Delivering Net Zero Carbon Buildings:

The Role of Cities in Skills Development and Training in North America

C40 CITIES

DELPHI GROUP

Content

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Glossary & Acronyms

AEC – Architecture, Engineering, Construction

BIPOC – Black, Indigenous, People of Colour

GHG – Greenhouse Gas. A gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. The primary greenhouse gases in the Earth's atmosphere are water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3).

Green Skills - a general term used in this report to define the capacities and knowledge needed to deliver net zero carbon buildings

HVAC - Heating, ventilation, and air conditioning

Just Transition – is a sector-, city-, region- or economy-wide process that produces the plans, policies, and investments so that: Everyone has social protection; All jobs are decent; Emissions are low or at zero; Poverty is eliminated; and Communities are thriving and resilient.

NGO – Non-government organization

NZCB – Net Zero Carbon Building

PACE -Property Assessed Clean Energy- a financing tool that allows property owners to borrow money to pay for clean energy improvements for their property, with the loan paid back on the property tax bill

PV – photovoltaics

STEM – Science, Technology, Engineering, and Math

1. Executive Summary

Buildings are a major source of greenhouse gas (GHG) emissions. Buildings have become an important component of the municipal toolkit to fighting climate change, meeting GHG targets, and building resiliency because buildings can often be locally regulated in North American cities.

For cities, efforts to reduce building energy use and mitigate associated GHG emissions are a key opportunity to not only respond to the climate crisis but reduce air pollution, lower the cost of living, improve health, enhance resiliency, create sustainable local jobs, and support a just transition. In this report, just transition is defined as a sector-, city-, region- or economy-wide process that produces the plans, policies and investments so that: Everyone has social protection; All jobs are decent; Emissions are low or at zero; Poverty is eliminated, and Communities are thriving and resilient—providing equitable and inclusive opportunities for all those seeking employment.[1]

Following the COVID-19 pandemic, current recovery initiatives offer the possibility for cities to play a pivotal role in enabling all those who wish to participate in the low-carbon building sector to have easy access. Developing a skilled and qualified workforce not only supports delivering on zero-carbon commitments but also supports the transition towards an economy that allows for an inclusive and equitable society.

This research paper focuses on how North American cities can bridge the gap between the building sector and skills training programs to accelerate the development of net zero-carbon buildings (NZCB). It examines NZCB, and other construction training programs in a variety of cities, including the role cities, play in their initiation and day- to-day operations, with a particular focus on funding models and other success factors – with case studies that showcase innovative and successful training models and partnerships. See Appendix B to view the case studies developed from the training programs examined in this study. See Appendix C for the full list of training programs researched in this study. Many of the programs examined also support the just transition. The COVID-19 pandemic has imposed a level of urgency on cities to explore and develop ways to 'Build Back Better', and these goals and actions are described in relation to the building industry.

This report puts forward a suite of considerations for cities to contemplate as they develop local capacity to deliver more NZC buildings. It is intended that this report will act as a useful resource for the local government members of C40 Cities and contribute to the efforts of several C40 Working Groups, including: the Green Economy Forum, the City Finance Programme, the Energy and Buildings Programme, and the Inclusive Climate Action Programme.

1. 'C40 : The Global Green New Deal' <https://www.c40.org/global-green-new-deal>

Achieving a low-carbon economy requires a culture shift

Construction is the number one employer in many jurisdictions and can accommodate workers of all skills and circumstances. However, in many cities, green building training programs are offered but are often under-utilized. One reason for that is a lack of alignment with industry needs. The cost to participate, inflexibility in schedule or learning modes, misaligned content with the need of industry, and a lack of awareness, keep many employers and workers from investing in their professional skill development. In addition, there is a lack of cohesion in the industry, which contributes to persistent barriers to green skill development. These include factors such as:

- Many building design and construction companies are small businesses operating within slim margins and do not have surplus human resources or financial bandwidth to invest in training.
- Builders install what owners ask for. Traditional procurement processes focus on the lowest capital cost, not lifecycle value, and owners do often not know to ask for NZC buildings or perceive them as too costly.
- The construction supply chain is complex and highly risk-averse, which makes it a slow-moving industry.
- A lack of a "culture for learning" in construction and no or little requirement for professional development for most occupations.

A highly trained workforce is critical to delivering low-carbon new construction and deep energy retrofits at scale. A more cohesive training and building sector can result in a pipeline of trained workers that can achieve local building standards, goals and performance targets.

The pivotal role of cities

Cities play a pivotal role as goal setters through short- and long-range policies and as facilitators to ensure existing programs are properly utilized and curricula are aligned with city policies and goals. Cities are well-positioned to catalyze the development of programs and convene green skill training program administrators and stakeholders across the construction value chain. Creating a forum for dialogue will contribute to a cultural shift across the entire construction value chain.

To meet the opportunities and challenges, a variety of approaches to training and workforce capacity development will be required. Every city will have its own unique issues and must tailor solutions to meet specific needs. Cities whose existing workforce is transitioning away from a fossil fuel-powered economy will require different types of training programs than those seeking to engage disadvantaged youth.

All cities have an important role to play. There is a shift happening in the construction sector driven by persistent labor shortages, an ageing workforce, and the

emergence of new technologies, products, and processes that drives the need to invest in new skills, amplified by the COVID-19 pandemic. This offers cities a unique window to get started.

Impact of COVID-19

With building construction being a labor-intensive industry and buildings being major sources of GHG emissions, many governments have identified NZCB new construction and energy efficient retrofits as activities that simultaneously reduces GHG emissions and energy consumption while providing a boost to employment after the COVID-19 pandemic. COVID-19 has forced sweeping operational and strategic changes onto cities and businesses, along with a recalibration of priorities. The global climate emergency is driving cities to put green and clean recovery efforts first. Now is an ideal moment in time for cities to push for upgrading skills to participate in the emerging green and low-carbon economy. Training will speed up introducing climate-forward building codes and preparing the workforce for a low-carbon economy. Cities can aid this effort by providing direct support for training and signalling that green building skills will be in demand in their community.

Montreal © Pierre Ogeron / Getty Images

Recommendations for municipal leadership for green skills in the building sector

Cities of all sizes have a leadership role to play in fostering alignment of green skills training programs with municipal policy, building performance, and standards. Below is a list of recommendations for municipal leaders when considering how to best support training and capacity development for advancing NZCB.

1. **Develop a forum for the building industry, trade unions, and training program delivery agents to connect.** This fosters cooperation, builds buy-in and increases the municipal understanding of industry needs and priorities.

2. **Create partnerships with local training program administrators.** This supports the alignment of local building performance standards and priorities with training content and provides on-site training opportunities for government-owned properties.

3. **Incentivize training.** Cities can mandate green building training if a building does not meet the local building performance standards.

4. **Lead by example and create a culture of innovation.** City procurement departments can obtain new technologies, practices, and processes that move toward zero-carbon construction best practices by embedding training or certification requirements in RFPs.

5. **Funding green skill training programs.** Cities can champion green skill training programs by providing financial support through training levies, sponsoring programs or stipends.

6. **Program marketing and promotion.** Cities can advertise programs through their networks and marketing channels or by creating an education hub to increase the participation rate by enhancing a program's credibility.

7. **Emphasize support of training programs that address a Just Transition.** Cities can serve as convenors and facilitators to create opportunities for diversity. As the hosts or chairs of engagement platforms, cities can select diverse representation, advise on topics of discussion and appoint resources to address these issues.

A City aspiring to be a leader in advancing green skills in the building sector should start with considering the following actions:

Understand issues and address the needs of the community	Placing the needs of the community first will catalyze alignment with green skill training opportunities.
Take the time to develop a deep understanding of all stakeholders' needs	Make sure to align program design with the city's strategic goals and priorities.
Map the construction, NZCB and green skill and training ecosystem	Understand the key actors and the connections between them. Consult with key stakeholders to test and validate any assumptions made.
Consult industry	Connect with trades, designers, contractors, educators to determine what projects are needed to meet NZCB goals, what skills are missing, and how to deliver training for their communities.
Maintain engagement throughout the program to maintain quality standards.	Set up an advisory panel to define and implement actions and provide a broad perspective and network.
Develop a strategic plan	A strategic plan with energy consumption and building GHG emission will define an optimal path. Include an analysis of finance pathways to operationalize initiatives.
Set up a centralized office to manage the initiative	A centralized office will focus efforts to enable policies, cooperation between industry and zoning, permitting, and communication between regulators, designers, trades, and educators.
Identify partners	Key partners that can contribute to the development of the forum and help to secure buy-in from industry and the community.
Centralize training and education resources and support systems for public access	Centralizing resources is an important for building industry cohesion. Put in place support systems to allow those seeking employment better access to training and entry into the workforce.
Secure bottom-up and top-down support for their policy agenda	Community, Mayor, council, and staff support to develop a forum for training programs and industry to collaborate will help to secure capacity and resources to dedicate to the development of the forum.

Funding Models for Green Skill Training Programs

Funding models for skills development come from the private or public sector, are citizen-led, or from partnerships comprising a combination of players.

- **Direct payment:** Direct payment from the participants for training by building construction workers and their employers.
- **Training levy:** Resourced by a levy on employers based on a percentage of employees' reckonable earnings in certain employment courses, which is collected through a centralized system (federal or provincial/state).
- **National training funds:** Grants from the federal government to support national strategies.
- **State/provincial level funds for training**: Grants to support state or provincial initiatives.
- **Energy companies and financial institutions:** Financial contributions from electricity or gas utility companies as well as construction pension funds.
- **Building products manufacturers:** Capital investment from private companies providing materials, products, models and venue hire.
- **Corporate sponsorship or business development-focused training:** Courses offered directly by manufacturers for product-specific training, for little or no charge, to encourage contractors to buy their products.

UK 2 . © Monty Rakusen / Getty Images

2. Introduction

Project background and context

For cities, efforts to reduce building energy use and mitigate associated greenhouse gas (GHG) emissions are key opportunities to respond to the climate crisis. Other important benefits can be realized in reducing air pollution, lowering the cost of living, creating sustainable, local green jobs, and supporting a just transition. These efforts rely on supportive policies and a construction workforce skilled in low-carbon, modern building practices. Construction is the number one employer in most jurisdictions and can accommodate workers of all skills and circumstances. One in 13 Canadians works in construction.

