Green Retrofit Economy Study

SUMMARY REPORT

DELPHI GROUP

CAGBC

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This report contains initial research findings from interviews and secondary research as part of a broader suite of project activities to support the Green Retrofit Economy Study Research. Further updates will be made to this report as and when other activities are completed, including additional interviews, focus groups, and quantitative analysis results.

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This report is a summary of findings gained through primary and secondary research between March 2021 and June 2022, building on existing knowledge from thought leaders across Canada and globally, and direct consultation with over 300 stakeholders engaged through the study.

Further insights about opportunities and challenges in the Canadian Green Retrofit Economy and the study methodology can be found in a series of technical reports at Delphi.ca.

Project Funding Partners

CIB BIC

OCS Ontario Construction Secretariat

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Glossary

Green Retrofit: To retrofit implies providing something with a component or feature not fitted during manufacture or adding something not present when first constructed. The term has been used in the built environment to describe substantial physical changes at building level and has often been used interchangeably with terms such as 'refurbishment', 'conversion', 'renovation', or 'refit'. At the city scale, a green retrofit economy describes the industrial and economic activity created through a series of projects; underpinned by sustainable financing and with a clearly defined set of goals and metrics.[1]

Deep Carbon Retrofit: A project involving multiple energy efficiency and/or renewable energy measures in an existing building, designed to achieve major reductions in net energy use (40 per cent or greater reductions).[2] A deep carbon retrofit describes a specific type of retrofit project under the more general term 'green retrofit'.

Retrofit Pathway: A set of common retrofit measures to achieve energy and/or GHG emissions reductions, grouped by building system and applicable to a group of buildings that share common features (e.g., building type, size, age, location). These groupings of common retrofit measures across multiple buildings and projects are sometimes referred to as 'horizontal retrofits'.

Net Present Value: Net present value (NPV) is an assessment of a project's financial viability that takes account of the time value of money. NPV calculates the cash flows – both savings and expenditure – expected over a project's time horizon and applies a discount rate to future cash flows. The discount rate represents either the minimum acceptable rate of return or the organization's borrowing cost or cost of capital. Cash flows should include the expected increase in utility prices over time and can include monetary non-energy benefits, such as savings due to improved efficiencies or reduced needs for cleaning and maintenance in addition to utility savings.

Aggregator: An entity that pools funding which is used to finance a group of energy service companies to undertake green retrofit projects on behalf of building owners/operators, thus removing the need for building owners/operators to provide upfront capital investment in green retrofit technologies.

Transition Plan: A costed out plan that outlines how a building will implement green retrofit measures over time by leveraging natural intervention points as part of a building's capital plan when retrofits would be required.

1.

Retrofit Pathway Definitional Framework

1.1 Context of the Market Opportunity

Growing the low-carbon economy is a key component of the federal government's plan to generate economic growth while reducing negative impacts on the planet's climate and natural systems. As part of this broader plan, over $3.6 billion has now been committed to finance energy efficiency and low carbon upgrades to large buildings from key funding organizations including Canada Infrastructure Bank, Infrastructure and Communities Canada, and the Federation of Canadian Municipalities.

The funding commitments in low-carbon retrofits are intended to catalyze widespread investment in building upgrades that will lean heavily on a skilled, qualified, and growing workforce, as well as require an accessible and affordable supply chain of relevant low-carbon products, materials, and equipment. Ensuring these enabling conditions are in place to support the growth of the green retrofit economy faces a number of key challenges.

Canada's construction workforce is expected to face significant reductions in capacity over the next 10 years, with a known shortage of skilled workers that predates the current COVID-19 pandemic. Expected labour shortages are a growing concern given the need to reduce building emissions through retrofits driven by commitments being made by governments and the private sector. These evolving low-carbon building requirements are also dependent on workforce transitions and new skills involving property managers, designers, building science professionals, building officials, real estate professionals, regulators, financiers / lenders and insurance providers, and others across the value chain.

To effectively address the gaps and potential risks presented by the existing retrofit workforce and supply chain, employers, job seekers, students, and educators need clear information about the occupations and skills required for building retrofits and any potential gaps in capacity in order to revise training and encourage efforts for retraining and upskilling.

As outlined in the Climate Forward Scenario of Canada Green Building Council's 2020 Market Impact and Opportunities Report, targeted government and industry intervention and investments will not only ensure that Canada can meet its 2030 GHG emission reduction targets (equal to a reduction of 50 Mt CO2e), but also:

- Generate significant economic income ($150B in GDP) over a 'business as usual' approach,
- Create new, highly-skilled jobs in the process (equal to 1.47 million jobs in the green building sector by 2030), and
- Make communities more resilient over the long-term.

Figure 1: Elements of a Green Building Industrial Strategy

To realize these environmental, economic, and social benefits, it will be essential that Canada's green building sector supply can meet the demand for green retrofit projects, at the right time and in the right locations. Supply includes:

1. Sufficient workforce capacity: including workers with low-carbon building skills and knowledge about latest clean technologies, and a sufficient number of workers to accommodate the growth in volume of projects, and;

2. Robust, accessible, and affordable supply chain: including products, materials, and technologies needed to service the retrofit economy.

Currently, a clear understanding around the supply-side of the equation, including the implications and workforce and supply chain gaps and risks is missing. Some elements of analysis have been tackled to various degrees in recent years, including through work by governments, sector councils (e.g., Build Force), non-profits (e.g., Canada Green Building Council, Pembina Institute, Efficiency Canada, and ECO Canada), educational / training institutions, industry associations (e.g., Canadian Construction Association, the Canadian Home Builders' Association, etc.) and private sector players.

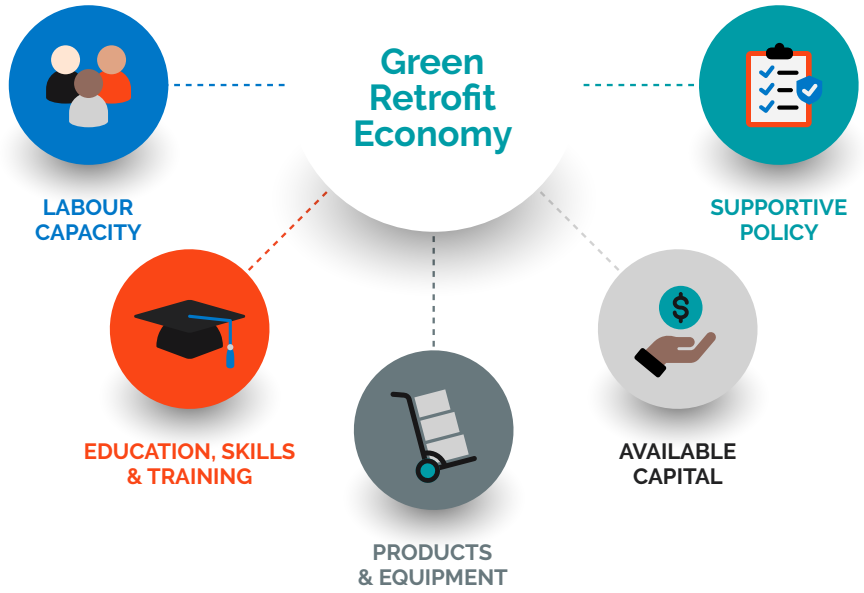
This study builds on existing research to provide a clearer picture of the supply side of the green building equation. This is intended to inform where key partnerships, programs, and other supports will help address gaps and equip the workforce with the technologies to enable a thriving green retrofit economy in communities across Canada.

1.2 Enabling Conditions for a Green Retrofit Economy

Currently most retrofits are completed as separate custom projects, requiring significant resources to make a business case, plan, design, execute, and verify the work. In order to catalyze a self-sustaining local green retrofit economy that facilitates investment and mobilizes capital towards large portfolios of building retrofit projects, several enabling conditions need to be in place, including:

- Adequate local workforce capacity to meet the labour demand
- Skills and training partnerships to equip the modern green building workforce with the knowledge required
- Access to high performance building materials in the local supply chain
- Strategies for securing available capital financing
- Supportive policy at all levels of government that provide a clear roadmap upon which investments in training and retrofit projects can be secured

Figure 2: Enabling Conditions



Drawing from the recent Decarbonizing Canada's Large Buildings study by CaGBC, considerations to help create the conditions to ramp up retrofit market activity and optimize deep carbon retrofits include:

- Aligning capital planning and regular infrastructure and equipment renewal timelines with green retrofit opportunities
- Supporting building owners to develop a strategy for securing capital financing for retrofit projects
- Leveraging an integrated design process approach to retrofit project development, moving away from single system improvements, and including an assessment of opportunities to maximize additional building performance and occupant health benefits
- Starting as soon as possible, through the implementation of proven emissions reduction and efficiency measures and development of zero carbon transition plans.

While momentum around creating these conditions is building, a key driver of these conditions will be policy leadership, signaling across the local supply chain the priority being put on green retrofits. Additionally, developing stronger partnerships between training institutions and industry is a priority in creating the workforce capacity in Canada to deliver green retrofit projects at the scale required to meet climate targets.

1.3 Framework of Retrofit Pathways

Regardless of a building's size and type, a "building as a system" approach to green retrofit could be highly conducive to meet greater emission reduction outcomes. Thus, the evaluation of viable retrofit pathways and developing an optimized transition plan necessitates adopting a holistic, systems-based approach. There are three main technical strategies that can serve as a starting point for transition planning and retrofit project development for most large building types in Canada:

1. Reduce or replace fossil fuel use for space heating, mainly through electrification (including heat pumps)
2. Implement energy demand-reduction measures
3. Incorporate on-site renewable energy systems

Table 1 on the following page provides examples of the key technical solutions and measures that can be employed to help establish viable retrofit pathways for the selected building types in this study, grouped by the four main building systems: electrical, enclosure, mechanical, and renewables.

