Toward a Canada Green Buildings Strategy

WHAT WE HEARD FROM THE PUBLIC AND BUILDINGS SECTOR STAKEHOLDERS

Natural Resources Canada
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Canada

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1.0 Toward a Green Buildings Strategy: Introduction

To protect our environment and reduce the impacts of climate change, the Government of Canada released its Emissions Reduction Plan (ERP) in 2022. This plan outlines our country's commitment to reducing emissions by 40 to 45% (below 2005 levels) by 2030, and to reach net-zero by 2050. As the buildings sector is the third-largest source of greenhouse gas emissions (GHG) in Canada, decarbonizing it is a critical part of achieving these goals.

Budget 2022 committed $150 million to develop the Canada Green Buildings Strategy (CGBS, the strategy) and to launch the Codes Acceleration Fund. Natural Resources Canada (NRCan) is leading this work for the Government of Canada and working closely with, provinces and territories, Indigenous partners, and stakeholders from across the buildings sector to develop pathways to decarbonization in Canada's buildings sector in Canada by 2050 and increase building resilience, with clear milestones along the way. To succeed, all levels of government, the private sector, communities, and individuals across Canada need to work together.

Engagement to inform the development of the Strategy took place from the summer of 2022 to early 2023.

This report summarizes feedback from the public, industry, municipalities/regional perspectives, and the financial sector.

The purpose of this report is to share what we've heard to-date. It is not to reflect policy direction or the intent of NRCan or the Government of Canada. Stakeholder feedback will help us to build informed options for the development of the strategy.

NRCan would like to thank everyone who provided feedback.

2.0 Engagement process

In August 2022, we launched an engagement process to inform the development of the strategy. To frame discussions and engagement, we released a discussion paper with six themes and associated questions.

2.1 How we received feedback

We received feedback via:

- 667 responses to our online questionnaires posted to the NRCan Green Buildings webpage
- approximately 210 touchpoints (i.e., written or verbal information exchanges) with more than 161 buildings sector stakeholders, including:
    - 68 written responses to the Discussion Paper
    - 8 in-person or virtual roundtables where we received input from a cross-section of individuals and organizations with expertise across the buildings ecosystem

2.2 Who we heard from

Stakeholders either: self-selected to participate based on their interest, expertise or proximity to the buildings sector; or were contacted by NRCan based on their relevance, knowledge, and leadership in the sector. They reflect a wide range of perspectives, including:

- the public;
- Industry (those working in, or with a professional interest in the buildings sector):
    - utilities;
    - professionals (e.g., architects, engineers, surveyors);
    - construction and trades (e.g., builders, HVAC specialists, window installers, insulators);
    - real estate;
    - buildings owners (individual or large-scale commercial), managers and operators;
    - think tanks, academia; and
    - non-government organizations
- municipalities and others with a regional perspective
- the financial and insurance sectors

To help to elevate the diverse needs, priorities, and views of Indigenous peoples in the Canada Green Buildings Strategy, over the past year, NRCan has engaged Indigenous partners across Canada on green buildings and energy efficiency – particularly related to housing issues.

Ongoing dialogues have now been established with many National Indigenous Organizations and governments, complemented by efforts to reduce over-engagement through targeted collaboration across the federal family to identify what Indigenous partners have already communicated to the Government of Canada on these topics.

Working-level dialogues were supplemented with additional meetings between some National Indigenous Organizations, National Indigenous Women's Organizations, regional organizations, and Indigenous industry representatives with senior Natural Resources Canada officials through Spring 2023.

The learnings from these conversations and analyses have been captured in the "Summary of Engagement with Indigenous Partners Report", which is being updated regularly with a view to providing ongoing guidance to aid the development of related policy and program measures.

3.0 Highlights: Opportunities, Challenges and Considerations

The challenge of decarbonizing Canada's buildings sector is complex and multi-faceted and brings with it strong climate and economic benefits for all Canadians. It will require innovation, collaboration and investment to reach the goal of net-zero buildings by 2050.

Overall, a key takeaway of engagement undertaken for the Strategy is that stakeholders largely agree with the content of the Discussion Paper. A significant majority of participants have stated that the discussion paper targeted the right strategic themes and areas requiring change overall. Where differences of opinion are expressed, it is within themes of the discussion paper and often on the prioritization or sequencing of activities and approaches to implementation, rather than on the overall themes.

Stakeholders also highlighted the **significant opportunities** of decarbonizing buildings including:

- increasing economic activity;
- growing the workforce;
- improving energy affordability for Canadians;
- reducing the impacts of energy price fluctuations;
- protecting homes and buildings from extreme weather events while increasing building resilience; and
- positioning Canada as a global provider of choice for innovative technologies and materials.

Stakeholders recognized the challenges of reaching Canada's 2030 and 2050 targets and pointed out multiple areas requiring sustained supports such as:

- **Affordability:** Energy costs, equitably addressing energy retrofits and energy efficiency improvements;
- **Technology:** Availability of solutions for different climate zones and need for ongoing research with amplified focus on commercialization of promising research;
- **Finance:** Financing the transition to a net-zero buildings sector (capital investments and operational costs); balancing the costs and benefits of action versus inaction;
- **Data needs:** Standardized, accessible, and accurate buildings energy performance data;
- **Market readiness:** How to prepare and transform the market by reducing risks associated with new approaches and building technologies;
- **Supply chain constraints**: Lack of low-carbon material and equipment, including made-in-Canada options;
- **Preparedness for climate emergency:** Resiliency retrofits to address environmental threats and non-weather-related consequences of climate change;
- **Public awareness:** Increasing public and buildings sector awareness and knowledge of the technological options available to decarbonize our homes and buildings;
- **Skills and capacity-building:** Making information available and capacity-building so that building owners, municipalities, etc. can make informed decisions.

Overall, stakeholders highlighted the importance of early action to meet Canada's emissions targets, recognizing that a range of related work is already happening, with a majority supporting the need for the Strategy to accomplish the following:

- **Vision:** Setting a clear path to 2050, including announcing any regulatory pathways and upcoming changes to building codes transparently, with long lead times;
- **Collaboration and Coordination:** Working closely with provinces, territories, Indigenous partners, and stakeholders from across the buildings sector on the development of a Strategy and its implementation plan over time;
- **Leading by example:** Implementing federal funding principles to green buildings, such as Buy Clean, in federal procurement and considering value-based procurement rather than lowest bidder; and

- **Supporting Research and Development:** Continuing to support research and commercialization, where appropriate, of buildings technologies to ensure new solutions are developed and adopted as quickly as possible. Several stakeholders highlighted the importance of work on embodied carbon, in particular.

Summarized below are the prominent issues, concerns, and messages we heard from some specific groups of stakeholders.

From the public:

- **Information:** A need for greater awareness and succinct information on what actions can be taken to decarbonize homes and improve climate resiliency, to enable individuals to confidently take action;
- **Cost / affordability**: Supply chain disruptions and labour shortages are increasing costs of home energy efficiency improvements. Rising utility costs (heat, electrical, and water) are also impacting Canadians and increasing anxiety;
- **Governments lead:** Primary responsibility for reducing buildings emissions lies with governments – both federal and provincial/territorial governments - but industry must actively participate in the transition to net-zero; and
- **Equity, inclusion and personal values:** Equity and inclusion considerations are critical to the success of the Strategy. Many also indicated the importance of the Strategy aligning with their personal values related to climate change and achieving Canada's emissions targets.

From Industry/buildings sector professionals:

- **Increase capital available**: Financial supports through incentives, programs, and partnerships with private investors are needed to increase the pool of available financing; Centralized, accurate, and accessible climate and energy use data is needed quickly to support decision making and enable more investments;
- **Labour force**: Immediate and long-term workforce shortages must be addressed to accelerate the pace of buildings sector decarbonization; and
- **Clarity**: Clarity on future strategic decisions and requirements, including long lead times and transparency on plans for building code revisions and any regulatory changes.