Following the COVID-19 pandemic, current recovery initiatives offer the possibility for cities to make progress on sector-specific climate targets. Cities can play a pivotal role in building demand for new skills to ensure that the right training opportunities are available and enable all those who wish to participate in the low-carbon construction sector to have easy access. The shortage or the presence of a qualified, skilled workforce would be pivotal for cities not only to deliver their net-zero carbon commitments but also to progress towards an economic transformation that allows for an inclusive, equitable and just society.

Efficiency improvements in existing buildings have been encouraged by cities through the implementation of building policies such as limits on energy use, requirements for renovations to bring buildings up to code, retro-commissioning and energy audits to ensure intended performance and use of energy performance certificates or labels on rental buildings.[3]

> C40 mayors identify the actions necessary for a green and just recovery as:
> - creating new, good green jobs, fast
> - supporting and lifting-up essential
> - workers
> - training and upskilling workers to
> - enable a just transition to an inclusive economy.[2]

This research paper focuses on how North American cities can bridge the gap between the building sector and skills training programs to streamline and accelerate the development of net zero carbon buildings (NZCB). It explores the city's role in these programs, with particular focus on **funding models** (which can include private sector-led, public sector-led, citizen-led, and/or partnerships), **coordination** (which includes the city serving as program convener), and **advocacy**. The case studies showcase innovative and successful training models and partnerships. They cast a broad net to capture programs at many levels, serving a variety of those involved in the building sector, with the common goal of reducing the carbon emissions of new and existing structures.

2. www.c40.org/other/agenda-for-a-green-and-just-recovery
3. https://www.c40knowledgehub.org/s/article/How-to-set-energy-efficiency-standards-for-existing- buildings

Finally, there is a suite of key considerations put forward for cities in North America that could also be applied to local authorities in other regions to contemplate as they build their local capacity to deliver NZC buildings. These considerations include investment opportunities in green skills development in the building sector as part of possible COVID-19' Build Back Better' economic recovery spending.

This work contributes to the efforts of three working groups at C40: Green Economy Forum, City Finance Programme, Energy and Buildings Programme, and Inclusive Climate Action Programme. This work will act as a useful resource for the local government members of C40 Cities.

Issues and market trends driving demand for workforce development

Building industries around the world are, by and large, significant contributors to local economies, highly diverse and yet primarily comprised of small businesses. Shifting to energy efficient, low carbon construction practices requires the involvement and buy-in from many companies, individuals and professions, including building owners, designers, engineers, builders, trades, energy advisors, and building officials.

There is an opportunity for the construction industry to overcome its traditional image of being inefficient, unsustainable, unsafe and lacking in diversity. Construction labour shortages are already a problem with an ageing workforce and are only going to grow in the future.[4] Coupled with COVID-19 recovery efforts, new programs to incorporate more modern construction methods that address energy efficiency and low carbon practices and employment practices that are more inclusive and equitable will set the course for the future of construction and help address existing and future labour challenges.

Green Skills' are a general term used in this report to define the capacities and knowledge needed to deliver net zero carbon buildings.

In many cities across North America, a lack of training programs is rarely a problem. In fact, there are numerous NZCB training programs available in most jurisdictions. **The empirical problem is that they are frequently under-subscribed and/or under- utilized because they are failing to align with industry needs.**

The reasons for this misalignment between industry and training are related to:

- the difficulty of access (e.g. inflexibility of schedule or learning modes);
- the cost to participate;

4. https://www.buildforce.ca/en/node/11857

Argentina_© Hispanolistic / Getty Images

- the program structure and content (too much/not enough technical depth or scope);
- a lack of proper promotion and awareness; and / or
- programming is not current enough with the trends and technologies needed by the industry.

These challenges are exacerbated by industry-wide issues that stem from a general lack of cohesion (many construction businesses tend not to be members of associations or unions and are hard to reach) and **a lack of political voice** (in many jurisdictions, the construction industry does not have a dedicated ministry or political representation). The most persistent barriers to uptake of training stem from broader issues that include:

- Many building design and construction companies are small businesses operating within slim margins and do not have surplus human resources or financial bandwidth to invest in training.
- Builders install what owners ask for. Traditional procurement processes focus on the lowest cost, not life cycle value, and owners do not ask for NZC buildings.
- Construction comprises a highly complex supply chain, and all key actors (owners, architects, etc.) need to be familiar with NZCB methods.
- Historically, there has been a lack of a "culture for learning" in construction – apprenticeship completion rates are low (about 50% according to Red Seal Canada[5]). Once complete, there may be little, if any, a requirement for keeping skills current.
- Construction is a very large, slow-moving industry that is highly risk-averse. There is tremendous inertia when it comes to change.

Net-zero carbon buildings come with different client and societal expectations, involve the use of new technologies and require the deployment of different construction processes. The key trades impacted are building envelopes and mechanical, plumbing and electrical workers. An NZCB project's success relies on all trades understanding (and buying into) the project performance goals and working collaboratively. Therefore, "green literacy" is required by all occupations to integrate high-performance, low-emissions technology and equipment, new materials and renewable energy and storage into the building project properly. The entire construction value chain requires a cultural shift that embraces:

- Systems thinking and multi-disciplinary problem solving that moves to holistic decision-making, looking at how constituent parts are interrelated and work within a larger context.

5. “Apprenticeship Completion, Certification and Outcomes” available at www.red- seal.ca/others/outcomes/rpt.4.5tc.4m.2s3-eng.html

- Project delivery solutions that foster true integrated design and collaboration;
- Project delivery solutions that foster true integrated design and collaboration;
- Pre-set KPIs to align multi-disciplinary teams and operationalize tasks and
- milestones of all teams toward a common building performance goal; and
- A culture of lifelong learning and upskilling.

There is not a single solution to meet these challenges. A variety of approaches that address a range of skills is required. Each city will have unique issues and must tailor solutions to meet their needs. For example, cities seeking to upgrade and/or revitalize older, possibly historic, neighborhoods to be more energy efficient and/or use greener and healthier materials will require different skillsets than those seeking to expand their suburbs with new construction. Cities whose existing workforce is transitioning away from a fossil fuel economy will require different types of training programs than those seeking to engage disadvantaged youth.

As building projects get more technically complex (e.g., due to having to achieve stricter energy performance goals), project teams seek opportunities to improve the workers' productivity in order to maintain affordability. Around the world, new powerful digital tools are starting to be used to improve the quality and productivity of the design, configuration, management and delivery of projects – from single-family homes to high rises.

Building Information Modelling (BIM), cloud-based project management platforms, digital tools for design and construction simulation, modelling and optimization, advanced building control systems, building information management to hardware requirements of sensors, meters and networks to gather and integrate building data are just a few of the technologies that need to be understood and considered. Advanced manufacturing and industrialized solutions for construction are just around the corner. This analog to digital shift means that digital literacy will be a foundational skill for everyone who works in construction. New highly technical jobs are already starting to emerge with the advent of prefabricated solutions such as mass timber, "plug-and-play" mechanical systems and modularization.

High-performance green buildings involve the use of new technologies and require the deployment of different construction processes. New digital tools are starting to improve the quality and productivity of the design, configuration, management, and delivery of construction projects. Soft skills are increasingly important for construction workers to operate in

collaborative, multi-disciplinary teams effectively. With the need for greater attention to quality, project teams must also understand the fundamental science behind building energy and environmental performance. To achieve this, the entire construction value chain requires a cultural shift that embraces lifelong learning and upskilling. In addition, integrated design, systems thinking and multi-disciplinary problem solving foster holistic decision-making and collaboration.

COVID-19 and impact on training

Many cities are turning to investments in construction and infrastructure projects to help re-start their economies and create urgently needed jobs after the COVID-19 pandemic. COVID-19 has forced sweeping operational and strategic changes onto cities and businesses, along with a recalibration of priorities. The global climate emergency calls for cities to put green and clean recovery efforts first. With building construction being labor-intensive and buildings being major sources of GHG emissions, many governments have identified encouraging energy efficiency retrofits and new construction of buildings to meet net zero carbon standards as an activity that simultaneously reduces GHG emissions and energy consumption while providing a boost to employment.

The COVID-19 pandemic has changed the way businesses do their work, the way countries and nations manage their resources. COVID-19 has presented an opportunity for societies to reconsider behaviors towards the climate crisis. Both Canada and the United States have followed in the EU's footsteps and have committed to "Building Back Better." The Government of Canada announced in its Fall Economic Statement $2.6 billion over seven years for home retrofits as well as a $1.5 billion investment in skills training for those most affected by job losses and help diversify sectors to include more women and other underrepresented groups.[6]

Building construction and building energy efficiency are labor-intensive. All levels of governments are exploring options to stimulate employment to reduce the impacts of the COVID-19 recession. The Canadian government's expert panel on Sustainable Finance has suggested creating a regional green bank network that would spur an 'on the ground' market for energy retrofits. This initiative could be launched via the competition to create "four long-term funds" for deep retrofits of large buildings, mentioned in ministerial mandate letters, or through funding structures that already exist.[7]

Similarly, retrofitting buildings for energy efficiency is a labor-intensive activity. This process can spur long-term economic recovery

6. Table of Contents | FES 2020' <https://budget.gc.ca/fes-eea/2020/report-rapport/toc-tdm-en.html> [accessed 13 January 2021].
7. 'Expert Panel Sustainable Finance - Canada.Ca' <https://www.canada.ca/en/environment-climate-change/services/ climate-change/expert-panel-sustainable-finance.html> [accessed 13 January 2021].

and help communities meet climate change challenges over the next decade.

A highly trained workforce is critical to delivering low carbon new construction and deep energy retrofits at scale. Cities can play an important role in catalyzing the reskilling and upskilling of the construction workforce. Cities, collaboratively with federal and provincial/state-level governments, will be instrumental in developing and delivering aligned educational programming.

Now is the time for cities to provide a big push for upgrading skills to participate in a green economy. While hands-on training is often preferred, there are a variety of online training options. We already see many training organizations ramp up online offerings. Training will speed up introducing net-zero energy ready building codes and preparing the workforce for a national goal of retrofitting all buildings to achieve a net-zero emissions economy.[8] Cities can aid this effort by providing direct support for training and signalling that green building skills will be in demand in their community.

