiring Zero-Carbon Skills**

Recommendations for policy decision makers, owners and developers, accreditation and professional bodies:

- **Create a “Green Seal” Certificate**
  
  Similar to the existing Gold Seal and Blue Seal certifications for management and business skills, create an industry-led “green seal” certification. The existence of a recognized industry credential will incentivize tradespeople to upskill, and help employers recognize the value of the skills workers have acquired.

- **Incorporate Zero-Carbon Skills into Apprenticeships**
  
  Individual trade apprenticeship programs should be enhanced by incorporating zero-carbon technical skills. Further, as construction becomes more complex and multi-disciplinary, all apprentices should be literate and skilled in building science, and buildings as a system as it applies to advanced construction.

- **Require Continuous Learning**
  
  Require mandatory continuing education to ensure that Alberta’s tradespeople are ready for the growing market demand for zero carbon buildings. A system of mandatory continuing education for construction trades should be modelled on what is currently required for Master Electricians in Alberta.

- **Strengthen Provincial and Local Apprenticeship Committees**
  
  Local Apprenticeship Committees (LACs) and Provincial Apprenticeship Committees (PACs) can help address the challenges of balancing emerging technologies and practices into the apprenticeship curricula without overwhelming learners. More frequent meetings, collaboration with post-secondary training institutions and industry members can help improve zero-carbon skills training through Alberta’s well-established apprenticeship programs. Helping ensure access to current training is especially important, as in many cases, the apprenticeship will be the only formal training tradespeople receive in their career.

- **Establish Micro-Credentials**
  
  Education and training partners need to offer education in micro-credentials to appeal to busy tradespeople. Micro-credentials are best utilized as an enhancement to apprenticeship training. This approach allows tradespeople to learn the skills or portions of skills that they require in a flexible manner that makes sense to their individual circumstances.
Create Additional Designated Occupations

Create new designated occupations for construction workers to attract new entrants, including younger people, or to allow displaced workers, such as those from the oil and gas industry, to transition to a new field. Further growth could be driven by including more occupations under the Registered Apprenticeship Program, which would make participants in those programs eligible for government financial support. Suggested occupations could include building envelope installers, cladders, window installers, heat pump technicians, refrigeration and air conditioning mechanics or gasfitters.

Make Zero Carbon Part of the Procurement Process

For Canada to drive market demand for zero carbon buildings, governments at all levels could lead the way by adapting their bid processes for construction projects. Contract agreements should be amended to require project teams to demonstrate experience with zero carbon buildings or to create incentives for on-the-job zero carbon training.

Encourage Governments to Demonstrate Leadership and Increase Directed Funding

Governments own large portfolios of buildings and are well-positioned to show leadership by prioritizing zero carbon when constructing or retrofitting buildings. Such action will provide a strong signal to the market and set an example by procuring construction in a way that advances zero carbon.

Ensure Relevant and Accessible Zero Carbon Training

Recommendations for education and training providers:

Create an Inventory of Available Zero Carbon Training and Funding

A comprehensive inventory of low-carbon training and available funding resources in Alberta would help address the zero-carbon skill gaps by creating a central training directory making it easier to find and access upskilling programs, as well as government funding for training. A comprehensive inventory could identify topic areas training partners could expand on and ensure all accredited zero carbon construction-related courses and training are accessible from a single location.

Establish Partnerships to Develop Relevant Training Content

Form partnerships between training providers, product manufacturers, suppliers, and distributors to address technology and product-specific gaps in education and training. Leverage partnerships between these key stakeholders to update and expand existing training, with industry bodies ensuring it is relevant and practical for tradespeople.

Mobilize Alberta’s Construction Ecosystem to Champion Zero Carbon Building

Establish a coalition of diverse stakeholders to champion policy, business, and regulatory actions that will accelerate zero carbon upskilling for trades. An independent secretariat should oversee the coalition and advocate on behalf of the industry to help develop and deliver zero-carbon education, curriculum, and training initiatives, as well as drive enrollment.
The transition to a low-carbon economy is one of the most pressing issues of our time and requires that industry immediately minimize greenhouse gas (GHG) emissions.

As a significant contributor to Canada's total GHG emissions, the built environment has a critical role to play. Buildings are responsible for 17 per cent of Canada's carbon emissions,\(^1\) however when considering construction and materials, buildings represent a further 11 per cent,\(^2\) a number expected to increase by another 9 per cent over the next two decades if the industry does not adapt.\(^3\)

The expectations are high, as the World Green Building Council (WorldGBC) has set a target for building construction and operations to eliminate GHG emissions by 2050.\(^4\) Canada Green Building Council (CaGBC) research indicates that significant reductions are possible. A 17 per cent reduction in sectoral GHG emissions compared to 2005 levels can be achieved if all new large buildings are built to zero carbon standards by 2030.\(^5\) A further 51 per cent reduction would be possible by retrofitting existing buildings to zero carbon standards.\(^6\) However, in order to achieve this goal, new buildings designed today must set zero carbon emissions as their target and retrofits of existing buildings must likewise emphasize deep emission reductions.

This change requires the industry to move from merely concentrating on energy efficiency measures accomplished with high-performance buildings\(^7\) to a more integrated approach. This approach should encourage energy efficiency while reducing both the carbon intensity of a building’s energy sources and the carbon footprint of construction materials – all achievable through zero carbon buildings.

The construction workforce must adapt, retrain, or upskill to accelerate zero carbon building adoption in Alberta. While Alberta has many high-performing buildings, there is still an opportunity for significant growth. To achieve this, industry and governments must understand the necessary conditions and associated training required to build and operate high-performing buildings on a large scale – and with reliable performance. Building high-performing, zero carbon buildings or retrofitting existing buildings to zero carbon standards, requires a combination of technical skills upgrading, market adaptation, and a retooling of mindsets. All are needed if we are to support the workforce transition and meet the industry's decarbonization targets.

This report analyzes what skills gaps exist in the zero carbon knowledge of the construction trades workforce in Alberta. It provides recommendations on opportunities for Alberta to transition its education and training system to support the growth of low-carbon jobs. While this report focuses on new construction and retrofits in Alberta, it also builds on other CaGBC research, including a report on the zero carbon building skills gaps of tradespeople in Ontario, and on the skills gaps of engineers, architects, and renewable energy specialists throughout Canada.\(^8\) Together, these works provide a holistic view of the challenges and opportunities facing the industry across Canada.

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\(^1\) Environment and Climate Change Canada (2016). *Pan-Canadian Framework on Clean Growth and Climate Change: Canada’s Plan to Address Climate Change and Grow the Economy*, p. 14.


\(^7\) Construction for high-performance buildings is the practice of designing, constructing, operating, maintaining, and deconstructing buildings in ways that conserve natural resources.

DEFINING A ZERO CARBON BUILDING

A zero carbon building\(^9\) is a highly energy-efficient building that produces onsite or procures carbon-free renewable energy or high-quality carbon offsets in an amount sufficient to counterbalance the annual carbon emissions associated with building materials and operations. A building has achieved a carbon balance of zero when the net emissions resulting from sources and sinks of carbon emissions are zero.\(^{10}\) To accomplish this, design features for hot water, heating, cooling, and the envelope, as well as the site location and orientation, and the materials used, need to be carefully chosen to integrate renewable energy generation and select technologies.

CaGBC’s research has confirmed that zero carbon buildings are technically feasible and financially viable.

On average, zero carbon buildings achieve a positive financial return on investment over a 25-year lifecycle (inclusive of carbon pollution pricing) and require only a modest capital cost premium. This financial return grows as the cost of carbon rises, while zero carbon buildings also mitigate future costs for utilities and retrofits.\(^{11}\)

Applying zero carbon building principles delivers more than just financial benefits. Zero carbon buildings can reduce impacts on land use and energy consumption and reduce overall operational costs. At the same time, improvements to both the indoor and outdoor environment benefit occupants and boost productivity – making a compelling case for building owners, tenants and developers considering zero carbon buildings.

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\(^{10}\) Net emissions are defined as embodied carbon (upfront carbon, use stage embodied carbon, end-of-life carbon) plus operational carbon (direct emissions, indirect emissions) less avoided emissions (exported green power, carbon offsets).

A NOTE ON METHODOLOGY

This study explores the following questions: What are the zero carbon skills needs of Alberta’s construction trades workforce, and how can these workers be upskilled to meet the design, construction, retrofitting, and operational goals of zero carbon buildings?

The purpose of the research is to:

1. Identify gaps in the knowledge and skills training that will be required for Alberta tradespeople to meet the demands of the construction of zero carbon buildings.
2. Describe the barriers Alberta tradespeople face when accessing zero carbon building training.
3. Recommend future education planning, program approaches, and training resources for tradespeople in Alberta.

Data for this report was gathered through two roundtable discussion sessions held with industry stakeholders and supported by an Advisory Group composed of experienced industry representatives. An industry survey, secondary sources, and previous research conducted by CaGBC on zero carbon skills gaps also contributed to this report.