From municipalities and those with a regional perspective:

- **Capacity-building:** Capacity building and funding are essential to support municipalities in their efforts to decarbonize buildings. Multiple types of supports are needed (e.g. staff grants, consistent funding to develop in-house expertise, support to enforce code compliance, training modules and other staff supports);
- **Use all policy levers:** Incentives are insufficient to drive change. Different policy levers, including regulation and required financial supports, are needed to achieve climate targets; Greater funding and new models of retrofitting that enables community-level scaling are needed to offset the costs of decarbonizing buildings, to facilitate an inequitable transition;
- **Asymmetry across Canada**: Municipalities fall under provincial and territorial jurisdiction and a tapestry of different legal authorities frame their maximum ambition in the buildings sector; and

- **Alignment:** Alignment on energy efficiency and other buildings programming is needed. Municipalities request streamlined program delivery, in partnership with provinces/territories or with utilities, to improve access and avoid competition or mixed messages among programs in their jurisdictions.

From the financial Sector:

- **Data:** High-quality, granular, data on energy use, emissions and climate risk is needed to accurately assess portfolios and expand 'green' financial offerings;
- **Increase demand**: Demand for green buildings could be created by accelerating public-sector procurement frameworks, such as Buy Clean, and awareness building among Canadians;
- **Partnership in Research, Development & Demonstration:** Early-stage public-private partnerships could accelerate the funding and commercialization of Research, Development & Demonstration (RD&D) projects; and
- **Transparency and knowledge mobilization:** All government investments could be used as demonstration projects. Coupled with transparent data and information on lessons learned, projects could serve as a public utility for investment.

4.0 What we heard: written submissions and roundtables

This section summarizes feedback from written submissions and roundtables, organized under the six themes introduced in the discussion paper. Some stakeholders also offered broad comments, for example noting the importance of bolder action in order to meet climate targets, suggesting market transformation as an area where the federal government could have a significant impact, and highlighting the importance of equity (leaving no one behind) for the Strategy to be successful.

Several submissions highlighted the importance of taking an integrated approach to the broad range of policy, regulatory, investment, RD&D, and other considerations to avoid siloed implementation. The Strategy will need to focus on implementation, including support for industry coordination to achieve its cross-cutting objectives.

4.1: Leading by example

Context from the Discussion Paper: Government buildings need to be decarbonized and climate resilient. Governments are doing this by leading and influencing policy, programs, and regulations. They also manage large procurement programs.

Strategic Objective: All levels of government show leadership. They decarbonize government buildings. They ensure buildings in their portfolios are climate resilient. They use their spending power to meet this goal.

Overall, stakeholders agreed that all levels of government could lead by example. Demonstrating higher standards for buildings could accelerate the transition to a net-zero sector. Stakeholders suggested that public sector building retrofits present an opportunity to showcase the optimal design, implementation, and operation of net-zero buildings. Generating confidence within the sector to invest in developing new products and materials, and using them in retrofits, is recognized as a key benefit.

Leadership in Achieving Net-Zero Buildings

There was widespread recognition among stakeholders that government leadership is necessary to trigger the scale of transformation required to achieve net-zero emissions in the buildings sector, and to send the necessary market signals to enable this. Suggestions to accelerate the transformation included:

- providing subsidies to consumers and/or builders to lower the cost of low carbon heating systems in new construction;
- providing subsidies to encourage heating system retrofits, energy efficiency improvements and deeper retrofits in existing buildings;
- providing publicly funded training for workers in the sector to learn about and use approaches and materials that align with Canada's net-zero goals; and,
- funding for standardized training for building owners, operators, and occupants on how to operate and live in high-performance buildings.

Driving Public Awareness

Stakeholders recognized the **role of leading by example in improving public knowledge and awareness** on all areas of building decarbonization, including:

- the value of energy efficiency and climate resilient retrofits;
- the challenges and opportunities of undertaking retrofits; and
- how buildings contribute to carbon emissions.

Improving public awareness of options to address commonly perceived barriers to undertaking retrofits was seen as a key role for governments. Promotion, outreach, and advertising to build awareness and support decision-making among building owners, helping them to understand the business case for undertaking retrofits and energy efficiency improvements was also suggested. This was proposed as a way to spur deeper retrofits and the adoption of net-zero emission solutions in new construction.

Striving for Net-Zero in Public Procurement

Stakeholders indicated support for the **development of a federal Buy Clean Strategy** that would support and prioritize the use of made-in-Canada, low-carbon products in Canadian infrastructure projects. Further to this, it was **proposed** that such a strategy should:

- embrace the principles of sustainable procurement;
- move away from a lowest bid procurement model towards Qualifications-Based Selection;
- incorporate building operation performance standard and standards for embodied carbon;
- implement requirements for embodied carbon disclosure;
- include phased targets for GHG emissions performance of building materials; and
- encourage the process of early contractor engagement through a collaborative delivery method.

At the municipal level, stakeholders indicated leading by example within local communities requires additional staff training and capacity-building related to energy efficiency, high performance construction, net-zero retrofits, and climate resiliency - to directly link specific actions to achieve net-zero emissions targets to community plans. Municipalities noted that parallel challenges of climate change mitigation, adaption, and affordability, often compete for the same funding.

Alignment of Government Policies and Programs

Stakeholders indicated a need for greater alignment of federal, provincial and territorial policies and programs across all jurisdictions to avoid overlap, inconsistencies and fragmentation. Suggestions included: streamlining program delivery (including information about available funding, eligibility and stacking) through a single-window mechanism to reduce the administrative burden and improve accessibility to potential recipients. Many stakeholders indicated that a collaborative and ongoing governance structure should be established across all levels of government and Indigenous communities to support strategy delivery over time.

Stakeholders recommended that **provincial and territorial governments develop action plans to articulate policies and performance requirements for achieving net-zero in all public buildings in their jurisdictions**. Furthermore, best practices could be adopted from other jurisdictions (including international examples) on integrating electrical and thermal energy systems for increased efficiency, e.g., such as through the development of localized district energy systems and plans for capturing of waste heat.

Related infrastructure

Some stakeholders highlighted a need to ensure the **necessary electric vehicle (EV) charging infrastructure is accessible for installation in all new parking spots**, and for federal fleet and public building retrofit programs to include smart charging solutions. Related, stakeholders highlighted the need for further funding dedicated to EV-readiness for multi-unit residential buildings and supports for public charging stations for those without access to a garage or dedicated laneway.

4.2 Mandating change

Context from Discussion Paper: Governments are uniquely positioned to apply policy levers, and related tools to advance decarbonization and climate resilience within the buildings sector. This includes the use of building codes, standards, legislation, and regulations.

Strategic Objective: Governments consistently use existing legislative authorities and develop new ones to set measurable, ambitious requirements with a clear timeline to provide necessary market signals to achieve net-zero emissions across the buildings sector.

Many stakeholders expressed support for a low-carbon regulatory approach, viewing it as necessary to achieve decarbonization within the buildings sector in Canada. Many stakeholders acknowledge the need to rapidly end the installation of oil or natural gas heating systems in new construction, while setting out clear timelines for when existing buildings need to meet net-zero emission and minimum energy efficiency/performance standards. Stakeholders further indicated that complementary and enabling federal, provincial and territorial, and municipal policies, programs and tools will be required to support the sector to meet legislative requirements and regulations.

Decarbonizing Space and Water Heating

Some stakeholders highlighted the asymmetries in technology readiness across Canada and highlighted that no one technology solution will be unanimously appropriate, [economically feasible or viable] to reach net-zero in all regions across Canada or across industries. Stakeholders suggested the Strategy **support emerging technologies including renewables, biofuel and alternative energy sources, including hydrogen**. Stakeholders also suggested the Strategy take a whole of economy perspective

including by providing a clear assessment of the costs and benefits of multiple tangential elements of greening buildings such as: the electricity required, including peak demand, in a full electrification scenario, energy system reliability and resiliency, energy affordability, versatility, and how different fuel and technology options – such as the adoption of hybrid systems that incorporate both electricity and natural gas – could contribute to decarbonization of the sector over time.