Included in this report

This report examines NZCB and other construction training programs in a variety of cities and the role cities play in their initiation and day-to-day operation. Many of these programs also support a Just Transition, providing equitable and inclusive opportunities for all those seeking employment.

- **Section 3** describes six categories of training programs. The category groupings reflect similar goals and the issues that the programs address.
- **Section 4** speaks to cities' specific roles and how to embark on a new initiative in one of these categories.
- **Section 5** provides a high-level overview of NZCB training programs' benefits in meeting broader goals for carbon reduction, increased employment, and the Just Transition.
- The methodology, criteria and programs evaluated in the case studies are in the appendix.

8. 'Energy Efficiency's Role in Canada's Economic Recovery - Efficiency Canada' <https://www.efficiencycanada.org/covid-19-part-2-energy-efficiencys-role-in-canadas-economic-recovery/?et_fb=1&PageSpeed=off> [accessed 13 January 2021].

3. Existing Programs and Lessons Learned

Several cities in North America currently provide effective and meaningful training programs for the construction workforce in various formats. Through our research, we identified six categories of programs that address a variety of needs have been identified. Below an overview of those categories, best practices, and an overview of municipal involvement is provided. Appendix B offers more specific details about the programs.

Training models for disadvantaged persons

Skills programs designed for entry-level employment in the construction industry are available in many cities, providing **new opportunities and pathways out of poverty for youth, minorities, women, veterans, indigenous people and the disabled.** These are often positioned as pre-apprenticeship programs, providing basic skills instruction alongside social support. Some programs offer the potential for those who complete the program to be eligible for admission into a full apprenticeship program, therefore, addressing different skills levels.

Generally, these programs offer very basic skills, "micro-credentialling," whereby trainees only learn a very specific or defined task in a program that only takes a few hours. Trainees receive a foundational level of knowledge sufficient to find an entry-level job (e.g., laborer or assistant) on a construction project. Social supports such as transportation, childcare, financial literacy instruction, and financial support during training help to encourage marginalized people to access the programs. Some programs also provide trainees with computer tablets and internet connections.

Advisory panels made up of representatives from the city, trade unions, industry associations, educators and contractors are often assembled to weigh in on matters such as curriculum content and focus, employment needs or sustainability goals, to make sure training is aimed where employment is anticipated to be available and for projects aligned with city priorities.

These training programs can be initiated and supported by city programs at their outset and can grow and continue through public and private donations. **Successful programs are often independent of the city but thrive based on partnerships with them as well as other supporting organizations.** Consultation at the outset with industry and trades organizations, community groups such as churches or youth organizations, and potential employers enables a local definition of each city's requirements, what supports might be needed and what opportunities are available.

While broadly applicable to most construction projects, this very

generic training approach can be adapted to introduce workers to the skills required for NZC buildings or other low-carbon priorities for a city. These "green" skills can then become part of the starting point for a career in construction**. For example, the energy efficiency priorities for rebuilding New Orleans are an essential component of the Louisiana Green Corps training** discussed in the case studies.

Skills transition training for high-carbon industries

Some cities in North America have grown up alongside (and have relied on) fossil fuel industries. Promoting reduced-carbon energy at the local level or other low carbon industries and providing training for the workforce can be a pathway to transition away from fossil fuel-based employment. This is particularly relevant in places such as northern Alberta, home of Canada's oil and gas fields, and the states of West Virginia, Pennsylvania and Kentucky, home to coal mines that have supplied energy for generations. For example, training programs that provide instruction in electrical and other skills required for the solar industry provide green and clean jobs for those moving out of fossil fuel-based employment while supporting new and expanding solar businesses and helping to meet GHG emission reduction policy goals. In this case, the **employment options envisaged with the new skills need to be commensurate in terms of compensation and opportunities for advancement** as for example, the former oil and gas jobs (some of which are extremely well paying) even though they may offer benefits such as improved safety, better working conditions, etc.

Consultation with all stakeholders, including businesses, workers, educators, city officials and Indigenous Nations and peoples, helps to define the current skill levels, training required and anticipated employment opportunities. Programs we have encountered in the case studies also have a strong focus on the inclusion of those who have been left out of the old energy economy, including Indigenous people and women. **For example, Iron and Earth in Edmonton, Alberta incorporates Indigenous principles of knowing and being to apply training appropriate to the territory they are being delivered on.**

Organizations such as these may also offer support in advocating for renewable energy for communities that have relied on the fossil fuel industry. Understanding both the environmental impacts and career pathways involve a changing mindset that can be provided through these opportunities.

City involvement can include **support of the programs through financial or regulatory means, support for businesses transitioning into technologies new to the community, and infrastructure projects** that provide momentum. Cities can

convene dialogues between the various stakeholders. Funding from additional public and private sources, foundations and corporations plays a significant role because a non-profit organization usually operates the programs.

Apprenticeship training models

Apprenticeships are an industry-accepted means of providing credentialled workplace training for the next generation of tradespeople. **City support for apprenticeship programs can increase their quantity, quality and completion rates through funding, incentives, policy and regulation.** For example, an affordable housing project that requires low-carbon materials and energy efficient construction could also require, incentivize or fund apprentices to participate in the construction team. This would increase the local workforce's knowledge of green construction methods.

Establishing, supporting or partnering with the training through organizations such as GPRO (a North America-wide initiative of the Urban Green Council, described in the case studies) gives cities a voice in the design and execution of training needed to advance their local policy goals. Apprenticeship programs are highly regulated, and making changes can take time. Having clear strategic objectives to pursue and then creating a structure that binds the training to the city's objectives is recommended. The UK

New York © Marco Bottigelli / Getty Images

Apprenticeship Levy has received criticism for the quality and types of training that have resulted because the funds available are used in any vocation, not just those seeking support. There is little follow-through on accreditation of educators, resulting in some poor offerings that lack industry engagement.

Businesses see value in apprenticeship programs as they can produce more well-rounded individuals and professionals who are suitably prepared for the tasks required. Partnerships with trade unions, educators, and non-profits such as the USGBC* or CaGBC** can be vital to design programs that support low carbon skills in an efficient manner that provide the appropriate workforce.

Institutional training delivery model

Institutional Training describes programs that offer more comprehensive instruction in the trades and can offer upskilling for the current workforce interested in more modern methods or skills required for the latest market trends. These programs can be part of a certificate or degree program or taken for credits applicable to professional licensing requirements. **Two examples are the City University of New York (CUNY) Building Performance Lab (BPL) and the British Columbia Institute of Technology (BCIT) High-Performance Buildings Lab (HPBL).**

BCIT offers its own courses and hosts other compatible programs (such as courses offered by Passive House Canada), and provides a cross-disciplinary, highly collaborative environment for architects, engineers, environmental scientists and builders to advance their skillsets to meet the requirements established by British Columbia to meet low-carbon construction goals.

To get the HPBL off the ground, the City of Vancouver provided letters of support and promotion through their network. They also provided gap-filling funding to reduce the overall cost and support participants who are working on city projects. Additionally, permitting officers were hired to work with participants to improve building performance. For example, if airtightness targets were missed slightly by a project attempting the Passive House standard (which would result in the project not getting certified), occupancy permits would still be granted if additional training is taken to improve capabilities for the next project.

HPBL courses are aligned with net zero, and Passive House requirements for City Request For Proposals' (RFPs) and proof of training is mandatory to win bids on these projects. Some courses are also eligible for professional development credits and accreditations required for builder licensing.

BCIT's HPBL may be unique in its singular dedication to high-

*US Green Building Council (USGBC)
**Canada Green Building Council (CaGBC)

performance building construction and its promotion of cross-disciplinary collaboration. The courses are offered through a combination of classroom instruction and work in the lab where a trainee can get hands-on experience building mock-ups, installing equipment, etc.

Classes have pivoted during **COVID-19** to have an instructor work in the lab with a **live demonstration of techniques over a video feed**. While the environment and collaboration of working in the laboratory is missed with this method, it became available to more students. **The cost was significantly reduced and grew from a class size of 10-25 people to 130 students online, with everyone having a "front-row" seat.**

Plans are in the works to expand the program, possibly providing training for indigenous communities to renovate buildings such as schools or designing specialized camps for women, at-risk youth, or other underserved groups. This would increase the workforce available to local developers and provide easier access to better corporate social responsibility pursuits.

Knowledge exchange centres

Forums for the green building industry to share best practices, advance their skills, and provide exhibits and technology demonstrations have been established across North America. The two leading examples are in New York and Vancouver, Canada.

The Building Energy Exchange (BE-Ex) in NYC was established in 2010 to facilitate knowledge exchange on energy efficient buildings. Staffed by industry experts, BE-Ex has grown to provide research, education, and a hub for information exchange such as exhibits and lunch 'n' learn talks about the principles of Passive House. These sessions improve understanding about what it is, why it is important, and how it fits into the climate action agenda. New offerings are taking it to the next level with components on topics such as insulation, ventilation, and thermal bridging, all in bite-sized pieces. They address the needs of professionals who wish to understand Passive House standards but do not require certification.

The Zero Emissions Buildings Exchange (ZEBx) is the Vancouver forum set up more recently following Be-ex's example. It was founded through seed funding from the City of Vancouver and is also supported by other public and private sources. ZEBx supports the city's zero emissions building plan by facilitating knowledge sharing and curating resources into more accessible content. Their focus has been events for both designer-level and construction audiences discussing zero emissions buildings for new construction and is now growing to include existing buildings and retrofits. In addition to events and research, ZEBx has started the Near Zero program, which incentivizes participants to

share performance data on electrification for new construction.

These centres catalyze the conversation among owners, developers, and city officials about the steps required to produce more zero emissions buildings. They attempt to bring municipalities together with owners and developers to work out issues with rezoning, permit applications and inspections, and train government workers to understand these buildings and their systems.

There are challenges in finding appropriate partners and funders to achieve their goals, which can impede progress. Without building performance disclosure legislation (where buildings are required to regularly report and display their energy efficiency and GHG performance data as is common in the EU), owners and developers may be reluctant to share building project performance data. They may also hesitate to be critical of city services so as not to damage existing relationships.