INDUSTRY SURVEY

An online industry survey was widely distributed through CaGBC’s network of members and partners. While the survey targeted tradespeople, it was also open to other members of the construction industry. In total, 84 industry members from across Alberta completed the survey. Two-thirds of the survey respondents were construction tradespeople, with electricians being the most represented. The remaining third of respondents were primarily project management and supervisory professionals, as well as a small number of building officials, inspectors, developers, architects, and those in other occupations related to construction. Of note, the majority of respondents had more than 15 years of industry experience.

INDUSTRY ROUNDTABLE DISCUSSIONS

Two roundtable sessions were held in Edmonton and Calgary in late 2019, with a total of 42 participants, including industry stakeholders, tradespeople, policymakers, and workers in related occupations. These roundtable discussions provided in-depth information on the challenges of upskilling the Alberta trades, as well as potential solutions. The information gleaned from the roundtables also provided important context to the quantitative data obtained from the industry survey.

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12 See Appendix A-C for more detailed information on the methodology, survey and roundtable sessions.
2 PATHWAYS FOR ZERO CARBON LEARNING FOR TRADES

Alberta has a robust education and training approach that supports a wide range of trades and occupations and ensures a continuous intake of new tradespeople to meet the demand for building construction.

These established pathways for education and training provide Alberta’s trades with a critical point of entry to facilitate zero-carbon skills training.

ALBERTA CONSTRUCTION LABOUR MARKET

Alberta’s construction labour market was headed towards a new normal after a disruptive 2014 collapse in the heavy industrial construction sector. Previously, that sector had accounted for almost half of the construction activity in the province. According to a report from BuildForce Canada, between 2021 and 2029, Alberta will “need to hire almost 65,000 workers over the coming decade to meet modest growth and replace an estimated 41,500 workers expected to retire as the workforce ages. During this period, the industry can look to draw in 40,300 new entrants aged 30 and younger from the local population, leaving a recruitment gap of more than 23,700 workers that will need to be met from outside the province’s construction labour force or from other industries.” The global health crisis is expected to impact workforce projections for all sectors, requiring re-evaluation post COVID-19.

10-YEAR WORKFORCE OUTLOOK FOR ALBERTA

| 2029 | 41,500 RETIREMENTS | 40,300 NEW ENTRANTS | 23,400 (+12.7%) EMPLOYMENT CHANGE |

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16 The global health crisis is expected to impact workforce projections for all sectors, requiring re-evaluation post COVID-19.
Although this research was conducted prior to the COVID-19 pandemic, the BuildForce report did identify the potential creation of 23,400 new jobs in construction, signalling an expected investment in the trades. Should these new jobs materialize, Alberta has a significant opportunity to encourage existing and new workers to develop the skills required for zero carbon buildings. This opportunity is especially relevant for Alberta, as these skills could support the much-needed retrofit of the province’s existing buildings. CaGBC’s Roadmap to Retrofits report found that addressing existing buildings in Alberta was critical to achieving Canada’s climate targets, given the province’s high-carbon grid and the number of larger buildings. By enhancing the construction industry’s zero carbon skills, the province would be well-positioned to accelerate retrofits, helping establish a competitive market environment able to attract and retain talent while stimulating Alberta’s economy.

Understanding Zero Carbon Skills

Zero carbon skills are defined as the capacities and knowledge needed to support the construction of new buildings and the retrofit of existing buildings so that they have the lowest possible carbon dioxide emissions. Zero carbon buildings generally require the same skilled tradespeople as conventional construction; however, tradespeople constructing and retrofitting zero carbon buildings require a different, yet complementary set of skills.

While the technical knowledge required differs between trades, a common core of knowledge is required to deliver zero carbon buildings successfully. Trades working on zero carbon building need technical skills in order to integrate high-performance, low-emissions technological components into complex buildings. They also need a solid understanding of building science and buildings as a system to deliver precise work on complicated components, such as building envelopes. Aside from technical skills, trades also require an array of “soft skills” in order to effectively operate in the collaborative, multi-disciplinary areas integral to high-performance buildings. Given the importance of both skillsets to the successful implementation of zero carbon buildings, an assessment of the current level of industry expertise and potential gaps is critical. Only with these insights and the guidance they provide will Alberta be able to transform its workforce into one capable of taking advantage of the opportunity zero carbon buildings represent.

EDUCATION AND TRAINING FOR CONSTRUCTION TRADES

The transition to zero-carbon skills for the construction trades will need to take place across Canada, but each province will differ in its construction marketplace, labour force, and the systems in place for training the trades. It is important to understand Alberta’s unique education and training landscape to determine what is needed to upskill Alberta’s trades for zero carbon buildings.

Alberta’s Apprenticeship System

Compulsory and Optional Trades

Trades training in Alberta is overseen by Alberta Apprenticeship and Industry Training (AIT). There are more than 50 designated trades and occupations in Alberta, of which 19 are compulsory certified trades, and 30 are optional certified trades based on March 2020 data. In construction, there are 12 compulsory and 20 optional trades (see Appendix D). The number of compulsory certified trades is higher in Alberta than in many provinces. For example, Ontario has only nine compulsory construction trades, Saskatchewan has five, while British Columbia has none. Notably, Alberta is the only jurisdiction in Canada where welders are a compulsory trade.

Designated trades have an apprenticeship program and either a compulsory or optional certification. A worker in a compulsory certification trade is referred to as a registered apprentice or a certified journeyperson.

18 https://tradesecrets.alberta.ca/about-us/
A worker in an optional certification trade can be self-employed or work for an employer who is satisfied that person has the skills and knowledge expected of a certified journeyperson. To learn or work in a compulsory or optional certification trade in Alberta, a person must be a registered apprentice.

A tradesperson having completed an apprenticeship and acquired the skills to perform their trade is referred to as a journeyperson. In order to work as a journeyperson in a compulsory certified trade, a tradesperson must have a valid certificate recognized by AIT. Tradespeople trained in other jurisdictions can work in optional certified trades without an AIT certificate if their employer believes that they have the necessary skills required or if they have a Red Seal certification (see below).

As a likely consequence of the decline in construction activity in Alberta, the number of apprentices in training has significantly decreased. As of 2018, there are 29 per cent less apprentices in training compared to 2015 levels, while the number of new entrants to the industry has declined by 20 per cent. According to a BuildForce report, “more than 84,200 apprentices were registered in the 20 largest construction trade programs in Alberta between 2013 and 2019, while completions totalled 40,260 over the same period. Alberta is projected to require 20,460 newly certified journeypersons to sustain the current workforce share of certifications and to keep pace with employment and replacement demands across all industries.”

As the existing workforce ages and retires, Alberta may experience a challenging situation in which there are an insufficient number of apprentices graduating to replace them.

**Apprenticeship**

Both compulsory and optional trades are part of the apprenticeship training system in Alberta, and new entrants must be registered as apprentices to learn their trade. Apprentices complete the majority of their training on a worksite, with approximately 20 per cent of their technical training taking place in a classroom. Apprentices need to complete a specific number of training hours on the job each year, and must be supervised by a certified journeyperson in their trade. Alberta trains a disproportionate amount of Canada’s apprentices; with only 12 per cent of Canada’s labour force, Alberta has approximately 18 per cent of the country’s apprentices.

Technical training for construction apprenticeships is offered by 10 colleges and two polytechnics (technical institutes) located across the province. Some of the colleges located in smaller centres offer apprenticeship training for only a few trades. The Northern Alberta Institute of Technology (NAIT) in Edmonton, the Southern Alberta Institute of Technology (SAIT) in Calgary, and Red Deer College are the largest post-secondary institutions offering technical training, with 23, 20 and 15 construction trade apprenticeships, respectively. Some of those institutions offer courses and education related to zero carbon skills or have a green buildings technology program.

Alberta’s apprenticeship training system is industry-driven, with each trade managed by a Provincial Apprenticeship Committee (PAC) and supported by a network of Local Apprenticeship Committees (LAC). All committees are composed of an equal representation of employers and employees. PACs are responsible for identifying training needs and making recommendations to AIT regarding content specific for their trade. Apprenticeship curriculum is reviewed annually, though the timeline from review to graduating new tradespeople trained under new curriculum is approximately six to nine years, depending on the program. LACs support their PAC by providing regional information and monitoring the apprenticeship system at the local level.

20 BuildForce Canada (2020). In Construction and Maintenance Looking Forward Highlights 2020-2029, p. II.
23 https://tradesecrets.alberta.ca/technical-training-centre/training-locations/.
CURRENT LANDSCAPE IN ALBERTA FOR SKILLED TRADES

Designated Occupations
In Alberta, certain occupations involved in construction but not designated trades, are called designated occupations. Training and certification requirements for these occupations are designed and provided by the industry, as either work experience, formal training, or a combination. For some designated occupations, training is provided by technical colleges and graduates are certified by AIT.24 However, it is possible for tradespeople to work in a designated occupation without a certificate.

There are other occupations involved in construction that do not fall under the purview of AIT and are not regulated in Alberta. New workers in these unregulated occupations are not required to take any formal training and no certification exists. For these workers, training happens on the job with their employer. Notable unregulated occupations include scaffolding erectors, cribbers (who construct formwork for foundations), and cladders (who install siding or other exterior elements of the building envelope).