Table 1: Retrofit Pathways

Key Technical Solutions	Building System - General	Building System - Detail	General Measure
1. Reduce Demand	Electrical - Lighting		LED retrofit, incl. full lighting system redesign
	Enclosure	Windows/Doors	Upgrade to triple glazed windows
		Walls	Upgrade of performance with exterior insulation, including improved air barrier system
2. Reduce fossil fuel use for space heating, mainly through electrification		Roofs	Upgrade of performance with installation of exterior insulation to meet Reff-20 to Reff-40 performance
	Mechanical	Space heating / Cooling	Replacement of existing system with low ambient direct expansion (DX) heat pump system
		Ventilation	Installation of energy recovery ventilators
3. Add on-site solar PV generation		Hot water heating	Replacement of gas system with a dedicated air to water heat pump, supported by a condensing gas boiler or a wastewater heat recovery heat pump and storage tank.
	Renewable Energy		Maximized on-site renewable energy generation through solar PV system installation, dictated by three factors, available roof area, utility regulations, and not greater than 100% of the annual electrical load.

2.

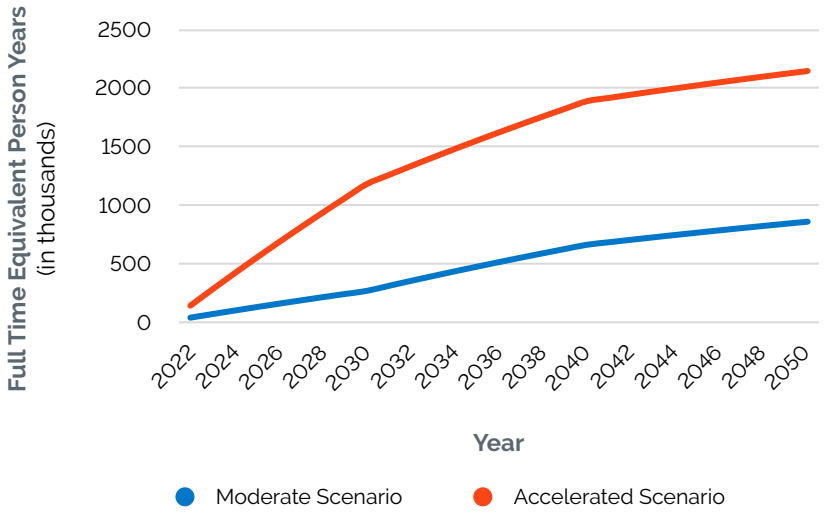
Green Retrofit Demand

2.1 Summary of Demand Scenarios

Energy efficiency and net-zero investments play a significant role in stimulating green job creation. The retrofit demand scenario analysis underpinning this study provides insight into the size and scope of Canada's green retrofit economy – in terms of the demand for key occupations created by a set amount of retrofit project activity. The study examines the macroeconomic impact of "moderate" and "accelerated" retrofit scenarios across a 28-year period to 2050.

Using our "what-if" scenario analysis calculations, the results indicate that either scenario would lead to significant job creation. Under the moderate scenario, Canada can expect **777 thousand direct job years**, generated from **445 million square meters** undergoing retrofit projects. In contrast, under the accelerated scenario, **730 million square meters of floorspace** is expected to undergo a retrofit, resulting in **2 million direct job years** (Figure 3).

Figure 3: Green Retrofit Occupational Demand in Canada (2022-2050), Under Moderate and Accelerated Scenarios



i.e. a sixty percent increase in retrofitted floor space yielding in more than double the associated job creation. This implies that a comprehensive transition of existing buildings to net-zero carbon operations, supported by strengthened policies and substantial investments, will rapidly generate demand for highly skilled green jobs.

The **moderate** scenario considers existing and announced climate strategies, targets, and building code updates. It adopts an almost linear implementation schedule, with completion of retrofits to the target building stock going beyond 2050 (5% residual beyond the study time period). Key assumptions include only those buildings with envelopes at least 40 years old (i.e., built in or before 1980) will receive a retrofit, with 25% of the target building stock receiving a full suite of retrofit measures. The scenario also considers that investment in green building retrofits will see increased activities compared to the historical trajectory.

The **accelerated** scenario reflects an ambitious retrofitting pathway to meet Canada's 2030 and 2050 emission targets. It assumes that local and provincial governments will adopt more stringent targets and implement strategies to accelerate green retrofit activity. It also includes increased investment into green building retrofits. Key assumptions include all available vintages of building stock receiving a comprehensive suite of carbon reduction retrofit measures.

2.2. Policy Framework

The Pan-Canadian Framework currently has signatories committed to develop a national code for existing buildings. By 2030, Canadians should expect a national retrofit code, titled Alterations to Existing Buildings. The Canada Infrastructure Bank's recent $2 billion Building Retrofit Initiative was created to drive reduction in greenhouse gas emissions through energy-efficient building retrofits as well as encourage innovative business models, bring together private capital, and establish retrofits as a distinct asset class.

Alongside CIB's efforts, the Pan-Canadian Framework's $2 billion Low Carbon Economy Fund is another federal resource that is being tapped by provincial and municipal governments to mitigate the cost of energy efficient upgrades for homeowners, businesses, and industrial operations. Other initiatives such as FCM's Green Municipal Fund and CMHC's minimum energy efficiency requirements for NHS funded projects show growing alignment in program objectives and resources at all levels of government.

Canada's national carbon tax on fuels and emissions is also a key policy driver. In 2020, The Government of Canada announced that the price of carbon will increase from the $30 per ton to $170 per ton by 2030. This will further incentivize the decarbonization of buildings and associated electricity grids.

Table 2 on the following page summarizes the high-level carbon reduction targets set by provinces and the policies that exist nationwide to drive the uptake of retrofits; specifically, those that also address commercial buildings in addition to residential retrofits. Of the provinces, British Columbia, Ontario, Quebec, and Nova Scotia are currently best positioned to drive widespread retrofits through the availability of several financing tools including:

- Incentives and Rebates
- Local Requirements and Incentives
- Energy Rating and Disclosure Programs
- Performance Requirements
- Net-metering and other Distributed Energy Policies

Currently, there are no existing mandatory provincially led mechanisms or focused targets in place to advance retrofits, but these policies are currently being developed in BC and Quebec.

2.3. Demand by Regions & Building Type

Regions

In our analysis, Ontario and Quebec contain the largest inventory of building stock targeted for retrofit, and correspondingly the greatest number of job years created, as shown in Figure 4 on page 15.

Along with British Columbia and Nova Scotia, Ontario and Quebec are primed to lead the growth of the green retrofit economy with some of the strongest existing policy frameworks and the availability of several financing tools. Currently, there are no mandatory provincially led mechanisms or targets in place to advance retrofits, but policies are currently being developed in British Columbia and Quebec.

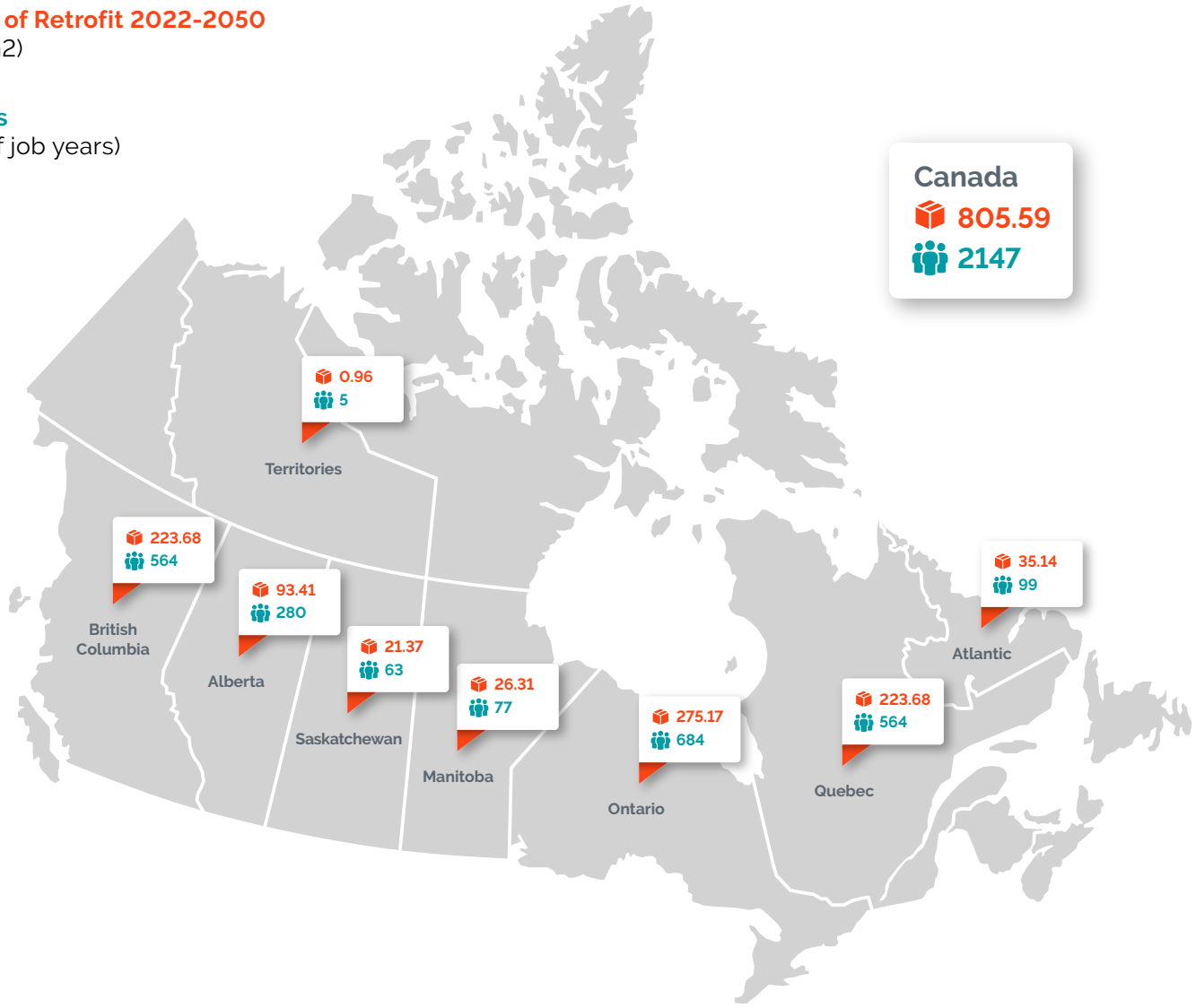
Table 2: Provincial and Municipal Policy Framework

