Best Practice Study on Climate-related Building Standards by Canadian Municipalities

Summary Report

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Prepared for: City of Calgary

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Contents

Executive Summary

This report summarizes Mantle Developments' (Mantle) study for the City of Calgary (Calgary) on the best practices for climate-related building standards implemented by Canadian municipalities. The key objective of this study was to identify program design elements that are needed to drive decisive climate action to inform the City's development and implementation of a climate-related building standard. The research includes both new construction and retrofit building standards for commercial, residential, and institutional buildings. Few municipal building codes focused on industrial buildings.

The study entailed policy reviews of six major municipalities, Vancouver, Toronto, Edmonton, Winnipeg, Halifax, and Montreal. Mantle interviewed staff from Vancouver and Toronto as municipalities with the most advanced standards and Edmonton as the municipality with the most similar context. The findings from the research were broken down into six sub-topics, identified by the City of Calgary, in Section 2:

- Topic and Scope covered in the standards
- Timelines
- Enforcement and Incentivization
- Market Impacts
- Benchmarking, Labelling, and Certification
- Success Levers

Mantle conducted a high-level review of Calgary's current policies and initiatives to understand the context better. Select Calgary's internal staff were interviewed to identify priorities, opportunities, and challenges. This information is provided in Section 3.

The key recommendations on the topics of interest identified by Calgary are listed below and elaborated on in Section 4.

1. Set science-based climate mitigation targets and establish a clear and phased timeline for implementing emissions reduction requirements to meet these targets starting with major building archetypes.

    - Requirements are recommended to start rolling out on a voluntary and incentive basis before making them mandatory.
    - Emissions reduction requirements are recommended to start with new buildings because the industry has a better understanding of cost-effective solutions. For existing buildings, requirements are recommended to start with reporting, while the cost-effective solutions for deep-carbon retrofits are being developed.
    - Enforcement is recommended to start with larger commercial and institutional buildings and market multi-unit and detached residential buildings. Lessons learned from these projects help build capacity in smaller projects.
    - Operational carbon emissions are recommended to be prioritized, while embodied carbon emissions reporting for new buildings is incentivized. Reporting embodied carbon is necessary to build industry capacity and knowledge and create a baseline for future embodied carbon reduction targets.

2. Develop the details of climate-related policies, standards, and requirements in close collaboration with internal departments to ensure effective implementation and alignment of priorities.

The core climate leadership team should identify the overall climate change priorities, targets, timeline, and best practice policy and technical solutions. The departments responsible for implementing a requirement should be engaged directly in developing it.

3. Work with the internal legal department and other local governments, like Edmonton, to identify legal tools to expedite the market transition.

   The City Charter may enable Calgary to integrate carbon emissions reduction requirements into the land use and development bylaws and approval processes.

4. Create structures for ongoing industry stakeholder engagement and feedback. Through this process, Calgary can identify ambitious yet achievable timelines, effective and efficient incentives, and enforcement measures that the industry supports.
   - Industry leaders: Input from industry leaders with experience building high-performance buildings is essential to identify targets and timelines, effective incentives, and barriers.
   - Industry representatives: Early engagement with industry representatives strongly signals City's directions and allows them to raise their concerns and needs.

5. Prioritize envelope improvement in new and existing buildings in short and medium-term policies and standards.

6. Use existing voluntary standards with proven performance like Passive House to develop the City-led standards and accept these voluntary standards as alternatives to alleviate the burden on municipal staff.

   Passive House US standard could be a strong starting point for Calgary as it is developed to respond to similar climate zones in certain midwest states in the US.

7. Plan for the future grid and address the carbon intensity of the electrical grid through partnerships with the provincial government, federal government, other Albertan municipalities, energy utilities, and private partners.

   While Calgary focuses on reducing energy demand through envelope improvements, it should not lose sight of a future clean grid's opportunities in long-term strategy developments.

8. Build capacity by showing leadership, supporting research and knowledge capture, supporting early adopters, and sharing learning with the broader industry.

   - Show leadership through higher requirements for City-owned buildings.
   - Support early adopters through removing the barriers and providing financial and process-based incentives.
   - Support on-going technical and economic studies and models that inform policies, standards, and communication with the City Council and other stakeholders.
   - Support knowledge sharing and educational programs and initiatives.

9. Prioritize climate equity and reconciliation with the indigenous communities through seeking input and implementing measures that address concerns and needs of vulnerable and equity-deserving communities.

Calgary should consider how its climate-related policies and programs would impact housing affordability and ensure the proper considerations are taken to avoid negative impacts. Incentives and support programs should reach the communities that need them the most. Calgary should engage with communities that policies and standards will impact in a language and format accessible to them.

1. Introduction

This report summarizes Mantle Developments' study of climate-related building standards in leading Canadian municipalities. This work intends to identify best practices to inform the City of Calgary's development of its climate mitigation and adaptation standards for buildings.

This report includes the research methodology, identified approaches and standards in the reviewed municipalities (where public information exists), a high-level overview of the City of Calgary's policy context, and key recommendations for the City of Calgary (Calgary) to drive effective climate actions.

1.1. Methodology

Mantle Developments conducted a desktop research study to understand the existing practices on building-related climate mitigation and adaptation standards in major Canadian municipalities. The cities included in this study were identified by the City of Calgary and are as follows.

- Toronto
- Vancouver
- Edmonton
- Winnipeg
- Halifax
- Montreal

Specific sub-topics to focus on were identified by Calgary and included the following:

1. **Topics & Scope:**
    - Climate-related topics covered (e.g. energy efficiency and stormwater management)
    - The type of buildings covered (e.g., new and/or existing buildings, City-owned and/or private buildings, type and size of building included in the standard)
2. **Timeline:**
    - The time it has taken to develop the standards
    - Timeline of implementation including immediate, medium, and longer-term actions
3. **Enforcement & Incentivization:**
    - The mandatory and voluntary requirements
    - Any optional higher tiers of compliance
    - Any incentives provided (e.g. financial incentives or leniency in the application process)
4. **Market Impacts:**
    - Any known market impacts the standards may have
    - Any considerations on the equitable implementations of these climate-related policies and standards
5. **Benchmarking, Labelling, & Certifications:**
    - Any energy benchmarking or labelling programs used
    - Any external certification programs used to set the requirements
6. **Success Levers:**
    - Any levers for success, including any policy support that may have been needed for implementation of the standard, such as amendments to land use/zoning bylaws

- The relationship of the standards to building codes
- The measures that are taken to prepare the internal and external stakeholders

These findings are summarized in Section 2 of this report. They can be found in-depth in Appendix A.1, with supporting graphs, visuals, and tables in Appendix A.3.

Mantle Developments conducted a high-level review of the current building-related climate actions by the City of Calgary to better understand the context. The focus areas for this review were the same six topics that were studied for the other municipalities. The summary of this review is provided in Section 3.1, with additional details in Appendix A.2, “Calgary” tab, with supporting graphs, visuals, and tables in Appendix A.3.

In addition to the desktop research, Mantle Developments conducted targeted interviews with key internal and external contacts identified through the research in consultation with the City of Calgary. The interviews were conducted first with internal City of Calgary staff from various departments to identify actions to date, priorities, challenges, barriers, and opportunities.

The findings from the internal interviews were summarized in Section 3. These findings were used to frame the questions for the external interviews. The interviews with external municipalities were conducted to capture learnings, experiences, and takeaways from their development and implementation process that are applicable to Calgary. The findings from these interviews informed the recommendations to the City of Calgary that are provided in Section 4. The external interviews were conducted with the following individuals.