24 https://tradesecrets.alberta.ca/trades-occupations/what-is-a-designated-occupation/
Continuing Education in Alberta

Continuing education is a broad term that includes several post-secondary learning activities, such as workforce training, non-credit training in post-secondary institutions, and for-credit programs targeting adult learners. Once certified as a journeyperson, there is no required upgrading or continuing education path for the trades in Alberta, except for the Master Electrician program regulated under the Safety Codes Act. This program requires that Master Electricians take code update training in order to maintain their ability to apply for electrical permits. However, participation in this program does not affect their ability to work in the trade. It is viewed as an additional yet separate requirement beyond the apprenticeship.

There are also several optional industry-recognized continuing education programs that tradespeople can take to demonstrate specific proficiencies:

- **Red Seal**
  The Red Seal Program is an interprovincial program that sets common standards designed to assess the skills of tradespeople and to enable worker mobility across provinces. It is a partnership between the federal government and the provinces, which are responsible for trades training and certification. Upon successful completion of an inter-provincial standards examination, tradespeople are awarded a Red Seal and are then able to work anywhere in Canada without the need to recertify in the province of their employment.  

- **Gold Seal**
  The Gold Seal Certification Program was created by the Canadian Construction Association to demonstrate construction management skills. Applicants must have a combination of industry experience, formal education, and approved training, as well as pass an exam. While the program is not specifically targeted towards journeypeople, credits are awarded for the highest level of formal education achieved, which includes education credits towards a tradesperson’s certificate.

- **Blue Seal**
  The Blue Seal Program was created by AIT specifically for journeypeople to demonstrate proficiency in business skills. Applicants must be certified journeypeople, and either complete an approved business certificate or diploma program or demonstrate 150 hours of study in approved business topics. The Blue Seal Program is specific to Alberta and Saskatchewan.

Other continuing education courses are offered in Alberta through post-secondary institutions, local construction associations, unions, and private training providers. These voluntary courses address a variety of topics, such as safety, building code updates, and technical skills. There are also courses available on energy efficiency and alternative energy, for example, those offered by Energy Efficiency Alberta, Red Deer College, NAIT, SAIT, Passive House, CIET, CaGBC and others. Product manufacturers also provide training and are often the most up-to-date and knowledgeable source of training and information on their products. While it can be beneficial for a tradesperson to learn about a specific product, this type of training does not necessarily provide a broad scope on the technology in general or similar products by other manufacturers that may also be available.

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26 [https://www.goldsealcertification.com/](https://www.goldsealcertification.com/)
27 [https://tradesecrets.alberta.ca/experiencedworkers/business-competencies/](https://tradesecrets.alberta.ca/experiencedworkers/business-competencies/)
The research conducted for this report indicates that important gaps exist in the knowledge and skills of Alberta's trades workforce related to constructing zero carbon buildings. As more zero carbon buildings are built, Alberta’s construction workforce will require a range of new or updated skills and capabilities. These skills and capabilities can be broadly categorized as either soft skills or technical skills.

SOFT SKILLS AND GREEN LITERACY

Soft skills as defined in this research include the ability to communicate and collaborate, as well as “green literacy.”

Green literacy can be understood as:
- Coordination with other trades: Knowledge of how a tradesperson's work connects with the work of other trades, and potential impacts to their work;
- Knowledge of general building science principles (e.g., the building as a system, inter-communicative elements, etc.);
- Overall understanding of green building construction strategies (e.g., water efficiency, energy efficiency, indoor environmental quality, etc.);
- Broad awareness of climate change; and,
- Understanding of the environmental impacts of GHG emissions.

Complex projects such as zero carbon buildings require more soft skills such as collaboration, communication, and cooperation among trades and the broader project team, as well as a deeper comprehension of the design, construction, and operations processes.

These soft skills include an understanding of the rationale behind constructing zero carbon buildings, and the contribution of each trade to the often-complex assembly of these buildings and any interdependencies. For optimal performance, tradespeople require an awareness of the design goals of complex building elements (such as the building envelope) and must understand how the operation and use of the building will affect its performance.

SOFT SKILLS

Problem Solving Critical Thinking Project Design Communication

"Green literacy" is a term coined by CaGBC and means the ability to understand the broad implications of key building activities on the environment, the market infrastructure, construction approach, and procurement process. It also includes an understanding of how various components, design elements, and strategies work together to deliver a zero carbon building.
In essence, zero carbon buildings require a working knowledge of the building as a system and an understanding that buildings are not just a sum of their parts.\textsuperscript{29} Often, multiple disciplines are required to work together to ensure success, such as plumbers and electricians collaborating to understand the problems that inadvertent air and moisture barrier penetrations can cause when working on the building envelope. This level of understanding requires insights into the work of other trades, as well as that of design and operations professionals.

The importance of soft skills cannot be understated. Based on results from the survey completed for this report, soft skills were given high ratings for job importance, especially for both personal knowledge and job importance, a finding consistent with the CaGBC’s Ontario-focused \textit{Trading Up} report. Respondents to the survey also rated the importance of soft skills to their job highly when compared to their knowledge for general building science principles, confirming its importance.

Participants in the roundtable discussions highlighted the importance of knowing general building science and indicated that it was an area in which there is not enough training. It was suggested that all apprentices should receive training, as all trades require an understanding of building science. Roundtable participants also noted that communication skills are of critical importance for minimizing problems on job sites. Further, communication needs to take place between all stakeholders, including between different trades, between owners and contractors, and between the design team and those constructing the building. Participants agreed that better communication would reduce costly changes and delays, while also ensuring that complex systems perform as intended.

This finding was also supported by the survey results, as respondents reported a significantly lower average knowledge score for communication than other similar skills.

The roundtable discussions also flagged the importance of better coordination between the trades. As construction trades often arrive onsite at different points in the construction process, they often work in silos, disconnected from each other. Understanding the work of other trades is crucial for the successful delivery of zero carbon buildings. Often, coordination between other members of the project team, such as designers or engineers, and the trades is lacking. This breakdown can lead to delays and potentially raise overall project costs. The roundtable participants felt that this could often be alleviated through a better understanding of the collective work of all the trades involved onsite.

Roundtable participants also support the idea of tradespeople being involved in project design at the earliest possible stage. Being involved in an integrated design process\textsuperscript{30} is important as tradespeople have the experience to flag potential problems when they can still be corrected cost-effectively.

**HIGH PRIORITY SOFT SKILL AND GREEN LITERACY GAPS**

- Knowledge of general building science principles (e.g., the building as a system, inter-connective elements, etc.)
- Communication
- Knowledge of how the work of a trade connects with the work of other trades
- Teamwork/coordination with other trades
- Project design

\textsuperscript{29} CaGBC, \textit{Trading Up}, p. 20.

\textsuperscript{30} USGBC, \url{https://www.usgbc.org/articles/green-building-101-what-integrated-process}. Integrated Design Process is an iterative, collaborative approach that involves the project’s stakeholders in the process from visioning through completion of construction and throughout building operation.
TECHNICAL SKILLS

Technical skills are related to knowledge of the construction practices and technologies used to deliver zero carbon buildings, including creating, assembling, installing, and operating the elements that together become a building. Zero carbon buildings are more complicated than conventional construction, requiring the precise installation of sometimes non-traditional components and systems, placing a higher focus on factors such as air sealing, and involving multi-disciplinary work that includes several trades. More complex construction requires the construction workforce to have additional technical skills. Further, the threshold for mistakes in zero carbon buildings is slim, demanding a higher level of sophistication and precision from the entire project team, including the trades.

Technical Skills include:
- Building performance and verification
- Mechanical systems commissioning
- Building science (envelope airtightness)
- Building automation systems
- Building envelope commissioning
- Integrated high-performance building systems installation
- Energy storage
- Determining the renewable energy technology best suited to a project. (e.g., solar versus wind, etc.)
- Solar renewable energy systems installation
- Impact of geographic and climatic conditions on renewable energy systems
- Low carbon/GHG emissions materials
- Geothermal renewable energy systems installation

Interestingly, on average, the survey respondents gave a low job importance score to technical skills. This result should be interpreted cautiously. For instance, technical skills require more specialized knowledge that may be relevant only to certain professions, whereas soft skills are more generally applicable. As an example, electricians rated the importance of skills related to their trade, such as solar installation and energy storage, higher than non-electricians. Similarly, plumbers gave a higher score to mechanical commissioning than trades not involved in that area. Recognizing that zero carbon building is an emerging approach, it is highly likely that respondents on average have a lower level of knowledge or understanding of individual skills categories listed and may not fully realize the significance or potential significance to delivering a zero carbon building. This is supported by the fact that respondents with more than 15 years of experience rated these skills higher in importance than the average.

Despite the lower average ranking, survey respondents still indicated that skill gaps exist in more than half of the technical skills listed above, more specifically, those related to building components such as building envelopes, mechanical systems, and building automation, as well as establishing the correct renewable energy technology for a project, and storing the energy produced. Another skill gap identified was the verification of a zero carbon building’s performance.

The roundtable discussions highlighted building envelopes as an important gap in current training. This finding relates to both building science (envelope airtightness) and building envelope commissioning. It was observed that building envelopes are critical to delivering high-performance buildings and trades would benefit from more detailed training in this area.