Province	Provincial Target	Provincial Policies and Programs	Examples of Municipal-Level Policies and Incentives
BC	Reduce emissions in buildings and communities by more than a half by 2030.	• Better Buildings BC • CleanBC Facilities Electrification Fund • CleanBC's Custom and Custom-Lite Incentives • The CleanBC Commercial Express Program	• Heritage Energy Retrofit Grant • Clean BC Better Homes - Municipal Top-Ups
AB	Reduce emissions by 30 mt by 2030 (~11 per cent reduction of total emissions).	• Clean Energy Improvement Program • Energy Savings for Business Program	• Clean Energy Improvement Program (CEIP)
SK	SaskPower has targeted to Reduce emissions by 50 per cent of 2005 levels by 2030	• Saskatchewan Home Renovation Tax Credit	• Home Energy Loan Program (HELP)
MB	Efficiency Manitoba has targeted to Reduce electricity consumption by 1.5 per cent and natural gas consumption by 0.75 per cent annually.	• Efficiency Manitoba's Commercial, Industrial, and Agricultural program • Natural gas reduction program fund through Efficiency Manitoba	• Green Existing Building Strategy including energy and water-performance benchmarking for City-owned and operated buildings over 3,000 square metres
ON	Reduce emissions by 3 per cent below 1990 levels by 2030	• Mandatory energy ratings and disclosures for buildings • Voluntary PACE programs and on bill financing programs.	• TAF's Retrofit Accelerator • High-Rise Retrofit Improvement Support Program • Guelph Energy Efficiency Retrofit Strategy • Hamilton's Home Energy Retrofit Opportunity (HERO) • Retrofit Halton Hills • The Newmarket Energy Efficiency Retrofit (NEER) initiative
QC	60 per cent reduction in emissions from government buildings and 50 per cent reduction of emissions related to heating for buildings by 2030.	• Ensuring that renewable energy and electricity will be prioritized when renovating buildings • 2030 Roadmap for commercial and institutional buildings • SOFIAC super-ESCO model	• The Social Housing Retrofit Project • Building energy disclosure bylaw
Maritimes	**Nova Scotia:** Reduce emission by 53 per cent below 2005 levels by 2030. **New Brunswick:** Reduce emissions by 47 per cent below 2005 levels by 2030.	• Efficiency Nova Scotia's Retrofit Program for residential and business properties • New Brunswick's Commercial Buildings Retrofit Program	• Switch Charlottetown
Territories	**Northwest Territories:** Reduce emissions 30 per cent from 2005 levels by 2030	• Arctic Energy Alliance (funded via Federal Green Homes Grant)	

Figure 4: Total Inventory of Retrofit and Direct Green Jobs by Province in the Accelerated Scenario

Total Inventory of Retrofit 2022-2050
(in millions of m2)

Number of Jobs
(in thousands of job years)



Building Type

The study primarily focuses on deep carbon retrofit opportunities across large residential and commercial buildings in Canada, across different regions. Large building retrofits represent significant opportunities to meet Canada's climate target. Estimation by CaGBC suggests that large building retrofits could potentially reduce building-sector emissions by 51 per cent (21.2 million tonnes of CO2e).[3]

The building typologies in scope for this study include multi-unit residential buildings (high, mid, low-rise), office, retail, logistics and hospitality). These typologies were chosen because they represent a significant portion of Canada's existing large building stock and associated emissions. The table below describes the definitional framework of the building inventory:

Table 3: Definitional Framework of Building Types

Building Type Category	Data Source Building Type
Multi-unit residential building	• Low-rise multi-unit residential (Part 3 buildings over 600 m²): • High rise residential (~13 storey or 13,000m²) • Mid rise residential (~4 storey or 6,000m²):
Office	• Office Building (non-medical) • Medical Office Building
Retail	• Food or Beverage Store • Non-food retail store
Logistics	• Warehouses
Hospitality	• Hotel or motel

Low-rise MURBs and offices represent the largest share of Part 3 building inventory available for retrofit across Canada. (Figure 5). Offices provide the most compelling business case for green retrofitting, as upgrades to these buildings can result in greater electricity savings and higher Net Present Value (NPV), compared to other archetypes.[4] Given its higher baseline energy usage as well as energy intensive systems such as dual-duct or constant volume with reheat – office archetypes provide significant opportunities to gain energy savings and a logical place to start when prioritizing retrofit programs. Figure 6 represents the regional distribution of the building typologies. Quebec and Ontario represent the highest share of available floorspace for retrofitting in Canada, indicating significant low carbon retrofit opportunities.

Figure 5: Total Floorspace Available to Retrofit in Canada by Building Archetype

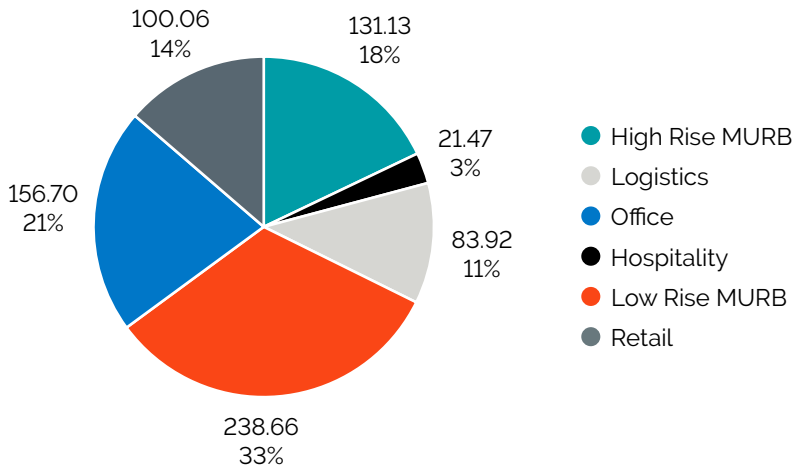
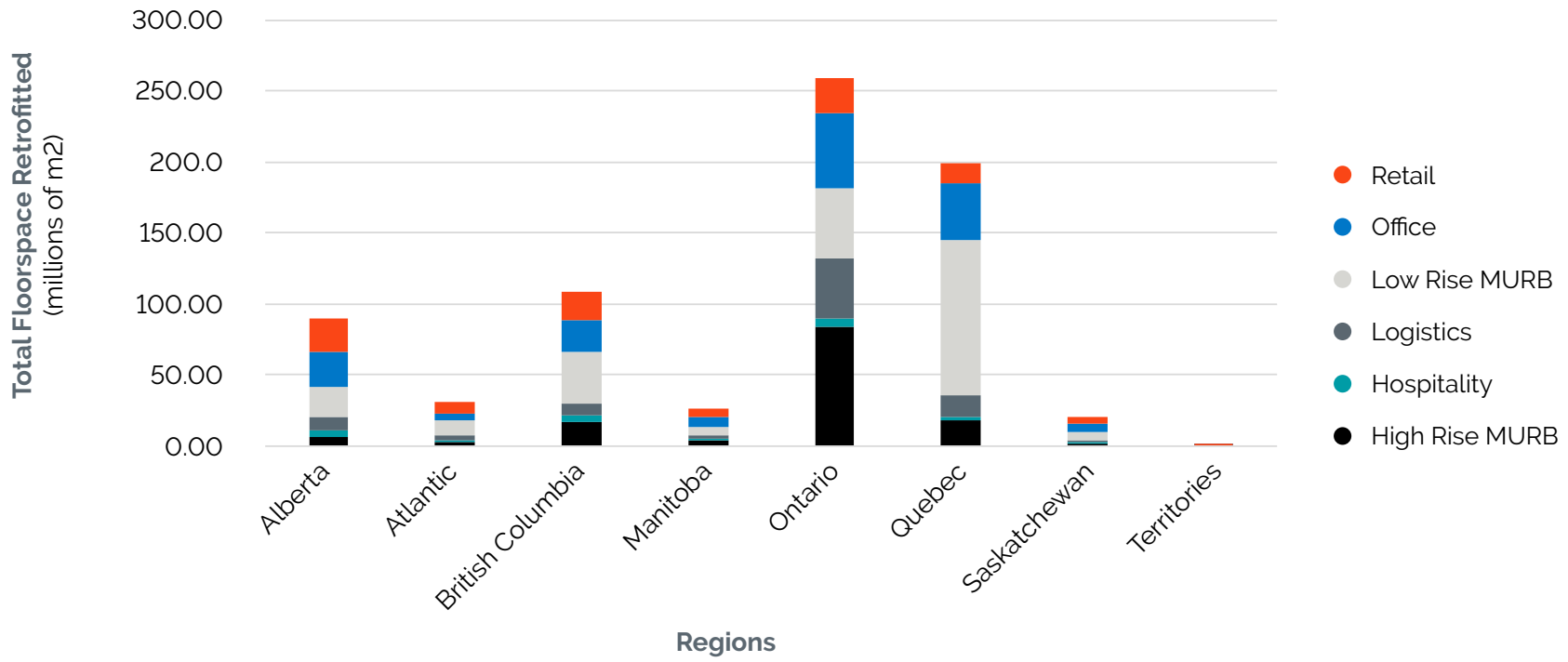


Figure 6: Total Inventory of Retrofit by Province and Building Archetype in the Accelerated Scenario



The technical solutions available and professionals required for retrofit pathways are similar across the various building types, despite differences in building operation and performance systems. Significant variation in priorities and sequences in retrofit measures arise with differences in electricity grid intensity and energy use. Buildings with higher domestic hot water loads (e.g., multi-unit residential and hotels) or higher energy demand and plug loads (e.g., retail grocery and malls) will require different sequencing of retrofit measures than their less energy intensive counterparts. Similarly, for buildings in regions that have more carbon-intensive electricity grids, there may need to be a greater emphasis on achieving emissions reductions through electrical demand reductions as compared to regions with low-carbon grids, where greater emphasis will be needed on space heating electrification measures.

