

# Deep Retrofit Supply Chain Analysis

Scaling capacity to decarbonize Canadian  
residential buildings

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Raidin Blue and Betsy Agar  
January 2024



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Contributors: Jessica McIlroy, Vishal Ingle, and  
Megan Gordan.

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The Pembina Institute  
#802, 322 – 11 Avenue SW  
Calgary, AB T2R 0C5  
Phone: 403-269-3344  
[www.pembina.org](http://www.pembina.org).

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## Acknowledgements



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# Executive summary

Solution providers along the deep retrofit supply chain have the know-how and technologies needed to deliver deep retrofits. To scale up they need regulations to drive demand, such as building energy performance standards, and investments in training and upskilling to ensure the necessary skilled workforce is in place. Canada's Green Building Strategy will need to address the needs of the supply chain to meet coming demand.

The purpose of this research was to better understand the scope of barriers deep retrofit solution providers face and the supports they need to scale up delivery of deep retrofits. Qualitative data was gathered through semi-structured interviews with deep retrofit solution providers and validated by way of a survey of a broad network of supply chain actors. Respondents identified barriers and supports associated with demand, regulations, technology costs and availability, business operations and workforce.

A review of four jurisdictions providing subsidies direct to the deep retrofit supply chain indicated primary investment in training and upskilling, however innovative jurisdictions such as New York State, Germany and France are investing in modernizing the retrofit process, such as through prefabricated panel manufacturing, supporting Energiesprong market development teams, and providing up to 50% of capital funding.

Four key recommendations have emerged:

- Recommendation 1:** Provide market certainty by implementing regulations that require deep building decarbonization.
- Recommendation 2:** Drive demand by clarifying the benefits of deep retrofits, helping to build trust in industry, and helping reduce complexity.
- Recommendation 3:** Work with utilities and other levels of government to increase grants and incentives to help reduce the high cost of innovative, low-carbon technologies used in deep retrofits that is holding back market growth.
- Recommendation 4:** Foster a more inclusive industry culture and practice by raising awareness and removing barriers to access for equity-deserving groups, and by requiring the employment of equity-deserving groups.

# 1. Defining deep retrofits

Canada's buildings sector is the third-largest contributor to the country's emissions at 87 Mt CO<sub>2</sub>e (13% of the total);<sup>1</sup> 80% of the buildings that will exist in 2050 are already built.<sup>2</sup> Deep retrofits offer a powerful solution to turn our buildings into strong allies in the fight against climate change while offering a range of significant benefits. Indeed, retrofitting existing buildings is the only climate action that can both drive down emissions and protect Canadians from weather events that are increasing in severity and frequency as our climate changes.

A deep retrofit goes beyond simple renovations, encompassing upgrades to various building systems and equipment, including the envelope, HVAC, lighting and building controls. Retrofits could also integrate renewable energy systems to enhance sustainability by reducing reliance on grid electricity, especially while Canada's electricity grid continues to decarbonize, thus freeing up grid capacity to enable electrification of other sectors of the economy. Natural Resources Canada (NRCan) typically expects *deep* retrofits to achieve reductions in energy consumption by 50% to 70% and greenhouse gas emissions by 80% to 100%.<sup>3</sup>

Retrofitting our vintage building stock presents a once-in-a-lifetime opportunity to incorporate non-energy benefits. Difficult to monetize, these additional benefits help make the case for shifting the paradigm from simple payback to capturing the actual value of thoughtful, integrated housing upgrades. Canadians spend upwards of 90% of their time indoors, and deep retrofits should make homes safer, healthier, more resilient and affordable to heat.<sup>4</sup>

Deep retrofit interventions that reduce carbon emissions also provide resilience by adapting buildings to extreme conditions. For example, transitioning homes from gas-

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<sup>1</sup> Environment and Climate Change Canada, *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2021 (2023)*, 12. [https://publications.gc.ca/collections/collection\\_2023/eccc/En81-4-1-2021-eng.pdf](https://publications.gc.ca/collections/collection_2023/eccc/En81-4-1-2021-eng.pdf)

<sup>2</sup> Madi Kennedy, Tom-Pierre Frappé-Sénéclauze, *Canada's Renovation Wave: A plan for jobs and climate*, (Pembina Institute, 2021), 16. <https://www.pembina.org/reports/canadas-renovation-wave.pdf>

<sup>3</sup> NRCan, *Deep Retrofit Accelerator Initiative – Application Guide*, February 2023. [https://natural-resources.canada.ca/energy-efficiency/buildings/deep-retrofit-accelerator-initiative/deep-retrofit-accelerator-initiative-application-guide/24923#\\_Definitions](https://natural-resources.canada.ca/energy-efficiency/buildings/deep-retrofit-accelerator-initiative/deep-retrofit-accelerator-initiative-application-guide/24923#_Definitions)

<sup>4</sup> Dylan Heerema, Vivian Chung, Steven Cretney, *The many benefits of energy efficient homes and buildings*, (Pembina Institute, 2017). <https://www.pembina.org/pub/efficient-buildings-infographic>

powered furnaces to more efficient and reliable heat pumps, and improving ventilation and air filtration, ensures fresh air regardless of extreme temperatures or pollution. Increasing insulation and sealing leaky building enclosures help reduce heat loss, which will reduce heating energy costs and maintain safe indoor temperatures for longer periods during power outages.