HIGH PRIORITY TECHNICAL SKILL GAPS
- Building science (envelope airtightness)
- Building envelope commissioning
- Building performance and verification
- Mechanical systems commissioning
- Building automation systems
- Determining the renewable energy technology best suited to a project (e.g., solar versus wind, etc.)
- Energy storage
ADDRESSING THE BARRIERS TO UPSKILLING FOR TRADES

In addition to identifying skill gaps in Alberta’s construction workforce, identifying barriers to upskilling or acquiring zero-carbon skills is a critical step to transitioning the industry toward a future of low-carbon jobs. During the study, several systemic barriers were identified that prevent Alberta’s trades workforce from adopting the new skills necessary to construct zero carbon buildings. These barriers must be addressed in order to drive the adoption of these new skills and to accelerate zero carbon building.

KEY BARRIERS AND BARRIER BUSTERS FOR TRADESPEOPLE PURSUING UPSKILLING

<table>
<thead>
<tr>
<th>BARRIERS</th>
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<tr>
<td>Lack of Incentives</td>
<td>Create Incentives</td>
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<td>Modes of Training</td>
<td>Amend Modes of Training</td>
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<td>Green Illiteracy</td>
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<td>Market Infrastructure</td>
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<td>Lack of Affordability and Access</td>
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ZERO CARBON SKILLS ARE NOT PART OF APPRENTICESHIP TRAINING

Apprenticeship involves two methods of training: on the job site, and in-classroom technical sessions. Apprenticeship is often the only mandatory period of training for people learning a trade. Therefore, it is important that the system impart the skills necessary for apprentices to succeed in a changing work environment. The roundtable discussions highlighted that currently, apprentices are not learning the skills they will need to support the transition to zero carbon building construction. For instance, roundtable participants noted that all apprentices might benefit from upskilling on building science principles, a topic currently absent from apprenticeship training curricula.

Constructing zero carbon buildings requires multi-disciplinary skills to grasp the innovative building technologies and practices needed, such as assembling building envelopes or installing thermal breaks. In both instances, several trades are involved in completing the associated tasks. Current apprenticeship programs, however, deliver training categorized by trade, and in many cases, these cross-disciplinary skills are not covered. For example, building envelopes are a key component of zero carbon buildings and can have a significant impact on energy usage. However, trades involved with building envelopes, such as electricians or carpenters, are often-times not taught about the implications of their work, and the potential impacts to building performance from improper air sealing or penetration of the envelope.

EXAMPLE OF COLLABORATION ONSITE: BUILDING ENVELOPE

The building envelope is an important element of a high-performing building. It requires the cooperation of multiple trades and allows only for slim margin of error, especially as they typically do not work on it at the same time.

Tradespeople include:
- BRICKLAYERS
- CARPENTERS
- CEMENT MASONs
- DRYWALL MECHANICS
- ELECTRICIANS
- PLUMBERS

[31] CaGBC, Trading Up, p. 41.
In Alberta’s apprenticeship system, as well as in others, nationally and internationally, the review cycle for curricula often progresses more slowly than the industry’s pace of change. In many instances, update cycles for course content are between six and nine years. Further, national efforts to harmonize apprenticeship standards can slow down the pace of curriculum changes. Roundtable participants recommended that the Local and Provincial Apprenticeship Committees (LACs and PACs) meet more frequently, include members with recent experience in new technologies and construction practices, and work collaboratively with technical training institutes to ensure apprenticeship curriculum includes emerging skill sets such as zero-carbon skills.

NO REQUIREMENT FOR CONTINUOUS LEARNING

Also impeding the adoption of zero carbon skills is the lack of statutorily required continuing education for tradespeople who have graduated from apprentice to journeyperson status, and none for tradespeople working outside the apprenticeship system. Roundtable participants noted that many workers do not receive any formal training beyond their initial apprenticeship. Thus, experienced journeypeople who received their technical training many years ago would have training that does not reflect emerging practices, including zero-carbon skills. Nevertheless, these journeypeople play a critical role in the trades training system in Alberta, as apprenticeships generally take place on the job, under their supervision and mentorship. As a result, many tradespeople, both experienced and newly graduated, have not been exposed to formal training on zero-carbon skills.

“Trades workers who have been out of a learning environment are typically hesitant to bridge this gap unless there is a strong motivator like job loss. You need to offer many kinds of training and education as opposed to just one type. In my experience many workers will only participate if it is mandated and paid on the job.”

- Quote from survey participant

AFFORDABILITY AND ACCESS

While some workers take the initiative to pursue skills upgrading on their own, the nature of employment in the construction industry can make it challenging. Employers are often reluctant to take their most productive and experienced workers off the job site which creates barriers to training. Zero-carbon skills are often not deemed to be a priority, as green construction is still perceived as a niche market.

Affordability can also be a critical barrier to upskilling, as the cost of training is often not reimbursed by employers. Additionally, workers are generally not paid for their training time, creating a significant constraint for many workers. Government funding for training, such as the Canada-Alberta Job Grant, is oftentimes difficult to access, or covers only a portion of the cost of training.

If the journeyperson conducting this training has not themselves upgraded their skills, then they will be unable to pass new knowledge and skills to the apprentice, who may graduate with no experience in new technologies or techniques.

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32 The Canada-Alberta Job Grant is a training program where an employer applies on behalf of their employee(s) for eligible training costs. Employers decide who gets training and what type of training may be needed. [https://www.alberta.ca/canada-alberta-job-grant.aspx](https://www.alberta.ca/canada-alberta-job-grant.aspx)
Stakeholders noted that training can be especially difficult to access in rural areas outside of Edmonton and Calgary. Training tends to be concentrated in the urban centres of the province, and travel entails additional costs and time off workers can ill afford. Further, information on available training is fragmented. A variety of education providers (e.g., product manufacturers, unions, professional organizations, and technical colleges, etc.), do offer training but not in a wide variety of locations – making it difficult for tradespeople to find relevant training in their area.

Survey respondents that primarily worked in northern Alberta were more likely to be satisfied or very satisfied with available training options than those that primarily worked in southern Alberta. This may point to a regional discrepancy in access or quality.

“Training costs are incredibly high, and most employers do not value the skills and knowledge and are unwilling to pay or provide time off to take the training.”
- Quote from survey participant

“Courses are expensive, and one needs time. In construction if one does not work, they don’t get paid, meaning no dinner on the table. Even if the employer gave them time off.”
- Quote from survey participant

DELIVERY METHODS AND DURATION

Industry-relevant content needs to be accessible in a variety of delivery methods and durations to accommodate tradespeople’s needs and schedules. Individuals have different learning styles, and training in zero-carbon skills is not always available in different delivery methods, nor is it accessible in every region. The survey confirms that there is no single method of training delivery that works for all industry members, as respondents were split on their preferred method of delivery. However, roundtable participants emphasized that some element of hands-on instruction is necessary for effective training, due to both the perceived high proportion of tradespeople who learn in a kinesthetic way, and to the desirability of practicing actual tasks that will be performed in the field. This makes remote delivery of training difficult, as learners are often required to travel to the few urban centres where in-person training is delivered.

Training is also not always delivered in durations that consider tradespeople’s schedules. The industry survey demonstrated strong support for shorter duration education and training programs, such as part-time certificate programs, professional development seminars, and workshops. Roundtable participants also suggested that education and training would be more accessible if delivered flexibly (e.g., with on-demand online modules, utilizing apps on mobile devices, or onsite training for specific applications). Participants noted that there is a lack of available short training modules to accommodate the seasonal work schedule of construction.
LACK OF CREDENTIALS FOR ZERO CARBON SKILLS

Journeypeople and other workers involved in construction lack a clear path to demonstrate zero-carbon skills to employers in a way that employers understand and value. The roundtable participants noted that without a recognized credential for zero-carbon skills – like Blue Seal or Gold Seal – tradespeople will struggle to articulate the value to employers, decreasing the incentive to pursue the skills. Certificate programs could help tradespeople demonstrate to employers that their upskilling efforts are in areas recognized by the building industry as relevant and obtained from credible and trustworthy training providers.

Further, the survey reflected that the lack of formal credentials is a significant barrier to acquiring zero-carbon skills.

The majority of survey respondents believed that if they possessed formal training and certification related to constructing energy efficient and low/zero carbon buildings they would be viewed as a more valuable employee. The majority also believed that formal training and certification would, at the very least, help them obtain more work.
CURRENT MARKET PRACTICES DISINCENTIVIZE ZERO CARBON UPSKILLING

Building owners ultimately dictate how buildings are constructed and, thus, which skills are in demand. Currently, buildings are largely built to the minimum standard established in the building code – far below what is expected of a zero carbon building. Without incentives substantial enough to change this on a large scale and without a shift in how owners and consumers understand and value zero carbon buildings, zero-carbon skills are likely to remain a niche skillset.

Further, for non-residential construction, building features are generally decided by the owner, not the contractors, and procured through a contract process that tends to emphasize the lowest bid price. This discourages innovations which may raise the bid price, even if that innovation results in a higher performing building with a better return on investment over its lifecycle.