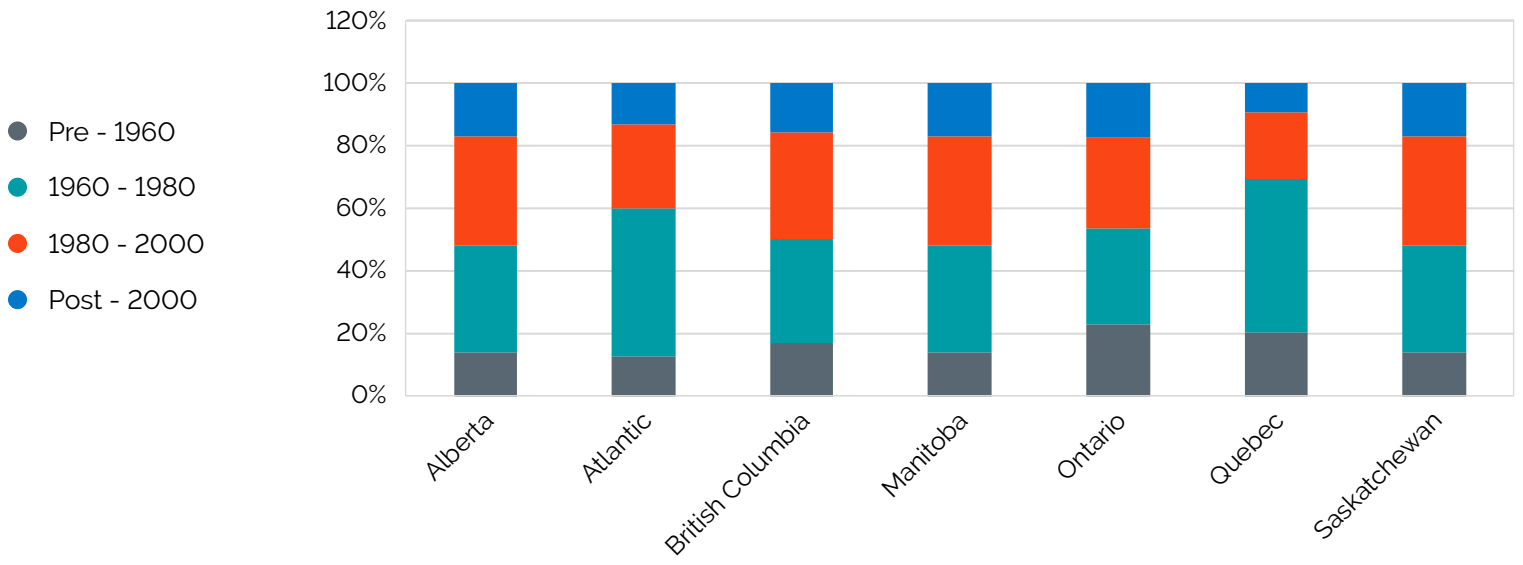
Vintage

The vintage of a building is a marker of the amount of thermal leakage and the associated cost of heating. In other words, the older the building is the less energy efficient it is likely to be. Compared to new buildings, the existing building stock in Canada experiences a greater rate of thermal leakage.[5]

Given that the median age of commercial and residential building stock in Canada is about 40-50 years, there are significant opportunities to achieve GHG savings by focusing retrofits on the older building stock. Buildings built in 1970 and earlier are at the key stages of their renewal cycle for critical mechanical and enclosure systems, which enables a business case for whole building retrofit projects. For example, the replacement of HVAC distribution systems, windows, and opaque enclosures requires buildings to be at least 40 years old.[6] For the purpose of the scenario analysis, 1980 was chosen as a cut-off vintage to capture the building stock at its prime renewal stage.

Figure 7 illustrates the percentage distribution of vintages of commercial building across regions.[7] The vintages 1960-1980, and 1980-2000 represent the majority of the commercial building stock in Canada, cumulatively accounting for sixty percent of the total. This distribution of building stock is similar across most provinces, except Atlantic provinces and Quebec, where much of the existing buildings were built during the 1960 to 1980.

Figure 7: Percentage Distribution of Commercial Building Vintages by Total Floorspace Across Regions



Professions

The analysis results indicate that electricians, contractors, and HVAC trades (plumbers, gasfitters, steamfitters, pipefitters, and air-conditioning mechanics) will be in highest demand, across both the scenarios (Figure 8). Both electricians and contractors are relevant to all the retrofit measures, which is reflected by the demand for the occupations. On the other hand. HVAC trades are crucial to the retrofitting of mechanical systems. Given the greater on-site involvement of trades during a retrofit project, the demand for trade occupations in terms of person years is higher than the consultant classes.

Among the regions, Ontario and Quebec will generate the highest number of employment opportunities through green retrofit activities. It is estimated that these regions have the potential to contribute 644 thousand and 505 thousand jobs respectively under the accelerated scenario – this cumulatively represents more than half of the total green jobs expected to be created nationally. Figure 9 represents the regional breakdown of the top five occupations in demand.

Figure 8: Total Occupational Demand by Scenario (2022-2050)

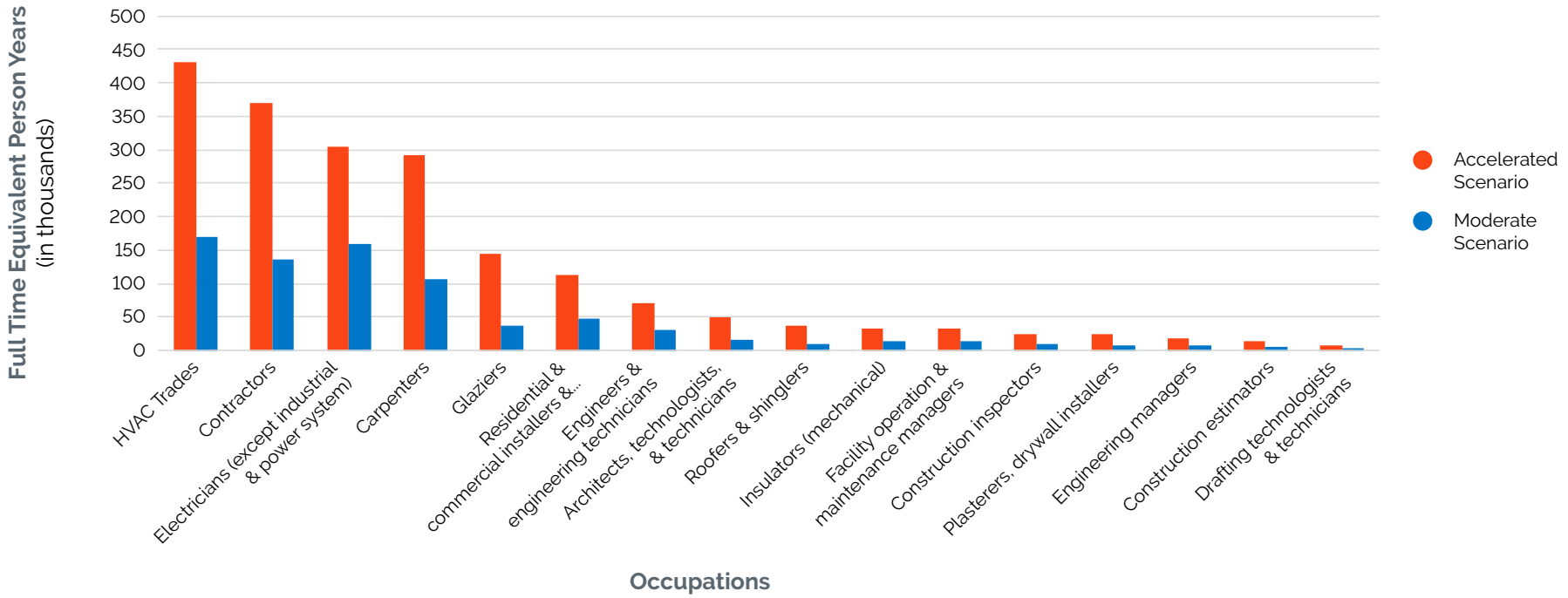
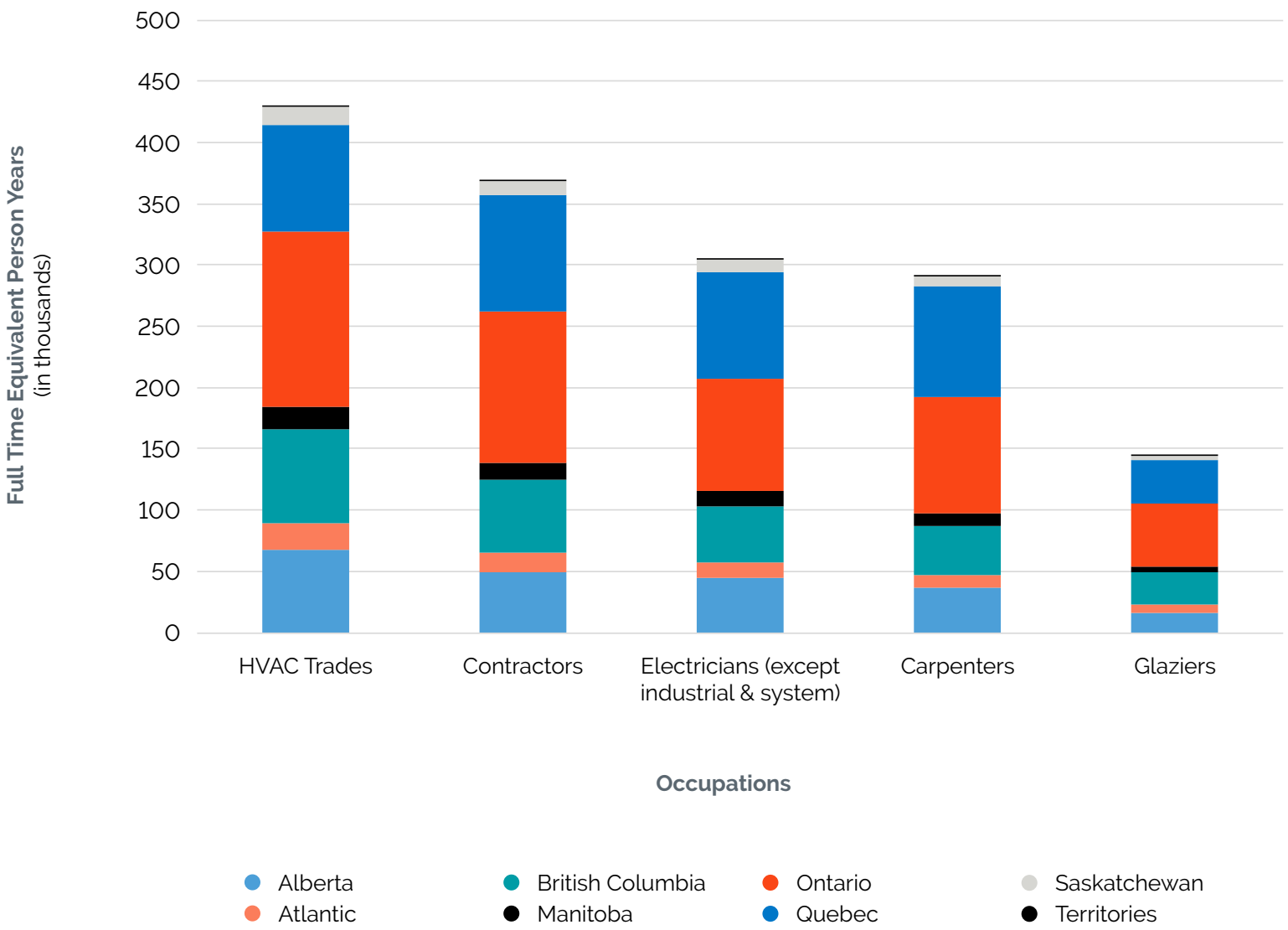


