EXECUTIVE SUMMARY
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A strong economy and environmental leadership are interconnected. Ontario now has a great opportunity to prove that economic growth, job development and combating climate change can be achieved at the same time.

In Ontario green infrastructure, investments are expected to increase along with demand for skilled tradespeople and a green workforce in the construction industry.

The transition to a low-carbon economy impacts all economic activity. It will inevitably bring about changes in occupations and workforce competencies. At the same time, the construction industry faces a wave of attrition with more than 85,000 retirements forecasted for the coming decade. For the Toronto region alone, it has been estimated that there will be 147,000 job openings in the construction industry over the coming 15 years. The impact of the skills gap in Ontario is estimated at $24.3 billion of Gross Domestic Product (GDP) in foregone company revenues, with an additional $3.7 billion lost in foregone taxation. Adequate education and training will be important to transition the labour force to the economy of the future. This study starts with the observation that, to date, insufficient attention has been paid to how the labour market needs to adapt to meet current and future challenges. Much attention has been paid to how carbon emissions can be reduced, as well as to the possible implications for economic and employment growth. However, to meet Ontario’s greenhouse gas reduction targets, fundamental changes to the structure of various occupations are needed to support the transition of the economy.

This report provides an education roadmap and insights on which technical and soft skills are necessary from the trades and the entire project team to achieve the successful construction of low-carbon, high-performing buildings.

Overall, the requirements for improved technical skills fall into the following areas:

- Geothermal systems, particularly heat pumps;
- Photovoltaic and solar thermal systems;
- Air and vapour barriers including sealing techniques and airtightness testing;
- The building envelope, including insulation, wall assembly and thermal bridging, especially on balconies or around fenestration;
- Temperature bearing systems;
- Plumbing and pipefitting;
- Installation of forced air mechanical systems including balancing air flow for ventilation;
- Building Automation Systems, mechanical and electrical systems and equipment and commissioning.
Also, embodied carbon and the selection of materials is a new subject for the entire building industry. Knowledge of the carbon embodied in building materials needs to be improved industry-wide so that material choices are not left to tradespeople alone.

However, one of the main findings of this report is that technical skills alone will not satisfy the requirements of low-carbon buildings. Changes to the larger construction approach and acknowledgment of soft skills are necessary to deliver high-performing buildings. We therefore need to increase overall levels of “green literacy” or said another way, the ability to understand the broad implications of key building activities on the environment and the market infrastructure. This works in concert with changes to the way construction projects are undertaken. The threshold for mistakes in high-performing buildings is slim and demands a higher level of sophistication and precision for the entire project team. The trades are extremely important for achieving high-performing buildings, but they need the support of the remaining construction ecosystem to succeed. This also means that the trades should be brought into the design and construction process early on. It also relies heavily on communication and collaboration among the trades as well as an allowances for more time to ensure better project outcomes.

Retraining the trainers is also critical. Coaches and professors who teach the construction ecosystem need to be brought up to speed. Different delivery modes for training, ranging from full-time in-class courses to short online training modules and project specific instructions on-site to videos are now required to better serve the needs of tradespeople.

On-site training will play an important role as it offers the opportunity of ad-hoc training and a continuous feedback loop that can involve multiple trades at the same time and cross traditional trade roles. The industry and the trades in particular need to develop a willingness to invest in lifelong learning and to continuously upgrade their skill sets to meet the demand of energy-efficient, high-performing buildings.

A major challenge will be retraining those already in the workforce as there are few incentives available at this time to upgrade their skills, especially when there is high demand for trades working on traditional building projects. There are highly capable skilled trades that have a good knowledge of high-performing building practices and jumped at the chance to become leaders in their industry. However, others seem to miss the basic understanding of building science necessary for a successful low-carbon building.

It is not only the trades who need to upgrade their skills and knowledge base. The entire construction ecosystem including designers, architects, engineers, buildings officials and buildings managers also need to add skills to successfully complete complex high-performing buildings.
When planning for the shift to low-carbon buildings, it is recommended that Ontario undertake the following steps:

A  **Improve green literacy**

- Foster a broader ecological mindset and awareness throughout the construction industry.
- Develop new green training and education that address the skills needs and training gaps identified in this report.
- Train all stakeholders in the construction industry ecosystem on the importance of developing low-carbon buildings – from architects and engineers to designers, building officials and building managers.

B  **Amend the modes of training**

- Incorporate low-carbon skills into all available courses, including Ontario apprenticeship programs, for people entering the construction industry.
- Make continuing education a requirement for professional development and to maintain credentials and make low-carbon skills a mandatory requirement for the certification of tradespeople.
- Consider making more construction apprenticeships compulsory to ensure a high-quality workforce for high-performing buildings.
- Leverage the existing educational infrastructure: Engage professional organizations, trades unions, colleges, universities and manufacturers to assist with low-carbon skills development, including continuing education.
- Train multiple trades in cross-disciplinary, hands-on training as low-carbon buildings require skills that cross traditional trade roles.
- Support a diversity of media and formats for training and education that addresses different learning styles, lifestyles and access to learning opportunities. Offer training in a range of formats – from extended, in-person sessions to short online videos or articles.
- Train the trainer: Create a peer-network for trainers, professors and coaches where people can learn from one another about how to include low-carbon technologies and take a more holistic approach to construction.
- Embrace new technologies and digitalization to develop new ways of working to construct high-performing buildings and retrofit older facilities.

C  **Adapt the market infrastructure**

Support a holistic view and work with an integrated design approach that brings in the trades early to improve the overall design and construction process. An alternative design-build-operate model can also help educate both tradespeople and designers on a new-building delivery process with stronger connections between intentions and actual performance.
Improve communication and collaboration on-site and during construction as this helps reaching a significantly higher level of sophistication and precision needed for high-performing buildings. Ensuring continuous communication allows for feedback and training opportunities for the entire team.

Adapt the bidding process and amend contract agreements so tradespeople are required to either demonstrate experience with low-carbon buildings or attend in person or on-the-job training for the skills needed to execute their tasks.

Allow more time for complex construction projects so that the tradespeople can complete their work in an efficient manner.

Institute quality assurance practices as continuous feedback loop and ad-hoc training opportunities on-site that ensure high-performing building projects avoid delays and perform as intended.

D Identify and create incentives

Leverage government funds to subsidize training and lower the cost barriers for trades to participate.

Develop a certificate for low-carbon skills that would help the labour market identify and secure skilled trades for their projects.

E Further research into training and opportunities

Undertake a detailed gap analysis of current curricula used in part-time certification programs, professional development and continuing education workshops and seminars, college courses, diploma and degree programs, and university degree programs. This research focuses on skilled trades, but there are significant gaps remaining for the rest of the construction ecosystem that need to be analysed in more detail. More research also needs to be done on the residential building sector and residential building retrofits, especially for low-rise single-family homes to get low-carbon buildings up to scale.

This study provides an education roadmap for Ontario’s labour force, government, educational institutions and industry. Ultimately, CaGBC and its partners intend for this plan to strengthen workforce training and technical capabilities, and thereby reduce greenhouse gas emissions over the long-term – in effect encouraging the widespread adoption of energy-efficient, high-performing building practices as industry standards.

Ontario has an opportunity to take on a national and international leadership role by supporting its workforce to the skills and capabilities needed to create the energy-efficient, high performing buildings. To tackle the challenges of the future and the changes that will come to Ontario’s economy and workforce by climate change, Ontario needs to be ready to support its workforce to be prepared for the jobs of the future.