In addressing the just transition, the New York and Vancouver exchanges support women and minority speakers when possible while maintaining a representation of the audience's demographics. In 2019, ZEBx launched the Women4Climate Mentorship Program, a collaboration with C40 Cities and the City of Vancouver[9]. Some cities have also encountered challenges with reaching their audiences in multiple languages or serving disadvantaged neighbourhoods that may be less trusting of city officials. For example, there is a business in NYC that is working with churches to do retrofits to gain footholds and earn trust in communities while raising awareness and understanding about energy efficiency. City-supported centers can use similar innovative approaches to reach a larger segment of the population.

The knowledge exchange centers expand the conversation about energy and emissions from the city to developers and workers so that there is a broader understanding of why changes are being made, the differences in construction, and the anticipated outcomes for building occupants and for cities as a whole. Several other cities are developing centers based on these examples.

Utility Rebate-based training models

The Utility Rebate/Skills Registry category describes programs where tradespeople who earn credits for different skills training can be listed on registries of qualified workers. Often these lists are available from utility companies, whereby hiring someone from the list to conduct energy efficiency retrofits for a home or building will qualify the owner for a rebate on their energy bill in addition to future energy savings.

Municipalities support the training programs that align with changes

9. https://vancouver.ca/green-vancouver/women4climate-mentorship-program.aspx?utm_campaign=w4c&utm_ medium=Vanity&utm_source=w4c_Vanity

to the building code or carbon reduction goals. This support can be in the form of coordination of permitting offices, utilities and educators, financial support for classes, official recognition for contractors, advisory services for course content, and promotion of the program through its network.

This method incentivizes owners to conduct retrofits and renovations sooner, in more energy efficient ways, using qualified contractors to ensure the best outcomes. It has been used to train women and minorities who might otherwise have difficulty acquiring those jobs, as well as workers who may have lost employment in other industries.

In North America, the PACE (Property Assessed Clean Energy) programs offer long-term financing opportunities for clean energy renovations that can be repaid through property taxes..

Linking these programs with city-wide skills registries would provide quality assurance to property owners and incentivize contractors to seek proper training.

What makes a good training program

Each city will have its requirements for filling the gaps in its NZC construction workforce. However, there are some common traits to all these solutions that will support those efforts. It begins with taking the time to develop a deep understanding of all stakeholders' needs, from the design and development level to contractors, trade unions, the current workforce, and those seeking employment as newcomers to the industry. The benefits of using NZC methods must be promoted to owners and designers. Roadblocks that may hinder owners from embarking on innovative construction projects, or methods

Phoenix © LordRunar/Getty Images

they are not familiar with, must be identified to craft solutions. Similarly, support systems to allow those seeking employment better access to training and entry into the workforce must be addressed.

The program's design must be aligned with the city's strategic goals and priorities, and engagement must be maintained throughout the program to maintain quality standards. Engagement with stakeholders to determine strengths and weaknesses and follow-up actions will sustain the programs. An advisory panel to define and implement these actions will provide a broad perspective and network.

Funding model considerations

Funding models for skills development come in various forms: private sector, public sector, citizen-led, and partnerships comprising a combination of players.

Funding Models for Green Skill Training Program	Description
Direct Payment	Direct payment from the participants for training by building construction workers and their employers.
Training Levy / Apprenticeship System	Resourced by a levy on employers based on a percentage of reckonable earnings of employees in certain employment courses, which is collected through a centralized system (federal or provincial/state, depending on country). This funding model is used in the QualiBuild Program.
National Training Funds	Grants from the federal government to support national strategies.
State/provincial level funds for training	Grants to support state or provincial initiatives.
Energy Companies & Financial Institutions	Financial contributions from electricity or gas utility companies as well as construction pension funds.
Building Products Manufacturers	Capital investment from private companies providing materials, products, models and venue hire.
Corporate sponsorship or business development-focused training	Courses offered directly by manufacturers for product-specific training, for little or no charge, to encourage contractors to buy their products.

4. Recommendations for Municipal Leaders on NZCB Skills Development

Cities of all sizes have a leadership role to play in fostering alignment of green skills training programs with municipal policy, building performance and standards. As authorities having jurisdictional control over local building performance standards, cities can guide the building sector by creating a net-zero building vision with corresponding goals and targets. Where cities have more limited power over building codes, they can advocate for change with state governments to realize their NZCB vision. The cities can act as a "north star" to create alignment between the building industry and the workforce that serves it and collaborate with other local governments in the region and with other government levels.

The building industry is large, diverse and risk averse. There is a role for municipalities to play as facilitators and convenors between the building sector and the building-related training institutions and delivery agents to foster cohesion. Cities can create a forum that builds industry alignment with local policy goals. As a result, municipalities help to streamline the workforce and advance the skillsets required to support policy direction, in this case, towards net zero carbon buildings.

Within the building sector, there is a wide diversity of training that pertains to the NZCB sector. Cohesion between the training programs and the building industry needs to ensure there is an educated workforce that can meet the policy goals, targets, and related timelines, without excessive risk to the industry, building owners, and the public at large. Municipalities are well-positioned to play this role.

There is also a role to play in secondary education, promoting interest in the trades and green buildings to youth, and strengthening STEM education programs. Jurisdiction over curriculum programs vary widely across North America, however cities can play a role as advocate for careers in the trades and education to support success in those disciplines.

The section below describes how municipalities in North America and other regions can drive industry cohesion between the green skill training programs and the construction sector to streamline net zero carbon building policy goals.

Fostering industry cohesion

- **Develop a forum for industry, trade unions, and training program delivery agents to connect.** Providing a platform to connect fosters cooperation , builds buy-in, as well as provides

municipalities a better understanding of the needs and priorities of the various stakeholders. Enabling a building specific platform for City officials and staff to connect with industry and training organizations can increase a culture of collaboration and innovation.

By creating a platform for dialogue between the construction value chain and skills training organizations, municipalities can ensure a diverse representation at the table and use the platform to address equity and inclusion. By developing a forum, the municipality can establish a mechanism to work with training program providers and industry to set building performance targets and standards and ensure training pathways advance toward the desired outcomes in harmony with industry and the workforce's ability to deliver.

- **Create partnerships with local training program administrators.** Municipalities that develop partnerships with training program administrators create an opportunity to align local building performance standards and goals with the next generation of trained professionals. Partnerships with training program providers and the construction industry can take a variety of forms with various objectives. Within a partnership, municipalities can act as program advisors and share local priorities with training administrators. As well, municipalities can provide training opportunities on government-owned properties (new construction and retrofit) in collaboration with local training program providers, providing 'hands on' learning opportunities.

- **Incentivize training.** Municipalities can drive industry cohesion by encouraging relevant green skills training programs within the construction sector. Municipalities can create incentives before or after building construction. For instance, within a building-related RFP, there is an opportunity to embed requirements for relevant training qualifications and/or certifications as a pre-requisite for successful bidders. In addition, after building construction, buildings that cannot achieve compliance in accordance with a high-performance or net zero carbon building standard, the construction company can be required by the municipality to participate in airtightness or other relevant training. Local gas and electric utilities can provide financial incentives to industry contractors that participate in NZCB training. Cities can partner with utilities to provide rebates for training and skill development.

- **Funder of green skill training programs.** Municipalities

can champion green skill training programs by providing financial support (cash or in-kind). Acting as a funder to a training program often enhances the credibility of the training program and helps the program secure third-party funding from other sources. There are several ways a municipality can provide funding to a training program, including training levies, sponsoring programs, and providing a stipend to training participants. Municipalities can prioritize their financial support to disadvantaged persons and programs that focus on addressing diversity and inclusion. Cities can provide in-kind support such as space for training within their municipally owned buildings.

- **Program marketing and promotion.** Municipalities can support the promotion of green skill training programs by advertising the program through their networks and marketing channels. By promoting relevant training programs within their local communities, they can increase the participation rate of programs. By promoting locally relevant green skill training programs, municipalities can enhance the program's credibility, which can help programs gain access to additional funding and increase enrollment. Municipalities can streamline training program promotion by creating an education "hub" where all programs are promoted in one place.

- **Emphasize support to training programs that address a Just Transition.** Municipalities can create opportunities for diversity when they act as convenor and facilitator between the local green skills training organizations and the building industry. Municipalities, as the hosts or chairs of the engagement platforms, can select diverse representation and appoint diverse leaders to the table, as well as advise on topics of discussion and appoint resources to address them.

  Municipalities can prioritize their financial support to training programs with an equity and inclusion lens. In addition, municipalities can develop grants, bursaries, or stipends for minority participants to reduce accessibility barriers for green skill training programs. Moreover, municipalities can carve out partnerships between green skill training programs and the construction industry that create employment pathways for training participants.

Where should cities start?

Cities should start with a solid understanding of the strengths and weaknesses of their current building and market environment. An analysis of current policies, building standards, expertise, and educational opportunities is important. A market analysis can

can determine how the policies and the market are aligned with the cities' goals. This will provide insights into priorities for workforce gaps that should be addressed. A market analysis of the economic impact of planned changes to policies will help shape those policies and the programs implemented and will help bring stakeholders on board.

Cities should focus on starting a forum to share knowledge, best practices, encourage innovation, and promote enthusiasm for NZCB methods. A forum might be an advisory committee or an online hub. It is a virtual and/or physical space where knowledge is shared with a goal to build cohesion in the sector. The forum is a place to collaborate with trade unions, educators, contractors, and designers to identify the roadblocks and where more training is needed will facilitate NZCB projects.

It is a place to understand accessibility issues to train disadvantaged segments of the population and pave hiring pathways into the net zero building industry. Prior to starting a forum, it will be important for cities to determine guiding objectives so that the City can prioritize the forums intent and key stakeholders to include.