Internal: Interviews with the City of Calgary’s staff

- December 20, 2021
  - Dawn Smith, Lead Adaptation, Climate Adaptation Team
  - Brit Samborsky, Lead Mitigation, Climate Mitigation Team
- December 21, 2021
  - Claire Beckstead, Corporate Environmental Specialist, Climate Mitigation Team
  - Brent Downey, Energy Advisor, Environmental and Safety Management
- December 22, 2021
  - Hugo Haley, Coordinator, Community Planning, Planning Approvals group
  - Arsheel Hirji, Sustainable Infrastructure Team Lead, Corporate Sustainable Building Policy
- December 23, 2021
  - Kris Dietrich, Customer Solutions Team in Calgary Building Services
  - Justin Pockar, Customer Advisory Services Team in Calgary Building Services
  - Michelle Feragen, Business Strategist with Calgary Building Services

External: Interviews with select leading municipalities

- January 14, 2022: City of Vancouver
  - Patrick Enright, Senior Green Building Engineer, Sustainability Group, Planning, Urban Design and Sustainability
  - Chris Higgins, Senior Green Building Planner, Sustainability Group, Planning, Urban Design and Sustainability
- January 19, 2022: City of Toronto,
  - Lisa King, Senior Policy Planner, Environment Strategic Initiatives, Policy & Analysis, City Planning Division
- January 27, 2022: City of Edmonton
  - Justin Phil, Senior Engineer, Green Building and Energy Code, Safety Codes, Permits & Inspections, Development Services, Urban Planning and Economy
  - Andrea Linsky, Senior Environmental Project Manager Energy Transition, City Environmental Strategies Urban Form and Corporate Strategic Development Department

2. Best Practices for Climate-Related Building Standards in Canadian Municipalities

This section provides the summary and highlights from reviewing the policies, strategies, and standards from the six leading municipalities. The content is organized by the key sub-topics identified by Calgary and listed in Section 1.2.

Further details are provided in Appendix A.1, which contains a table with relevant information, organized in the same order as the content of this section, i.e. the policies and standards reviewed for each municipality and the sub-topics. Appendix A.3 provides supporting graphics and tables from the reviewed references.

2.1. Toronto

Toronto's climate strategy, TransformTO Net Zero Strategy, released in 2021, outlines a pathway for Toronto to achieve net-zero emissions in all sectors by 2040. The sectors are divided into categories like waste, transportation, renewable energy, industrial improvements, residential buildings, and commercial buildings. The impact of key actions in the City of Toronto's strategy are modelled (see Figure 8, Appendix A.3). For the different sectors, the pathways are then used to identify the emission reduction targets. The specific actions and requirements to achieve these targets are outlined in building-specific standards and strategies, including Toronto Green Standard (TGS) for new buildings and the Net Zero Existing Building Strategy (NZEB Strategy) for existing buildings.

TGS is Toronto's set of sustainable design and performance requirements for City-owned and privately-owned developments. This standard consists of performance tiers, with "Tier 1" being mandatory and applied through the planning approval process.

NZEB Strategy provides a plan to decarbonize all existing buildings in Toronto by 2040. This strategy outlines the key policy actions that the City of Toronto will take to accelerate acceptance of low carbon retrofits. For the full list of key policies and action items, refer to the "Topics & Scope" column in the "Net Zero Existing Building Strategy" of the "Toronto" section of Appendix A.1.

2.1.1. Topics & Scope

For buildings, TransformTO focuses on improving energy efficiency, fuel switching (electrifying and shifting to clean renewable energy) and using low-carbon materials. TransformTO has an equity lens, drawing attention to affordability and occupants' health. TGS has specific requirements that address air quality, energy efficiency, operational and embodied GHG emissions reduction, resilience, balance, quality, and efficiency of water used, ecology and biodiversity, and solid waste. The NZEB Strategy focuses only on operational and embodied GHG emissions reduction and offsets through disclosure, benchmarking, commissioning, retrofit, energy supply decarbonization, and offsetting.

TGS covers new buildings, and NZEB Strategy covers the existing buildings in a wide range of building types and archetypes. Commercial, single-family and multi-unit residential, and institutional buildings owned by City of Toronto Agencies, corporations and divisions, or by private residents are included in the strategy.

During the interview with the City of Toronto, it was noted that topics covered in TransformTO, TGS, and NZEB Strategy are all based on modelling from studies that the City of Toronto commissioned. Quantitative modellings and studies helped identify the most effective measures to respond to climate change and extreme weather.

2.1.2. Timeline

The creation of TGS began about 15 years ago, using the National Energy Code of Canada for Buildings (NECB) as a foundation. The building blocks of the TGS were originally used as a tool for energy utilities to provide incentive for modelling and energy improvements under the Better Building Partnership. The TGS then became a tool then for the High-Performance New Construction (HPNC) incentive program, which was eventually cancelled and transitioned to a required standard, that is known today as the TGS. Over time, as the industry's capacities grew, and the requirements became more stringent. The City of Toronto used modelling and actual data to identify emission reduction requirements to achieve its climate change targets.

Every four years, TGS is updated, the lowest tier is phased out and the requirements of the succeeding tier take its place. That means voluntary requirements in Tier 2 become Tier 1 and are therefore mandatory. The requirements from Tier 3 becomes Tier 2, and new or more stringent measures are introduced in the higher voluntary tiers.

The overarching target timeline for buildings are specified in TransformTO is as follows:

- City-owned buildings
    - 2022: All new buildings are to be zero carbon emissions
    - 2030: 65% GHG reduction for existing building (from 2008)
    - 2040: All buildings to be net-zero
- All other buildings - operational emissions:
    - 2030: all new buildings to be net-zero
    - Existing buildings: 50% reduction from 2008 (80% by 2040-2050)
    - Commercial & Industrial: 25% (floor area) connected to low-carbon thermal energy sources
- 2040: all buildings, new and existing, to be net-zero
- Embodied emissions: Evaluate and limit impacts by 2025

The reduction requirements and associated action items are listed in the NZEB Strategy as three terms, short (2021-2025), medium (2025-2030), and long (after 2030), for different building stock.

Short-term actions in NZEB Strategy focus on incentivizing performance disclosure, benchmarking, and labelling, setting targets, piloting best practices in public buildings, providing incentives for performance improvements, increasing financing for deep retrofits, education, support, and outreach.

Mid-term actions in NZEB Strategy include requiring performance disclosure, benchmarking, and labelling, requiring performance improvement for larger buildings while expanding rebate and low-interest late loan opportunities, especially for low-income residential and rental buildings.

Long-term actions in NZEB Strategy include continuing to require disclosure and performance improvements, providing access to competitive financing and incentives for buildings that go beyond requirements, supporting energy supply decarbonization, and encouraging continuous commissioning.

2.1.3. Enforcement & Incentivization

Adhering to the requirements defined by Tier 1 of TGS are mandatory for new buildings as part of the development planning approval process. During zoning, site plan control, and permit, developers must submit documents and reports for review. Everything submitted is binding. The Planning Act in Ontario requires that approved planning drawings are consistent with construction drawings. The City of Toronto relies on this clause that the site plan carries on to construction.

The higher tiers in TGS are voluntary and incentive-based for privately-owned buildings. Financial incentives are currently available for new buildings achieving higher tiers of TGS as development charge refunds (see Table 1 in Appendix A.3). The budget allocated to development charge refunds was asked from the Council based on an extensive cost-benefit study, showing that significant infrastructure costs can be avoided in the next 25 years if buildings meet higher compliance tiers.

As discussed in Section 2.1.2, NZEB Strategy proposes the City of Toronto introduces voluntary and incentive-based programs and policies for existing privately-owned buildings in the short term, followed by mandatory requirements for larger buildings in the medium term. The City of Toronto will expand mandatory requirements to smaller buildings in the longer term. Before transitioning to mandatory emissions reduction requirements, reporting, benchmarking, and labelling of buildings will become required to inform and update reduction targets. Targets will continue to be reviewed and updated regularly as more data and knowledge become available.