Canadian government incentive programs have primarily focused on incentivizing building owners to invest in incremental, one-off energy efficiency measures. In many regions across the country, governments are doubling down, but retrofits need to go deeper and scale up until 4% to 6% of Canada's building stock is being decarbonized yearly in order to meet our 2050 decarbonization goals.<sup>5</sup> The research in this report aims to support the supply chain needed to make these deep retrofits happen.

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<sup>5</sup> *Canada's Renovation Wave*, 13.

## 2. Scaling up deep retrofits

The supply chain has four key stages for delivering and maintaining effective deep retrofit outcomes: assessment, design, implementation and operation (Figure 1).

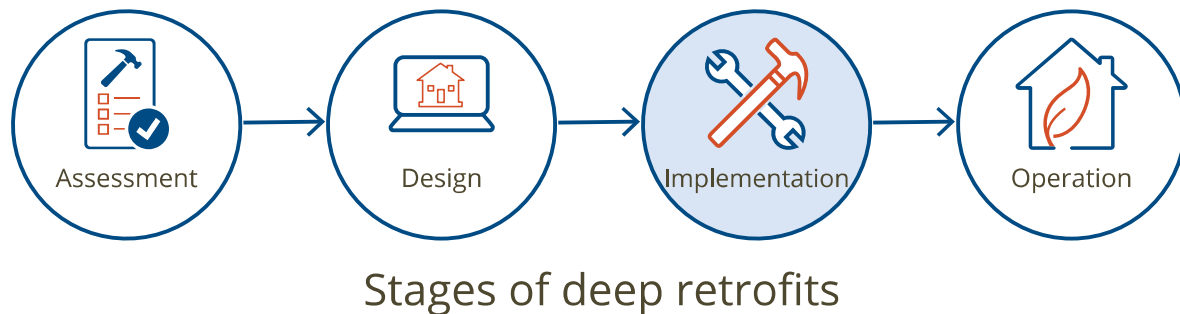


Figure 1. Stages of deep retrofits

At the assessment stage, building owners, energy advisors, auditors and consultants identify the feasibility and cost-benefits of deep retrofitting a given building.

Once retrofitting is determined to be the appropriate path forward, architects, engineers and contractors develop the technical specifications and plans and then work with regulators to obtain the necessary permits and approvals. Contractors continue through the implementation phase, working with suppliers, installers, inspectors and verifiers to procure and install the components and equipment while ensuring quality control and verification of the work.

At the point of operation, building owners, operators and managers work with occupants and evaluators to monitor and maintain systems, ensuring the deep retrofit performs as intended.

This research seeks to understand the paradigm shift needed to stimulate advancement and growth in the supply chain, focusing on actors participating in the implementation phase of the supply chain. We set out to unpack the key barriers the sector faces and the support they need to scale up the delivery of deep retrofits, as well as potential areas of weakness that may be limiting opportunities for the sector as a whole and for participation in the industry by underrepresented populations.



# 3. Methodology

The primary data for this work was collected through interviews and a survey. The interviews helped shape the survey questions and supplemented research on core supports that governments and third-party actors, such as market development teams, can provide to help advance and grow the supply chain.

Interviewers asked deep retrofit solution providers about the barriers they face and the supports they need to advance the deep retrofit market. Participants were prompted to rate how strongly they agreed with the statements describing barriers and solutions using a scale of 1 to 5, with 1 signalling low alignment with the statement and 5 strong alignment.

The survey data results were analysed through a four-phase framework:

1. **Comparing and contrasting responses about supports and barriers:** What are the top barriers and how do they relate to the top supports?
2. **Comparing and contrasting responses to related questions:** How do the responses to a specific question confirm or contradict the responses to other specific questions?
3. **Zeroing in on field-specific interests:** How did mechanical equipment specialists respond to specific questions?
4. **Assessment of significant differences in responses between specialties:** How, for example, do the responses of mechanical experts compare with the responses of enclosure experts?

# 4. Results

## 4.1 Participant characteristics

In total, there were 80 participants to the survey, however only the 59 who completed at least two-thirds of the survey were included in the data analysis. Most participants reported they work in implementation, with 50% being mechanical equipment and design experts (heating, cooling, ventilation) and 18% working in enclosure (windows, doors, walls, roofs). Not surprisingly, there was low representation from emerging specialties such as digital capture.

While nearly 20% of respondents reported working in all provinces and territories across Canada, a majority indicated they work in B.C. (78%), Alberta (25%) and Ontario (21%). This geographical representation may have come about because invitations to participate were sent through networks hosted by the Pembina Institute, TAF and the Zero Emissions Innovation Centre, which operate mainly in those provinces. However, this outcome may also indicate how mature the deep retrofit supply chain is in those regions. For example, British Columbia has made significant strides in advancing energy-efficient construction through the B.C. Energy Step Code, which could contribute to a higher proportion of supply chain actors engaging in deep retrofits.