Washington_ © Glowimages / Getty Images.jpg

High level steps for developing a forum

Understand issues and address the needs of the community	Placing the needs of the community first will catalyze alignment with green skill training opportunities.
Take the time to develop a deep understanding of all stakeholders' needs	Make sure to align program design with the city's strategic goals and priorities.
Map the construction, NZCB and green skill and training ecosystem	Understand the key actors and the connections between them. Consult with key stakeholders to test and validate any assumptions made.
Consult industry	Connect with trades, designers, contractors, educators to determine what projects are needed to meet NZCB goals, what skills are missing, and how to deliver training for their communities.
Maintain engagement throughout the program to maintain quality standards.	Set up an advisory panel to define and implement actions and provide a broad perspective and network.
Develop a strategic plan	A strategic plan with energy consumption and building GHG emission will define an optimal path. Include an analysis of finance pathways to operationalize initiatives.
Set up a centralized office to manage the initiative	A centralized office will focus efforts to enable policies, cooperation between industry and zoning, permitting, and communication between regulators, designers, trades, and educators.
Identify partners	Key partners that can contribute to the development of the forum and help to secure buy-in from industry and the community.
Centralize training and education resources and support systems for public access	Centralizing resources is an important for building industry cohesion. Put in place support systems to allow those seeking employment better access to training and entry into the workforce.
Secure bottom-up and top-down support for their policy agenda	Community, Mayor, council, and staff support to develop a forum for training programs and industry to collaborate will help to secure capacity and resources to dedicate to the development of the forum.

5. Conclusion

Key considerations for cities

Buildings are a major source of GHG emissions, but cities have control of them (i.e., buildings are locally regulated), and buildings can be a force for good in the fight against climate change. Cities have an opportunity to advance the development of the construction sector, NZCBs and green skills within their community.

Construction is the number one employer in most jurisdictions and can accommodate workers of all skills and circumstances. One in thirteen Canadians work in construction[10]. Construction comprises a highly complex supply chain, and all key actors (owners, architects, etc.) need to be familiar with (and value) energy efficient design. The development of soft skills (communication, teamwork, leadership, etc.) will be increasingly important for construction workers to effectively operate in collaborative, multi-disciplinary teams. Modern construction methods that save energy, produce more comfortable, healthy buildings, and reduce carbon emissions will attract both the construction leaders and inspire youth to consider a career in construction positively, not as a job of last resort. This forum can contribute to changing the mindset of business-as-usual that has persisted in construction.

The analog to digital shift is only getting started for the construction industry. Digital literacy will be a foundational skill for everyone who works in construction. Highly digitized fabrication will require workers training in digital and technological skills as much as construction.

There is a shift happening in the construction sector driven by persistent labor shortages and the availability of digital technologies driving the need to invest in new skills. This, together with the suite of COVID-driven, "build back better" investments, offers cities the perfect moment to get started. Low carbon buildings require companies to embrace innovation. Innovation is attractive to the workforce of tomorrow.

Cities have an important role to play, but their primary and pivotal role is as goal setter through short and long-range policies and as the convener to ensure existing programs are properly utilized and curricula are up to date with policy goals. By acting as a facilitator between green skills training program providers and the building industry, cities will be able to contribute to a cultural shift across the entire construction value chain. Cites that create a "virtual table" for the building industry and training organizations enable a platform to create industry alignment.

A cohesive training and building sector can result in a pipeline of trained workers that can achieve the local building standards goals and performance targets.

Net Zero Carbon Buildings require a highly collaborative and integrated

10. *Meeting Construction and Maintenance Workforce Challenges National Industry Strategy*, 2015 <https://www.constructionforecasts.ca/sites/forecast/files/pdf/Meeting-Construction-and-Maintenance-Workforce-Challenges-Sept-2015.pdf> .

approach across the construction value chain. An NZCB project's success relies on all trades understanding (and buying into) the project performance goals and working collaboratively. A culture shift is therefore required across the entire construction value chain that embraces:

Cities are well-positioned to facilitate the development of programs and play the role of "cohesion builder" for the stakeholders across the construction value chain, including green skill training program administrators. Cities can act as a promoter of net zero building initiatives and convener of innovative ideas. The city's primary role could be as a convener and forum for dialogue, advising to align programs with city policies and goals. Ultimately, a more cohesive building sector will increase the resilience of buildings and reduced building sector emissions.

Los Angeles_© Ron and Patty Thomas / Getty Images.

Appendix A: Methods & Approach

Literature review and jurisdictional scan

To ground this work, a high-level literature review and a jurisdictional scan of existing resources and leading skills training programs and models for green and net zero carbon building construction was conducted, with a particular focus on innovative funding and partnership models, as well as the role of cities in their delivery. The focus of the research was North America, Ireland, UK and Germany. The information on 'best practice' training models was collated in a spreadsheet-based inventory. In addition, the research identified how NZCB industry and market trends drive the demand for new training program development and the innovative funding models and partnerships required.

Evaluation criteria for training programs

The training programs identified in the research were evaluated against the following criteria:

- Name of Training Program and Launch Date
- Jurisdiction (City + Province / State / Country)
- Lead Administrator and Key Partners
- Program Description
- Role of the local government
- Delivery Model (In-person, virtual, hybrid, Theory vs Experiential, applies, mentorship etc.)
- Target Demographic (e.g., BIPOC, distressed Zip Codes, women, other disadvantaged populations)
- Technical focus (new construction, retrofits, homes, multifamily, etc.)
- Target skills (i.e., energy modelling, building science, envelope, HVAC, etc.)
- Targeted Subsector (e.g., trades, engineers, architects, energy advisors, building officials, etc.)
- Target Career Level (mentorship, (pre-)apprenticeship, post-secondary education, professional development, mid-career re- or upskilling
- Funding Model (e.g., private, public, public-private, NGO, citizen-led, community-based etc.)
- COVID-19 Impact & Adaptations
- Relevance to equity and just transition
- Name of Certification and Outcome
- Co-benefits, Skills and Gaps

Key informant interviews and case study development

Case studies and best practice models were developed to showcase best practices and lessons learned from leading green skills training programs to inform how cities can best position themselves to enable net zero carbon buildings through green skills training. Particular attention was paid to how and/or the extent to which training programs align with the needs of industry and workers, including around

accessibility and program flexibility (e.g., unconventional delivery models), how they have overcome cost barriers to participation, how they have handled awareness building, and how they integrate the latest technologies.

To complement the case studies, 13 key informant interviews with training program funders or administrators were conducted to gather more detailed information, understand the target audience challenges and issues with program development, as well as the success factors, cost effectiveness and other key metrics, and if/how a 'just transition' and equity lens was applied.

A summary of this research can be found in the PowerPoint deck provided to C40 Cities, as well as in the Appendices.

The list of training programs below is analyzed in greater depth. More details are provided in Appendix B:

Training Models for Disadvantaged Persons
- Priority Hire, Seattle, Washington, USA
- GRID Alternatives, Los Angeles, California, USA
- Highway Construction Careers Training Program, Illinois, USA
- Louisiana Green Corps, New Orleans, Louisiana, USA

Skills Transition Training from High-Carbon Industries
- Iron and Earth, Alberta, Canada

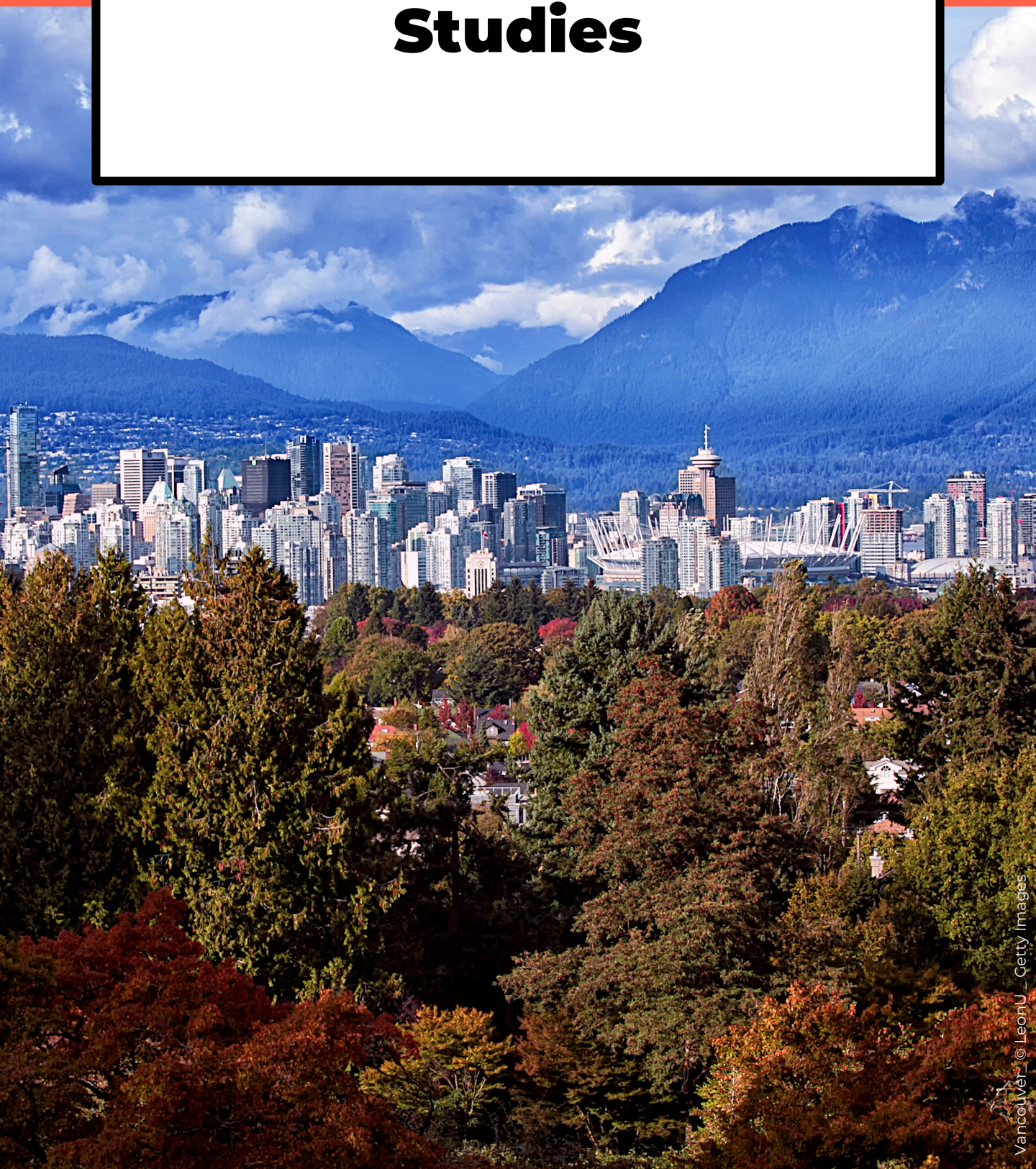
Apprenticeship Training Models
- UK Apprenticeship Levy, UK
- GPRO, New York City, NY, USA

Institutional Training Delivery Model
- High-Performance Buildings Lab, BCIT, Vancouver, BC, Canada

Knowledge Exchange Centers
- BE Ex building energy exchange, New York City, NY USA
- ZEBX, Zero Emissions Building Exchange, Vancouver, BC, Canada
- AHDLI, Affordable Housing Design Leadership Institute, Multiple Cities, USA

Utility Rebate-based Training Models
- QualiBuild, Irish Green Building Council, Ireland
- CleanBC Better Homes Program, BC, Canada

Appendix B: Case Studies



Vancouver © LeonU – Getty Images

Training Models for Disadvantaged Persons

1. Louisiana Green Corps – New Orleans, LA (USA)

The Louisiana Green Corps began in New Orleans after Hurricane Katrina with the vision of building a greener and more equitable city. It was created jointly by a partnership of other organizations with support from the city. It is now a non-profit organization offering youth and young adults opportunities to learn and develop skills through construction and conservation projects that benefit the community and environment.