As of the delivery of this report, the City of Toronto offers a number of funding, incentive, and funding programs for retrofit projects. These include:

- High-Rise Retrofit Improvement Support Program (Hi-RIS) for rental apartments
- Home Energy Loan Program (HELP) for Single Family Homes (SFHs)
- The Energy Retrofit Loan (ERL) for all existing buildings
- Sustainable Towers Empowering People (STEP) for MURBs
- Green Will Initiative and Navigation & Support Services for institutional, commercial, industrial buildings, and MURB

The City of Toronto launched BetterHomesTO also has a list of additional programs available to Toronto homeowners and renters not provided by the City. Other program providers include the Government of Canada, the Government of Ontario, and utility companies.

In addition to the rebate and incentive programs, potential future financing options for private sector building retrofits include the following:

- **Green Banks:** A tool to be considered by the City of Toronto (in collaboration with key federal and provincial partners) is the establishment of a Green Bank. Green Banks are public-purpose finance institutions designed to facilitate private investment in energy and emissions reduction projects. For instance, Canadian Infrastructure Bank (CIB) can provide financing for deep retrofit and retrofit project aggregations.
- **Credit Enhancements:** A tool that mobilizes private capital by encouraging lenders to provide long-term financing or lower interest rates, lowers the overall cost of capital for retrofit financing, and makes financing available to customers who would not otherwise be eligible for credit. This can include loan guarantees, loan loss reserves, or interest rate buy-downs.

The City of Toronto leads by example in both new and existing buildings. New City Agency, Corporation & Division-owned buildings must meet Tier 2 or higher tiers of TGS. As for existing buildings, NZEB Strategy proposes institutional buildings to take action ahead of the rest of the industry to test and prove solutions for deep decarbonization, build capacity, and share lessons learned.

2.1.4. Market Impacts

Several costing studies conducted between 2016 and 2020 supported by the City of Toronto, showed the capital cost premiums to construct net-zero emissions new buildings is 5-10%. However, this market transition also creates more jobs (The City of Toronto Zero Emissions Buildings Framework, 2017). The investment required for deep retrofit projects are higher as

The NZEB Strategy indicates that deep emissions retrofits at the level and scale necessary to affect market transformation are currently not cost-effective in the traditional sense, even when the current planned cost of carbon is taken into consideration. Therefore, strong regulation and financial support are required. To maximize cost-efficiency, the strategy recommends taking advantage of co-benefits or aligned priorities that also require retrofit, including improved climate-change resilience. Lastly, increasing density through renewal rather than new construction can contribute to affordability and embodied carbon saving and storage opportunities.

Affordability is one of the key challenges in Toronto that is often felt most by Toronto's equity-deserving groups. More thorough equity analysis projects are planned to ensure emissions reductions actions support equity-deserving groups. These studies will explore opportunities to align climate change actions with the City of Toronto's initiatives on housing affordability, such as RentSafeTO and HousingTO. Additionally, the City of Toronto plans to build and expand on existing programs on equitability in workforce capacity building. An example of such existing initiatives is Toronto Community Benefits Network, which supports job creation and opportunity development in the construction sector for historically disadvantaged communities.

2.1.5. Benchmarking, Labelling, & Certifications

Ontario's Energy and Water Reporting and Benchmarking regulation (Ontario's Reg. 506/18) has partially launched the Energy and Water Reporting and Benchmarking (EWRB) program, which requires building owners to report building's energy and water use once a year to the Ministry of Energy. The dates for launching requirements by building size is as follows:

- July 1, 2019, for buildings 100,000 ft² and larger
- July 1, 2023, for buildings 50,000 ft² and larger

Within version 4 of TGS, which will come to effect on May 1st, 2022, for new planning applications, some requirements in addition to the EWRB program will come into place, including the following:

- **Low-rise residential buildings** (Less than 4-storeys with a minimum of 5 dwelling units):
    - **Privately-owned buildings:**
        - **Tier 1:** ENERGY STAR for New Homes, version 17.1 or R-2000 is required.
        - **Tier 2:** CHBA Net Zero Home Labelling Program or Passive House is required.
    - **City-owned residential buildings:**
        - **Tier 2:** CHBA Net Zero Home Labelling Program and Passive House are encouraged.
        - Reporting embodied carbon emissions of the structure and envelope is required.
- **Mid to high-rise residential & non-residential buildings** (Residential developments 4 storeys and higher, and all Industrial, Commercial and Institutional (ICI) developments):
    - **Tier 2:** Benchmarking and reporting through Energy Star Portfolio Manager is required.
    - **Tier 2:** Reporting embodied carbon emissions of the structure and envelope is required.
- **City Agency, corporation & division-owned facilities** (Non-residential development for all City agencies, corporations & divisions):
    - Annual energy consumption reporting is required through Energy Star Portfolio Manager, per Ontario Regulation 397/11.
    - Reporting embodied carbon emissions of the structure and envelope is required.

A new requirement has been added in TGS v4 for embodied carbon assessment for Tier 2 and Tier 2 projects.

NZEB Strategy also has plans for benchmarking and labelling, including:

- Advocate the launch of EWRB for buildings under 25,000 ft², and later buildings between 10,000 ft²-25,000 ft²
- Explore the City of Toronto's ability to expand reporting beyond EWRB and develop a labelling program for EWRB covered buildings
- Expand home energy disclosure and labelling using EnerGuide, beginning with a voluntary program as a part of education and awareness-raising activities and transitioning to a mandatory program

For additional information on short and medium-term benchmarking and labelling targets for each building type, see the "Energy Benchmarking and/or labelling" column of the "Net Zero Existing Building Strategy" row in the Toronto section of Appendix A.1

2.1.6. Success Levers

A deep understanding of the legal context was crucial to the success of TGS. The sustainability team developed a strong relationship with the City of Toronto's in-house legal team from the early stages of developing the standard to understand their jurisdictional levers. Following the success of this working partnership, the City of Ottawa's lawyers are working with Toronto's lawyers to advance their building standards. This was possible because the regulatory context of the two cities is very similar. This infers that the City of Calgary's legal team could take a similar approach and consult with lawyers from other cities who have similar jurisdictional contexts, such as Edmonton.

The City of Toronto is prohibited by Ontario's Building Code Act, 1992, from setting its own requirements for the construction of buildings. Therefore, climate mitigation, adaptation, and resilience policies cannot be mandated through the building code unless added by the Province of Ontario.

To successfully implement TGS, the City has taken advantage of Policy 5.1.3 of Toronto's Official Plan. This policy allows the City to secure sustainable design features that address the exterior design of buildings and site matters through Site Plan Control Application (SPA). TGS is integrated as part of the development planning approval process. The City of Toronto mandates submitting documents and reports indicating TGS Tier 1 requirements are met during the approval process (zoning, site plan control, and permit). If requirements are not met, buildings cannot enter the permitting stage.

To ensure the built projects comply with the proposed design, the City of Toronto relies on Ontario's Planning Act, making everything submitted in the approval process binding. That means approved planning drawings must be consistent with construction drawings submitted during the Development Planning approval process.

The City of Toronto initially made TGS requirements voluntary and incentive-based, giving the industry advance time to build capacity for the requirements and avoiding market resistance. TGS has continued to use the same approach by making higher performance requirements initially voluntary in the higher tiers.

The City of Toronto does not currently have the authority to implement mandatory performance targets for existing buildings. Therefore the short-term actions in NZEB Strategy are incentive-based. In the meantime, the City of Toronto is working with the Province of Ontario to expedite the creation of a retrofit building code that includes carbon emission targets.

TGS was developed in close collaboration with and support from teams across various internal City of Toronto units to ensure support and alignment among different City of Toronto departments. The core sustainability team is small and leads setting the vision and targets. They coordinate and support different groups who develop the TGS requirement details. Most mandatory Tier 1 requirements are the climate-related objectives of other departments incorporated into the development approval process to ensure the requirements are consistently met. Therefore, these internal stakeholders have the incentive to engage in developing, updating, and implementing TGS. These departments also write their own specifications for their TGS sections, and are the ones to review the documents from developers pertaining to their requirements. One example of integrating other departments' targets into TGS is achieving tree planting targets that the City of Toronto's Parks, Forestry & Recreation Division had difficulty achieving. These targets were successfully achieved by requiring them in the permitting process through TGS.