Figure 9: Total Occupational Demand by Province (2022-2050), Accelerated Scenario



2.4 Demand Drivers for Retrofit

As part of this study, key informant interviews were conducted with industry stakeholders, including manufacturers, building contractor companies, building owners and operators, municipal governments, industry associations, and financers.

The interviews validated existing research on the demand drivers of green retrofits. Table 4 summarizes the main drivers that were highlighted through the study.

Table 4: Demand Drivers for Retrofit

Electrification	For manufacturers, electrification of buildings to reduce carbon intensity is driving the uptake of heat pumps as well as other green building technologies. Retrofits have also been a key driver of heat pump installations as the technology has been updated to be more easily installed across different buildings and HVAC systems, as well as in colder climates.
Low Carbon Grids/Cost of Electricity	The GHG intensity of electrical grids varies from province to province which impacts the business case and uptake of retrofit technologies. For example, BC and QC were flagged as two provincial innovators and leaders when it comes to adopting heat pump technology. Both provinces rely on low carbon hydroelectricity which translates into a better environmental case for electrifying heating and cooling systems compared to provinces that rely on a mix of more carbon-intensive energy sources.
Regional Climate	The colder climate regions across Canada tend to show slower rates of green retrofit technology adoption due to concerns over reliability and efficacy of relatively newer technologies, particularly heat pumps, at colder temperatures.
Carbon Tax	Interviewees of this study pointed to the carbon tax as a driver that will have a larger impact as time goes on. While some of the interviewees do not believe that many building owners or managers are taking the carbon tax seriously, they do expect this attitude to shift as carbon tax increases to 2030. We also heard that some building portfolio owners are already using a $300/tonne shadow carbon price for transition planning purposes.

In summary, widespread expansion of green retrofit activity will be a significant driver to employment generation. In the accelerated scenario, which represents ambitious climate forward policies and targets, the retrofit economy could generate almost two million jobs over the next three decades. Among the relevant occupations, electricians, contractors, and HVAC trades are expected to be in the highest demand as retrofit activities scale up.

3.

Workforce Supply

The retrofit workforce includes decision-makers, designers and consultants, construction trades, and building performance professionals. Many of these occupations are also in demand across the broader construction sector and other industries, resulting in competition for all levels of talent and a potential shortage of workers in some areas.

The study highlighted several occupations which are key to facilitating green retrofits. These occupations are profiled in more detail in the companion report on Workforce Supply.

3.1 Current & Projected Workforce Supply

Several key occupations in the green retrofit workforce are already projected to face a significant supply deficit in the coming years. As many of these occupations are also projected to be in high demand as retrofits scale-up, a scarcity of these occupations could be a substantial obstacle to meeting retrofit targets. A factor in this potential shortage is that each of the main retrofit measures rely on these occupations to some extent. Another important consideration is that these workforce supply shortages are already projected without accounting for the significant increase in retrofit activity described in the demand scenarios above.

With the onset of the global pandemic, Canada experienced tight labour markets in several regions of the country, as employment levels outpaced the labour supply, leading to historically low unemployment levels. The impending wave of retirement in the construction industry got accelerated by the pandemic restrictions, as many older workers in the core working age group left the labour force earlier than they would have under previous conditions. As more construction workers continue to retire, the labor force pressure will continue in the coming decades. While immigration and interprovincial mobility can help to mitigate skilled labour shortages, it also leads to increased housing demands in large urban centers causing a cyclical problem.[8]

Figure 10: Key Occupations in the Green Retrofit Economy

Decision Makers

These occupations make decisions about when and where building retrofit projects happen.

KEY OCCUPATIONS

• Estimators • Planners • Finance

Designers & Consultants

Once a decision has been made to undertake a retrofit project, these occupations help to determine how the project will be conducted.

KEY OCCUPATIONS

• Engineers • Architects

Construction Trades

These are the hands-on trades and professionals that work onsite to execute the project.

KEY OCCUPATIONS

• Contractors & supervisors • HVAC trades
• Electricians • Carpenters • Installers

Building Performance

Once complete, these occupations ensure the success of the project and ongoing performance of the building.

KEY OCCUPATIONS

• Facility operation & maintenance managers

Additionally, the current Canadian immigration policies favour white collar workers, thus limiting the potential to attract skilled trades. Other contributing factors to the tight labour market include the lack of diversity and inclusion in the construction workforce.

The introduction of new technologies and skills required to decarbonize buildings has further intensified existing workforce supply and training challenges. Many organizations are striving to address these issues, and in order to meet the demand for retrofit projects, existing initiatives will need to be scaled up and out. Many different organizations are already involved in the team effort to solve workforce supply and skills training concerns across Canada: businesses across the supply chain, labour unions, colleges and universities, professional and industry associations, First Nations, non-profit organizations, and all levels of municipal, provincial, and federal government departments.

The Retrofit Workforce Supply Picture at a National Level

According to BuildForce labour indicators (the non-residential market ranking and estimated apprenticeship certification requirements), carpenters and steamfitters are most likely to experience labor market shortages over the next three years to 2025. A shortage of these occupations in the short run could limit retrofit activity, as these occupations are expected to be in high demand with retrofit market growth. Carpenters play a pivotal role in the insulation and weatherization of existing buildings.

Additionally, a recent Canadian Occupational Projection System (COPS) Assessment of Projected Labor Market Conditions estimates that mechanical engineers and technicians are projected to be in short supply over the period of 2022-2028. These design and consultant occupations are integral to electrical and mechanical systems upgrades.

The labour market outlook for these trades has been made without factoring for a significant increase in retrofit activity described in the demand scenarios above. Tighter markets are expected for most trades over the short run, reflecting the growing demand as non-residential construction activity starts to peak from 2022 following a pandemic slowdown. In other words, the availability of skilled labour is expected to be limited (or generally not available) by the short term increases in demand. As such, employers across industries will compete to attract the required talent.

Occupations in Short Supply

The following retrofit occupations are likely to see a supply shortage (at a national level) in the near term, even without factoring in a scale up of retrofit projects:

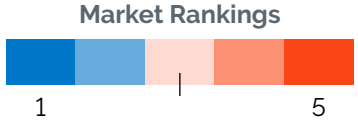
- Carpenters
- Steamfitters, pipefitters, & sprinkler system installers
- Plasters and drywall installers
- Refrigeration and air conditioning mechanics
- Mechanical engineers and technicians

Non-residential Market Ranking

The non-residential market ranking is a barometer of the local labour supply responsiveness in face of short-term increases in industry demand in the non-residential construction sector (industrial, commercial, institutional and large building projects).

Table 5 below provides a breakdown of market rankings over the period of 2022-2025; as such the cells represent the average ranking for the trade, indicating overall labour conditions of surplus/balance/shortage.

Table 5 Non-Residential Market Ranking of Construction Trades and Occupations (2022-2025)



	Province									
	Alberta	British Columbia	Manitoba	New Brunswick	Newfoundland and Labrador	Nova Scotia	Ontario	Prince Edward Island	Quebec	Saskatchewan
Carpenters	3.0	3.5	3.0	2.8	2.5	3.8	3.5	3.3	3.0	3.3
Construction estimators	3.3	3.4	3.0			3.5	3.7		3.3	3.0
Contractors and supervisors	2.8	3.4	2.8	2.8	2.5	3.5	3.6	3.3	3.3	3.0
Electricians	3.0	3.5	3.0	2.8	2.5	3.8	3.1	3.3	3.0	3.3
Gasfitters	3.0	4.0					3.6			
Glaziers	3.3	3.5	2.8				3.4	3.0	3.0	3.5
Insulator	3.5	3.4	3.0	3.0	2.8	3.3	3.2		3.0	3.0
Plasterers and drywall installers	3.3	3.8	2.8			4.3	3.6		3.0	3.3
Refrigeration and air conditioning mechanics	3.3	3.5	2.8	2.5	2.8	4.0	3.2		3.0	3.5
Residential and commercial installers and servicers	3.3	3.4	2.8	2.8	2.8		3.6		3.8	3.5
Roofers and shinglers	3.0	3.8	3.0				3.5		3.0	3.3
Steamfitters, pipefitters, and sprinkler system installers	3.5	3.6	3.0	2.8	2.3	3.5	3.8		3.0	3.0