Best Practices

Partnering with community groups to gain support drives interest in participation in the program as well as hiring from the program among local businesses. Enhancing relationships with trade unions and industry associations to understand workforce needs and what type of training will best meet those needs is an ongoing process.

The support of soft skills in addition to construction skills and assistance overcoming social obstacles provides opportunity to those who would otherwise have challenges participating.

Funding Model

The Green Corps is financed through a combination of public and private funding, including support from the Workforce Innovation Opportunity Act, the Department of Children and Family Services, the Kellogg Foundation and JP Morgan Chase. Recent increases in funding have allowed them to double the number of programs offered, with dedicated classes for a deeper dive into both green infrastructure and stormwater management. Partnerships with some corporations have supplied tools and resources, including tablets and internet access during COVID-19 for some online training.

Just Transition

This program has a strong focus on the just transition. Participants are predominantly from disadvantaged neighborhoods that have historically provided fewer opportunities for young people. Providing soft skills, social supports such as transportation and childcare, and basic skills such as construction math and personal finance, enhances the opportunity and gives them a better chance of succeeding. Four times a year, 15-20 people begin the training, with 91% obtaining employment at the end of the program.

Website:
https://www.lagreencorps.org

2. Priority Hire – Seattle, WA (USA)

The Priority Hire program in Seattle was created in 2015 for City public works construction projects of $5 million or more, in 2017 it expanded to public/private partnership projects with significant City investment.
In 2020, due to Covid-19, there was a shift to focus on worker retention (Construction Recruitment, Training, Job Readiness and Retention) in collaboration with community-based organizations:

a. Apprentice and/or journey worker retention support to increase the number of Priority Hire individuals that stay in and advance in construction careers
b. Recruitment of Priority Hire individuals, with a focus on those who are also justice system-involved
c. Pre-apprenticeship construction training and/or job readiness services.

Best Practices

As with other cases, strength is found through partnerships, in this case with the Port of Seattle, Sound Transit, unions, the apprenticeship programs and community-based organizations, bringing everyone to the table. A hope is that community-based organizations will partner with unions and pre-apprenticeship and apprenticeship programs. Priority Hire invests in community awareness, training and ongoing support in the worker pathway. Workforce requirements and goals are set on public works & City public-private partnership projects. All stakeholders and partners are engaged throughout development and implementation.

Funding Model

Annual collaborative funding of the City of Seattle, in partnership with the Port of Seattle and Sound Transit, recently sought proposals for the Construction Recruitment, Training, Job Readiness and Retention using public funds ("local dollars", internal revenue). An estimated total of $1,754,000 will be available for the program period of January 2021-December 2022. The COVID-19 pandemic response caused no change in funding.

Link to Just Transition

The program prioritizes the hiring of residents that live in economically distressed areas, particularly in Seattle and King County. In addition, City projects and public/private partnership projects have apprentice utilization requirements and women and people of color aspirational goals. Recruitment, training and support services are provided for workers living in economically distressed ZIP codes, women and BIPOC (Black, Indigenous and people of color). Priority Hire is designed to reduce economic inequities by opening doors to well-paying construction careers for underrepresented groups to enter and maintain employment.

Website:
https://www.seattle.gov/purchasing-and-contracting/priority-hire

3. Highway Construction Careers Training Program – Illinois (USA)

In Illinois, the Department of Transportation has developed the Highway Construction Careers Training Program (HCCTP) in cooperation with the Chicago Building Trades Council and local colleges for pre-apprenticeship training for construction applicable to highways and building construction. This program is unique in its relationship with both the colleges and trade unions to understand the current and anticipated market for construction, the skillsets required, and the gaps in those skillsets.

Best Practices

From the outset of the program, the HCCTP administrators consulted with trade unions, city offices and colleges to develop an understanding of what employment opportunities were available and what skillsets were needed. Developing a platform for this conversation aided in establishing buy-in and cooperation from those who would be doing the hiring and designing the training to prepare students for what would be required. An Advisory Board continues to direct dynamic offerings of courses based on the anticipated needs of industry and openings in trade union apprenticeships.

Funding Model

The Illinois Department of Transportation is a state agency which partially subsidizes schools to provide the training and reimburses contractors who hire apprentices from the program $15/hr per employee. The state funding has been consistent, and the program has not needed to seek funding from other sources. The relationship with the community colleges as a state agency allows the program to allocate funding through an agreement rather than through a procurement process, which simplifies the approach.

Just Transition

The HCCTP is intended to provide better access to minority groups, disadvantaged persons, and women in construction, with its recent classes consisting of 58% Black, 8% Hispanic, and 20% women graduates.
Following HCCTP, students are better prepared for other programs in the Chicago area, such as Hire360, which assists with apprenticeship opportunities for minorities and employment in the trades.

Website:
https://idot.illinois.gov/about-idot/employment-opportunities/specialized-training/highway-construction-careers-training-program

Skills Transition from High Carbon Industries

4. Iron and Earth – Alberta (Canada)

Iron and Earth, located in the province of Alberta, Canada, provides an introduction to Solar Photovoltaic (PV) System Design for fossil fuel industry workers transitioning to careers in solar. Programs are available for electricians and laborer's.

Best Practices

Training is designed to be paired with hands-on project experience. The pandemic created a need to shift to hybrid models of program delivery. Some of the training is suitable for remote learning, and this also allows workers to spend less time away from work.

Funding Model

Funding is currently provided through Energy Efficiency Alberta and the Municipal Climate Action Fund. This is supplemented by foundation funding. Likely opportunities to scale up the program with federal funding for the development of remote learning programs. Further interest from energy companies interested in the transition to net zero.

Just Transition

Training is designed for people who have been left out of the old energy economy – a goal is to make the training welcoming to women. Developed in partnership with Louis Bull Tribe, and they are co-owners of the training programs. Curriculum was developed in partnership with elders, represent Indigenous ways of knowing and being, and can be applied differently depending on the territory they are being delivered on. Program enrollment prioritizes either 50% women or 50% Indigenous workers.

Website:
www.ironandearth.org

5. GRID Alternatives - Oakland, CA (USA)

GRID Alternatives provides hands-on solar PV installation training and experience to marginalized persons while installing solar electric systems for low-income families in LA region. The program has been in operation for ten years and operates under a 12-week program structure. The program trains approximately 60 people each year.

Best Practices

GRID Alternatives works with the local community to design programs that meet their needs and empowers each community to create job opportunities in the green building sector by offering entrepreneurship training. They have developed strong relationships with employers so that once training is complete participants have access to jobs in the sector. e.g., job fairs within partnership with industry associations.

Funding Model

GRID Alternatives relies on a layered funding approach and partners with local municipalities, corporations and foundations to provide the systems; businesses and community and technical colleges to provide job training; and non-profit organizations, affordable housing providers, and other community organizations to reach the families the receive roof top solar installations.

Just Transition

GRID Alternatives works with formerly incarcerated individuals, at risk youth, veterans, people of colour and women. Some program participants received a stipend to participate in the program. The paid training component of the program helps to increase the programs accessibility for disadvantaged persons. GRID Alternatives partners with a variety of organizations to provide "wrap around services" such as mental health services, legal support and access to transportation.

Website:
https://gridalternatives.org/

Apprenticeship Training Models

6. Apprenticeship Levy - (UK)

A longstanding decline in employer investment prompted the UK to try to reverse the trend in 2017 by implementing the Apprenticeship Levy to increase the quantity and quality of apprenticeships. However, a lack of strategic objectives or structure in the program aligned with goals for the workforce has allowed for misuse. Businesses value the apprenticeship program because it produces more well-rounded individuals and professionals and still hope to see it expanded. They are seeking adjustments that allow it to operate as originally intended.

Best Practices

The example of the UK Apprenticeship Levy provides lessons for other governments on strategies for implementation. In this case, there was no emphasis on specific industries or skillsets which were in demand by industry. Insufficient follow-through also resulted in poorly run programs whose accreditation may have been misguided. To be more successful, the program might have been set up to address industries lacking appropriately skilled workforce, including NZC construction. Follow-up should be conducted on newly accredited training programs to ensure quality and relevance to required skillsets. Oversight is needed to ensure the program is being conducted as intended with the appropriate regulations.

Funding Model

The levy is paid by large employers with a pay bill of over £3 million (2% of employers). They pay 0.5% of their total annual pay bill into the levy. Those funds are then accessible by those employers and other SMEs to fund apprenticeships.

Just Transition

There is no specific just transition focus. The program has 10-11% minority participation.

Website:
https://www.gov.uk/government/publications/apprenticeship-levy-how-it-will-work

7. GPRO – New York City (USA)

GPRO (Green Professional Skills Training) is an international training and certificate program based in New York City that aims to teach the principles of sustainability and trade-specific green building construction knowledge to people who build, renovate and maintain buildings. It is targeted towards experienced building professionals (e.g., building operators, plumbers HVAC technicians etc.) who seek to integrate green practices into their existing trade.