2.2. Vancouver

The City of Vancouver's overarching climate change plan is Vancouver Climate Emergency Action Plan (CEAP) and was approved by the council in October 2020. CEAP was developed in response to the City's Climate Emergency Declaration in January 2019 and approved a roadmap to achieve the following four major targets (referred to as "Big Moves"), all to be achieved by 2030:

- **Big Move 2:** Two-thirds of trips are made on foot, bike or transit
- **Big Move 3:** 50% of the distance driven are by zero-emissions vehicles

- **Big Move 4:** Carbon pollution of buildings are cut by 50% from 2007 levels
- **Big Move 5:** Embodied emissions of new buildings are cut by 40% from a 2018 baseline

The remaining two objectives are still undergoing approval. **Big Move 1** (by 2030, 90% of people live within an easy walk/roll of their daily needs) is being addressed through the Vancouver Plan. **Big Move 6** (Remove carbon pollution from the atmosphere through sequestration actions) was scheduled to be reported separately.

The City of Vancouver has identified the focus areas and targets based on scientific modelling that showed the most effective measures to achieve Vancouver's overall climate change targets.

Big Move 4 and 5 are the building-related targets achieved through specific plans and strategies. The key policies and strategies which set the roadmap for these targets are listed below. The supporting guidelines, programs, standards and regulations for these policies and strategies are discussed in the following sections.

- **Big Move 4 (Operational Emissions):** These emissions currently constitute 54% of the City's carbon pollutions
    - **Zero Emissions Building Plan (ZEB Plan)**: This plan, approved in 2016 and updated through CEAP, sets Vancouver on a pathway that has successfully put City on the pathway to make all new buildings zero-operational carbon by 2030.
    - **Zero Emissions Building Retrofit Strategy for Existing Buildings (ZEBR Strategy):** Introduced as an appendix to CEAP (Appendix J, CEAP), this strategy builds on the success of ZEB Plan to decarbonize existing buildings.
- **Big Move 5 (Embodied Emissions):**
    - **Embodied Carbon Strategy (EC Strategy)**: This strategy is another appendix to CEAP (Appendix K, CEAP). It sets the City's vision to reduce carbon emissions from construction techniques and material choices.

2.2.1. Topics & Scope

As discussed in the previous section, CEAP covers a wider range of actions addressing climate change mitigation. CEAP does not specifically address targets for climate mitigation and adaptation but it directly supports the Climate Change Adaptation Strategy (initially released in 2012 and updated in 2018) and the Resilient Vancouver Strategy (2019). These two strategies recommend objectives and actions to build resilience to major climate change shocks and stresses impacting Vancouver now and in the future.

As for building-related topics, the following are the focus areas and building types covered in the policies and standards mentioned in the previous section.

ZEB Plan:

- **Topics:**
    - **Operational emissions:** The plan focuses on the following measures:
        - Setting GHG limits by building type and stepping these down over time to zero emissions. The plan allows two pathways to achieve these emission reductions:
            - High-performance building envelope and ventilation systems, using technologies and solutions similar to the Passive House standard
            - Neighbourhood renewable energy systems (NRES) in dense urban settings (as well as hospital or university campuses)
        - Requiring zero-emissions space and water heating for new buildings (This was added in the CEAP the updates.)

        - Facilitate accessing renewable energy sources such as electricity (including heat pumps), bio-gas, and NRES
    - **Embodied emissions:** Starting to require embodied carbon reporting to inform future actions.
- **Building types:** This policy covers new buildings. These include detached housing, low-rise and high-rise MURBs, offices, retails, hotels/motels. The number of other building types is relatively small in Vancouver, so absolute GHG reduction targets are not yet defined. The City of Vancouver, therefore, relies on percentage reduction compared to established standards. These building types include food service, hotels, retail, light industrial, hospitals, and schools.

ZEBR Strategy:

- **Topics: Operational emissions:** Setting GHG limits by building type, reducing them over time, and streamlining the regulations. The key approaches to meet these limits include:
    - Requiring annual energy and emissions reporting and labelling
    - Transitioning heating and hot water equipment to renewable electricity-based systems, such as heat pumps
    - Facilitate access to renewable energy
- **Building types:** The strategy covers existing building including detached homes, MURBs (rental, non-market housing, and condos), and commercial buildings (office, retail, hotel, restaurants, and warehouses)

EC Strategy:

- **Topic: Embodied carbon:** The Strategy describes the City's plan to set rules requiring new buildings to be built using low-carbon materials and designs. This is achieved through the following key actions.
    - Require reduction targets through starting with the rezoning bylaw and transitioning to the building code through time.
- **Building types:** The strategy applies to both private and public new buildings.

Vancouver sets more stringent targets for City-owned facilities and infrastructures, which are described in Section 2.2.3, Enforcement & Incentivization.

2.2.2. Timeline

CEAP builds on Vancouver's long history of climate actions starting in 1990. The Greenest City 2020 Action Plan, developed in 2011, aimed to make all buildings constructed from 2020 onward to be carbon neutral in operations. These objectives were not achieved, but the GHG emissions from new buildings were reduced by about 50%. The Renewable City Strategy, developed in 2015, set the target of deriving 100% of the energy used in Vancouver from renewable sources and reducing GHG emissions by at least 80% below 2007 levels by 2050. A list of Vancouver's other previous climate-related policies and plans is provided in the "Notes" column of the "Climate Emergency Action Plan" row in the Vancouver section of Appendix A.1.

Vancouver started developing its building-specific climate-related plans, policies, and strategies mainly since 2015, starting with the release of ZEB Plan in 2016. In the following years, Vancouver developed specific guidelines, tools, programs, and regulations to achieve the targets set in the ZEB Plan. These include Green Building Policy for Rezoning and Zero Emissions Building Catalyst Policy, which are described in more detail in the following sections.

Vancouver is taking a phased approach in developing and implementing its zero-emissions building policies, starting with operational carbon emissions of new buildings. This approach gave time to the industry to prepare, allowed data collection, and paved the way for existing building retrofits and embodied carbon emissions, which are more complex undertakings. Below is a high-level summary of carbon emissions reduction targets. Detailed implementation timelines of these policies per building archetype are provided in Appendix A.3, Tables 13-17 for existing buildings, Table 18 for embodied carbon emissions of new buildings, and Tables 20-23 for operational emissions of new buildings.

ZEB Plan: **Operational carbon emissions of new buildings**

- 2025:
  - Majority of new buildings to be near zero operational carbon emissions
  - Zero Emissions space and water heating (added in CEAP): new & replacement heating & hot water systems to be zero emissions
- 2030: All new buildings to be net zero

ZEBR Strategy: Operational carbon emissions of existing buildings

- 2030: 50% reduction from a 2007 baseline
- 2050: 50% reduction (net-zero emissions)

EC Strategy: **Embodied carbon emissions of new buildings**

- 2020:
  - Target 40% reduction in civic buildings from a 2018 baseline
  - Civic infrastructure projects to explore carbon reduction potentials
- 2030:
  - 40% reduction overall
  - 50% reduction for civic buildings

2.2.3. Enforcement & Incentivization

Vancouver has a phased approach to requiring its zero-carbon building targets. They start with voluntary targets for new buildings and provide incentives and support for early adopters. The requirements have become mandatory for City-owned buildings and larger and more complex buildings first. Learnings from early adopter projects are shared with the industry to build capacity. The requirements for City-owned and complex buildings get more stringent after a few years, while the previous requirements become mandatory for other buildings.

The City of Vancouver uses certain policies and bylaws to incentivize or enforce the targets set in the ZEB Plan.

- Green Building Policy for Rezoning (last updated in 2018) sets performance requirements that must be addressed at the rezoning application stage.
- Higher Building Policy (last updated in 2018) applies to projects seeking significant additional height above their current zoning and high buildings in areas that affect the city's skyline.