Most respondents reported working in small businesses:

- 40% in workplaces of less than 10 employees; 36% in workplaces of 10 to 49 employees
- 32% conduct between \$1million and \$10 million in business annually; 24% under \$500,000

As of 2021, 98% of Canadian employers were classified as small- to medium-enterprises (SMEs), and construction makes up the highest proportion (16%) of Canada's total number of SMEs, while 5% are in manufacturing.<sup>6</sup> The Pembina Institute's experience through the Reframed Initiative has also shown that small, nimble supply chain actors may be more able and willing to adopt innovative technologies and practices.

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<sup>6</sup> Statistics Canada (June 2022). *Small and medium businesses: driving a large-sized economy*. <https://www.statcan.gc.ca/o1/en/plus/1253-small-and-medium-businesses-driving-large-sized-economy>

## 4.2 Key barriers

Questions were clustered into categories to facilitate thematic analysis. On average, respondents rated the lack of demand and regulation barriers to scaling up deep retrofits as the top categories, as shown in Figure 2:

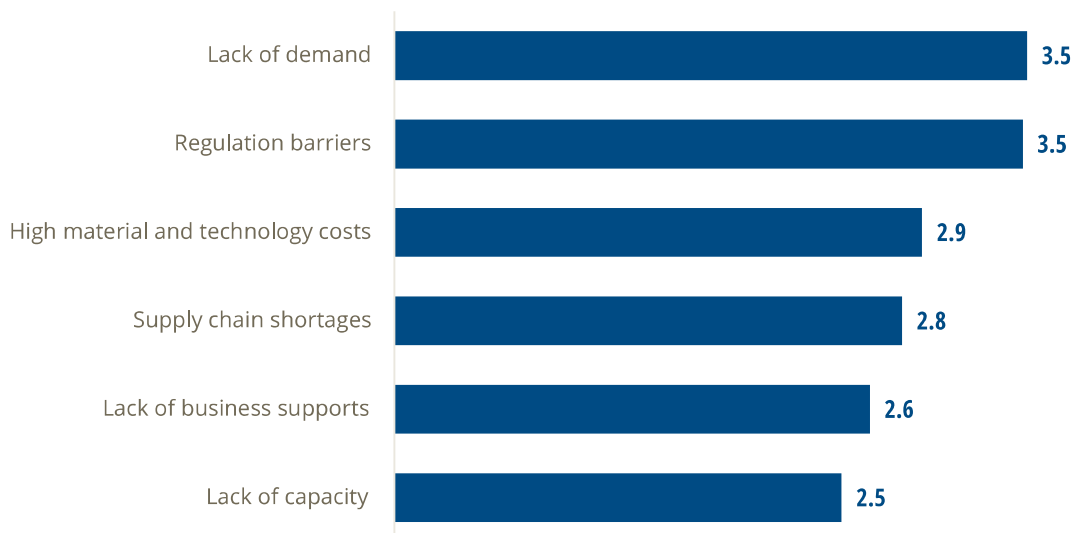


Figure 2. Barriers listed in order of priority based on respondent ratings

Rated from 1 (not a barrier) to 5 (a major barrier)

When broken down by question, the single highest-rated barrier, as shown in Table 1, was the lack of government regulations needed to send a clear market signal that actors along the supply chain can invest in growth with confidence. The next four highest-rated barriers were associated with a lack of demand for deep retrofits due to cost, complexity and unfamiliarity with the industry and technologies. Lack of understanding and costs also received ratings above 3. These responses demonstrate a direct link between the need for regulations and the need to stimulate demand, as well as for support services to help procure deep retrofits.

Respondents also rated building inspector lack of knowledge and difficulties attracting skilled labour as relatively high barriers to scaling up deep retrofits. Combined with the call for regulations, this suggests that with clear market signals through government regulation and regulator capacity building, industry is ready to invest in scaling up delivery of deep retrofits. A complete list of barriers is provided in Appendix B.

Table 1. Top ten barriers to scaling up delivery of deep retrofits (n=57)

Barrier	Rating
Governments have not put in place the necessary regulations requiring deep building decarbonization that would send a clear signal that it is worth investing in market growth	4.4
Building owners don't know who in industry they can trust	3.9
Building owners are put off by the high premiums for innovative, low carbon technologies used in deep retrofits, so market opportunities remain small	3.8
Building owners are not asking for deep retrofits because the benefits are not clear	3.8
Deep retrofits are complex and challenging for building owners to navigate	3.7
Local building code officials lack knowledge of low carbon technologies	3.7
Challenges in attracting skilled labour	3.5
There is poor or no return on investment for owners and investors	3.4
Owners are comfortable with what they know and fear new technologies	3.4
There is a lot of misinformation out there about heat pumps not working well in Canadian climates	3.3

Interviewees identified a lack of direct-to-supplier supports as a barrier to investment in market growth. Somewhat contradictory, survey respondents were not concerned with current supply availability and rated market expansion as a low priority. Taken together with concerns about a lack of demand, supply chain actors appear able to keep up with current demand. Still, they will need greater direct supports to grow and advance to ensure supply keeps pace with expected growth in demand.

Respondents assigned the lowest ratings for questions reflective of their operations (Figure 2), signalling that solution providers are confident in their own capacities and knowledge to advance the deep retrofit supply chain. Despite being in an inflationary economic climate, supply chain costs were the lowest rated of the barriers to scaling up deep retrofits.