Similarly, residential construction is ultimately driven by the market. Homeowners may not be educated on the value of living in a zero carbon building and may not be aware that resale prices of zero carbon buildings might actually go up, given realtors may not adequately market high performing buildings and their premium features. Many homeowners are primarily concerned with the initial upfront capital costs of construction or the purchase price, without considering the long-term savings zero carbon buildings provide due to lower energy costs over the lifecycle of the building. In addition, homebuilders are often more comfortable with delivering more traditional practices and technologies, such as installing furnaces instead of heat pumps, and are less likely to push for more advanced technologies. For zero carbon buildings to become mainstream, the majority of actors in the construction ecosystem will need to be educated on their value.

Roundtable participants noted that upskilling makes workers more valuable, but only if there is sufficient demand for those new skills. At the present time, many owners and developers lag when it comes to recognizing the value of zero carbon buildings. As such, there is less motivation in the workforce to learn the new skills related to advanced building design and construction practices.

“There still remains the stigma that cheap is better. A lot of opportunities are missed due to poor planning during budget processes which limit the payback of going real green.”

- Quote from survey participant
Trading Up: How Alberta’s trades can build a zero carbon future
The research conducted for this report demonstrates that gaps and significant barriers exist for zero-carbon skills and their adoption by the Alberta trades’ workforce.

The following recommendations address these gaps and barriers. Further, the recommendations detail actions needed to support the adoption of zero carbon building expertise within the Alberta trades. The recommendations are structured to reflect the suggested lead organizations and bodies needed to put these recommendations into action: these include policy decision-makers, accreditation and professional bodies, and education and training providers.

PROVIDE INCENTIVES FOR ACQUIRING ZERO CARBON SKILLS

Recommendations for policy decision makers, accreditation and professional bodies:

**CREATE A “GREEN SEAL” CERTIFICATE**

Tradespeople need to demonstrate the value of their skills to potential employers in a way that can easily be understood and verified. This proof is especially important given the project-based nature of construction, where labour mobility is common. Similar to the existing Gold Seal and Blue Seal certifications for management and business skills, an industry-led certification program that incorporates relevant green building skills and is delivered by trusted training providers, would meet this need for both employers and employees.

A recognized credential also creates a common reference point for employers and facilitates the transferability of skills between projects. With a “green seal” certificate, employers can quickly recognize the value of the skills workers have acquired, and eliminate the uncertainty caused by the current informal and unorganized method of upskilling. Further, the existence of a recognized industry credential will provide an incentive for tradespeople to upgrade their zero-carbon skills. As zero-carbon skills and construction practices vary between trades, many new streams will likely need to be created. However, many skills necessary for zero carbon buildings require collaboration and cross-disciplinary knowledge and could form a common core for all of the streams.

The resulting “green seal” would be an additional certification outside of the apprenticeship system; however, it would be accessible to both journeypeople as well as other construction workers. It could also be open for workers from outside Alberta to increase worker mobility between provinces if administered nationally. Similar to the Gold Seal Program, credits under the formal education requirement could be awarded for a tradesperson’s certificate.

**REQUIRE CONTINUOUS LEARNING**

Continuing professional development is a feature of many occupations but currently is not required for Alberta’s construction trades’ workforce. Due to the rapid changes taking place in construction, adaptive and nimble upskilling and continuous learning is necessary to be informed of the latest advancements, new technologies and practices, and to facilitate the construction of increasingly complex and demanding structures.

Mandatory continuing education needs to be developed for journeypeople to ensure that Alberta’s tradespeople are ready for growing market demand for zero carbon building. Journeypeople are particularly critical, due to their role in supervising new apprentices onsite.
Journeypeople need to understand new and evolving practices and technologies in order to properly pass those skills to apprentices under their mentorship. A system of mandatory continuous education for the construction trades should be modelled on the continuous education currently required by Master Electricians in Alberta.

**ESTABLISH MICRO-CREDENTIALS**

Education and training partners need to offer education in small competency-based modules, or micro-credentials to reduce the time tradespeople spend away from work. Micro-credentials are a method of structuring training so that broader topics are broken into individual competencies for which learners receive credentials. Micro-credentials are best utilized as an enhancement to the broad trade skills gained through the apprenticeship training system, and not used as a replacement that will limit tradespeople to a small niche in their trade. This approach allows tradespeople to learn the skills or portions of skills that they require in a flexible manner that makes sense to their circumstances.

**INCORPORATE ZERO CARBON SKILLS INTO APPRENTICESHIPS**

Alberta’s apprenticeship training system provides an established education pathway to develop the necessary zero carbon building skills for the majority of Alberta’s construction trades workforce. Individual trade apprenticeship programs should incorporate the zero carbon technical skills most relevant to their trade. As construction becomes more complex and multi-disciplinary, all apprentices should be literate and skilled in building science and buildings as a system as it applies to advanced construction. Understanding the building as a system will help each trade to better comprehend their role in the process of constructing high-performing buildings, and the relevance of certain techniques and practices. While the details will be different for each trade, it is critical that current training is adapted to include these topics.

Zero carbon skills should be an enhancement to the already full curriculum of apprenticeship. By adapting existing content, we can change how construction is approached and executed. Understanding the building as a system will help each trade to understand its role in the building process and the relevance of certain techniques and practices within the context of each trade.

**STRENGTHEN PROVINCIAL AND LOCAL APPRENTICESHIP COMMITTEES**

Local Apprenticeship Committees (LACs) and Provincial Apprenticeship Committees (PACs) form a vital link between industry and Alberta’s apprentice training system. This relationship can be strengthened through more frequent meetings, implementing curriculum updates on a shorter cycle, and collaborating more closely with the post-secondary training institutions that deliver the curriculum. Further, industry members from innovative companies should be represented, and the nomination criteria for both LACs and PACs committee members should be updated to prioritize recent field experience and experience with zero carbon construction. In this way, the committees will ensure that some members are knowledgeable about the importance of transitioning to zero carbon buildings.

Further, LACs and PACs are best positioned to understand the challenges inherent in incorporating additional content into the apprenticeship system. This work requires a balance between the need for trades to know about emerging technologies and practices and not overwhelming learners with too much information. Alberta’s training system, like any other apprenticeship system, can benefit from incorporating new and emerging content in a timely way. Access to current training is especially important, as in many cases, the apprenticeship will be the only formal training tradespeople receive in their career.
CREATE ADDITIONAL DESIGNATED OCCUPATIONS

Many occupations related to the construction of zero carbon buildings are currently not regulated in Alberta.

New designated occupations for construction workers could help attract new entrants, including younger people or allow displaced workers, such as those from the oil and gas industry, to transition to a new field. Further growth could be driven by including more occupations under the Registered Apprenticeship Program, which would make participants in those programs eligible for government financial support. The following occupations could be designated to support zero carbon building:

- **Building Envelopes**: While extremely important to high-performance buildings, building envelopes are currently not covered by apprenticeship training.
- **Cladders**: Responsible for applying materials to the outside of a building envelope, cladders currently do not have any formal training. Adding cladders to the apprenticeship system would benefit this occupation and make it more desirable to new entrants.
- **Window Installers**: Their work ultimately impacts the efficacy of the building envelope. However, consideration should be given to making them a designated occupation as high-performance windows must be installed correctly to perform as intended.
- **Heat Pump Technicians or “Residential HVAC Mechanics”**: An intermediate trade tied to the existing Refrigeration and Air Conditioning Mechanic trade, based on Ontario and Manitoba’s approach for example. A specific license for the residential building sector that addresses the installation and servicing of heat pumps is needed.
- **Refrigeration and Air Conditioning Mechanics or Gasfitters**: These are both regulated trades in Alberta, as well as Red Seal trades. Skills related to heat pump installation could enhance apprenticeship training and be provided as a training option for currently employed workers.

Zero carbon construction requires cross-disciplinary practices that require traditional trade roles to be redefined in order to capture the skill set required for zero carbon buildings. The long-term effect of aligning those roles and skills with the efforts of other provinces will also allow workers more inter-provincial mobility and help alleviate skills shortages, especially if these skills were added to the Red Seal trades.

MAKE ZERO CARBON PART OF THE PROCUREMENT PROCESS

The procurement process is critical to any building project but is especially significant when it comes to delivering zero carbon buildings. Greater market demand for zero carbon buildings require that governments at all levels adapt their bid processes for construction projects. Contract agreements should be amended to require the trades and/or the entire project team to demonstrate experience with zero carbon buildings or to create incentives for on-the-job zero carbon training. The content of a bid or offer could include requirements for zero-carbon skills or certification for tradespeople – such as a “green seal” or certain micro-credentials – or a demonstrated willingness to access zero-carbon training before or during a project.