Best Practices

The curriculum is developed in collaboration with industry to incorporate best practices. Program delivery is flexible in order to meet the needs of the target audience (existing building professionals) and is offered online and in-person (pre-COVID). GPRO also has selected delivery partners that are authorized to provide training to organizations and the general public in local markets or to audiences at member organizations, such as unions.

The content incorporates sustainability education, stressing the 'why' behind the focus on sustainability and helping the participants draw the connection between their jobs, skills development, and purpose-driven work. This includes an action-oriented follow-up, where all participants complete the training with key action items to focus on.

Stakeholder engagement (e.g., unions, educational institutions, employers, USGBC, CaGBC etc.) is a key factor in marketing and success. Market trends and policy are a key driver for participation e.g., NYC's Climate Mobilization Act or Local Law 97.

Funding Model

GPRO is run by the Urban Green Council, a non-profit organization, with partial funding provided by NYSERDA. Delivery partners include unions, green building associations, educational institutions, employers – real estate and construction firms, who also have additional avenues for funding. Fees are also charged for the program.

Just Transition

Efforts are underway to improve opportunities for marginalized groups. GPRO is looking to reincorporate environmental justice content as part of the curriculum.

Website:
https://www.gpro.org/

Institutional Training Delivery Models

8. BCIT High-Performance Buildings Lab - Vancouver, BC (Canada)

The High-Performance Buildings Lab of BCIT (British Columbia Institute of Technology), BC Energy Step Code[11] courses and the Passive House training[12] program are part of BCIT's School of Construction located in Burnaby, British Columbia. The courses are targeted to the construction industry to support the transitioning to the BC Energy Step Code, the City of Vancouver Zero Emissions Building bylaws and the changes to Canada's National Building Code.

Best Practices

The City of Vancouver heavily promoted the program in their newsletters and covered 50% the cost of the training program for participants who were working on any city related projects. This resulted in half of the class participants receiving a program grant from the city. The training program linked City building performance targets, e.g., if builders do not meet the City's air tightness target by a small fraction, the City will approve the occupancy permit under the conditions that a person from the builder's team attends the Passive House training program.

Funding Model

BCIT's High-Performance Buildings Lab, BC Energy Step Code courses and Passive House training program are funded by the Province of BC, WorkBC, BC's Real Estate Foundation, Vancity, BC Hydro, BC Housing, City of Vancouver and Fortis BC.

Just Transition

The programs offer grants to programs participants funded by the City of Vancouver and WorkBC to increase the accessibility of the program. The High-Performance Buildings Lab is partnering with the Construction Pension to deliver training to marginalized communities so enable pathways to employment in the construction industry.

Website:
https://commons.bcit.ca/energy/research/high-performance-building-lab/

11. https://energystepcode.ca/
12. https://www.passivehousecanada.com/

Knowledge Exchange Centers

9. BE-Ex – New York City (USA)

The building energy exchange (BE-Ex) is a New York City forum supporting the strong climate action agenda in the city and state, connecting real-estate and design communities to energy and lighting efficiency solutions through education, exhibitions, technology demonstrations and research. They facilitate resources for building decision-makers and nurture partnerships with other organizations to develop outreach to a broader audience. Their efforts have a strong focus on retrofits to assist with response to Local Law 97 which was passed in 2019, requiring existing buildings to limit their carbon emissions or face penalties beginning in 2024.

Best Practices

BE-Ex provides access to a variety of resources to support NZC construction, including:

- monthly symposia designed for stakeholder engagement on topical events
- exhibits which are hands-on experiences about energy efficiency, displaying technology and inspiring action
- educational forums, technology demonstrations, and professional training programs to affect change in the building industry by advancing progressive discourse on high-performance, low-carbon buildings.

Their courses are defined by market conditions, defining gaps in current capacity and skillsets, and anticipated regulations that may require further training.

Funding Model

A significant portion of funding for their programs is provided by NYSERDA, a public benefit corporation which uses fees from utility bills throughout the state to support innovative energy solutions. Additional funding is provided by other public and private corporations, memberships and professionals within the community. There has been discussion of a subscription service, where be-ex would help other cities set up a similar center and share content.

Just Transition

BE-Ex works with the NYC Accelerator to understand the challenges faced by neighborhoods that experience high levels of pollution and poverty in an attempt to transform their services to better serve disadvantaged neighborhoods. They are also working on developing programming in more languages and partnering with other organizations to broaden their network.

Website:
https://be-exchange.org/

10. ZEBx – Vancouver, BC (Canada)

In Vancouver, the Zero Emission Building Centre (ZEBx) is a center to support the goals of the City's zero emission building plan. The City of Vancouver was instrumental in setting up the center and drew on the example of be-ex in NYC. Currently the role of the City is as a partner and advisor as ZEBx becomes more established and autonomous. The center is a forum for innovation in the building industry, enabling a creative culture between different professions in construction to collaborate on issues surrounding zero emissions. One of their main goals is to identify and support the removal of barriers such regulatory, research and knowledge gaps, supply chain limitations, etc.

Best Practices

The current focus is on new construction, with expansion planned into topics of embodied carbon, and existing buildings and retrofits. Activities are focused in three main areas:

1. Events – webinars, workshops, dialogues, seminars, tours, technology demonstrations – to disseminate knowledge surrounding zero emissions building and share best practices.
2. Resource development – case studies, technical playbooks for high performance construction, trend analysis for new construction and its performance, policy guides for industry.
3. Incentivizing
    - Using their platform to provide a channel for leaders and innovators to share expertise with the construction community while promoting their services.
    - Near Zero - financial support promoting electrification through shared knowledge of operational performance data, construction costs and utility savings for near zero emissions buildings.

Funding Model

Seed funding was provided by the City of Vancouver and gradually decreased over three years. Continued funding will be supplied by public or private grants, or the center may become part of the Low Carbon Cities Canada (LC3) program.

Just Transition

ZEBx encourages younger, racially diverse and women speakers at their events to broaden the variety of ideas exchanged and promote their participation.

Website:
https://zebx.org/

11. Affordable Housing Design Leadership Institute - USA

For over 10 years, the Affordable Housing Design Leadership Institute (AHDLI) in the US has brought together building developers and design leaders to share best practices and to take on affordable housing's increasingly complex construction, policy and finance challenges. As a result, developers in cities across the United States have amplified their projects to improve the lives of the residents and communities they serve.

Best Practices

Educating and training developers are a key intervention point in greening existing and new construction buildings.

Leveraging urban design principals through an equity lens can help the real estate development ecosystem unpack development complex challenges require to advance green buildings.

Buy-in from City Mayors is essential for the training program to have lasting impact throughout the building development value chain. There is a need for City leaders to believe in big ideas that can transition the building stock to net zero.

Funding Model

AHDLI is funded through foundations and local sponsorship. Participants must apply to be accepted into the program. Once accepted participation is free.

Just Transition

Educating and training developers on equitable and sustainable design principals for low-income housing development can maximize the development's impact on the local community.

Website:
https://www.enterprisecommunity.org/

Utility Rebate-based Training Models

12. CleanBC: Better Homes Program – BC, Canada

CleanBC Better Homes Program led by the BC Provincial Government has a Registered Contractors Program that provides training for contractor on heat pumps and insulation. Once a contractor goes through the training, they get on a preferred list on the Clean BC Better Homes website. The program is linked to BC Hydro's rebate program so that contactors and offer their customers rebates on insulation and heat pumps.

Best Practices

The development of this program is linked to BC's home performance stakeholder council. The council informs training to foster training alignment with the building code. Municipalities support this program and promote it within their networks. A growing number of local governments in BC are offering top-up rebates (Municipal Top-ups) to the CleanBC Better Homes and Home Renovation Rebate Program. This creates an additional economic incentive for contractors within the local region to become a preferred contractor.

Funding Model

The program is funded by BC Hydro, Fortis BC and the Province of BC.

Just Transition

This program in not directly linked to a just transition.

Website:
https://betterhomesbc.ca/

13. Qualibuild - Ireland

While not a program initiated by a city, the Qualibuild project provides some insights into how government, industry, and education can collaborate, and each contribute to a program to initiate change in the green buildings sector. Qualibuild was a time-limited training program that was implemented by the Irish Green Building Council in cooperation with educational partners. Local government assisted in an advisory and facilitating capacity. The goal was to upskill the existing workforce to complete renovations with green building practices. It began with a Foundation Energy Skills (FES) Course that encouraged discussion and participation among all workers, from trades to contractors, emphasizing "System Thinking" to understand principles of low energy building throughout the construction chain. After successful completion of the courses, the workers would have their training history added to an online Construction Worker Skills Register (CWSR), which could then be used by those interested in hiring qualified workers for green building construction.

Best Practices

Encouraging active participation and collaboration between trades in courses was well received and increased understanding of the larger picture and process. The three-day course and combination of weekday or weekend options appealed to a wide audience because the time allotted was manageable for schedules from both large and small enterprises.

This short introduction also increased interest in follow-on training. Many participants felt the FES course should be mandatory and would like to see greater recognition of the qualifications to improve the value of the course. The Irish government provided a tax credit for homeowners who conducted repairs, renovations and improvements using contractors listed on the CWSR, however further incentives may be needed to encourage further adoption. A communications campaign was recommended to broaden the understanding of the importance of employing trades workers who are qualified in energy efficient methods.

Funding Model

IGBC coordinated the program with the Irish government serving in an advisory and facilitating capacity. Limerick Institute of Technology and other universities provided courses through contracts with IGBC. Funding was provided through the Intelligent Energy Europe Programme for the three-year term of the program.

Just Transition

This program focused on the existing workforce and did not have specific goals for the just transition. However, bog workers (similar to fossil fuel sector) who had recently been laid off with the phasing out of peat harvesting for fuel were identified and recruited to participate in the program.