To gain a finer understanding of the unique challenges faced by specific supply chain actors, we broke down the data further based on respondent relationships to major building systems. The two primary groups were associated with the building envelope, such as windows, insulation, roofs, doors, and with mechanical equipment including space and water heating and ventilation.

For the most part, there was no significant difference in the responses submitted by these two groups, with one exception. The respondents from the envelope category rated the lack of capacity to prepare business plans, financial projections and loan applications that give lenders and investors confidence more highly than those in the mechanical equipment category.

One explanation may be that equipment manufacturing processes and business models are well established (this is consistent with data out of the U.S. that indicates most of the workforce contributing to building efficiency technologies work in HVAC; see section 5.1), while envelope retrofitters are exploring new implementation strategies to help scale and speed up delivery. The construction industry is still in the early stages of industrializing its practices, such as through prefabrication.<sup>7</sup> However, a strong interest in growing prefabrication solutions was indicated through the Reframed Initiative, where the Pembina Institute hosted a community of practice made up of retrofitters, who provided insights on working with existing buildings, and manufacturers of panel and modular housing, who shared strategies for streamlining production.

In expressing a need for more business supports, survey respondents associated with building envelopes may be signalling they are exploring new business models to streamline delivery of solutions that have traditionally involved the coordination of multiple actors along the supply chain in live construction time.

### 4.3 Supports to scale up delivery of deep retrofits

Consistent with the top barrier ratings, the three highest rated supports (Table 2) were the need for regulations, including mandating building performance standards and disclosure, and for mechanisms to mandate implementation of measures outlined in the coming alterations to existing building codes.

Just behind these, respondents indicated a need for supports to drive demand through raising consumer energy literacy and awareness of benefits, debunking myths about heat pumps, increasing incentives to soften cost premiums and funding demonstration projects and case studies.

Within the top ten, respondents signalled a need for trade upskilling, although this somewhat contradicts the low rating given to concerns about a lack of opportunities for

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<sup>7</sup> Craig Mitchell, *The State of Prefabrication in Canada A Market Study of Mass Timber, Panels, and Volumetric Modular Construction*, prepared for Forestry Innovation Investment (2021), 54.

<https://www.naturallywood.com/resource/the-state-of-prefabrication-in-canada/>

training and upskilling. This may signal an important nuance about the workforce: while finding, training and retaining *entry-level* labour were low barriers, supports are needed to help attract *skilled* labour and provide trade upskilling.

Table 2. Top ten supports needed to scale up delivery of deep retrofits (n=52).

Supports	Average rating
Set energy performance standards for buildings	4.6
Require disclosure of energy performance to build consumer awareness and inform policy and program design to drive demand	4.5
Develop mechanisms to require measures identified in the (coming) alterations to existing buildings code for all building renewal types and scales	4.4
Drive demand with more government and utility incentives directed toward deep retrofit projects	4.3
Raising awareness among owners and decision-makers about the energy, cost and other non-energy benefits of deep retrofits	4.2
Trade upskilling	4.1
Conducting pilot projects and showcasing successful deep retrofit case studies	4.1
Grants for deep retrofit demonstration projects	4.1
Building science literacy (buildings as a system, heat and moisture transfer, historic construction)	4.1
Raising awareness about the available supports for deep retrofit projects	4.1

Several survey respondents' comments indicated financiers and real estate representatives need more information about the value of deep retrofits; there was a push among respondents for building performance metrics to be shared in real estate listings and appraisals and transactions. This aligns with the high-rated support calling to raise awareness among decision-makers about the benefits of deep retrofits. It also may contribute to the high ratings assigned to the need for more government capital grants and incentives. It is consistent with the ongoing cost challenges deterring demand for deep retrofits.

Support for driving demand is generally provided through a 'demand-pull' approach, according to Innovation Solutions Canada, which recommends a supply-push procurement policy mechanism. In this model, solutions providers can test and

implement innovations not yet available to consumers, which helps small businesses enter the market.<sup>8</sup> Natural Resources Canada has recently launched the Greener Neighbourhoods Pilot Program and Deep Retrofit Accelerator Initiative to fund market development teams to help advance innovative solutions and scale up delivery of deep retrofits. The success of these innovative government-sponsored programs will depend on access to capital.

Social procurement is another initiative to support equitable development of the deep retrofit supply chain. As described by The Atmospheric Fund, "social procurement mobilizes the power of the purchasing process to prioritize working with local workforces and suppliers [and equity-deserving groups] by giving preference to bidders and contractors that meet such social considerations in their workforce and supplier relationships."<sup>9</sup> Such policy initiatives have gained traction in the City of Toronto<sup>10</sup> and among B.C. elected officials.<sup>11</sup>

The lowest-rated responses indicated respondents are not concerned with accessing markets outside of Canada. Similarly, the respondents rated having greater access to innovations developed overseas as a low priority. While these ratings may be more indicative of a maturing sector that is more accustomed to serving hyper-local markets, Canada's relatively small, dispersed market share means our supply chain should be building a longer-term strategy and planning for domestic and foreign export markets to achieve efficiencies of scale.