ENCOURAGE GOVERNMENTS TO DEMONSTRATE LEADERSHIP AND INCREASE DIRECTED FUNDING

Governments can play an important role in transitioning the marketplace to zero carbon. Governments own large portfolios of buildings and are well-positioned to show leadership by prioritizing zero carbon when constructing or retrofitting buildings. Such action will provide a strong signal to the market and set an example by procuring construction in a way that advances zero carbon. Further, government mandated pricing of GHG emissions creates a financial incentive for owners to demand low-emission buildings. Similarly, government workforce training programs can be directed to support the advancement of zero carbon practices and address identified barriers for many trades, by making training easier to access and by covering or subsidizing the majority of the cost for training or upskilling.
ENSURE RELEVANT AND ACCESSIBLE ZERO CARBON TRAINING

Recommendations for education and training providers:

CREATE AN INVENTORY OF AVAILABLE ZERO CARBON TRAINING AND FUNDING

Creating a comprehensive inventory of low-carbon training and available funding resources in Alberta would help address the zero carbon skill gaps. Currently, information on available training is fragmented, with no central training directory. With several different training and education providers across the province, it is not easy to locate and compare course information. Education and training are also not uniformly available throughout the province, and some areas may be underserved. A comprehensive inventory could identify topic areas training partners could expand on, and ideally, could simplify access for tradespeople by making training more available throughout the province. Further research should be undertaken to understand what zero carbon upskilling options exist in Alberta. All accredited zero carbon construction-related courses and training should be accessible from a single location, such as through the proposed “green seal” program and would be similar to the Gold Seal program.33

ESTABLISH PARTNERSHIPS TO DEVELOP RELEVANT TRAINING CONTENT

To address gaps in education and training offerings, and to effectively update and expand existing training, partnerships between key stakeholders need to be leveraged appropriately. Product manufacturers and suppliers have a role to play in zero carbon-related education, as they can supply up-to-date information on their products and how they support zero carbon building. Trade and industry associations can work with manufacturers and suppliers to offer related technology-specific training across Alberta. Product distributors also have an important role in bridging the knowledge gap between manufacturers and tradespeople. This can include offering onsite demonstrations that could provide an excellent venue to learn about and experience new technology in a hands-on manner. Critically, the involvement of industry bodies can ensure training offered by manufacturers and distributors are relevant and practical to the needs of tradespeople.

MOBILIZE ALBERTA’S CONSTRUCTION ECOSYSTEM TO CHAMPION ZERO CARBON BUILDING

Transitioning to a low carbon construction workforce requires a multi-stakeholder approach. Establishing a coalition of diverse stakeholders to champion policy, business, and regulatory actions can accelerate zero carbon upskilling for trades. The coalition should include labour associations, training providers (e.g., colleges and universities), professional associations (e.g., unions), developers, manufacturers, and others. An independent secretariat should oversee the coalition and should advocate on behalf of the industry for a low-carbon skilled workforce by mobilizing leaders across Alberta to support the development and delivery of low-carbon education, curriculum, and training initiatives, and to help drive enrollment in these training programs.

Trading Up: How Alberta’s trades can build a zero carbon future
Construction in the future will increasingly need to deliver complex, zero carbon buildings.

Alberta’s construction tradespeople will need to master a new set of zero carbon skills in order to take advantage of the new opportunities this transition will provide. Alberta has a comparative advantage as it moves to ensure its trades’ workforce has the zero-carbon skills necessary to meet the future of the building industry. The province’s apprenticeship training system covers the majority of the skilled workers entering the construction sector. This approach provides the ideal knowledge transfer platform to facilitate the uptake of zero-carbon skills. In comparison, other provinces have a much smaller percentage of tradespeople completing apprenticeship programs. However, there are still challenges facing Alberta. While this report looks at only construction trades training and upskilling, tradespeople are just one part of a larger construction ecosystem. To successfully introduce the skills necessary for zero carbon buildings, Alberta must encourage all the stakeholders, most specifically owners, to embrace this transition.

This report confirms that to introduce zero carbon skills to the construction trades’ workforce in Alberta, knowledge gaps need to be recognized and addressed, and available training amended to support this transition. Targeted actions must be taken by education and training providers, accreditation and professional bodies, and policy decision-makers. Working together, they can minimize the zero carbon building skill gaps for all construction trades. By providing much-needed leadership, these stakeholders can ensure a highly educated and empowered construction workforce able to support Alberta’s transition to a zero carbon building future.
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APPENDICES
APPENDIX A: METHODOLOGY

The study explores the following questions: What are the zero-carbon skills needs of Alberta’s construction trades workforce, and how can these individuals be upskilled to meet the design, construction, retrofitting and operational goals of zero carbon buildings?

To answer these questions, data was gathered through two roundtable sessions held with industry stakeholders and supported by an Advisory Group composed of experienced industry members. An online survey was also conducted.

The purpose of this research is to:

1. Identify gaps in knowledge and skills training required for Alberta tradespeople to meet the demand of zero carbon building construction.
2. Describe the barriers Alberta tradespeople face when accessing zero carbon building training.
3. Recommend future education planning and training resources for tradespeople in Alberta.

Roundtable Discussions

Two roundtable discussions were held with industry participants representing tradespeople, related building occupations, and policy makers. In total 42 industry members participated in the sessions: 16 people at the session held in Edmonton on September 26, 2019, and 26 people at the Calgary session held on November 7, 2019. Participants were given an overview of the findings of CaGBC’s Trading Up report on zero-carbon skills gaps of construction trades in Ontario, as well as a summary of the results of the industry survey conducted on the Alberta trades workforce. Participants then broke into small groups to discuss questions related to barriers to upskilling and potential solutions. The roundtable discussions provided the opportunity to obtain in-depth information from Alberta from industry experts. These discussions provided important context to the industry survey.

Roundtable Participants

Session participants represented a broad collection of construction stakeholders in Alberta, including governments, post-secondary institutions, industry and trade groups, labour organizations, general contractors, and trade contractors. Participants also included those from groups that are typically underrepresented in the construction industry, including women, visible minorities, and people with disabilities.

Industry Survey

An online survey was designed and conducted to identify the knowledge and skills gaps of the Alberta construction trades workforce as it relates to their involvement in constructing and retrofitting energy efficient and zero carbon buildings. It was widely distributed through the CaGBC’s networks, including through its partners. While the survey was focused on tradespeople, it was also open to other members of the construction industry. The survey comprised multiple-choice and open-ended questions; and the option to provide individual comments.

In all, 84 industry members from across Alberta completed the survey. Two-thirds of respondents fell within the primary target audience of construction tradespeople, with electricians being the single largest trade represented. The remaining third of respondents were from the project management and supervisory professions, as well as a small number of building officials, inspectors, developers, architects, and other occupations related to construction. The majority of respondents had more than 15 years of industry experience.
Many key skills related to zero carbon buildings were identified based on previous trades-related research conducted in Ontario by CaGBC. Respondents to the survey were asked to report on their perceived knowledge/skills and the importance to their job for a number of core skills required for zero carbon building practices. These skills were categorized as either General Knowledge/Awareness, Technical Knowledge & Skills, or Professional Skills. Professional skills were inclusive of several soft skills, including teamwork/collaboration, communication, problem solving, and time management.

**General Skills**
- Knowledge of how your work connects with the work of other trades
- Knowledge of general building science principles (e.g., the building as a system, interconnective elements, etc.)
- Overall understanding of green building construction strategies (e.g., water efficiency, energy efficiency, indoor environmental quality, etc.)
- Broad awareness of climate change
- Understanding of the environmental impacts of green-house gas emissions

**Professional Skills**
- Problem solving/Critical thinking
- Communication
- Safety procedures
- Time management
- Project design/Design assist services (e.g., Shop drawings, etc.)
- Teamwork/Coordination with other trades/LEAN construction processes
- Project finance/Return on investment
- Regulatory framework/Data collection & analysis/Predictive technology
- Marketing support

**Technical Skills**
- Building performance and verification
- Mechanical systems commissioning
- Building science (envelope airtightness)
- Building automation systems
- Building envelope commissioning
- Integrated high-performance building systems installation
- Energy storage
- Determining the renewable energy technology best suited to a project. (e.g., solar vs wind, etc.)
- Solar renewable energy systems installation
- Impact of geographic and climatic conditions on renewable energy systems
- Low carbon/GHG emissions materials
- Geothermal renewable energy systems installation

**Survey Data Analysis Approach**
The survey aimed to identify skills gaps in general knowledge/awareness, professional skills, and technical knowledge and skills. The approach to data analysis was to compare mean knowledge/skills ranking with mean job importance. A Likert scale was used, with a range of one to five. One represented no knowledge/no job importance, while five represented high knowledge/high importance. A comparison of the difference between the mean score of personal knowledge and the mean score of job importance demonstrated areas where aggregate knowledge was lower or higher than the importance to the average respondent’s job. Means were chosen to capture the overall state of knowledge and job importance in each profession while minimizing outliers. By comparing respondent knowledge with the importance of the core competency to their job, a picture is created of where the gaps exist and to what extent. For this research, it was assumed that skill gaps where action needs to be directed are evident where the average respondent’s knowledge/skills has a low rating while the importance to job is rated high. Skills, where there is a low to average rating on knowledge/skills but also a low rating of job importance, represent either areas of less importance or areas that have not yet been recognized widely within the industry.

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Industry Survey Results

Demographic Information
In total, 154 industry members began the survey, with 84 of those fully completing the survey with representation from across Alberta. Of the 145 respondents that provided their profession, 68.3 per cent fell within the primary target audience of construction tradespeople, with electricians being the single largest trade represented. The remaining respondents were primarily made up of project management and supervisory professions, as well as a small number of building officials, inspectors, developers, architects, and other occupations related to construction.