Market Rankings

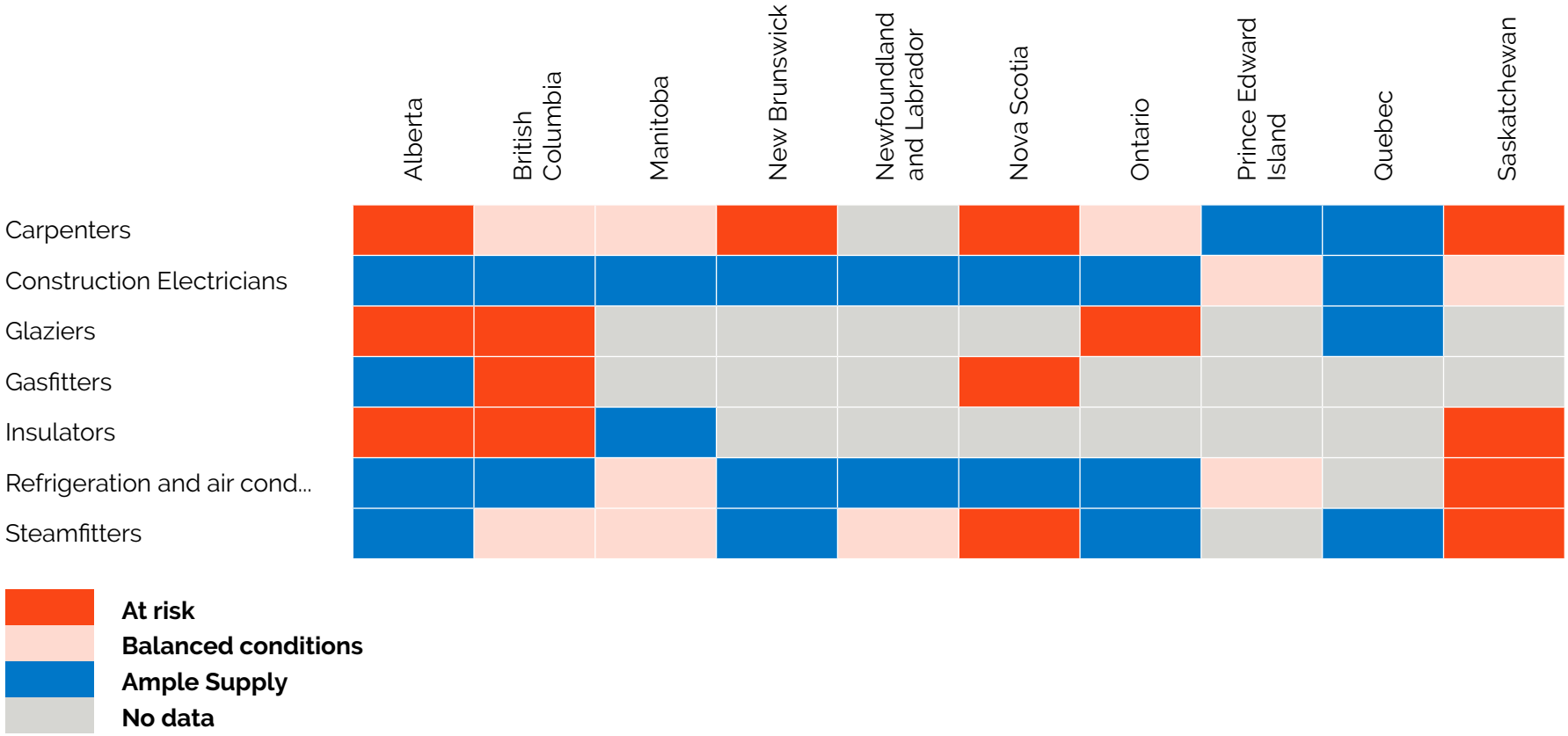
1	**Excess Supply**	Workers meeting employer qualifications in local markets exceed the demand at the current offered rate of compensation and other current working conditions.
2	**Potential Surplus**	Workers meeting employer qualifications could potentially exceed the demand at the current offered rate of compensation and other working conditions.
3	**Balanced Conditions**	The availability of workers meeting employer qualifications is in line with anticipated completions of projects.
4	**Potential Shortage**	Workers meeting employer qualifications are generally not available in local markets to meet any increase in demand.
5	**Excess Demand**	Needed workers meeting employer qualifications are not available in local markets to meet current demand so that projects or production may be delayed or deferred
6	**No Data**	

- Based on the market rankings, Ontario, British Columbia, and Nova Scotia are projected to experience shortages of the relevant trades in the near-term. The labour pressure in these markets is caused by increases in projects and investment growth.
- Other trades that are at risk of undersupplying labour across several regions include carpenters, residential and commercial installers, drywall installers, steamfitters, and air condition mechanics.

Estimated Apprenticeship Certification Requirements

This supply risk indicator evaluates the anticipated supply of new journeypersons against the certification of qualification (CoQ) requirements to meet future employment and replacement demand across all construction sectors. It provides an indication of the trade demand and supply equation, as the focus is on the flow and balance of new entrants.

Table 6 Estimated Construction Certification Demand and Projected Target of New Entrants by Trade (2022 to 2027)



- Based on the projected trend of new registration, most trades are expected to meet or exceed the construction industry's employment and replacement demand.
- Carpenters and gasfitters are at the highest risk of potentially undersupplying the number of new journeypersons by 2027.
- Other trades including glaziers and insulators are at risk of not meeting the target number of new entrants required to fulfill demand requirements across several regions.

3.2 Key Skills in the Green Retrofit Workforce

Canada's broader construction workforce has the potential to benefit greatly from retraining initiatives related to the green retrofit economy. Careers in construction and building retrofits offer a relatively stable job prospect over the next 30 years – working in a growing industry that is helping to respond to the climate crisis. Many initiatives are already underway, creating significant green job opportunities across a range of occupations, from entry-level to professional, in both small towns and major cities.[9] New entrants and existing professionals will find the green retrofit space to be an attractive proposition, as it includes jobs with lifelong careers, with high pay and paid training. while providing social and environmental benefits to the community

The skills required for green retrofits may be divided into three categories: technical skills, soft skills, and green literacy. Competencies and skills highlighted through the study are presented in Table 7.

Digital skills are necessary for the workforce of tomorrow
Trades and occupations will be increasingly required to build digital skills and literacy, as building systems become digitized and automated. This includes technical knowledge to interact with new building systems, as well as communicating project information across teams using digital tools.

Table 7: Key Categories of Skills in the Green Retrofit Workforce

Skill Type	Example
Technical Skills As construction gets increasingly complicated and multi-disciplinary, tradespeople will need to gain new technical abilities that will allow them to go beyond their conventional positions. Performance testing, air sealing, appropriate installation practices of the building envelope and HVAC systems, and adaptive lighting systems are some of the technical competencies required for low-carbon buildings.	• Assessment of existing buildings • Integrated design • Business acumen (including knowledge and understanding of the real estate market) • Digital capture • Building preparation • Building equipment, materials & techniques • Off-site construction and prefabrication • Commissioning
Soft Skills To navigate through the technical and logistical complexity of retrofit projects, a mix of soft skills is required, such as communication and negotiation. Considering potential disruption to building occupants, trades and other professionals will need to engage and manage relationships with residents and owners while working on-site.	• Communication • Occupant engagement • Negotiation • Teamwork • Systems thinking
Green Literacy Green literacy requires gaining a wide understanding of sustainability issues such as energy and resource efficiency, climate change and resiliency, and GHG consequences. It also includes the understanding of the building as a system approach and the inter-connectedness of construction responsibilities.	• Building science fundamentals • Green building construction strategies • Climate literacy • Understanding environmental impacts

3.3 Green Retrofit Training Ecosystem

Specific skills required to support green retrofits include hands-on skills, project approaches and procedures, familiarity with new products and technologies, and a general grasp of efficient building systems. While these abilities are obtained through a variety of training techniques and educational pathways, onsite practical experience and mentoring are particularly significant training mediums for tradespeople.

The current training landscape is based on established construction industry standards that equip professionals to fulfil market demands. As retrofit activity increases, training pathways will need to adapt to meet evolving standards for building performance in terms of carbon reduction and energy efficiency. The figures below illustrate the typical educational pathway for trades and consulting professionals.

Figure 11: Common Education Pathway for Construction Trades

Secondary School

Secondary School Diploma

Apprenticeship

A combination of work experience & class time offered through Industry Training Authority, public or private training institutions & employers

Red Seal Exam

Journey Person

Red Seal Certification

Mastership / Certificate of Qualification

Continued Professional Development

Usually optional / voluntary training provided by colleges, manufacturers, unions, & industry associations

Figure 12: Common Education Pathways for Engineers, Architects, and Construction Managers

Secondary School

Secondary School Diploma

Bachelor's Degree

Undergraduate degree in applied science or related field

Master's Degree

Sometimes required for architects and engineers

Internship

3-4 years of supervised work experience

Licensing Exam and Accreditation

Relevant to architects and engineers

Continued Professional Development

Training provided by colleges, manufacturers, unions, and industry associations

3.4 Current State of Training

A review of relevant training initiatives indicated a shortage of green retrofit courses and programs, particularly outside of major urban centres. The majority of the programs reviewed are voluntary, with limited certification being awarded or established learning objectives. Existing offerings are limited to subjects such as energy efficiency and renewable energy and typically delivered by universities, industry and trade associations, non-profit organizations, and specialized training centers. High-performance building product manufacturers also provide important training and guidance for designers and tradespeople.

The current green building training options for designers, consultants, and tradespeople vary greatly. Post-secondary green building courses and programs are generally designed for engineers, architects, and other building professionals, with the exception of a few programs designed for tradespeople. Most energy efficiency and green retrofit-related training options do not receive continuing professional development (CPD) credits, which can reduce their value to professionals. Due to the periodic review and approval cycle of new apprentice curricula, many programs are slow to incorporate emerging green building practices. Labour unions also provide green building skills to their members, many of which are applicable to large-scale building retrofit projects.

While green retrofit skills training is still a niche market, significant progress has been achieved through peer-to-peer learning, on-site training, case studies, and select post-secondary courses.

Examples of leading training initiatives are illustrated in the sidebar below. Further opportunities to grow this market are described in Section 5.