For specific performance requirements set through these two policies, see Table 22 in Appendix A.3.

A key strategy for ZEB Plan is to develop catalyst tools to remove barriers and support private builders and developers to demonstrate effective approaches to zero emissions new buildings. ZEB Catalyst Policy (last updated in 2019) provides clarity and guidance to staff and applicants on tools to mitigate the challenges voluntary leaders will have to overcome as they advance the

transformation of near-zero-emission MURBs. Examples of tools used is bylaw amendments that allow:

- Increasing floor plate limits within a planning policy to accommodate additional insulation
- Relaxing frontage requirements to facilitate a near-zero emissions building
- Allowing a limited increase in permitted floor area

The increase in floor space ratio (FSR) has proven very effective, as it can enable adding one more unit to a MURB, which can make up for additional costs of zero-emissions buildings. To ensure that applicants will meet the performance they propose in the design phase the City of Vancouver requires them to get Passive House or an International Living Future Institute Zero Energy standard certification.

Vancouver's charter allows the City to have its own building by-law to regulate the design and construction of buildings. This is unique to Vancouver among all the jurisdictions in British Columbia and allows Vancouver to have energy and GHG emissions limits ahead of the province. The performance requirements in Vancouver Building By-law (VBBL) move a few years behind Green Building Policy for Rezoning (Referred to as Rezoning Policy hereafter) to allow the market to build capacity and prepare for the upcoming requirements. The proposed 2023 updates to VBBL and Policy for Rezoning City are provided in Table 24. The 2023 Rezoning requirements would be likely to move to VBBL in 2025. These updates cover operational and embodied emissions as well as building resiliency. Vancouver is currently collecting feedback from the experts and broader industry on these proposed requirements.

A similar approach is taken in ZEBR Strategy for existing buildings, where Vancouver will start with incentive programs and mandating reporting energy and emissions to be used for benchmarking. The incentives and removing barriers will support demonstration projects. Vancouver will also support and offer innovative financing for deep retrofits. The first mandatory carbon limit requirements for existing buildings are expected to be introduced in 2025. Initially, the limits only apply to large commercial and retail buildings and detached homes. They are expected to be modest and only impact the most inefficient buildings. Vancouver will introduce limits for additional building types in the next round of updates. They will also make the limits more stringent for building types with existing limits every five years.

Vancouver uses its building to show leadership by defining performance requirements in Real Estate and Facility Management Design and Technical Guidelines. These guidelines apply to all City-owned and city capital-funded, new construction and major retrofit projects. The buildings constructed for Vancouver using Community Amenity Contribution (CAC) funding and those with long-term leases should also adhere to the same requirements. These buildings are mandated to achieve the following requirements:

- Be LEED Gold certified
- Have Passive House Certification or an approved alternative zero-emissions building standard
- Use only low-carbon fuel sources
- Use no fossil fuels
- Calculate embodied carbon emissions and identify reduction opportunities by 40%
- Capture and treat a minimum of the first 48 mm of rainfall per day

Vancouver allows for some flexibility in these requirements if they are not technically, financially, or operationally feasible.

2.2.4. Market Impacts

Each time Vancouver intends to add new requirements, they conduct extensive research, modelling, and stakeholder consultation. These are done to understand current building design and construction practices, inform stepped reduction targets that are ambitious yet achievable, and ensure the cost of housing is not affected. Voluntary pilot and demonstration are key in advancing the industry capacity and providing reliable data for cost analysis studies.

Studies that the City of Vancouver commissioned have shown that major residents and business investments in addition to governmental investment will be required, especially for retrofitting existing buildings. However, these investments are predicted to generate major savings over the lifetime of the investments, create significant local economic opportunities and job opportunities, provide health benefits, and reduce climate risk and adaptation costs. Potential net benefits of a low-carbon retrofit code and supporting actions to drive an increase in the uptake of low carbon retrofits over are shown in Table 12 in Appendix A.3

The City's experience with ZEB Plan has also shown that building practices and the availability of cost-competitive building systems evolve quickly in response to the initial targets. By clearly signalling future carbon limits, owners, trades, and the building industry will be able to prepare for and benefit from a predictable transition.

Equity and reconciliation were high priorities in developing the CEAP. A Climate and Equity Working Group was formed to develop a Climate Justice Charter to ensure equity is integrated and supported through the Vancouver's climate actions. Recommendations from the Working Group were reviewed by three independent groups in the engagement phase. Examples for equity-related topics included in zero emissions building policies and strategies include:

- Avoid displacement and burdening disproportionately impacted communities by
    - Avoid setting limits for rental and non-market housing in the initial stages.
    - Enhance incentives, energy audits, capital planning assistance and implementation supports through expanding existing programs like Market Rental Retrofit PLUS Resilience Program and the Zero-Emissions Non-Market Housing Retrofit Program
    - Partner in pilot projects focused on non-market housing
        - These projects support performance improvements in buildings that otherwise cannot afford it. They are robust case studies that prove the feasibility of zero-emissions building with limited budgets.
- Set higher expectations through regulation for those with resources and opportunities and lower expectations for those lacking resources or facing exceptional barriers.
- Ensure financial support and capacity building to those who need it most
- Engage meaningfully with the people and businesses that will be impacted in a language and format that is accessible
- Advance equitable sourcing of building materials, including sourcing from indigenous-managed areas

2.2.5. Benchmarking, Labelling, & Certifications

The Rezoning Policy has two requirement pathways. The first pathway requires designing to and receiving Passive House Certification or an alternate near-zero-emissions building standard, such as the International Living Future Institute's Zero Energy Building Certification, that is accepted by the City of Vancouver. Alternatively, the projects should meet performance limits specified by the City of Vancouver, which are similar to the Passive House performance

requirements. That way, the City of Vancouver allows using certifications that have proven to be effective but does not mandate them.

For energy benchmarking, the current version of the Rezoning Policy requires energy reporting through Energy Star Portfolio Manager. However, this requirement is proposed to be removed in the 2023 update and be addressed through ZEBR Strategy.

For existing buildings, over a thousand buildings in Vancouver already voluntarily benchmark their energy use with ENERGY STAR Portfolio Manager (See Building Benchmark BC Annual Report, 2022, for more information). ZEBR Strategy proposes mandating annual energy and emissions reporting starting with larger commercial buildings and MURBs in 2023. This will come in advance of carbon limits coming into force to provide owners time to determine compliance, plan improvements and implement retrofits.

For detached homes, Vancouver required EnerGuide home energy assessments for new homes and house renovations since 2007. The City of Vancouver is also working with Natural Resources Canada (NRCan) to develop a Virtual EnerGuide Rating System for homes instead of an in-person home assessment. The City is considering using these virtual ratings as the initial emissions compliance metric for Vancouver homes, subject to verification by the homeowner.

For embodied carbon, the City of Vancouver will create new standardized reporting forms to accompany existing submittals for rezoning, development permit, and building permit applications and clarify any additional documentation that must be submitted.

2.2.6. Success Levers

The City of Vancouver engages with key stakeholders to develop climate-related building policies, strategies, or regulations. This includes:

- Engaging with industry leaders in the early stages to get their suggestions on meeting climate targets and the support needed from the City of Vancouver. This can include small expert group discussions and workshops with a larger group of key stakeholders.
- Using feedback and support from the industry representatives to communicate the proposed approach with the broader industry groups. Hearing input from peers creates more trust in the feasibility of the required targets. As a specific example, the City of Vancouver solicited feedback from developers for 18 months as new standards were introduced.
- Clearly communicating future targets years in advance. The clarity and certainty allow the industry to plan and prepare in advance. It is essential to make it clear that the staff are following what Council has mandated them to achieve and that the targets are aligned with the Federal Government's upcoming targets.