Respondent Experience
Of the respondents, 91 per cent indicated that they worked primarily in Northern Alberta (45%) or Southern Alberta (46%). A much smaller proportion of respondents indicated that their primary place of work was Central Alberta (3%), all of Alberta (2%) or other parts of Canada (3%). Respondents reported that the type of projects they had worked on was evenly distributed between residential (28%), commercial and institutional (35%), and industrial construction (31%). The majority of respondents were very experienced in the industry, with 63.4 per cent reporting more than 15 years of experience. The majority of respondents identified as a multi-generational tradesperson (they had a parent or grandparent that also worked in the trades). A further 10 per cent of respondents identified as First Nations/Indigenous.
Education
Respondents were also asked to answer several questions related to education:

Satisfaction with Training
Half of the survey respondents were neutral about the training options currently available in Alberta. Approximately 15 per cent of respondents were either satisfied or very satisfied or dissatisfied or very dissatisfied. Approximately one in six respondents were unaware of available training.

Educational Programs
Respondents were asked to select up to three types of educational programs that they believed were best suited to provide tradespeople with the knowledge and skills necessary for green building construction in Alberta. The most popular options for educational programs were part-time certificate programs, professional development seminars/workshops, and apprenticeship training. University or college degree or diploma programs were the least popular by a significant margin.
Delivery Methods
Respondents were also asked to select up to three types of delivery methods that they believed were effective for providing education to the trades relating to the knowledge and skills gaps currently present. There was no strong preference for delivery format, with an almost even split between the options presented apart from low support for Physical Job Aids or Instructional Guides and Online Communities of Interest.

Formal Training and Certification
Respondents were asked to indicate whether they felt formal training and certification related to constructing energy efficient and low/zero carbon buildings would make them a more valuable employee, and whether such training and certification help them obtain more work. The majority of respondents believed formal training and certification would make them a more valuable employee, but only 37 per cent believed that it would assist them in obtaining work.
Trades Survey: Green Building Construction in Alberta

You are invited to participate in our survey “Survey on the Trades: Green Building Construction in Alberta”. This survey will take approximately 10 minutes to complete. All responses will remain confidential and will only be used in aggregate form.

Survey Purpose: This survey aims to identify gaps in the knowledge and skills of the Alberta construction trades’ workforce as it relates to their involvement in constructing energy efficient and low/zero carbon buildings.

Background: Canada has ambitious goals to reduce the amount of greenhouse gas emissions, including emissions associated with the built environment. One way in which to meet these goals is to transition to energy-efficient buildings, and the trades workforce plays a key role helping buildings meet their low-energy use goals.

Section A: General Information

Please select which of the following best describes your profession.

- Boilermaker
- Bricklayer
- Carpenter
- Cladder
- Concrete/Foundations
- Concrete Finisher
- Construction Craft Worker
- Contract Manager
- Electrician
- Drywall Finisher and Plasterer
- Gas Fitter
- Glazier
- Heavy Equipment Operator
- Instrument and Control Technician
- Insulator/Firestopping
- Ironworker
- Lather
- Machinist
- Mechanic
- Metal Fabricator
- Millwright
- Mobile Crane Operator
- Painter
- Plumber
- Project Manager
- Refrigeration and Air Conditioning Mechanic
- Roofer
- Sheet Metal Worker
- Site Supervisor
- Solar
- Steamfitter/Pipefitter
- Structural Steel Worker
- Tilesetter
- Tower Crane Operator
- Welder
- Other (please specify) ____________________
Where in Alberta do you work most often?

- Northern Alberta (e.g., Edmonton or further north)
- Central Alberta (e.g., Red Deer, etc.)
- Southern Alberta (e.g., Calgary, Lethbridge, etc.)
- Other (please specify) ____________________

How many years of experience do you have working in a construction or trades related field?

- Less than 1 year
- 1 to 3 years
- 4 to 6 years
- 7 to 9 years
- 10 to 12 years
- 13 to 15 years
- More than 15 years

What types of projects have you worked on? (Select all that apply)

- Single-Family Residential/Low-Rise MURB
- MURBs (5+ Storeys), Commercial or Institutional (e.g., Schools, Hospitals, etc.)
- Industrial (e.g., Warehouse, Other Steel-Building Structures, etc.)
- Other ____________________

Section B: Green Building Construction Knowledge and Skills

Please rank the following topic areas based on the following:

1. Your level of knowledge (1=No Knowledge/Skills | 5=Advanced Knowledge/Skills)
2. How important the topic areas are in relation to your Job (1=Not Important | 5=Very Important)

<table>
<thead>
<tr>
<th>Knowledge/Skills</th>
<th>Job Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broad awareness of climate change</td>
<td></td>
</tr>
<tr>
<td>Knowledge of general building science principles (e.g., the building as a system, inter- connective elements, etc.)</td>
<td></td>
</tr>
<tr>
<td>Knowledge of how your work connects with the work of other trades</td>
<td></td>
</tr>
<tr>
<td>Overall understanding of green building construction strategies (e.g., water efficiency, energy efficiency, indoor environmental quality, etc.)</td>
<td></td>
</tr>
<tr>
<td>Understanding of the environmental impacts of green-house gas emissions.</td>
<td></td>
</tr>
</tbody>
</table>
Please rank the following topic areas based on the following:

1. Your level of knowledge (1=No Knowledge/Skills | 5=Advanced Knowledge/Skills)
2. How important the topic areas are in relation to your Job (1=Not Important | 5=Very Important)

<table>
<thead>
<tr>
<th>Knowledge/Skills</th>
<th>Job Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building envelope commissioning</td>
<td></td>
</tr>
<tr>
<td>Mechanical systems commissioning</td>
<td></td>
</tr>
<tr>
<td>Building performance and verification</td>
<td></td>
</tr>
<tr>
<td>Energy modelling</td>
<td></td>
</tr>
<tr>
<td>Building science (Envelope airtightness)</td>
<td></td>
</tr>
<tr>
<td>Solar renewable energy systems installation</td>
<td></td>
</tr>
<tr>
<td>Geothermal renewable energy systems installation</td>
<td></td>
</tr>
<tr>
<td>Impact of geographic and climatic conditions on renewable energy systems</td>
<td></td>
</tr>
<tr>
<td>Determining which renewable energy technology is best suited to a project. (e.g., solar vs wind, etc.)</td>
<td></td>
</tr>
<tr>
<td>Low carbon/greenhouse gas (GHG) emissions materials</td>
<td></td>
</tr>
<tr>
<td>Building automation systems</td>
<td></td>
</tr>
<tr>
<td>Integrated high-performance building systems installation</td>
<td></td>
</tr>
<tr>
<td>Energy storage</td>
<td></td>
</tr>
</tbody>
</table>
Please rank the following topic areas based on the following:
1. Your level of knowledge (1=No Knowledge/Skills | 5=Advanced Knowledge/Skills)
2. How important the topic areas are in relation to your Job (1=Not Important | 5=Very Important)

<table>
<thead>
<tr>
<th>Knowledge/Skills</th>
<th>Job Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td></td>
</tr>
<tr>
<td>Marketing support</td>
<td></td>
</tr>
<tr>
<td>Project design/Design assist services (e.g., Shop drawings, etc.)</td>
<td></td>
</tr>
<tr>
<td>Problem solving/Critical thinking</td>
<td></td>
</tr>
<tr>
<td>Project finance/Return on investment</td>
<td></td>
</tr>
<tr>
<td>Regulatory framework/Data collection &amp; analysis/Predictive technology</td>
<td></td>
</tr>
<tr>
<td>Safety procedures</td>
<td></td>
</tr>
<tr>
<td>Teamwork/Coordination with other trades/LEAN construction processes</td>
<td></td>
</tr>
<tr>
<td>Time management</td>
<td></td>
</tr>
</tbody>
</table>

Please provide any additional comments you may have related to Section B: Green Building Construction Knowledge and Skills.
Section C: Education

Overall, how satisfied are you with the current green building construction education and training available for the construction trades in Alberta?

- Very Dissatisfied
- Dissatisfied
- Neutral
- Satisfied
- Very Satisfied
- Unaware that Education and Training was available

Please provide specific details about why you are not satisfied with the current green building construction education and training available for the trades in Alberta.

What type of educational programs do you believe are best suited to provide tradespeople with the knowledge and skills necessary for green building construction in Alberta? (Please select up to 3)

- Part-Time Certificate Programs
- Professional Development Workshops/Seminars
- Job Shadowing
- College Certificate Programs
- College Diploma Programs
- College Degree Programs
- Apprenticeship Programs
- University Degree Programs
- Other ____________________

What are effective education delivery formats for providing education to the trades relating to the knowledge and skills gaps currently present? (Please select up to 3)

- Online Courses
- In-Person Courses
- Blended Courses (e.g., Mix of In-Person and Online Education)
- Education on the Job Site
- Integration of Operations’ Trades into Early Design Meetings
- Integration of Trades into Buildings’ Design Phase
- Physical Job Aids or Instructional Guides (e.g., Paper-Based Checklists, etc.)
- Electronic Resources (e.g., Online Resources Centre, Electronic Version of Building Codes, etc.)
- Online Community of Interest (e.g., Individuals ask Questions and/or provide Guidance to Others.)
- Other (please specify) ____________________
Please provide any additional comments you may have related to Section C: Education.