Examples of Leading Training Initiatives

Post Secondary Courses

- Endeavour Canada Sustainable Building Design
- Holland College Heritage Retrofit Carpentry Program

Demonstration Projects

- Prefabricated Exterior Energy Retrofit (PEER) Pilot Project
- Future Homes Ottawa (FHO) initiative

On-the-Job Training

- Butterwick Projects, Sundance Housing Cooperative
- iHuman Youth Society's Solar Install and LED Retrofit Project

Dialogues and Case Studies

- Zebx's Deep Emission Retrofit Dialogue Series
- EGBC Case Study Series on Low-carbon Retrofit

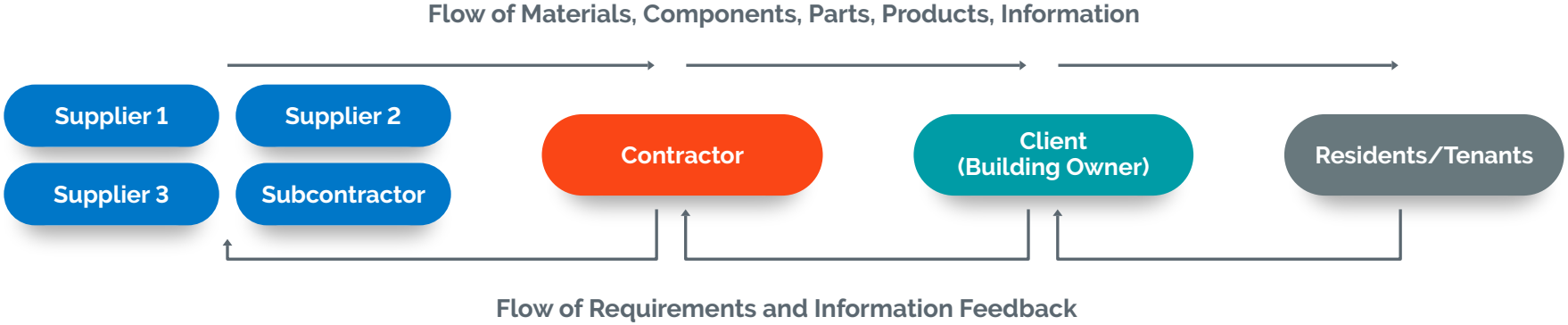
4.

Supply Chain Readiness

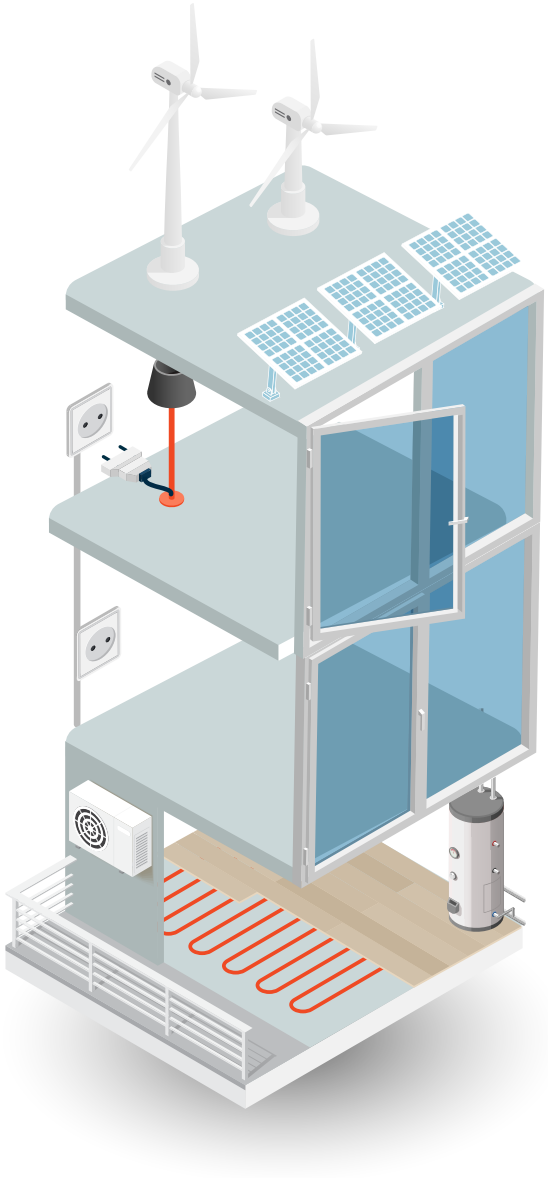
The speed and depth of Canada's building retrofit activity will be dictated in part by the availability of low-carbon technologies and products. Today, the supply chain faces immense challenges, as unprecedented bottlenecks from the global pandemic and political unrest have resulted in material shortages, construction delays, rising costs, and other major disruptions. In this moment of supply challenges and climate crisis, there is an opportunity to redefine the building sector by shifting our focus to sustainable building technologies and products.

A stable low-carbon supply of technologies and products can decrease carbon emissions, improve the resilience of global supply chains, and bring about a more sustainable future. However, it will require attention to what technologies and products should be prioritized, education of the market, support for access through distribution or manufacturing, and downward pressure on pricing.

Figure 13: Elements of the Supply Chain for Retrofit Industry



4.1 Technologies & Products by Retrofit Measure



RENEWABLES
PV systems • Wind • Energy storage

ELECTRICAL
Lighting • Plug Loads • Digitalization

ENCLOSURE
Windows • Doors • Walls

MECHANICAL
Space heating • Hot water • Ventilation

There are clear technical interventions needed to achieve energy and carbon reductions in Canada's building stock. Grouped by building system, these include electrical, enclosure, mechanical, and renewable energy systems.

For each building system there are sub-building measures that constitute a building performance improvement. Each measure relies on certain technologies and products to enable a green retrofit.

Table 8: Technologies and Products by Retrofit Pathway

Building System	Sub-Building System Measures	Technology / Product	
Electrical	Lighting	• LED lighting products • Lamps and Ballasts	• Control systems for lighting and mechanical systems
	Plug loads/digitalization	• Building Automation System (BAS) • Premium Efficiency Motors	• EV chargers
Enclosure	Windows/doors	• Clips, frames, cladding • Energy efficient windows/doors	• High R-value Roll-up Receiving Doors
	Walls and roofs	• Insulation and air barrier systems • Reflective Roofs • High efficiency curtain walls	• Wall recladding systems • Thermal break technology
Mechanical	Space heating/cooling	• Heat pumps (including hybrid gas/ heat pumps, geoexchange)	• Variable Air Volume (VAS) Systems • Airside economizer damper controls
	Hot water heating	• Electric high efficiency domestic hot water	• Modulating burners
	Air distribution systems Ventilation	• Heat and energy recovery systems • Demand controlled ventilation	• Piping and duct work • Distribution system insulation
Renewables	Renewable energy system	• PV systems • Solar domestic hot water • Building Integrated Photovoltaics	• Hybrid (Wind and Photovoltaics) • Energy Storage

4.2 Readiness Evaluation

The readiness of key technology and products will inhibit or accelerate the market's capacity to undertake green retrofits. For the assessment of market readiness, this study considered three factors:

1. **Awareness:** The knowledge and capacity of professional design firms and construction teams to specify, construct and operate products and technology.
2. **Availability:** The ability of the market to procure the product or technology for use in Canada.
3. **Affordability:** The cost of the product or technology as compared to its conventional alternative.

Technology/Product	Awareness	Availability	Affordability
Electrical			
LED lighting products	✓	✓	✓
Lamps and Ballasts	✓	✓	✓
Building Automation Systems (BAS)	◑	✓	◑
Premium Efficiency Motors	✓	✓	✓
EV Chargers	◑	◑	◑
Enclosure			
Clips, frames, cladding	✓	✓	◑
Energy efficient windows/doors	◑	✓	◑
High R-value Roll-up Receiving Doors	✗	✗	✗
Insulation	✓	✓	◑

Reflective Roofs	◑	✓	✓
High efficiency curtain walls	✗	✗	✗
Wall recladding systems	✗	✗	✗
Thermal break technology	◑	✓	◑
Mechanical			
Heat pumps	◑	◑	◑
Variable Air Volume (VAV) Systems	✓	✓	✓
Airside economizer damper controls	✓	✓	✓
Electric high efficiency domestic hot water	◑	◑	◑
Modulating burners	✓	✓	✓
Heat and energy recovery systems	✓	✓	◑
Demands controlled ventilation	✓	✓	✓
Piping and duct work	✓	✓	◑
Distribution system insulation	✓	✓	✓
Renewables			
PV systems	◑	◑	◑
Solar domestic hot water	◑	◑	◑
Building Integrated Photovaltaics	◑	✗	✗
Energy Storage	◑	✗	✗
Hybrid (Wind and Photovoltaics)	✗	✗	✗

4.3 Priority Technologies & Products

There are key building technologies and products that stand out as having greater relevance on the future of building improvements.

The retrofit market would benefit from increased awareness, access, and cost optimization to enable greater uptake.

Technologies and Products	Description
Building Automation Systems (BAS)	A building automation system is an intelligent system that connects the heating, venting, and air conditioning system (HVAC), lighting, and security to communicate on a single platform optimizing building performance. The barriers to adoption include awareness and willingness of owners to implement the technology and the skills and competencies of building managers and operators to leverage the technology in service of the efficiency goals.
Heat Pumps	Heat pumps are high-efficiency heating and cooling systems. The two primary types of heat pumps are ground source, or geothermal, heat pumps (GSHPs) and air source heat pumps (ASHPs). What sets them apart is where they source their heat from: GSHPs transfer heat from the ground, while ASHPs transfer heat from the air. Heat pumps are available for every major building type, including apartment-style residential, small to medium commercial, and larger commercial and institutional buildings. Air-to-water, and cold climate air-source heat pump technology do exist but the number of options available in the North American marketplace is still very limited. High-efficiency electric technology for central domestic hot water applications is less widely available, especially for larger commercial and institutional applications. In the case of retrofits, the installation of heat pumps may also be reliant on drilling wells in parking lots which require skills and equipment that is not widely accessible.

Heat and Energy Recovery Systems	Heat recovery systems extract heat from sources of energy that would otherwise be considered waste heat (e.g., heated air vented out of a building for cooling or air quality purposes, chillers, industrial processes that require extremely hot water or steam, hot water drains, and sewage). Technology for heat capture and recovery are readily available for all major building types however can be costly to install and not common practice in the design of retrofits.
Wall recladding systems	Wall cladding involves laying material over another material to form a 'skin' on the walls to increase efficiency. Wall recladding systems are not widely available and can be expensive. They are not in use across the industry despite being associated with substantive carbon and energy savings.
Building Integrated Photovoltaics	Building-integrated photovoltaics (BIPV) are solar power generating products or systems seamlessly integrated into the building envelope and part of building components such as façades, roofs, or windows. While BIPV continues to see substantive market growth in Europe and the United States, it still has not been widely adopted in Canada and not often considered in retrofit designs.
Energy Storage	Thermal energy storage works as an HVAC 'battery' for a building. It can store and recover thermal energy, charging and discharging depending on building operation. Energy storage systems are not yet widely available or cost-effective in the Canadian marketplace. Typically considered for large commercial and industrial buildings, battery systems provide an opportunity for peak demand management and can increase resiliency by offering backup power during an outage.