Website:
https://www.igbc.ie/projects/qualibuild/

Appendix C: Inventory of Existing Training Programs

Philadelphia © bonniej / Getty Images

Name of Training Program	Jurisdiction (City + Province / State)	Country	Program Description
Knowledge Exchange Training Model			
Zero Emission Building Centre of Excellence (ZEBx)	Vancouver, BC	Canada	ZEBx is a collaborative platform that strengthens the public, private and civic capacities and passion for zero emission buildings. Developing a Community of Practice: ZEBx facilitates applied knowledge sharing about zero emission buildings through focused dialogues, project tours and demonstrations. Fostering Innovation: ZEBx curates resources into accessible and digestible content, including case studies, academic research, industry guides and technology advanced. Collaborating with Partners: ZEBx connects industry to solutions, identifies opportunities, navigates barriers and brokers relationships using its network of partners across government, industry associations, research, trades programs, suppliers and global experts.
Affordable Housing Design Leadership Institute (AHDLI)	11 Cities / States across the USA	USA	AHDLI is a short-burst intensive learning experience, culminating in a 3-day in-person convening that builds organizations' skills and confidence in managing the design process. The Institute curriculum – both in-person and online – is based on both research and real-life projects and is outcome-oriented. At the completion of the Institute, developers reflect on what they learned and map strategies to make large and small changes in their development process. The Institute curriculum consists of: 3-day in-person convening of developers, designers, city officials and policy makers. Here participants engage in interactive design charrettes with real-life development projects and learn creative and innovative approaches to design, construction, policy and finance challenges. 5 online modules provide a foundation for integrating design principles into the challenging affordable housing development process and feature real-life case studies

BE-Ex (Building Energy Exchange)	New York, NY	USA	The Building Energy Exchange (BE-Ex) connects New York City's real estate and design communities to energy and lighting efficiency solutions through education, exhibitions, technology demonstrations, and research. BE-Ex Ed offers on-demand content on energy efficiency and high-performance design. Earn continuing education credits while learning how to master your next building project.
NYC Accelerator	New York, NY	USA	Services for owners and property managers. Information hub for training, finance, information, incentives. Works with thousands of buildings across the five boroughs to build a cleaner future by lowering pollution and carbon emissions.
Institutional Training / Facility Model			
BCIT's High Performance Buildings Lab/ BC Energy Step Code Courses and Passive House Training	Burnaby, BC	Canada	The building lab comprises of display cut-away assemblies, practice walls, an airtight house and a lecture area. The airtight testing hut is a small-scale building that brings together all the aspects of a high-performance building system in a coherent example that is used for tests training. The lecture area is located within the practice area and its 21st century classroom design allows easy back and forth between theory and practice.
CUNY BPL	New York, NY	USA	CUNY's Building Performance Lab works to advance high-performance building operations through training, workforce development, and research. They are a leading provider of Building Operator Certification and offer a wide range of other training programs.
Construction Scotland Innovation Centre (CSIC)	Scotland, UK	Scotland	Host site for a variety of educational programs including BIM training, virtual reality, modular construction, offsite construction.
Utility Rebate Model			
QualiBuild	Country-wide	Ireland	Time-limited program to upskill the existing workforce to complete renovations with green building practices. After successful completion of the courses, the workers would have their training history added to an online Construction Worker Skills Register (CWSR), which could then be used by

QualiBuild *(continued)*	Country-wide	Ireland	those interested in hiring qualified workers for green building construction. Foundation Energy Skills Training, webinars, LEED courses, BREEAM courses, Home Performance Index, Life Cycle Analysis, Energy Renovation Upskilling, Construction Workers Skills Register.
CleanBC Better Homes - Program Registered Contractor	BC	Canada	Contractors register for training and then qualify to become a "program registered contractor" and can offer their clients rebates to retrofit their homes. They also get preferential treatment such as exposure and quick turnaround times for rebates they can provide to their clients.
Energy Trust of Oregon Trade Ally Program	Oregon	USA	The ETO provides home energy reviews using their qualify energy advisors and provides homeowners with a list of qualified contractors through its Trade Ally program. The ETO oversees the process for existing homes, administers the prescriptive rebates on equipment, provides a business development and training fund for its Trade Ally contractors, and undertakes QA on approximately 10 per cent of all projects under the Hope Performance with Energy Star banner. Contractors that participate in training get ahead of the queue for receiving rebates for their clients. The more training the contractor gets the better off they are in the Trade Ally program.
Association for Energy Affordability	Bronx, New York and Emeryville, California	USA	Education at AEA encompasses a wide range of formal and informal training offerings, including certification training, multifamily Weatherization training and related courses delivered on-site and via its Distance Learning Network, EA-Quip energy modeling software webinars, guest speakers on technical topics, sessions held for contractor qualification and orientation, and presentations on new technology. We offer more than 50 courses for building performance professionals, energy efficiency and technical and program staff, installers, weatherization workers, and job seekers in green industries.

Training Models for Disadvantaged Persons			
LA Green Corps. Youth Construction and Conservation Corps	New Orleans, LA	USA	The LAGC's YCCC is a 14-week construction and conservation training program that provides nationally recognized certification training, soft skills training, and performance incentives to youth aged 18-25 in the Greater New Orleans Area. Through a partnership with the SBP, Inc, formerly the St. Bernard Project, local youth rehabilitate blighted homes in the Greater New Orleans Area while incorporating building science best practices into their work. Students also receive the opportunity to concentrate on math, reading and language skills from an academic instructor. Financial proficiency, employability skills, resume writing, resiliency and tool training workshops are also included in our program. LAGC provides training stipends as well as transportation assistance. The YCCC program offers four classes a year free for those who qualify.
Highway Construction Careers Training Program	Chicago, Illinois	USA	HCCTP was initiated in an effort to provide training and skill-improvement opportunities to assure the increased participation of minority groups, disadvantaged persons and women in all phases of the highway construction industry. HCCTP emphasizes life-long learning and provides opportunities for further education and assistance to improve employability. The HCCTP is conducted at twelve community colleges throughout the state. The Department strongly encourages the prime contractor and their approved sub-contractors to hire minority, women and disadvantaged individuals from the HCCTP to help meet workforce and trainee goals. Graduates are well-trained and ready to become productive entry-level construction workers.
Priority Hire	Seattle, WA	USA	The City of Seattle contracts with community organizations and construction pre-apprenticeship training programs to recruit, place and train women, people of color and those living in economically distressed areas.

Project JumpStart	Baltimore, MD	USA	87-hour pre-apprenticeship training program that provides intensive classroom and hands-on training. Their mission is to train low-income city residents to enter the building trades on a construction career track that will help them advance beyond the entry-level.
HIRE360	Chicago, Illinois	USA	HIRE360 will expand employment and advancement opportunities and ongoing support for community residents in the ... construction industries through recruitment, training and placement assistance. By upgrading the skills of the currently employed, HIRE360 will provide entrée to the trades for youth and gainful employment for underrepresented populations. It is the first step in an important chain of events that ultimately strengthens communities.
Green Construction Training Project	San Francisco, CA	USA	This program provides an intensive 400-hour construction training bootcamp, providing pathways out of poverty for Bay Area residents who are most in need. The ETC's core program is a 16-week training that integrates hard skills training in green construction and related trades with life skills training, academics, intensive case management, wraparound services, career coaching, and job placement and retention services
City Build Construction Training	San Francisco, CA	USA	Comprehensive pre-apprenticeship and construction administration training to San Francisco residents
Blade Runners	British Columbia	Canada	This program has been helping unemployed, at-risk youth prepare for and find employment since 1994. Blade Runners provides life skills, job readiness skills, work experience/on-the-job training, job coaching and ongoing supports to unemployed youth at risk.
Upskilling from High Carbon Industries or Practices to Low-Carbon Job Opportunities			
Introduction to Solar Photovoltaic (PV) System Design and Installation.	Calgary	Canada	Retraining / upskilling oil and gas workers into renewable energy and energy efficiency through short 2-week upskilling courses (offering 2 at the moment, 3 under development).

Introduction to Solar Photovoltaic (PV) System Design and Installation. *(continued)*	Calgary	Canada	The goal of the program is to empower fossil fuel industry workers and Indigenous workers to build and implement climate solutions.
GRID Alternatives	Oakland, California	USA	SolarCorps Fellowship, Women in Solar, Solar Futures (grade school), Installation Training apprenticeships
The Wood Institute	Washington DC	USA	Architects, engineers, contractors and building code officials to earn continuing education credits on-demand from the American Wood Council, Think Wood, and WoodWorks
Blue Seal Certificate	Alberta	Canada	The Blue Seal program was established by Alberta Apprenticeship and Industry Training (AIT) to encourage and recognize business training. If you are a certified Alberta journeyperson in a designated trade or occupation, earning a Blue Seal proves that you not only meet Alberta's high industry standards, but you also have the drive to develop your business skills and succeed in business not green building related - but a Green Seal could easily be imagined (the Province of Nova Scotia is contemplating it, lots of project going on including capacity building, they might be worth talking to: Karen Daniels of the Ministry of Mines would be the contact).
Apprenticeship, College, Professional Development, Skilled Trades Oriented Program Models			
GPRO	New York, NY	USA/ Canada	GPRO is a certificate program that teaches the people who build, renovate, and maintain buildings the tools to integrate high-performance construction and maintenance practices into their everyday work. Our holistic approach to sustainability training—combined with expert advice and the latest adult learning techniques—have made GPRO an education trailblazer for building trades and operators across the country.

Green Jobs Training Centre	Howard Beach, NY	USA	Private company partnering with city jobs programs
Apprenticeship Levy	Country-wide	UK	Apprenticeship and pre-apprenticeship facilitation paid through a levy on employers' total wage bill in excess of £3m to assist with a pledge to create 3 million new apprenticeships by 2020. It is a 0.5% tax.
Vocational training / Apprentice-ship System	All states	Germany	Vocational training in Germany takes place predominantly through dual education. The major part of training within the dual system is done in companies. The young person is trainee/apprentice in a company and is part-time released to attend vocational school. Whereas the in-company vocational training concentrates on teaching specialized practical skills and providing the necessary occupational experience, the vocational school focuses on providing the specialized theoretical knowledge for the relevant occupation and on consolidating and improving the level of general education. Training lasts between two and three and a half years, depending on the profession. The company bears the training costs and the trainee receives apprenticeship pay[13].
BC Housing Continuing Professional Development for Residential Builders	BC	Canada	Training requirements for licensing for residential contractor in BC.

13. https://www.bmwi.de/Redaktion/EN/Dossier/vocational-training-and-work.html, https://www.bmwi.de/Redaktion/EN/Downloads/duales-ausbildungsprogram.pdf?__blob=publicationFile&v=4

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