Stakeholders noted that **incentives for the elimination of fossil-fuel equipment for space and water heating will not be sufficient to drive the scale of change required** to meet net-zero emissions in 2050 and suggested that the federal government take **more aggressive action to end the use of natural gas, and oil and propane as the primary fuel source in space and water heating systems.** In some cases, stakeholders supported provisions for provinces or territories to opt-in early. They also noted the challenges that associated municipalities may face in enforcing hybrid systems.

Affordability Concerns

Current household spend on utilities, extensive reliance on fossil fuels in regions of Canada where electricity prices are typically higher, and potential strain on energy systems to meet peak demand - with corresponding health risks introduced by extreme temperatures, blackouts or brownouts - were each noted as factors contributing to affordability concerns. Some suggested that these concerns would be heightened by the pursuit of full electrification across Canada, without thorough consideration of energy system security, resilience and redundancy.

Stakeholders indicated that ensuring the most energy efficient and low-carbon materials and applications are not cost-prohibitive for building owners is key to the decision to undertake retrofits or net-zero new construction and improving affordability. To support this, stakeholders proposed several actions, including:

- reducing the cost and time required to certify high-performance equipment for use in Canada (particularly when already approved by recognized international certifying bodies);
- aligning low carbon electrification programs with demand side management initiatives;
- providing funding for capital costs of retrofits or new construction, including for multi-unit residential buildings (MURBs);
- demonstrating the business case and return-on-investment to building owners for demand management and deep energy retrofits based on life cycle costs versus up-front capital costs;
- addressing the split incentive issue within the rental market which is a barrier to energy efficiency investments;
- providing financial supports to low-income people for up-front capital costs of retrofits;
- supporting property-tied financing for new construction;
- including improvements to a person's health and equity as eligibility criteria for funding;
- targeting renewable energy funds to support vulnerable people – including those in remote and Indigenous communities – to reduce reliance on diesel; and
- growing spending on targeted programs to low-income and vulnerable households to fund no-cost deep retrofits and renovations of social housing.

Achieving High Performance Buildings

Some stakeholders point to a corresponding need to strongly **support compliance activities**, ensuring those implementing measures to achieve high performance buildings are not unfairly penalized in the

market or undercut by competitors. Suggestions included meaningful penalties for those not in compliance and that barriers to meeting higher building performance standards are navigated through comprehensive policy alignment across levels of government, open data and information sharing on building energy performance and new/innovative solutions, and agility to confront difficulties encountered, rather than reducing performance goals.

A Net-Zero Energy-Ready Standard

Many stakeholders indicated that **expanded and more stringent building codes and standards** are required to achieve net-zero emissions. To enable high-performance and net-zero emissions from new construction and building retrofits, stakeholders suggested amendments to existing codes and the introduction of new ones. Codes could be modernized to address life cycle emissions and embodied carbon. Some stakeholders advocated for a new code development process (with clear political accountability), to prioritize higher energy performance standards, alignment with emissions targets, and climate change resilience.

Net-Zero New Construction

To drive the uptake of net-zero new construction, stakeholders indicated a need for a **clear timeline for code development and implementation**. Public clarity on timelines would help to overcome the uncertainty associated with the pace of new code adoption and address the misperception of additional costs associated with subsequent implementation of higher code levels. Stakeholders noted that the timing of updated/new codes is important for investment decisions, and that early awareness of the intention to regulate is necessary.

Stakeholders suggested that while codes are an important measure, they alone will not be sufficient; **complementary legislation and regulations were deemed necessary by many stakeholders** to ensure the adoption of increasingly higher tiers of codes. With regards to existing codes, some stakeholders suggested that, for new construction, the National Building Code of Canada could include:

- minimum cooling requirements, demonstrated using either mechanical cooling or modelled results;
- minimum Air Change Per Hour requirement for residential buildings, with compliance using blower door tests;
- a GHG metric pathway to be included as in the national model code to ensure the application of a 'climate lens' to building and community energy planning decisions;
- a review of the Canadian Electrical Code (CEC) to identify sections that could be updated to better accommodate the electrification of buildings, such as extending guidance on the use of panel management technology and considerations for battery storage as a part of smart grid electrical systems; and
- provisions adjacent to the Strategy, such as requirements that buildings support EV charging.

Some stakeholders indicated support for mandating change by harmonizing municipal policies, regulations, and accelerated adoption and enforcement of higher performance tiers of the model codes across Canada. Additionally, support was expressed for enabling municipalities to opt-in to high performance climate resilient, zero-carbon buildings codes while they are being developed. Many stakeholders suggested that a schedule of deadlines for adoption of higher tier codes by provinces and territories is vital for Canada's building sector to achieve net-zero emissions by 2050.

Alterations to Existing Buildings

Regarding the Alterations to Existing Buildings (AEB) code, stakeholders suggested expanding the list of measures included to cover:

- mechanical systems replacements;
- requirements for retrofitting and recommissioning of energy using systems in existing buildings; and
- developing a low-carbon equipment standard (such as for Heating, Ventilation and Air Conditioning (HVAC) and Domestic Hot Water equipment) that phases out fossil fuels.

Some suggested that the AEB code be aligned with Provinces and Territories and require prompt action on energy efficiency, GHG emissions and climate resiliency with incremental stages - ultimately transitioning to outcome-based codes and regulations. Stakeholders strongly recommended adoption of a carbon performance standard that:

- integrates embodied carbon of materials, building lifecycle and GHG emissions;
- applies to new builds and retrofits of all existing residential homes and buildings greater than 600m^2 (Part 3 and Part 9 of the National Building Code of Canada); and
- requires a schedule for achieving carbon performance metrics.

While it is widely recognized that mandating change in this space may be necessary in order to reach Canada's 2030 climate targets, **prompt and transparent timelines for the introduction and implementation of new code provisions by industry are viewed as critical.**

Stakeholders called for investment into municipal governments' administration and enforcement of building code provisions. Furthermore, funding could be made available for resource and capacity development to empower the workforce in municipalities, industry, building officials and building owners to fulfill their role regarding codes compliance used to reach net-zero targets.

4.3: Enabling investment decisions

Context: To produce the swift and drastic growth required within the retrofit market, access to the right information and support for property owners and investors must be improved to mobilize private sector capital.

Strategic Objective: Canadians, businesses and investors have more information on the performance of different building types and cost-effective strategies that improve performance to make investment decisions

There was a widespread recognition among stakeholders that a **substantial long-term financial commitment is necessary** to support market transformation, and to ensure affordability and equity for Canadians. This includes both government and private sector investment.

Increasing the Pool of 'Green' Private Capital

To increase the pool of available green financial capital, that is, capital that values reductions in emissions and/or the conservation of natural resources alongside economic gains, stakeholders suggested that **the federal government has a role to play in enabling market conditions and incentivizing private capital to support buildings decarbonization.** Stakeholders suggested that

developing, piloting and adopting climate-resilient and net-zero building standards will help guide future investment. Stakeholders noted that the government could facilitate access to property-level data through energy performance labelling initiatives that could support financial institutions in designing and delivering financial products to customers that implement measures to reduce energy consumption and protect against the impacts of climate change/adverse weather events. Some contributors suggested that the design for time-of-sale home labelling should consider the supply of Energy Advisors and ensure rapid scalability of the final approach. Stakeholders also noted the importance of considering, the potential impacts to vulnerable groups and other potential unintended consequences as a result of financial products being made based on labeling.

Additionally, stakeholders suggested that governments could accelerate market development by transparently assessing how private finance plays a role in constructing and retrofitting net-zero buildings across Canada. This assessment could help provide regional insights including pace of change, change by building types/vintage, and ownership types to inform future action.