The City of Vancouver shows leadership in city-own or funded projects and supports early adopters. The experiences gained from these projects inform the next policy actions. These real-world examples also showcase the feasibility of policy requirements. Demonstration projects built with limited budgets, such as non-market housing projects, are particularly effective in motivating the rest of the market to take similar actions.

The City of Vancouver put extensive efforts into removing barriers through consultation with internal and external stakeholders. ZEB Catalyst Policy is an example of measures taken to remove or alleviate barriers to new buildings.

The City of Vancouver created or supported the establishment and operation of centres such as Zero Emissions Building Exchange and Carbon Leadership Forum Vancouver Hub for broader adoption of successful measures. These Centres can house or coordinate sector-specific support, training, and knowledge sharing programs, provide decision-support tools, inform about or administer incentive programs, demonstration funding programs, and innovative financing.

As mentioned in Section 2.2.3 (Enforcement & Incentivization), Vancouver has the authority to include energy and carbon emission performance requirements in the VBBL, the building code that applies to Vancouver. However, before that, Vancouver creates capacity through providing incentives and enforcing requirements to larger and more complex projects through the Rezoning Bylaw and Higher Building Policy. To ensure the requirements are followed as intended, Vancouver develops bulletins to clearly specify the compliance expectations for these bylaws and policies. An example of these bulletins is the Process and Requirements bulletin for Green Buildings Policy for Rezoning, which in itself refers to another bulletin developed by the City of Vancouver that details the energy modelling requirements (Energy Modelling Guidelines).

The City will build on the successes for new buildings to achieve its targets for existing buildings. Through the efforts made on new buildings through the ZEB Plan and the B.C. Energy Step Code, which was informed by ZEB Plan:

- The expertise, skills, materials and equipment required for retrofits are already developed and further advanced.
- A highly collaborative network between governments, NGOs and industry is already established.

Lastly, Vancouver has built strategic relationships with energy utility providers to expedite transitioning to a clean energy supply. The City has a formal Memorandum of Understanding (MoU) with FortisBC, the primary natural gas supplier. The MoU acknowledges misalignment but also opportunities, including a path forward for natural gas. That is by allowing renewable natural gas and natural gas in energy-efficiency projects (Passive House level) and thereby permitting FortisBC to support their business model by creating new gas connections.

2.3. Edmonton

Edmonton Community Energy Transition Strategy and Action Plan (Referred to as CET Strategy hereafter), released in 2021, set the mitigation plan and the path forward for a low-carbon city. The plan aims to shape the Edmonton economy's future just and frame an equitable transition. The plan includes building-related targets and actions, (specifically Pathway #2: Emission Neutral Buildings).

2.3.1. Topics & Scope

Pathway #2 (Emission Neutral Buildings) of the CET Strategy focuses on increasingly stringent energy codes in alignment with federal and provincial governments to achieve highly energy-efficient and healthy homes and buildings. The five key strategies within Pathway #2 are the following:

- Supporting the acceleration of emission-neutral buildings
- Supporting residential, commercial and institutional property owners to reduce overall energy use and utility costs through retrofits
- Supporting low embodied carbon buildings and infrastructure
- Promoting programs to alleviate energy poverty and increase energy efficiency in affordable buildings
- Supporting the attraction and expansion of opportunities for green building technology, products and services

Through Pathway #1 (Renewable and Resilient Energy Transition), the CET Strategy also sets the pathway for Edmonton's energy to be supplied with 100% emission neutral electricity and heating and a complete build-out of a city-wide decarbonized district energy network by 2050.

The building types that are priorities in Pathway #2 are residential and commercial, including new and existing, and privately-owned and City-owned buildings.

2.3.2. Timeline

Edmonton's City Council declared a climate emergency in August 2019 and directed the City of Edmonton's Administration to update its existing Community Energy Transition Strategy. In fall 2020, the first draft of the CET Strategy was presented to the Council.

Pathway #2 is planned to be implemented between 2021-2030. The implementation stages are as follows. For detailed action items and timeline, see Appendix A.3, Table 26.

- 2021–2022: Building capacity and offering incentives
- 2023–2026: Performance-based voluntary tiers and data collection
- 2026–2030: Mandatory requirements in bylaws and voluntary embodied carbon reporting

2.3.3. Enforcement & Incentivization

CET Strategy plans for the City to lead by example by setting an emission-neutral building standard for new City buildings, retrofitting existing municipal buildings, implementing embodied carbon disclosures, and reporting energy performance beginning in 2021.

For privately-owned buildings, the City of Edmonton outlines voluntary actions and explores introducing mandatory requirements in 2026. These actions include:

2021–2022:

- Developing and expanding existing retrofit incentive programs, such as Building Energy Retrofit Accelerator rebate program, which provides financial incentives for energy efficiency upgrades to commercial and institutional buildings
- Continue incentives for voluntary energy labelling and disclosure
- Piloting an income-based home renovations program
- Adding energy efficiency criteria to the affordable housing grants and incentive programs

2023–2026:

- Developing performance-based incentives for new construction, with increasing requirements (Tier 1 in 2022, Tier 2 in 2025, and Tier 3 in 2028)

2026–2030:

- Explore mandatory energy benchmarking, disclosure, and labelling bylaws
- Voluntary reporting of embodied carbon emissions in new construction

Edmonton's incentive programs are mainly tax-funded from operating municipal funds. Edmonton tries to coordinate its incentive programs with any available provincial or federal funding programs. Aligning these incentive programs has been challenging because provincial and federal programs tend to change frequently.

2.3.4. Market Impacts

CET Strategy notes that a thriving retrofit industry will create significant local job opportunities. Pathway #2 is expected to require approximately an average of $180 million in annual public and private investment over the next 30 years.

One of the CET Strategy's principles is to be just and equitable. This is achieved by fostering and prioritizing a good quality of life for all Edmontonians, serving not only those today but serving those who come after and protecting the natural environment. The City of Edmonton will create a "Just and Equitable Transition Initiative" for equity-seeking groups that identify challenges, solutions and participation opportunities.

2.3.5. Benchmarking, Labelling, & Certifications

Edmonton has already deployed a few energy benchmarking and labelling actions, including:

- Change Homes for Climate, a voluntary home energy labelling program that offers rebates for EnerGuide home energy evaluations.
    - The corresponding EnerGuide labels are shared publicly on Edmonton's Home Energy Map.
- Building Energy Benchmarking Program, a voluntary program that encourages large commercial, institutional, industrial and multi-family buildings to submit their energy performance data to the City for benchmarking and disclosure purposes
    - This is the first program of its kind to be hosted by a municipality in Canada.
    - 120 City-owned buildings have disclosed their energy performance.

Action items in Pathway #2 for benchmarking and labelling are:

2021–2022:

- Continue incentives for voluntary energy labelling and disclosure
- Reporting and disclosing the energy performance of City-owned buildings

2023–2026:

- Collaborate with energy utility companies to develop market-wide, electronic access to energy consumption data for all buildings
- Implementing embodied carbon disclosure into procurement processes of building materials and products

2026–2030:

- Explore mandatory energy benchmarking, disclosure, and labelling bylaws
- Voluntary reporting of embodied carbon emissions in new construction

2.3.6. Success Levers

The CET Strategy identifies incentives, pricing and subsidies, infrastructure investment, policy and regulation, and supporting and creating awareness as key success levers. Sections 2.3.3 and 2.3.5. mentioned actions to provide incentives and show leadership through City-owned facilities.

The City of Edmonton finds sharing success stories from cost-effective net-zero buildings in the region to be a very effective measure to accelerate the adoption of best practices. Therefore CET Strategy has set a set of actions to support early adopters, share knowledge, and build capacity. These actions are:

2021–2022:

- Establish an industry advisory group for ongoing advice and recommendations
    - The City of Edmonton has found input from industry stakeholders crucial to identifying effective incentive programs and creating trust and support among industry peers.
- Establish an Emission Neutral Building Knowledge Exchange collaborative platform/hub that includes working with partners, such as post-secondary institutes, on training
- Continue the Building Blocks information and discussion series to support learning and discussions on high-performance buildings and industry best practices.