It is worth noting that while respondents generally assigned low ratings for supports to provide training on reconciliation, equity, diversity, inclusion and intersectionality, one respondent commented that sexism and racism are affecting employee retention in trades and renovations. This contradiction could reflect workplace culture and industry blind spots to barriers uniquely faced by equity-deserving groups, which would be consistent with Pembina-led research that shows women and equity-deserving groups

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<sup>8</sup> Innovation, Science and Economic Development Canada, "Innovation and procurement: the secret sauce," September 27, 2022. <https://ised-isde.canada.ca/site/innovative-solutions-canada/en/innovation-and-procurement-secret-sauce>

<sup>9</sup> Fatima Crerar, "More efficient homes plus new local jobs can create lasting affordability," *The Atmospheric fund*, December 8, 2023. <https://taf.ca/more-efficient-homes-plus-new-local-jobs-create-lasting-affordability/>

<sup>10</sup> City of Toronto, "Social Procurement Program," 2023. <https://www.toronto.ca/business-economy/doing-business-with-the-city/social-procurement-program/>

<sup>11</sup> British Columbia Social Procurement Initiative, "What is social procurement," *BCSPI*, 2023. <https://bcspi.ca/what-is-social-procurement/>

are underrepresented in the energy sectors and trades.<sup>12, 13</sup> Pembina attributed underrepresentation to workplace culture; barriers to training and entry attributed to industry cultural norms; lack of representation; and experiences of harassment and violence in the workplace.

Demographic data on the energy efficiency workforce in Canada was unavailable at the time of publication, and demographic information was not collected as part of this work. However, we can compare to adjacent workforces such as the energy efficiency sector in America and Canada's electricity sector. In America, more than 70% of the energy efficiency workforce is white and male.<sup>14</sup> In Canada's electricity sector, female employment represented 16% of the workforce, and racialized groups under 22%.<sup>15</sup>

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<sup>12</sup> Calyssa Burke, Sarah Winstanley, Jaymes MacKinnon, and Laura Hughes, *Equitable Net-Zero: Recommendations for advancing gender equity in Alberta's energy transition* (Pembina Institute, 2022). <https://www.pembina.org/pub/equitable-net-zero>

<sup>13</sup> Genevieve Doiron, Emma Severson-Baker, Laura Hughes, *Women in Alberta's Energy Transition: A Review of Barriers to Participation and Leadership* (Pembina Institute, 2021). <https://www.pembina.org/reports/2021-10-14-womeninalbertasenergytransition-pembina.pdf>

<sup>14</sup> E4TheFuture, *Energy Efficiency Jobs in America* (2023), 5. <https://e4thefuture.org/wp-content/uploads/2023/10/Energy-Efficiency-Jobs-in-America-2023.pdf>

<sup>15</sup> Electricity Human Resources Canada, *Electricity in Demand: Labour Market Insights 2023-2028* (2023), 55-56. [https://ehrc.ca/wp-content/uploads/2023/11/EHRC\\_LMIReport-EN\\_Digital\\_v4.pdf](https://ehrc.ca/wp-content/uploads/2023/11/EHRC_LMIReport-EN_Digital_v4.pdf)



## 5. Jurisdictional scan of retrofit subsidies

In Canada, retrofit investments have focused on demand-side supports, meaning they incentivize building owners to implement deep retrofits. For example, the Canada Greener Homes Grant provides grants from \$125 to \$5,000 for home retrofit projects including insulation, air-sealing, and switching space and water heating; and interest-free loans of up to \$40,000 for larger projects.<sup>16</sup> Supply-side subsidies have predominantly focused on growing and developing the skills of the workforce. Efficiency Canada estimates 436,000 workers are in energy efficiency jobs.<sup>17</sup>

The following sections summarize supports emerging out of the United States, New York State, Germany, and France, which helped to inform Recommendation 3. By comparison, jurisdictions outside of Canada are demonstrating greater direct support for growing and advancing the deep retrofit supply chain.

### 5.1 United States

In the United States, an estimated 2.2 million Americans work in energy efficiency (Table 3). These jobs are disaggregated by position, industry and technology in Figure 3. The majority of workers are in administrative, sales and management positions, and predominantly in the construction industry and working with HVAC technology.

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<sup>16</sup> Natural Resources Canada, “Canada Greener Homes Initiative,” August 24, 2023. <https://natural-resources.canada.ca/energy-efficiency/homes/canada-greener-homes-initiative/24831>

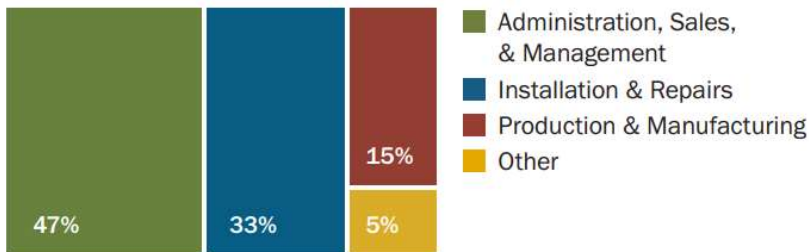
<sup>17</sup> Efficiency Canada, “Career Hub,” 2023. <https://www.energycanada.org/career-hub/>

Table 3. Energy efficiency jobs in the U.S.