Stakeholders indicated that to encourage more investors, and a larger audience, the Strategy could consider social goals as well as green goals to maximize opportunities to access ESG (environmental, social, governance) interests.

Overcoming Barriers to Capital Investment

Rent control policies and split incentives were identified as barriers to unlocking potential capital investment. **Stakeholders would like to see a more direct, rapid, and transparent allocation of funding to facilitate greater innovation.** In particular, programs are needed to financially incentivize Small and Medium Enterprises (SMEs), to embrace emerging and sustainable technologies, materials, and processes. Funding could be allocated to pilot projects that prioritize the use of made-in-Canada, low-carbon heat transfer technologies, growing the skilled trades workforce with a focus on equity and diversity.

New or scaled financing models and solutions that help support and set investment milestones for decarbonizing buildings are needed. The certification of green buildings to enable green bond financing, and the expansion of tax incentives for clean energy equipment to spur capital investments were examples of additional tools seen as supportive to overall growth of green capital.

Overcoming Cost Barriers

Without the right support such as incentives, programs, energy performance data and financing, many stakeholders indicated that there will be substantial challenges to decarbonizing the buildings sector, and actions such as retrofits, are unlikely to occur if they are not affordable. Stakeholders suggested that the **federal government has a role to play in supporting industry and the public to overcome cost barriers for investing in cleaner materials and new technologies.** It was also noted that financial support should target ongoing operating costs associated with new materials and technologies and not only the upfront costs.

Given the level of investment required to achieve net zero in the building sector, stakeholders emphasized the need for accountability in the appropriate use of public funds. Many stakeholders encouraged the **establishment of milestones and tracking targets for government investment**, to determine if more funding will be needed over time and if funding has been effective in incentivizing the development of low-carbon, climate resilient net-zero buildings.

4.4: Growing Canada's advantage in building practices, technology and building materials

Context: the buildings sector needs advanced, holistic low-carbon solutions to overcome persistent challenges in decarbonization. Sustained innovation and science and technology is required to ensure that decarbonization and enhanced climate resilience through evolving technology, materials, and building practices, will be timely, efficient, cost-competitive, and affordable.

Strategic Objective: Low-carbon and climate-resilient, high-performance technologies, building materials, and construction practices are cost-competitive, and their use is common practice in building design, construction, and operation.

Overall, there was widespread agreement among stakeholders that **Canada could benefit from growing its competitive advantage in building practices, high-performance technologies and building materials.** In order to do so, stakeholders proposed a range of options to facilitate decarbonization of buildings, improve energy performance and achieve enhanced climate resilience, while remaining cost competitive and stimulating market growth.

Advancing Building Practices

Stakeholders suggested that growing the market for – and normalizing – performance driven buildings practices could be spurred through:

- the development of standardized tools and guidelines for: conducting life cycle assessments, to generate accurate comparisons of structural systems, estimations of GHG emissions linked to the manufacture of structural materials, and comparisons of potential building scenarios;
- facilitating green construction principles;
- building upon the Local Energy Efficiency Partnership Initiative; and
- encouraged use of International Organization for Standardization (ISO) GHG Accounting standards for projects to highlight mitigation activities.

Low-carbon materials and high-performance buildings technologies

Many indicated that the federal government has a role to play in sending clear market signals to scale the production and use of clean construction materials. Advocating for a national Buy Clean policy and net-zero construction materials sector, stakeholders in this space are seeking federal government collaboration to set ambitious targets to reduce embodied carbon, increase the uptake of low-carbon materials and to champion net-zero and lower carbon alternatives through bulk purchasing and longer-term contracts, while also supporting research and evaluation to bring new low-carbon technologies and alternative materials to market.

To facilitate the growth of a low-carbon building materials sector, stakeholders suggested a focus on:

- developing a consistent, national approach and regional decarbonization pathways and workforce plans;
- establishing agreed emissions reporting standards based on evidence, data, and evolving best practices, as well as publishing embodied carbon benchmarks and life cycle datasets to support the creation of comparable Environmental Product Declarations (EPDs) for materials and

products (including for cement, concrete, steel products, structural wood products, aluminum, and other materials);
- material-neutrality;
- supporting ambitious climate action specifically for embodied carbon in construction materials, with achievable targets for emissions reductions across all industrial sectors;
- setting embodied carbon targets for provincial and local governments to adopt in procurement policies;
- supporting workers and jobs in low-carbon manufacturing, green buildings and other growth sectors; and
- complementary priorities (including climate resilience, energy security, and housing affordability).

Additional suggestions included the development of a 'seal of approval' for green products and communications materials to support consumer understanding of the environmental merits and impacts of products available on the market. Initiatives to support the selection of low carbon-materials and made-in-Canada technologies and materials were offered as examples of essential steps to market creation. Stakeholders also suggested that peak demand management technologies and approaches (such as distributed energy resources and energy storage to support grid resilience and reliability, etc.) have a role to play, beyond the provision of low-carbon electricity supply.

Others highlighted opportunities to further Canada's strategic objective to make low-carbon technologies, building materials, and construction practices common practice by building on the existing applied research and development ongoing at academic institutions across Canada (with research activities developing innovative technologies, advancements in buildings materials and supporting the development of green skills as they provide learners with tangible work-integrated learning opportunities). Several stakeholders noted the value of developing a made-in-Canada supply chain for materials, technologies and equipment required for decarbonization (such as heat pumps, etc.). This could also include fostering related industry coalitions to accelerate research and development and create commercialization opportunities.

Supply Chain

Reliability and affordability – of energy supply, labour, and materials and equipment – were highlighted as critical in the design of the Strategy, as well as diversity of supply to ensure energy system resiliency and redundancy. Investment in supply chains is required, with some suggesting that "if there is no demand, there is no investment". Stakeholders acknowledged that industry investments in technology, supply chain and workforce training will be required, alongside strong industry advocacy that achieving net-zero in the buildings sector is possible.

Stakeholders suggested that the normalization of approaches to decarbonize buildings - such as by raising minimum energy performance standards, identifying barriers to net-zero early on, sharing insights of projects with industry peers, and applying new approaches to facilitate necessary provisions in building designs and electrical infrastructure upgrades - will help avoid significant financial costs and delays of long-lead items, particularly when facing on-going supply chain challenges.

Some suggested that involving Local Distribution Companies in retrofit projects, particularly deep retrofit projects, could aid in expediting and simplifying the planning process (from project inception, to

approval, to procuring equipment or materials), thereby better enabling investment decisions and mobilizing private sector capital. Others advocated for a more widescale approach to retrofits, such as the 'energiesprong' model, to move away from tackling buildings retrofits as distinct projects, towards a model of transforming multiple buildings at once by coordinating supply chains, using mass-produced assemblies and mechanical pods. Stakeholders suggested that milestones should be set for the delivery of technology solutions for alternative electricity generation and supply chain functionality.

Housing Supply

With demand for skilled labour, equipment and materials increasing, some stakeholders raised concerns about the potential impact on housing supply overall, including worry that buildings decarbonization policies could further exacerbate current housing supply issues and affordability. Some stakeholders suggested that the way to manage the parallel challenges of housing supply, affordability, climate change mitigation and adaptation is to focus on improving the existing building stock and on low carbon resilient upgrades. Others indicated the opposite, that moving quickly on improving building practices of new construction would enable faster reductions of GHG emissions and that retrofits while require a longer time horizon. Some stakeholders highlighted cost and labour supply issues that make retrofitting buildings a particular challenge, with implications for housing supply. They suggested that one way to address this could be through the transfer of municipally controlled land for new housing construction. Overall, stakeholders suggested that the Buildings Strategy must strike a balance between GHG emissions reductions, affordability and housing supply challenges and include clear and time bound market and regulatory signals.

4.5: Training and incentivizing the future workforce

Context: To respond to an increased demand for high performance construction and net-zero, climate-resilient retrofits, the labour market faces the challenge of re-skilling existing workers and attracting new workers.

Strategic Objective: A skilled workforce is in place to support building decarbonization and enhanced climate resilience in the buildings sector.