Section D: Optional - A Few Last Questions About You

Do you feel that if you possessed formal training and certification related to constructing energy efficient and low/zero carbon buildings you would be a more valuable employee?

☐ Yes
☐ No
☐ Maybe

Do you feel that if you possessed formal training and certification related to constructing energy efficient and low/zero carbon buildings you would obtain more work?

☐ Yes
☐ No
☐ Maybe

Are you a member of a Union?

☐ Yes
☐ No

What is your age?

☐ 18-25 years old
☐ 26-35 years old
☐ 36-45 years old
☐ 46-55 years old
☐ 56-65 years old
☐ 66+ years old

You identify your gender as:

☐ Female
☐ Male
☐ Other
Which of the following do you consider to be applicable to you? (Please check any that apply)

- First nations/Indigenous
- Temporary foreign worker (TFW)
- New Canadian
- Current or former member of the armed forces
- Travel card/Out of province
- Multi-generational trades person (e.g., Your Father/Mother or Grandfather/Grandmother also worked in the trades)

Please provide any final comments you may have.

Please indicate if you interested in taking part in a roundtable in either Edmonton or Calgary to discuss the survey findings in more detail. If yes, please add your name and contact information in the prize draw listed on the next page. Note: There is limited seating available, so the survey’s Advisory Group will select round-table participants to ensure a broad representation.

- Yes - I am interested in participating in the roundtables.
- No - I am satisfied with providing survey data only.

First Name: ________________________________
Last Name: ________________________________
Email Address: ________________________________
APPENDIX C: ROUNDTABLE FACILITATION GUIDE

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00am</td>
<td>Welcome and Introductions</td>
</tr>
<tr>
<td>11:30am</td>
<td>Getting to Zero Project Summary &amp; Trading Up Report Review</td>
</tr>
<tr>
<td>12:00pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:30pm</td>
<td>Getting to Zero Survey Results and Round Table Format</td>
</tr>
<tr>
<td>1:00pm</td>
<td>Small Table Working Groups #1</td>
</tr>
<tr>
<td>1:50pm</td>
<td>Feedback Session #1</td>
</tr>
<tr>
<td>2:15pm</td>
<td>Health Break</td>
</tr>
<tr>
<td>2:30pm</td>
<td>Small Table Working Groups #2</td>
</tr>
<tr>
<td>3:15pm</td>
<td>Feedback Session #2</td>
</tr>
<tr>
<td>3:45pm</td>
<td>Wrap Up and Next Steps</td>
</tr>
<tr>
<td>4:00pm</td>
<td>End</td>
</tr>
</tbody>
</table>

**Getting to Zero Project Summary**

The CaGBC Alberta Chapter has received funding from Energy Efficiency Alberta for a project to identify skills and capacity gaps for the trades in Alberta. This project is entitled “Getting to Zero: Equipping Alberta Trades with the Skills for the Future” and will include a series of round tables, research surveys, and a suite of recommendations in a report that will be shared more broadly with industry stakeholders and post secondary institutions. In 2018, the CaGBC secured funding from the Ontario Ministry of Training, Colleges and Universities (MTCU) to undertake a study to determine where skill gaps exist for the construction of energy efficient/low carbon buildings. The results of this research will be published in January 2019 in a report entitled Trading Up: Equipping Ontario Trades with the skills for the Future. The key findings will outline the technical skills needed to support low carbon buildings and the pathways to support their adoption.

**Round Table Objectives**

- Identify how the Ontario gaps relate to Alberta and evaluate the gaps that are specifically unique to Alberta.
- Confirm and acquire additional information related to the findings of the Alberta trades’ survey.
- Discuss how Alberta’s current education programs can be expanded, or new education programs created, to fill the gaps.

**Survey Results**

In all, 84 people, primarily tradespeople, completed the Survey on the Trades: Green Building Construction in Alberta. In general, professional skills and general knowledge were rated higher than technical skills for importance on the job. Survey respondents preferred short and flexible training options. A lack of affordable and relevant training, and the lack of employer support and available time to complete the training were noted as barriers.

*Please note this is a preliminary summary, full analysis of the survey is still in progress.*

**Round Table Format**

The format of the round tables will be small groups (four or five) of six people, diversity of sector representation across tables is encouraged. These groups will discuss a set of four questions per session, with a recorder who will report back to the larger group. A note-taker will collate all feedback to and from the larger group.
Small Table Working Groups #1 – Zero Carbon & Skills for the Trades

Trades working on low/zero carbon buildings don’t always understand why they are being asked to do their job in a different way, and the impact that can be felt if work isn’t completed in a particular manner.

1. How can a greater understanding of the benefits of sustainability in the built environment be fostered in the industry as a whole?
   a. What is the best way to ensure trades understand the importance of what they are being asked to do vs. completing “business as usual”?

2. How can communication on the job site between trades, management, designers, and building operators be improved to ensure all parties are fully aware of the end goals of the project (e.g., achieving low/zero carbon building status)?
   a. How can peer collaboration and “train the trainer” best be fostered?

3. Do you feel that if the trades possessed skills and training for low carbon and green buildings, they would be a more valuable employee and/or obtain more work?

4. How can employers motivate their employees to continue upskilling and training?
   a. Should continuing education be mandatory for tradespeople after they have finished their apprenticeship?

Small Table Working Groups #2 – Training the Trades

The green building marketplace is rapidly adopting innovative, low-carbon solutions that often require new technical skills across the trades, and/or new training in processes. Consider the following questions in relation to the trades in Alberta.

1. What differences in training (delivery method, timing, etc.) are needed for the skills that fall into the general skills, technical skills, and professional skills categories?

2. To what extent should low carbon knowledge and skills be incorporated into apprenticeship programs, continuing education, and formal education?
   a. How would this training be incorporated? (suggestions)
   b. What barriers exist to incorporating this training?

3. How can training providers ensure their training remains relevant to skills needed on the job site?

4. What role should professional organizations, unions, and product manufacturers play in delivering low carbon education?
   a. What would training resources look like? (example: online training, in person training, combinations).
   b. What sources of funding exist to support access to new or ongoing training?

Next Steps

Produce a summary report that captures the key findings of the roundtable discussions with the aim of encouraging the expansion of education offerings by higher education institutions, industry associations and government to fill the identified low carbon skill gaps. Disseminate the summary report back to project partners and key stakeholders to elicit feedback and discuss recommendations for next steps, and to support the implementation of the findings. This would also include a release at an in-person event promoted across Alberta. Delivering a summative evaluation to roundtable to event participants to support measurement of the success of the project.
APPENDIX D: CONSTRUCTION TRADES IN ALBERTA

Compulsory Certification Trades
- Appliance Service Technician
- Boilermaker
- Crane and Hoisting Equipment Operator
- Electrician
- Elevator Constructor
- Gasfitter
- Heavy Equipment Operator
- Ironworker
- Plumber
- Refrigeration & Air Conditioning Mechanic
- Sheet Metal Worker
- Steamfitter-Pipefitter
- Welder

Optional Certification Trades
- Bricklayer
- Cabinetmaker
- Carpenter
- Communication Technician
- Concrete Finisher
- Electric Motor Systems Technician
- Floorcovering Installer
- Glazier
- Industrial Mechanic (Millwright)
- Instrumentation and Control Technician
- Insulator (Heat and Frost)
- Lather (Interior Systems Mechanic)
- Locksmith
- Machinist
- Metal Fabricator (Fitter)
- Natural Gas Compression Technician
- Outdoor Power Equipment Technician
- Painter and Decorator
- Parts Technician
- Powerline Technician
- Power System Electrician
- Roofer
- Sprinkler Systems Installer
- Tilesetter
- Transport Refrigeration Technician
- Water Well Driller
APPENDIX E: ADVISORY GROUP PARTICIPANTS

- Lisa Fox, Jennifer Benner, Jennifer Cossette, Dr. Susanne Ruhle, CaGBC
- Brad Bent, Christian Labour Association of Canada Alberta (CLAC Alberta) Training
- Kelsey Chegus, Energy Efficiency Alberta (EEA)
- Ken Gibson, Alberta Construction Association (ACA)
- Lisa Gibson, Ledcor
- Ben Hildebrandt, Southern Alberta Institute of Technology (SAIT)
- Doris MacKinnon, Red Deer College
- Dr. Douglas MacLeod, Athabasca University
- Craig Mathes, Alberta Trades and Apprenticeship Board (AIT)
- Juan Monterrosa, City of Edmonton and CaGBC Alberta Chapter Leadership Board
- Alycia Picketts, Skills Alberta
- Greg Robertson, Northern Alberta Institute of Technology (NAIT)
- Melanie Ross, Southern Alberta Institute of Technology (SAIT) and Chair of the CaGBC Alberta Chapter Leadership Board
- Matthew Simard, Clark Builders and Vice Chair of the CaGBC Alberta Chapter Leadership Board