- Include information in City of Edmonton newsletters for regular communication and expand Change for Climate consumer and tenant resources to include resources on life-cycle costs and other benefits of emission neutral buildings
- Pilot a home renovation program designed to address energy poverty and implement income-based programs to help residents living in energy poverty make their homes more energy-efficient, access renewable energy and realize the benefits of energy transition.

2023–2026:

- Forecast, track and report on energy poverty while collaborating with existing poverty reduction initiatives to lessen energy burden in Edmonton.
- Support, retain and grow green technology and service businesses in the region that are locally owned and controlled by diverse groups, and market and promote local green building expertise, innovation, technologies, products and services with regional economic development partners.

The City of Edmonton requires local improvement projects to be built to the same standard as the City-owned facilities. Local improvement projects are typically undertaken near or adjacent to development projects and are paid, in whole or in part, by benefitting property owners through a local improvement tax. This creates cash flow for high-performance and low-carbon civic buildings. When developers want to build, they must pay these improvement taxes. Because the improvements are for city assets, the developers must pay for net zero (i.e., if the fire department is required to be built to net-zero standards and net-zero fire truck fleet). The City initially received push back from the industry since the City of Edmonton's requirements to build net-zero buildings can result in 15-30% incremental costs. However, since this requirement is approved by the City Council, adhering to it is mandatory.

Edmonton has a very small group dedicated to planning and implementing climate actions. The core team has established a strong allyship with other City departments, who support them with the development of the details for implementing the actions.

The City of Edmonton is exploring ways to add performance limits to the building code. The City Charter allows Edmonton to regulate areas not already regulated through other provincial policies and legislation. Since the provincial code already has regulations for building energy use, Edmonton cannot include additional limits. However, there is an opportunity to add carbon emission limits, which the City is exploring through zoning bylaw (See Zoning Bylaw Renewal Discussion Paper: Climate Resilience & Energy Transition, 2020, for more information).

Given the similar regulatory context between Edmonton and Calgary, there is potential to collaborate on identifying pathways to use zoning bylaws and energy and emission codes in alignment with federal and provincial governments.

2.4. Winnipeg

Winnipeg's Climate Action Plan: Planning for Climate Change, Acting for People (referred to as the CAP hereafter) was released in 2018.The CAP consists of seven strategic opportunities with supporting key directions and action items that form a comprehensive package of solutions to enable climate action in the City of Winnipeg. Strategic Opportunity #5 is focused on "Low Carbon and Energy Efficient Buildings". The other Strategic Opportunities include corporate leadership, empowering community leaders and collaborating with stakeholders, advancing sustainable transportation, increasing urban density, waste diversion, and climate resiliency.

2.4.1. Topics & Scope

Strategic Opportunity #5 covers City-owned and privately-owned, new and existing, residential, commercial and industrial buildings. It focuses on the following areas:

- Increasing energy performance of existing and new buildings
- Renewable energy use, such as biomass district energy systems, geo-exchange, and solar systems
- Strategic land use and increased density

2.4.2. Timeline

Winnipeg's CAP was developed between Summer 2017 and Spring 2018. CAP builds on several years of work and research on understanding Winnipeg's current energy use and GHG emissions and the modelling of reduction scenarios, which were reported in Winnipeg's Community Greenhouse Gas Inventory and Forecast (2015). This previous work was referenced in the CAP to set realistic reduction targets. The process also included public engagement events to collect feedback that was incorporated in CAP.

For buildings, Winnipeg's CAP sets the target to decrease community-level GHG emissions by 20% relative to the 2011 baseline by 2030. This is done by attaining the following goals:

- By 2030, incorporate renewables and/or significant energy efficiency upgrades in:
    - 8% of all residential homes
    - 12% of all commercial & industrial buildings
- By 2031, 50% of all new residential construction will be built in strategic infill locations.

The timeline for implementing the action items is broken down into the following categories: The detailed timelines are available in Appendix A.3, Tables 27-31.

- **Short-term (2018-2022):**
    - Collect data through benchmarking
    - Explore current building practices and improvement potentials
    - Assess the feasibility of support and incentive programs
    - Explore updates to the City of Winnipeg's bylaws
- **Medium-term (2022-2026):**
    - Launch incentive, educational, and support programs
    - Build and expand on partnerships and collaborations with key stakeholders to develop and advance programs, standards and policies, and equity
    - Incorporate performance requirements in land use and approval processes
- **Long-term (2027 onwards):**
    - Provide resources and incentives for high energy efficiency

Some identified objective points are intended to be ongoing, even though they may have been identified as short or medium-term.

2.4.3. Enforcement & Incentivization

Winnipeg's CAP begins with data collection and voluntary incentive programs while exploring requirements through bylaws, land use and development permit processes, and building code.

The action items in Strategic Opportunity #5 for future creation of incentive programs include the following:

- **Short-term:**
  - **Existing Buildings:** Advance a business case analysis to support the design and development of a residential and commercial energy performance program that includes both financial and non-financial incentives
- **Medium-term:**
  - **Existing Buildings:** Develop a residential energy efficiency grant incentive program that targets emission reduction in homes. Seek to complement provincial, federal, Manitoba Hydro and/or Efficiency Manitoba initiatives
- **Long-term**:
  - **New Buildings:** Provide resources and incentives such as a property tax relief or permit cost reduction program for energy efficiency

Action items for future creation of mandatory requirements include the following:

- **Short-term:**
  - **New & Existing Buildings:** Review City of Winnipeg by-laws to identify opportunities to facilitate high energy performance and/or use of renewable energy
  - **New Buildings:** Review existing practices to enforce existing Energy Codes and identify future improvement and innovation opportunities

- **Medium-term:**
  - **New Buildings:**
    - Work with the provincial government and other stakeholders to advance building code standards and other policy tools
    - Incorporate energy performance requirements in the City of Winnipeg's land use and development approval processes
    - Identify and advance new policy tools

2.4.4. Market Impacts

Winnipeg's CAP has a holistic lens to the interconnections and co-benefits of climate change actions. It identifies that climate actions can increase jobs and economic activities, improve citizens' health, and increase social equity and affordability. Strategic Opportunity #2 within Winnipeg's CAP lays out the actions to empower community leaders and collaborate with stakeholders. These include engaging community leaders and associations, including the Mayor's Indigenous Advisory Circle, on an ongoing basis to help shape and implement the Plan.

Strategic Opportunity #5 starts with simple measures to reduce energy use emissions and even cost. Action items within Strategic Opportunity #5 are planned to increase access to educational materials and build partnerships with key stakeholders to build local capacity and equity.