Expanding the green buildings workforce

Stakeholders signaled that building decarbonization is not possible without an available and skilled workforce, and the overall **lack of capacity and ready labour force in all trades - and especially green buildings trades - and in related professions, is a major barrier to market transformation.** Several stakeholders suggested that actions as outlined in the discussion paper would be insufficient to transition the labour force to achieve net-zero buildings and address growing capacity issues. As a result of retirements and demographic shifts, some noted that many industries will be left with mid-career roles to fill in the short to medium term. Stakeholders would like to see governments address this by positioning affected industries, such as construction, as a career choice and supporting efforts to attract new talent.

Several stakeholders cited targeted immigration as a potential solution in addressing workforce shortages in the short to medium term. Stakeholders emphasized the need to facilitate quicker entry of skilled and unskilled immigrants, and temporary foreign workers to address immediate and long-term shortages. While recognizing the role of increased immigration, some stakeholders further noted the

need to address possible language barriers that skilled and technically capable immigrants face, further hindering the industry. Language training and establishing common vocabulary for skilled immigrants was strongly suggested.

Enabling diverse skillsets across the green buildings sector

Gaps in workforce knowledge, training or skills were among the most common barriers cited to progress in the net-zero building sector. In recognition that the building sector requires diverse skillsets, **stakeholders expressed the need for greater support for training programs geared towards skill sets which are ripe for growth** (such as in low-carbon construction, architecture, urban design, and sustainable buildings engineering). Most stakeholders viewed training initiatives specific to the implementation of promising technologies, including heat pumps, as critical to accelerated progress in the sector. Most stakeholders were supportive of investments in initiatives such as the Sustainable Jobs Training Centre and other funding opportunities to support workforce expansion.

Supporting equitable workforce participation

Stakeholders also noted the **importance of additional supports and training for vulnerable communities, including Indigenous communities as well as training supports for equity-seeking groups to help ensure the buildings sector of the future reflects the communities it serves**. Stakeholders indicated that beyond initial training, on-going support (e.g., job fairs, case management, etc.) are necessary to ensure retention.

Modernizing training and professional pathways

Stakeholders expressed their desire for the government to work with educational institutions, such as universities, colleges, and trades schools, to **review and modernize current curriculum and develop new professional pathways to grow the workforce.** Additionally, stakeholders would like to see a more holistic approach to training as there can be a gap in the understanding of building systems as a whole. Stakeholders from various academic institutions indicated their readiness to partner with the government to transition to a net-zero economy with training for green jobs and by assisting businesses with technological advancements through applied research and demonstration.

Targeted apprenticeships, training sessions and increased retention of international students may also present opportunities. Some stakeholders agreed that Canada's ability to attract and retain international students will directly impact the country's ability to build a strong and diverse green jobs workforce.

Measuring progress

Some stakeholders recommended establishing public milestones and tracking progress on related competencies. For example, this could include the number of professional associations that have incorporated or are working to incorporate green competencies - such as climate resilience training - in their education and professional development requirements. The government could then evaluate the number/proportion of any given membership or association that have completed or are enrolled in 'green' training. Such milestones could enable/facilitate identifying workforce green training gaps and overall help track progress toward decarbonizing the buildings sector.

4.6 Enabling informed actions

Context: Robust, accurate, and science-based data and information provide the basis for policy development and decision-making that will support the provision of a net-zero emission, low-carbon building stock.

Strategic Objective: Robust, transparent data and modelling are easily accessible to market participants – while respecting (individual) privacy – to inform investment decisions, public sector programming and evolution of the Strategy.

Developing a public data strategy for the buildings sector

Most stakeholders advocated **for the development of a data strategy as a foundational investment needed to accelerate buildings decarbonization and to track progress in reducing emissions over time**. Several stakeholders noted or offered their individual capacity to provide data of their own toward the development of a pan-Canadian data strategy. Others suggested the government learn and adopt best practices from foreign data strategies that support buildings decarbonization.

Many expressed that a data strategy for the buildings sector could go beyond voluntary labelling and disclosure and instead put forward a common set of metrics, and related data collection guidelines, that are collected on a regular basis across the country. For example, providing guidelines for both voluntary and mandatory disclosure of energy and GHG emission performance of individual buildings would greatly accelerate the collection of data in a standardized format. In addition, whole of building life cycle assessments were identified as an important framework for acquiring detailed understanding of the energy footprint of a building. Some stakeholders proposed that developing standardized 'best practices' for reporting - which incorporate metrics for embodied carbon and climate resilience, as available – would be constructive to enable building a foundation of open-source buildings level data. Stakeholders noted that ideally energy and emissions performance reporting align with international standards such as the ISO, which could optimize opportunities for entities in Canada to present and highlight their mitigation efforts in a universally understood way.

Tracking buildings emissions

Stakeholders suggested the need to develop a robust and publicly accessible national buildings emissions database, to collect commercial, institutional and residential buildings level data. A database could further provide guidelines for performance-based buildings assessments and support the standardization of buildings data across Canada. The "gold standard" data requested was utility data, but stakeholders suggested consistent, quality modeled data at Forward Sortation Area (FSA) or postal code level would be a welcome step forward.

Some municipalities noted the need to increase access to data on building performance across Canada held by energy utilities and building owners as voluntary labelling and disclosure often covers a small portion of the building stock.

Enabling access to impartial buildings-level energy use data

Reliable, energy use, climate, and resiliency data were repeatedly raised as essential for decision-making and investment within the buildings sector. Open access to high-quality individual building data on energy use, emissions, embodied carbon, and climate risks, could support the risk assessments of financial institutions and support growth of a green capital market. Stakeholders pointed to the current

lack of accessibility of this data, as well as the lack of consistency on how data is reported (e.g., frequency of collection, level of granularity) as a major barrier to investment in the Canadian buildings sector. Other more specific feedback suggested the need for improved data accessibility pertaining to climate modeling at a granular level and the need to publicly track and report on human population migration patterns to support decision-making. Some noted that, without the data, it is difficult to demonstrate progress towards emissions reduction targets that Canada is looking for.

Others highlighted the entire buildings sector would benefit from the value chain created through data collection, verification, and verification of related performance improvements.

5.0 What we heard: online engagement

5.1 Online engagement process

From 17 August to 17 November 2022, 330 members of the public and 337 interested professionals (total 667) participated in the online engagement process by responding to a questionnaire.

The full list of questions asked to the general public and interested professionals can be found in Appendix B.

General Public:

Climate change was widely acknowledged as an important issue by Canadians, with concern for future generations, cost saving opportunities, climate adaptation and resilience topping considerations cited. Climate adaptation and resiliency against the impacts of environmental threats were noted as particularly important topics to consider as part of developing the Strategy.

A general view was that the **primary responsibility for reducing building emissions lies with federal, provincial, and territorial governments, with industry also responsible for participating in the transition**. Contributors indicted that through their roles as community members they believe they can have the most influence on helping Canada achieve its net-zero targets and achieve climate resilient buildings sector, even more so through their roles as a 'voters' or as 'consumers'.

A majority indicated they were aware of their home energy consumption. Just over a third said they were aware of their residential GHG emissions, and three quarters indicated that reducing emissions in the buildings sector is especially important to them. Most contributors identified innovation, technology, and low-carbon construction materials as the aspects they are most interested in as part of a net-zero emissions and climate-resilient buildings sector.

Few contributors expressed interest in upskilling or reskilling for themselves, but strongly supported recommending younger people pursue a career in a buildings-sector related profession or skilled trade.

A majority indicated they have a high level of concern about environmental threats (e.g., extreme weather events such as flooding), as well as a high level of concerns for non-weather-related consequences of climate change (e.g., food scarcity, mass migration, national security). However, **close to half of contributors expressed limited awareness of what actions they can take towards climate resiliency and adaptation in their daily life**. The issue of climate change in daily life is of high importance to the majority of public contributors.