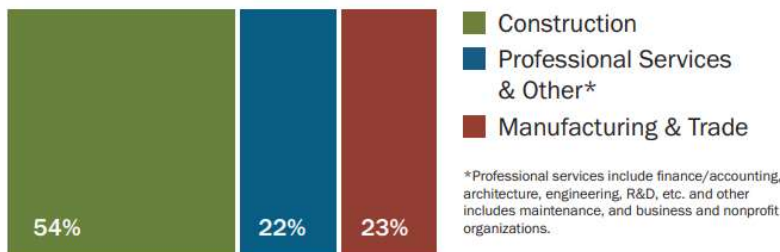
Jurisdiction	Energy Efficiency Jobs
United States	2.2 million
California	294,396
Texas	164,470
New York	126,008

Source: E4TheFuture<sup>18</sup>

### ACROSS POSITIONS



### ACROSS INDUSTRIES



### ACROSS TECHNOLOGIES

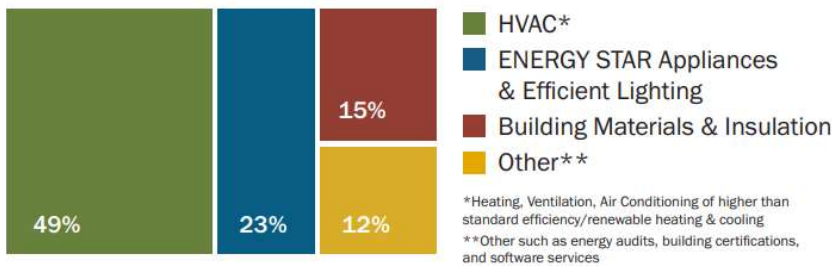


Figure 3. Energy efficiency jobs in the U.S. by position, industry and technology

Source: E4TheFuture<sup>19</sup>

<sup>18</sup> E4TheFuture, *Energy Efficiency Jobs in America* (2023), 1.

<sup>19</sup> E4TheFuture, *Energy Efficiency Jobs in America* (2023), 4.

Two key pieces of legislation in the United States that will contribute to advancing the deep retrofit supply chain are the *Inflation Reduction Act* and the *Infrastructure Investment and Jobs Act*. This legislation has enabled the State-Based Home Energy Efficiency Contractor Training Grants (\$150 million of the \$200 million fund has been allocated), administered by state energy offices to expand the retrofit workforce.<sup>20</sup> The funding is designed to reduce the cost of contractor training and certification. States applying for this funding must include workforce needs assessments, workforce development plans, performance metrics, and community benefit plans.

## 5.2 New York State

The State of New York stands out as an energy efficiency leader and is a better scale comparison with Canada in terms of population. Through the state-based Home Energy Efficiency Contractor Training grants mentioned above, New York has been awarded \$6.4 million. In addition, the state has dedicated more than \$230 million to clean energy workforce development and training through the public-benefit corporation New York State Energy Research and Development Authority (NYSERDA).<sup>21</sup> This has included career pathways training for high-efficiency HVAC and heat pumps, on-the-job training for new clean energy workers, internships for students at clean energy companies, and training for building and operations staff to operate and maintain buildings systems properly.

New York State also hosted the RetrofitNY program, which program launched in 2018 and will be sunset at the end of 2023. With a focus on low- to moderate-income multi-family housing, RetrofitNY supported the market entry of new companies that provide net-zero carbon building retrofits that are modular, replicable, and scalable. The program also drove adoption of a cost-transparent and efficient delivery model, and motivated private investments in the supply chain. Examples of this work has included the program NYSEDA PON 4878 which provided \$136,000 as an initial design award and up to \$54,000 per unit. This funding was received by projects delivery whole-

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<sup>20</sup> U.S. Department of Energy, “State-Based Home Energy Efficiency Contractor Training Grants,” Office of State and Community Energy Programs, July 2023. <https://www.energy.gov/scep/state-based-home-energy-efficiency-contractor-training-grants>

<sup>21</sup> NYSEDA, “Workforce Development and Training,” 2023. <https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Workforce-Development-and-Training>

building, carbon neutral retrofits of 1-7 story residential buildings, by qualifying affordable housing owners, and by component manufacturers.<sup>22</sup>

## 5.3 Germany

Since 2021, Germany has hosted a subsidy program directly supporting installers with product development, which includes two funding streams.<sup>23</sup>

The first funding stream supports the development and testing of serial retrofit components for individual pilot projects. The program highlights the need for prefabrication as a means to replicate and scale up retrofit delivery. The funding is capped at 25% of eligible costs and up to 35% for small to medium enterprises.

A second funding stream promotes development of production capabilities for the industrial production of building exterior elements, and associated building systems and technologies. Eligible development activities can include expanding or establishing new production facilities or purchasing equipment. Funding is available for up to 20% of eligible expenses for small companies (maximum \$2.9 million), 10% for medium (maximum \$1.5 million).

## 5.4 France

Energiesprong France<sup>24</sup> provides a unique example of supply chain subsidy because it is government funded. Like Canada's Deep Retrofit Accelerator Initiative, a third-party market development team directly intervenes in the market to assist in the delivery of deep retrofits by aggregating deep energy retrofit demand and matching projects with supply chain actors. The financial support comes from the European Union through the *Interreg North-West Europe* (a sustainable development program) and *Horizon2020* (a research and innovation funding program), *L'Agence de la Transition Écologique* (the Environment and Energy Management Agency) and from the *Caisse des Dépôts* (a public financial institution).