4.4 Enabling Services

As the retrofit market grows, there are services needed to support low carbon renovations at scale. These include models for aggregation and standardization, as well as monitoring and verification.

The investment thresholds, cost-compression and climate imperative require the market to consider how it can identify and aggregate multiple projects for financing. For example, the minimum threshold for the Canada Infrastructure Bank's (CIB) *Commercial Building Retrofit Initiative* is $25 million. An investment this size would be typical of at least 25 projects. Models for aggregation are emerging and include portfolio-wide approaches by large commercial owners. They may undertake a horizontal aggregated approach whereby they bulk purchase a key technology such as lighting or heat pumps and apply it across their buildings. A second aggregation approach could be brokered by turnkey providers such as ESCOs, engineers and contractors, municipalities through C-PACE, utilities through on-bill repayment, third-party investment vehicles, or property management firms. In these scenarios, projects are identified and collected from multiple owners and onboarded through a unified process.

Standardization, monitoring and verifications services have never been more important as owners seek pathways to secure emissions and energy savings in alignment with financing requirements and climate targets. The CIB requires the Investor Ready Energy Efficiency certification to standardize the retrofit planning process, and verify the planned savings - setting up the project for monitoring and verification upon completion. These approaches are reliant on engineering services such as energy modeling as well as data collection and reporting post-project completion.

ESCO Model

An Energy Services Company (ESCO) mitigates the technical and performance risks by designing and implementing retrofit interventions that provide a financial guarantee to project lenders/owners that the energy savings generated will cover the debt service.

Super ESCO Model

A super ESCO is an organization that is capitalized by government and private sector investors to secure retrofit projects and service them through a network of ESCO delivery partners. As a project aggregator, they also help overcome barriers to retrofits by launching calls for tenders on behalf of clients, supporting training activities for the industry and taking on financial as well as technical risks to eliminate financial barriers for ESCOs in the private sector.

SOFIAC (Société de financement et d'accompagnement en performance énergétique)

SOFIAC is Canada's first Super ESCO. It was launched in January 2021 and is the largest energy efficiency initiative of its kind in Canada, providing financing for commercial, industrial, and multi-residential buildings to undertake energy-efficient infrastructure upgrades. It also provided turnkey solutions to the energy efficiency projects, including design, implementation and monitoring supports. The energy cost reduction target for all projects funded through SOFIAC ranges from 25 to 40 per cent per, which could reduce greenhouse gas emissions by 30 to 50 per cent, resulting in the complete decarbonization of these buildings.[10]

5.

Barriers, Opportunities & Recommendations for Further Analysis

Building a green retrofit economy is a complex and multi-faceted challenge with many different organizations able to play a key role.

The barriers, opportunities, and lead organizations identified in the study are described below across the four theme areas of finance, policy, education and awareness, and technology.

5.1 Barriers & Opportunities

Theme	Barriers	Opportunities	Lead Organization/Entity
Finance	• **Cost of labour and green retrofit technologies:** The cost of skilled labour and high-performance materials reduces the business case. • **ROI:** Lack of standardized information about the ROI on retrofit projects.	Encourage adoption of expanded criteria related to benefits of green retrofits to improve the business case. This can include the social and environmental benefits and quality assurance frameworks such as the Investor Confidence Project.	Finance Sector, Government
		Prioritize retrofit projects in publicly-owned portfolios (e.g., social housing) with clear social and environmental benefits to catalyze the local green retrofit economy.	Government, Housing Authorities

Finance (cont'd)		Provide mechanisms for the capital costs of green retrofit upgrades to be worked into the operating funds of the project once complete.	ESCOs
		Develop and disseminate clear information targeted as specific groups about how to make retrofit projects result in positive investment returns.	Industry and Professional Associations, Training Organizations
Policy	• **Lack of green retrofit policy and regulation nationally and provincially:** Inconsistencies across provinces are slowing the uptake of technologies that are ready to be deployed at scale. • **Price of energy and carbon pollution:** A major barrier to making many retrofit projects viable is the relatively low price of carbon and electricity.	Create more transparency around building performance to provide benchmarking and set market scope on building inventory.	Building Owners
		Develop supportive policy to allow financing tools and incentives to show long-term project savings.	Government
		Adjust green building codes and standards to be carbon-based instead of energy-based.	Government
Education & Awareness	• **Limited knowledge and understanding of the business case and language around green retrofits:** The terminology and concepts that shape the business case for retrofits are still not widely accepted and understood across the supply chain. • **Knowledge and skills gaps in the workforce:** Due to the lack of knowledge and experience with green retrofit technologies among contractors and building owners, specifically in heat pumps and air tightness.	Develop education campaigns targeted at building owners to build familiarity with terms, concepts, and the business case for green retrofits.	NGOs, Government, Industry Associations
		Develop education for builders and trades on the business case for renovations and retrofits. Support climate and energy literacy across the value chain to help customers know what to ask for in a project.	Training Organizations, Industry Associations
		Develop step-by-step guidance to transition each type of building to net zero, including the decision-making process and a strategy to secure capital financing.	Training Organizations, Industry Associations

Education & Awareness (cont'd)	• **Lack of practical experience:** New entrants into the workforce need the opportunity to develop practical experience through a variety of approaches.	Connect retiring professionals with new entrants to provide mentorship support and onsite training.	Industry Associations, NGOs
Technology	• **Supply chain availability and volatile cost:** Equipment such as heat pumps is mainly sourced from Europe and will be in high demand in order to meet climate targets. Global market forces and disruptions can lead to highly variable prices and shortages. • **Underlying grid infrastructure:** Enabling technologies and infrastructure need to be in place from the ground up to enable different retrofit pathways.	Coordinate efforts to connect the Canadian market with global manufacturers and distributors, eventually leading to opportunities to invest in domestic manufacturing facilities to meet the local market demand.	Government, Economic Development Agencies, Industry Associations
		Invest in smart grid systems and building energy exchange systems to make better usage of energy and intelligent building technologies.	Utilities, Building Owners

5.2 Recommendations & Solution Areas

To achieve the ambitious scale up required to build a thriving green retrofit economy in communities across Canada, several enabling conditions need to be in place.

This section highlights the key recommendations to make progress towards this goal across the given areas of enabling conditions.

Enabling Conditions	Recommendations
Supportive Policy	• Continue to develop policy roadmaps (such as Canada's Green Building Strategy) that can provide the business certainty needed to justify investment in projects, training, and manufacturing. • Support the development of mandatory energy benchmarking, disclosure, and labelling programs. • Require transition plans as part of retrofit programs for all building types to ensure the effective timing and sequencing of carbon reduction measures.
Labour Capacity	• Work with the education sector to promote a career in the building trades as a meaningful pathway to climate action for students at an early age. • Develop occupational roadmaps that prioritize supply-constrained occupations and relevant skills and connect job seekers, new entrants, and newcomers to Canada.
Education, Skills & Training	• Advance innovative training approaches that address skill shortages rapidly such as on-the-job training. • Provide partnership incentives for colleges and training organizations between large urban centres and less populated regions.

Products & Equipment	• Advance a Buy Clean Strategy that will enable public and private procurement to use Canadian-made low-carbon materials. • Strengthen product information on the environmental impact of building materials by supporting certification products like Environmental Product Declarations (EPD) and Life Cycle Assessments (LCA) for Canadian SMEs. • Raise awareness about low-carbon materials to with industry including owners, designers, the construction industry and building operators. • Work with specifiers to refine cost estimates and highlight areas for incentives.
Available Capital	• Promote aggregation of projects that can be bundled into investment opportunities such as portfolio-wide interventions and super ESCO models. • Prioritize infrastructure funding to support green retrofits with verifiable outcomes in terms of carbon emission or carbon intensity.

In Summary

Canada's green retrofit economy is primed for significant growth between now and 2050, and this growth can come with many benefits. These include contributing to net zero climate targets, making our homes and built environment more resilient to climate change and extreme weather events, providing rewarding job opportunities across many occupations and skill levels, and strengthening our domestic supply of low carbon products and services.

In order to realize this growth and associated benefits, the existing approach to retrofit projects will need to level up and transform to a more systematic ecosystem of aggregated project and investment opportunities. Building owners and managers will need expert support in developing and implementing transition plans to leverage building renewal cycles and market opportunities.

The good news is that we have many of the technologies available today and innovation is already happening in communities large and small across the country. By fostering collaboration through the value chain and ensuring the enabling conditions are in place, stakeholders across the green retrofit economy can contribute to modernizing Canada's built environment while helping to meet our climate targets.

Endnotes

1. https://www.theiet.org/media/8758/retrofit.pdf

2. See: https://taf.ca/wp-content/uploads/2020/09/TAF-Business-Case-Deep-retrofits_2020.pdf

3. https://www.cagbc.org/CAGBC/Advocacy/A_Roadmap_for_Retrofits_in_Canada.aspx

4. See: https://portal.cagbc.org/cagbcdocs/advocacy/2021_CaGBC_Decarbonization-Retrofit-Costing-Study_2DEC21_EN.pdf

5. See: https://www.corporateknights.com/built-environment/recovering-stronger-building-low-carbon-future-green-renovation-wave/

6. See: https://portal.cagbc.org/cagbcdocs/advocacy/2021_CaGBC_Decarbonization-Retrofit-Costing-Study_2DEC21_EN.pdf

7. The percentage distribution of multi-unit residential buildings vintage by total floorspace is not available

8. https://www.reuters.com/world/americas/canada-plans-double-homebuilding-decade-where-are-workers-2022-04-10/

9. See more: https://www.pembina.org/pub/deep-retrofit-skills-training

10. https://econoler.com/en/news/major-investments-in-sofiac-for-large-scale-energy-efficiency-retrofit-projects-in-quebec/