General public contributors expressed their sense of obligation, as individuals, to act. However, **over half indicated that making home energy efficiency improvements was currently too expensive**. Contributors see an evidence-informed green buildings strategy as important and said they would feel better informed if they understood the data and evidence used to support the Strategy. They also said that equity, diversity and inclusion considerations and a strategy aligned with their personal values are important.

Professional Interest:

Among those contributing with a professional interest in this issue, **personal and employer values were the main motivator to work towards net-zero emissions buildings**. Values ranked higher than other driving forces such as codes, incentive programs, and client requests. Half of contributors indicated climate adaptation and resilience are a key component of their work. A quarter were aware of how climate adaptation and resilience feature in their work but feel limited in what actions they can take.

Capacity building and training on the implementation of innovative technologies (including heat pumps) was considered the most important measure required to achieve net-zero carbon emissions in commercial and institutional buildings.

When undertaking work in the net-zero emissions building sector, contributors indicated that **the most common barriers overall were**:

- prohibitive costs;
- lack of confidence in return on investment; and
- gaps in workforce knowledge, training, and skills.

Other barriers include: a lack of available technology, equipment or material to achieve net-zero carbon reductions (e.g., due to supply chain shortage, not market ready, additional innovational required); and an overall lack of interest. Limited budgets and costs also prevented implementation of measures to save energy or achieve GHG emissions reductions.

Most contributors indicated they have access to information and data to inform planning for emissions reductions. However, less than half of contributors indicated they have access to comparative information to identify poorly performing assets and to target investments. **Most contributors also supported more stringent energy requirements in codes and standardized protocols for energy modeling**.

Contributors were more familiar with 'home energy assessments and labels' (non-specific) than NRCan's EnerGuide Rating System. Home energy assessments can be an important source of housing and energy use data. **Many contributors indicated that they needed greater information on impact of home attributes on energy consumption, such as HVAC, windows, insulation**, which is not currently available. Contributors also expressed that having more information available on the availability of low-carbon materials would be beneficial to progress, and that cost-savings from upgrades could spur energy efficiency retrofits.

Regarding the private sector undertaking deep retrofits to achieve net-zero emissions from homes and buildings, contributors identified cost, lack of confidence in the return on investment, and lack of awareness of benefits as the top three greatest challenges. The top three measures or tools required to

implement high-performance, zero-carbon emissions houses and residential buildings (both new builds and retrofits) were:

- more stringent energy requirements in national building codes;
- capacity buildings and training on the implementation of new technologies (including heat pumps); and
- standardized protocols for energy modelling, costing, and calculating life cycle emissions.

Regarding data through home energy labels, contributors indicated the following top three actions/incentives as required to undertake retrofits:

- estimated energy cost saving per year through upgrades;
- estimated costs of recommended upgrades; and
- suggested home energy efficiency improvements.

Contributors indicated that home energy labels with this information would help inform actions and encourage or facilitate undertaking retrofits.

Appendix A – What we asked: questions from the discussion paper.

The Canada Green Buildings Strategy discussion paper included seven questions.

1. Does this discussion paper target the right strategic themes and areas requiring change, and communicate the level of action required?
2. This discussion paper identifies current and potential actions that the federal government is taking under each theme. What actions can your organization contribute to support achieving the changes needed within each theme?
3. Are there other actions that you believe need to be taken, best practices we should consider, or potential risks to pursuing the Strategy?
4. What milestones should be used to track progress toward a net-zero emissions, climate-resilient buildings sector?
5. What structures or processes should be put in place to support continued collaboration to 2050?
6. What modelling has your organization done that could inform modelling out all the actions that will be identified under this strategy to ensure they are ambitious enough to meet our net-zero buildings sector commitment?
7. How can we best consider Indigenous priorities that have been raised through existing federal processes and initiatives regarding the built environment on reserves and in other remote and northern communities (e.g., the work to close critical infrastructure gaps by 2030, conduct infrastructure needs assessments, develop and implement Indigenous distinctions-based housing strategies, and co-develop the Urban, Rural and Northern Indigenous Housing Strategy)?

Appendix B – What we asked: questions from online engagement

Members from the public were able to answer the following 19 questions via the online engagement portal. Questions were not mandatory, and the results are not representative of the views or experiences of the wider public. Totals may not equal 100% due to rounding.

1. Do you own or rent your home? Please answer with respect to your primary residence (i.e. where you live most of the time). Select one. Base: Stakeholders providing a response at Q1 (n=330)

I own my home or co-own it with another individual (even if it is still being paid for).	72%
I rent my home (even if no cash rent is paid).	18%
I live in a home that is owned or rented by another member of my household.	8%
Other	1%
Prefer not to answer	1%

2. Do any of the following descriptions apply to your home? Select one. Base: Stakeholders providing a response at Q2 (n=330)

It is part of a condominium development.	16%
It is part of a not-for-profit and/or co-operative housing.	2%
None of the above	82%
Prefer not to answer	1%

3. Is this dwelling in need of any repairs? Select one. Base: Stakeholders providing a response at Q3 (n=330)

No, only regular maintenance is needed, for example, painting, furnace cleaning.	45%
Yes, minor repairs are needed, for example, missing or loose floor tiles, bricks or shingles, defective steps, railings or siding.	36%
Yes, major repairs are needed, for example, defective plumbing or electrical wiring, structural repairs to walls, floors or ceilings.	17%
Prefer not to answer	2%

4. How frequently do you do each of the following activities? (Scale: Very Frequently, Frequently, Occasionally, Rarely, Very Rarely, Never) Base: Stakeholders providing a response at Q4 / % shown is net for 'Very Frequently/Frequently/Occasionally' only for each category (n=274)

Explore online (websites, blogs, YouTube, social media sites, etc.) to learn about climate change	86%

Explore minor changes that you can make to your home (at low cost) to save energy and make your home more comfortable (such as replacing incandescent light bulbs with LED light bulbs)	82%
Explore green (lower emitting) or alternative energy options to heat or cool your home (such as heat pumps)	75%
Explore major changes you can make to your home (at a modest or higher cost) to save energy and make your home more comfortable (such as upgrading to energy-efficient windows, air-sealing or better insulation)	70%
Explore online (websites, blogs, YouTube, social media sites, etc.) to learn about assessing and improving your homes energy efficiency	69%
Explore specific information about high-performance, low-carbon and/or climate-resilient construction practices, technologies and materials	68%
Explore general information about construction practices, technologies and materials	64%
Search government resources for rebates or incentives to help with the cost of undertaking energy efficiency retrofits or upgrades	61%
Search utility websites or other service providers for rebates or incentives to help with the cost of undertaking energy efficiency retrofits or upgrades	59%

5. How important is the issue of climate change to you in your day-to-day life? Select one. Base: Stakeholders providing a response at Q5 (n=274)

Very important	82%
Somewhat important	12%
Not very important	3%
Not at all important	3%

6. How important is reducing greenhouse emissions in the buildings sector (that is, our homes and residential, community, and institutional buildings) to you in your day-to-day life? Select one. Base: Stakeholders providing a response at Q6 (n=269)

Very important	76%
Somewhat important	19%
Not very important	3%
Not at all important	3%

7. To avert the worst impacts of climate change, the Government of Canada is committed to achieving net-zero emissions by 2050. Achieving net-zero emissions means our economy either emits no greenhouse gas emissions or offsets its emissions, for example, through actions such as tree planting or employing technologies that can capture carbon before it is released into the

air. Overall, how familiar are you with Canada's emissions reduction plan to reach net zero by 2050? Select one. Base: Stakeholders providing a response at Q7 (n=270)

YES - have heard of it and know all the details	6%
YES - have heard of it and know most of the details	31%
YES - have heard of it and know some of the details	47%
YES - have heard of it, but don't know any details	16%
NO – have not heard of it	0%