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<sup>22</sup> NYSERDA, "Program Opportunity Notice (PON) 4878,"

<https://portal.nyserda.ny.gov/servlet/servlet.FileDownload?file=00Pt000000auQKiEAM>

<sup>23</sup> Bundesministerium für Wirtschaft und Klimaschutz, "Bundesförderung Serielles Sanieren," 2023.

[https://www.bafa.de/DE/Energie/Energieeffizienz/Seriell\\_Sanieren/serielles\\_sanieren\\_node.html](https://www.bafa.de/DE/Energie/Energieeffizienz/Seriell_Sanieren/serielles_sanieren_node.html)

<sup>24</sup> Energiesprong, "Energiesprong fr," 2023. <https://www.energiesprong.fr/>

With the objective to create mass demand for renovation without imposing uniformity and with stringent performance criteria, Energiesprong France engaged 64 stakeholders, including 14 social housing providers, in 2018 and committed to retrofitting 6,550 homes by 2023.<sup>25</sup> Continuing to deepen its commitment, *L'Agence de la Transition Écologique* has increased its cap on capital funding to 50% for a call for proposals ending January 2024.<sup>26</sup>

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<sup>25</sup> Energiesprong, “Energiesprong is growing in France! 64 stakeholders are now committed to retrofit 6,550 houses,” 12 October 2018. <https://energiesprong.org/energiesprong-is-growing-in-france-64-stakeholders-are-now-committed-to-retrofit-6550-houses/>

<sup>26</sup> L'Agence de la Transition Écologique, “FAQ : les principales questions qui se posent au moment de déposer un dossier,” March 2023. <https://agirpoulatransition.ademe.fr/entreprises/sites/default/files/FAQ%20ADEME%20-%20France%202030.pdf>

## 6. Recommendations

To support growth in Canada's deep retrofit supply chain with the goal of scaling up deep retrofits that make homes and buildings healthier, safer, more resilient, and affordable to heat, our research indicates governments at all levels across Canada need to work together to:

**Recommendation 1:** Provide market certainty by implementing regulations that require deep building decarbonization:

- Set energy performance standards for buildings.
- Require disclosure of energy performance to build consumer awareness and inform policy and program design to drive demand.
- Develop mechanisms to require measures identified in the (coming) alterations to existing building codes for all building renewal types and scales.

**Recommendation 2:** Drive demand by clarifying the benefits of deep retrofits, helping to build trust in industry and reduce complexity:

- Raise awareness among owners and decision-makers about the energy, cost and other co-benefits of deep retrofits.
- Support market development teams and retrofit accelerators to ease the customer journey through solution development and concierge services.

**Recommendation 3:** Work with utilities and other levels of government to increase grants and incentives to help reduce the high cost of innovative, low-carbon technologies used in deep retrofits that is holding back market growth:

- Provide greater government and utility incentives directed toward deep retrofit projects.
- Connect market development teams sponsored through the Greener Neighbourhood Pilot Program and the Deep Retrofit Accelerator Initiative with access to last-mile funding to ensure projects are completed while market forces catch up and costs come down.

**Recommendation 4:** Foster a more inclusive industry culture and practice by raising awareness and removing barriers to access for equity-deserving groups, and by requiring the employment of equity-deserving groups:

- Use social procurement practices to increase representation of women and other equity deserving groups in the sector.

- Provide training in reconciliation, equity, diversity, inclusion and intersectionality.
- Help improve access to skilled labour opportunities.
- Create good job standards, particularly for working parents.
- Help support career advancement pathways.
- Develop measures to address the income gap.

In sum, Canada's Green Building Strategy will need to integrate supports for deep retrofit solution providers working to grow and advance the supply chain in tandem with developing supports to grow demand through supportive funding programs and regulations.