8. Are you aware that Canada has committed to achieve net-zero emissions and a climate-resilient buildings sector (that is, in homes and residential, commercial and institutional buildings) by 2050? Select one. Base: Stakeholders providing a response at Q8 (n=268)

Yes – I am aware of this commitment	90%
No – I am not aware of this commitment	10%

9. How well informed do you feel about how Canada will develop a strategy to achieve net-zero emissions and a climate-resilient buildings sector by 2050? Select one. Base: Stakeholders providing a response at Q9 (n=268)

Very well-informed	4%
Well-informed	16%
Somewhat well-informed	39%
Not well-informed	35%
Not well informed at all	6%

10. What, if anything, would help you feel better informed about how Canada will develop a strategy to achieve net-zero emissions and a climate-resilient buildings sector by 2050? Select all that apply. Base: Stakeholders providing a response at Q10 (n=266)

Understanding the data and evidence used to inform the strategy	91%
Understanding how equity and inclusion considerations will underpin the strategy	48%
Understanding how the strategy aligns with your own values	42%
Information about career opportunities within the clean energy and/or buildings sectors	33%
Information about economic opportunities for businesses	26%
Other	30%
None of the above	5%

11. Overall, how would you prefer to receive information about how Canada will develop a strategy to achieve net-zero emissions and a climate-resilient buildings sector by 2050? Select up to three. Base: Stakeholders providing a response at Q11 (n=271)

Government of Canada website	51%
Traditional news media	48%
Social media from government	28%
Your city or municipal government website	26%
Online webinars	25%
TV or radio commercials	22%
Social media from non-government content creators	20%
Your provincial government website	17%
Other	15%
Ethnic media	2%
None of the above	2%

12. Which of the following, if any, form the basis of your interest in net-zero emissions and a climate-resilient buildings sector? Select all that apply. Base: Stakeholders providing a response at Q12 (n=265)

Concern for future generations	87%
Climate values	78%
Cost-savings opportunities	54%
Equity and inclusion	43%
Technology and innovation	40%
Career opportunities	17%
Business opportunities	13%
Other	11%
None of the above	2%

13. Which of the following aspects, if any, of a net-zero emissions and climate-resilient buildings sector are you interested in? Select all that apply. Base: Stakeholders providing a response at Q13 (n=263)

Innovation and technology	67%
Low-carbon construction materials	65%
Building codes	61%
Regulations	55%
Energy codes	55%
Workforce (jobs, skills or training)	38%
Other	14%
None of the above	6%

14. How prominently does climate adaptation and resilience feature in your day-to-day life today? Select one. Base: Stakeholders providing a response at Q14 (n=260)

A key component / consideration	45%
Aware, but limited in what action I can take	45%
Aware, but don't consider it a key component / consideration	8%
Not aware / not a consideration	2%
Don’t know	1%

15. Rank each of the following in order of how concerned you are about their impact on you, personally. (1 = highest concern; 6 = lowest concern) Base: Stakeholders providing a response at Q15 / % shown is net rating for scores 1,2,3 only for each category (n=255)

Environmental threats (e.g. extreme weather events such as flooding)	84%
Non-weather-related consequences of climate change (e.g. food scarcity, mass migration, national security	77%
Utility costs (heat, electrical, and water)	58%
The cost of housing (renting or buying)	46%
Access to well-paying jobs	15%
Access to job training or upskilling	9%

16. The scale of action required to achieve net-zero emissions in the buildings sector (that is, in our homes and residential, commercial, and institutional buildings) will require significant behavioural and societal change. Which of the following terms best describe how you view your own role in helping Canada to achieve a net-zero emissions and climate-resilient buildings sector by 2050? Select up to three. Base: Stakeholders providing a response at Q16 (n=261)

As a member of a community	59%
As a voter	52%
As a member of a household	44%
As a consumer	44%
As a parent	29%
As a volunteer	14%
As an employee	13%
As an influencer	12%
As an investor	7%
As a business leader	3%
As an employer	2%

17. Please indicate which of the following apply to you. Select all that apply. Base: Stakeholders providing a response at Q17 (n=256)

I would encourage my child or other young people I know to pursue a career in a profession (such as an architect or engineer).	68%
I would encourage my child or other young people I know to pursue a career in the skilled trades (such as mechanical heating and cooling systems technician, electrician, or construction).	64%
I am personally interested in upskilling or reskilling to pursue a career in the skilled trades.	11%
None of the above	19%

18. Are you…? (Gender). Base: Stakeholders providing a response at Q18 (n=220)

Atlantic	7%
Quebec	2%
Ontario	41%
Manitoba/Saskatchewan	28%
Alberta	6%
British Columbia	15%
Territories	0%
Prefer not to answer	2%

19. In what region of Canada do you live? Base: Stakeholders providing a response at Q19 (n=219)

Male	47%
Female	46%
Non-Binary	2%
Prefer not the answer	5%

Those with a professional interest in the buildings sector were able to answer the following 17 questions via the online engagement portal. Questions were not mandatory, and the results are not representative of the views or experiences of the wider public. Totals may not equal 100% due to rounding**:**

1. Please indicate your professional role / area of expertise? Select all that apply. Base: Stakeholders providing a response at Q1 (n=328)

Architect/Engineer or other professional	38%
Energy advisor	15%
Government	13%
Builder/Construction	11%
Energy advocacy organization	9%
Academic	8%
Real estate/Property developer	7%

Supply chain organization/Manufacturer	7%
Trade association	7%
Commercial building owner	5%
Skilled tradesperson (incl. business owner)	5%
Building operator	4%
Skills/training/certification organization	4%
Workers union	1%
Other	16%

2. In what region of Canada do you carry out most of your work? Base: Stakeholders providing a response at Q2 (n=318)

Atlantic	8%
Quebec	4%
Ontario	33%
Manitoba/Saskatchewan	13%
Alberta	7%
British Columbia	26%
Territories	1%
Prefer not to answer	8%

3. Are you…? (Gender). Base: Stakeholders providing a response at Q3 (n=308)

Male	61%
Female	26%
Non-Binary	1%
Prefer not to answer	12%

4. How frequently does your work involve each of the following activities or items (specifically related to the decarbonization of Canada's residential, commercial or institutional buildings sector)? (Scale: Always, Often, Sometimes, Rarely, Rarely, Never, Don't know, Not Applicable) Base: Stakeholders providing a response at Q4 (n=230) / % shown is net for 'Always/Often/Sometimes' only for each category

You have access to information and data needed to develop plans to achieve greenhouse gas emissions reductions in your work/projects/business operations.	79%
An energy performance assessment is completed to identify possible energy savings opportunities (resulting in an energy performance report or label).	72%
You have access to comparative information and data about the energy performance of equipment or materials you use in your work.	73%
Sharing of best practices in energy management with others in the industry	75%
You have access to comparative information and data needed to identify poorly performing assets (equipment or materials) and to target investments to lower operating costs.	65%
Recommendations received from energy performance assessments are implemented.	72%

An opportunity assessment is undertaken (e.g. consultation about project financing options, tendering and awarding of contracts, and project monitoring).	67%
Use of an energy management information system to monitor, document and report on energy performance	57%
You receive training dedicated to the operation of new or existing equipment, systems or technology to maintain energy savings over time.	54%

5. How frequently do you face the following challenges in your work (specifically related to the decarbonization of Canada's residential, commercial or institutional buildings sector)? (Scale: Always, Often, Sometimes, Rarely, Rarely, Never, Don't know, Not Applicable) Base: Stakeholders providing a response at Q4 (n=210) / % shown is net for 'Always/Often/Sometimes' only for each category

You encounter limited capital budgets to implement energy saving opportunities or other measures that would reduce greenhouse gas emissions associated with your work/projects/business/clients.	90%
Costs prevent the implementation of measures that would save energy or achieve greenhouse gas emissions reductions.	90%
You face skills or other workforce gaps that that prevent you/your work/business/clients from implementing energy-saving measures or emissions reductions.	80%
You encounter a lack of technical expertise (e.g. design, engineering or energy management expertise) to support your work/projects/business/clients.	73%
You face supply chain shortages (for materials, equipment or technology) that prevent you/your work/business/clients from implementing energy-saving measures or emissions reductions.	75%

6. What is your biggest motivation to undertake work in the high-performance, net-zero emissions buildings sector? Select one. Base: Stakeholders providing a response at Q6 (n=211)

Personal/company/employer values	39%
To be a market leader (e.g. first to market or to define the market)	16%
Client requests (market demand)	11%
Incentive programs (e.g. rebates)	9%
Other motivation	9%
Building codes (market regulation)	9%
Profitability/lucrativeness	2%
Not applicable	5%

7. What are the most common barriers to undertake work in the high-performance, net-zero emissions buildings sector? Select up to three. Base: Stakeholders providing a response at Q7 (n=223)

Cost is too high	64%
Gaps in workforce knowledge, training or skills	41%
No interest/client is not interested	29%

Lack of available technology, equipment or materials to achieve net-zero carbon emissions reductions (e.g. due to supply chain shortage, not market-ready, more innovation required)	29%
Familiar with, but lack personal experience in implementing measures to achieve net-zero carbon emissions	22%
Other barrier	20%
Not familiar with net-zero carbon performance standards	16%
I've not personally had the opportunity to undertake work in this area.	4%
Not applicable	4%

8. In your experience, what are the biggest challenges to the private sector undertaking deep retrofits to achieve net-zero emissions from homes and buildings? Select up to three. Base: Stakeholders providing a response at Q8 (n=216)

Too costly	56%
Lack of confidence in the return on investment	49%
Lack of awareness of the benefits	32%
Workforce challenges (e.g. not enough people in related trades/professions to implement/maintain retrofits)	26%
Lack of know-how or experience	25%
Too intrusive/takes too long	23%
Other	17%
Supply chain is too uncertain or insufficient (e.g. lack of materials and product availability).	12%
Lack of personal opportunity to undertake work in this area	4%
Don't know	1%
Not applicable	3%

9. In your experience, what are the top three measures or tools required to implement high performance, zero-carbon emissions commercial and institutional buildings (both new builds and retrofits)? Select up to three. Base: Stakeholders providing a response at Q9 (n=212)

More stringent energy requirements in national building codes	49%
Capacity building and training on the implementation of new technologies, including heat pumps	44%
Standardized protocols for energy modelling, costing, and calculating life cycle emissions	37%
Open access data sets that establish baseline energy performance for different building typologies and regions	33%
Tools to track and maintain optimal building operation and efficient performance (such as Key Performance Indicators, fault detection diagnosis, on-going commissioning)	29%
Innovation in building controls and operations	19%
Enhanced laboratory capacity to test and validate high efficiency heating, cooling and hot water systems for the Canadian climate	13%
Other	22%
Don't know	3%
Not applicable	5%

10. Based on your experience, how important are each of the following tools and measures in enabling high performance, zero-carbon emissions commercial and institutional buildings (both new builds and retrofits)? (Scale: Very Important, Somewhat Important, Neutral, Not Very Important, Not at all Important, Don't know, Not Applicable) Base: Stakeholders providing a response at Q10 (n=187) / % shown is net for 'Very/Somewhat Important' only for each category.

More stringent energy requirements in national building codes	80%
Capacity building and training on the implementation of new technologies, including heat pumps	85%
Standardized protocols for energy modelling, costing, and calculating life-cycle emissions	81%
Open access data sets that establish baseline energy performance for different building typologies and regions	79%
Tools to track and maintain optimal building operation and efficient performance (such as Key Performance Indicators, fault detection diagnosis, on-going commissioning)	78%
Innovation in building controls and operations	69%
Enhanced laboratory capacity to test and validate high efficiency heating, cooling and hot water systems for the Canadian climate	64%

11. In your experience, what are the top three measures or tools required to implement high performance, zero-carbon emissions houses and residential buildings (both new builds and retrofits)? Select up to three. Base: Stakeholders providing a response at Q11 (n=201) /

More stringent energy requirements in national building codes	56%
Capacity building and training on the implementation of new technologies, including heat pumps	49%
Standardized protocols for energy modelling, costing, and calculating life-cycle emissions	26%
Labelling and/or design and installation certification requirements for high performance equipment (e.g. heat pumps, high efficiency HVAC)	25%
Open access data sets that establish baseline energy performance for different building typologies and regions	25%
Development of an industry/trade association specifically dedicated to heat pumps (e.g. to gather and disseminate information, performance tracking, sales, training courses, and certification)	22%
Tools to track and maintain optimal building operation and efficient performance (such as Key Performance Indicators, fault detection diagnosis, on-going commissioning)	20%
Innovation in building controls and operations	15%
Other	21%
Don't know	2%
Not applicable	4%

12. Based on your experience, how important are each of the following tools and measures in enabling high performance, zero-carbon emissions houses and residential buildings (both new builds and retrofits)? (Scale: Very Important, Somewhat Important, Neutral, Not Very Important, Not at all Important, Don't know, Not Applicable) Base: Stakeholders providing a response at Q12 (n=181) / % shown is net for 'Very/Somewhat Important' only for each category.

More stringent energy requirements in national building codes	79%
Capacity building and training on the implementation of new technologies, including heat pumps	80%
Standardized protocols for energy modelling, costing, and calculating life-cycle emissions	74%
Labelling and/or design and installation certification requirements for high performance equipment (e.g. heat pumps, high efficiency HVAC)	70%
Open access data sets that establish baseline energy performance for different building typologies and regions	73%
Development of an industry/trade association specifically dedicated for heat pumps (e.g. to gather and disseminate information, performance tracking, sales, training courses, and certification)	56%
Tools to track and maintain optimal building operation and efficient performance (such as Key Performance Indicators, fault detection diagnosis, on-going commissioning)	65%
Innovation in building controls and operations	64%

13. How familiar are you with home energy assessments and labels? Select one. Base: Stakeholders providing a response at Q13 (n=183)

Very familiar (use it frequently)	26%
Familiar (use it or have used it recently)	44%
Somewhat familiar (heard of it, but do not use it)	28%
Not at all familiar (never heard of it)	2%

14. How familiar are you with the Natural Resources Canada EnerGuide Rating System for homes? Base: Stakeholders providing a response at Q14 (n=183)

Very familiar (use it frequently)	19%
Familiar (use it or have used it recently)	40%
Somewhat familiar (heard of it, but do not use it)	33%
Not at all familiar (never heard of it)	7%

15. Home energy assessments can be an important source of housing and energy use data. What information do you/your clients need about the built environment that is not already available? Select all that apply. Base: Stakeholders providing a response at Q15 (n=184)

Availability of low-carbon materials	53%
Specific attributes of the home that have an impact on energy use (e.g. HVAC system, levels of insulation, number of windows)	52%
Greenhouse gas emissions performance	49%
Vulnerability to weather-related climate hazards (e.g. flooding or wildfires)	47%

Energy efficiency performance	45%
Energy performance for different building typologies and regions	37%
Other	14%
Don't know	3%
Not applicable	5%

16. What information do you/your clients require on a home energy label to incentivize action to undertake energy efficiency retrofits? Select all that apply. Base: Stakeholders providing a response at Q16 (n=182)

An estimate of how much could be saved per year on energy costs through upgrades	76%
An estimate of how much recommended upgrades might cost	64%
Suggested home energy efficiency improvements	61%
How much energy the home uses relative to similar homes	57%
How much greenhouse gas the home produces relative to similar homes	56%
Other	14%
Don't know	4%
Not applicable	6%

17. How prominently does climate adaptation and resilience feature in your work today? Select one. Base: Stakeholders providing a response at Q17 (n=184)

A key component/consideration	54%
Aware, but limited in what action I can take	26%
Aware, but don’t consider it a key component/consideration	13%
Not aware/not a consideration	2%
Don’t know	2%
Not applicable	2%