# Appendix A. Respondent details

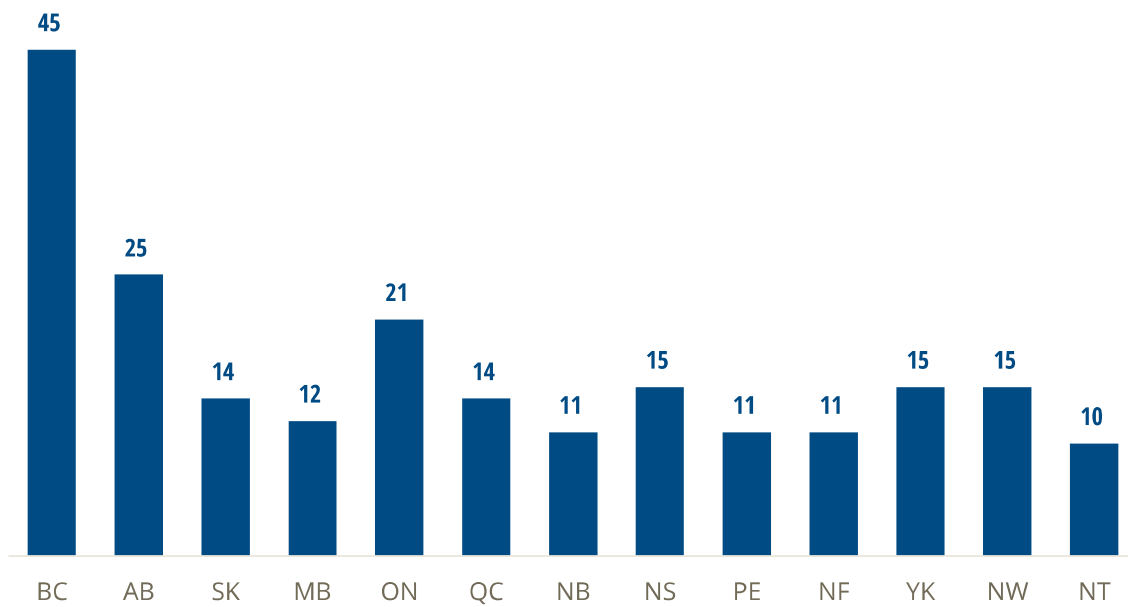


Figure 4. Region of operations of survey respondents (n=58)

Note: respondents may operate in multiple regions



# Appendix B. Barrier questions and results

Table 4. Average response to barriers, rated from 1 (not a barrier) to 5 (a major barrier)

Barriers	Average rating
Governments have not put in place the necessary regulations requiring deep building decarbonization that would send a clear signal that it is worth investing in market growth	4.4
Owners don't know who in industry they can trust	3.9
Owners are put off by the high premiums for innovative, low carbon technologies used in deep retrofits, so market opportunities remain small	3.8
Owners are not asking for deep retrofits because the benefits are not clear	3.8
Deep retrofits are complex and challenging for owners to navigate	3.7
Local building code officials lack knowledge of low carbon technologies	3.7
Challenges in attracting skilled labour	3.5
There is poor or no return on investment for owners and investors	3.4
Owners are comfortable with what they know and fear new technologies	3.4
There is a lot of misinformation out there about heat pumps not working well in Canadian climates	3.3
Unstable demand makes it hard to project long-term market opportunities that would give us confidence to invest in growth	3.1
There are a lack of lending supports to help grow our business	3.0
Regulatory hurdles and compliance requirements make it hard to specify innovative, low carbon technologies and materials	2.9
Regulations limit access to cutting-edge innovations manufactured outside of Canada	2.9
Difficulties due to lack of domestic products	2.9

There are long delivery delays and waitlists for key, low carbon technologies and products	2.8
We struggle to attract investors in growing our business	2.6
Shipping costs discourage us from specifying innovative technologies and materials produced outside our region	2.6
Lack of research done on the state of the deep retrofit market	2.5
Challenges in attracting entry-level labour	2.5
Challenges in retaining labour	2.4
Supply chain costs are making revenue margins too small to justify expanding our operations right now	2.4
We don't know who else is working in the deep retrofit space	2.3
We lack capacity to prepare business plans, financial projections, and loan applications that give lenders and investors confidence	2.3
There are not enough opportunities for training and upskilling	2.2
Lack of information on key, low carbon technologies and products	2.0

# Appendix C. Support questions and results

Table 5. Average response to supports, rated from 1 (not helpful) to 5 (very helpful)

Supports	Average rating
Set energy performance standards for buildings	4.6
Require disclosure of energy performance to build consumer awareness and inform policy and program design to drive demand	4.5
Develop mechanisms to require measures identified in the (coming) alterations to existing buildings code for all building renewal types and scales	4.4
Drive demand with more government and utility incentives directed toward deep retrofit projects	4.3
Raising awareness among owners and decision-makers about the energy, cost and other non-energy benefits of deep retrofits	4.2
Trade upskilling	4.1
Conducting pilot projects and showcasing successful deep retrofit case studies	4.1
Grants for deep retrofit demonstration projects	4.1
Building science literacy (buildings as a system, heat and moisture transfer, historic construction)	4.1
Raising awareness about the available supports for deep retrofit projects	4.1
Help owners connect with trusted industry players	3.8
Work with lenders on developing mechanisms to increase access to capital for business growth	3.8
Facilitation of collaboration along the deep retrofit supply chain on innovative projects	3.8
Providing technical assistance and financial planning guidance to building owners to overcome fear of the unknown	3.7
Building performance monitoring (automation, instrumentation)	3.7

Funding and resources to establish centres of excellence	3.6
Providing small business supports to build capacity in business management and market growth strategies	3.6
Recruitment training passing on knowledge, attracting labour)	3.5
Work with investors on developing mechanisms to increase access to capital for business growth	3.5
Provide one-stop-shop concierge services to help owners navigate the complexities of deep retrofit planning	3.5
Digital literacy (digital capture, data management, data analysis)	3.5
Logistics and planning (manufacturing, prefabrication, construction management)	3.5
Create trusted supplier and manufacturer networks to facilitate owner decisions	3.4
Knowledge of regulations, standards, and certification metrics	3.4
Financial planning	3.4
Team communications	3.3
Business management	3.3
Financial support for manufacturers and suppliers to help expand market reach	3.3
Reduce barriers to accessing cutting edge low carbon technologies produced outside Canada	3.2
Support access to international markets for domestic products and know-how	3.2
Training in diversity, equity, inclusion, intersectionality, and reconciliation	2.9
Prioritize sourcing domestic supply and manufacturing of materials and components through procurement policies	2.6