2.4.5. Benchmarking, Labelling, & Certifications

Winnipeg's CAP identifies numerous short-term (2018-2022) actions to collect data from existing buildings and classify existing and new buildings based on their energy performance. These actions are:

- Implement energy benchmarking for all City-owned buildings (using a Portfolio Manager) to identify improvement opportunities
- Work with CaGBC and Manitoba Hydro to generate Winnipeg-specific energy performance data to target the highest emitting buildings in the reduction efforts
- Work with key stakeholders to accelerate the implementation of an energy performance labelling program for existing and new buildings

2.4.6. Success Levers

Winnipeg's CAP acknowledges that the details of the actions identified need to be further developed. To successfully implement these actions, the City of Winnipeg requires:

- Increased funding levels
- Increased staff resources
- Improved corporate collaboration across all municipal departments
- Improved monitoring
- Continued collaboration with stakeholders and community

In addition to exploring financial and regulatory incentives and leverages through the actions mentioned in Section 2.4.3 (Enforcement & Incentivization), the City of Winnipeg will show leadership in City facilities and buildings by taking the following actions:

- **Short-term:**
  - Implement energy benchmarking
  - Conduct energy audits to identify energy performance improvement opportunities
- **Medium-term:**
  - Regular recommissioning and retrofits in existing facilities
  - Create a comprehensive energy management program for existing facilities
  - Explore investing in renewable energy technologies at City buildings
- **Long-term**:
  - Install publicly accessible energy consumption displays at City facilities

The City of Winnipeg also will support the community and industry by providing resources and education through the following actions:

- **Short-term:**
  - Work with key stakeholders to develop and offer educational courses and provide access to locally-sourced green building material resources
- **Medium-term:**
  - Launch programs that provide information and resources to homeowners
  - Connect green builders and retrofit teams to building owners and tenants
- **Long-term**:
  - Support establishing a green building centre of excellence to promote education and awareness

Winnipeg's CAP specifies responsible municipal departments for each action. These are as follow:

Planning, Property and Development Department

- Implement low-carbon and energy-efficient City facilities and buildings
- Increase energy performance of existing buildings
- Improve energy performance of new buildings

Office of Sustainability

- Increase access to educational materials
- Build climate equity

2.5. Halifax

HalifACT 2050 (2020) is Halifax's long-term action plan to reduce emissions and help communities adapt to changing climate (HalifACT hereafter). Through this plan, the City of Halifax commits to a net-zero community by 2050. HalifACT identifies that the City of Halifax's pathways align with the global climate change targets. Five key areas identified for decarbonization opportunities are electrifying transportation, large-scale renewables, rooftop solar, net-zero new buildings, and retrofitting existing buildings (see Figure 29 in Appendix A.3).

HalifACT includes 46 actions, organized under three categories; each of them has a number of sub-categories. Below are the three main categories and the sub-categories that support the City of Halifax's building-related targets:

- Decarbonized and Resilient Infrastructure
    - Efficient Buildings
    - Renewable Energy
    - Greening Government Operations
- Prepared and Connected Communities
- Governance and Leadership
    - Carbon accounting

2.5.1. Topics & Scope

The building-related scopes covered include both new and existing, City-owned and privately-owned, residential and non-residential buildings. Topics covered include the following:

- Net-zero emissions and climate-resilient new buildings
- Deep energy and climate resilience retrofits
- Water-use reduction
- Rooftop solar systems and energy storage
- Decarbonizing the grid
- Decarbonize and expand district energy systems
- Carbon accounting for both operational and embodied carbon emissions

2.5.2. Timeline

HalifACT was developed in response to Halifax Regional Council declaring a climate emergency in January 2019. Council adopted the Plan in June 2020.

Building-related targets set and their timeline are as follow:

2020

- New municipal buildings to be net-zero operational emissions

2030

- All new buildings to be net-zero operational emissions
- Retrofitting and future-proof all existing municipally-owned buildings to achieve net-zero municipal operations

2040

- Retrofit all existing buildings

2050

- Energy demand to be decreased by 60%, and GHG emissions by 92%

The timeline for implementing the action items identified in the Plan is broken into the following:

- **Immediate** (begin right away)
    - Develop, adopt and apply a standard for net-zero and climate-resilient new construction
    - Develop a retrofit program to enable and fast-track deep energy and climate resilience retrofits in residential and non-residential buildings
    - Expand programming for rooftop solar systems and energy storage
- **Short** (Within 2-3 years)
    - Adopt a commitment, develop a detailed and costed infrastructure plan, and finance implementation to achieve net-zero municipal operations
- **Long** (Next 6-10 years)

- Develop an industrial coalition and support program for improving industrial process efficiency
- Include embodied carbon in new construction standards for buildings

For the complete timeline for implementing actions for efficient buildings, renewable energy, and greening government operations, see Figures 32-36 in Appendix A.3.

2.5.3. Enforcement & Incentivization:

At this time, no specific mandatory or voluntary actions are required by buildings other than for municipal buildings. Incentives have not been identified, but HalifACT acknowledges that new funding mechanisms are needed to enable the needed investments.

2.5.4. Market Impacts

One of the medium-term actions under “Prepared and Connected Communities” is to expand workforce and technology development programs and funding to grow skills and trades for decarbonization and resiliency services.

Overall, the decarbonization transition is expected to have significant market impacts. The low-carbon transition will require $22 billion investments across various sectors over 30 years and stimulate economic activity (see the breakdown in Appendix A.3, Figure 30). These investments will generate financial returns, a net benefit of $22 billion, or $8.7 billion, using a social discount rate of 3%. Savings are expected to result from:

- Avoided energy costs
- Avoided operations and maintenance costs,
- Avoided carbon pricing costs
- Increased energy generation revenue

Low-carbon transition is expected to create approximately 170,000 person-years of employment generated between 2020 and 2050, an average of 5,500 annually. See the breakdown in Figure 31 in Appendix A.3.

HalifACT acknowledges that equity needs to be considered in program development and delivery because the transition to deep emission reductions will be disruptive. Halifax intends to make a “just transition" and minimize the impact on workers and communities and engage with the individuals and organizations impacted by the transition. The City of Halifax also intends to deploy actions that simultaneously deliver other health, equity, poverty alleviation, and reconciliation objectives.

2.5.5. Benchmarking, Labelling, & Certifications

No requirements or actions are mentioned in HalifACT regarding benchmarking and labelling of buildings. However, developing annual indicators to report on the progress is one of the action items under “Governance and Leadership”.

2.5.6. Success Levers

Five of the seven priority actions HalifACT identifies for the next five years to enable Halifax to remain within the low carbon pathway are building-related. They are as follow:

- Retrofit and renewable energy programming
- Retrofit municipal buildings to be net-zero ready and climate-resilient
- Net-zero standards for new buildings
- Capacity building for climate adaptation; and,
- Financing strategy to operationalize the HalifACT 2050 plan over 30 years

The City shows leadership by setting more stringent requirements for municipally-owned buildings. In addition to the actions mentioned in Section 2.5.2 (Timeline), the council passed a motion that requires all energy used by municipal buildings to be on/off-site renewables.

2.6. Montreal

Montreal's Climate Plan 2020-2030 includes 46 actions, including 16 key actions, grouped into five sectors to set Montreal onto the path to becoming a resilient, inclusive, and carbon-neutral city. These actions support Montreal's climate targets of 55% reduction of GHG from 1990 levels by 2030 and carbon neutrality by 2050.

Buildings are one of the five key sectors identified with emissions reduction opportunities.

1. **Mobilization of the Montreal community:** support the community and provide access to information
2. **Mobility, urban planning, and urban development:** More sustainable modes of transportation
3. **Buildings:** Reduce the use of fossil fuels in buildings
4. **Exemplarity of the City:** Leading by example in both transportation and building initiatives
5. **Governance:** Revising existing rules to consider the climate impacts in all decisions

2.6.1. Topics & Scope

Montreal's Climate Plan focuses on residential, commercial, and institutional buildings as they generate most emissions from this sector. This plan sets more stringent requirements for City-owned buildings. The key action items for the "Buildings" sector in the Climate Plan are the following:

- Eliminate the use of heating oil in buildings, and promote renewable energy sources
- Adapt by-laws and support programs to enhance energy efficiency and resilience
- Design funding programs
- Improve the energy performance of large existing buildings by using a rating system

Under the "Mobilization of the Montreal community" sector, Montreal's Climate Plan also calls for forming a multistakeholder work team to eliminate embodied carbon from construction projects.

2.6.2. Timeline

Montreal's Climate Plan took about two years to develop. The development of the plan started after Montreal signed a collaboration agreement in 2018 with a few leading non-profit organizations to develop a plan to respond to the climate and environmental emergency.

Action items in the Climate Plan are to be implemented from 2020 to 2030. Montreal's policies, plans, strategies, and programs will be updated to consider climate issues by 2025. All other non-significant vulnerabilities to climate hazards will be targeted from 2030-2050.

2.6.3. Enforcement & Incentivization

Montreal's Climate Action sets a combination of incentive-based and regulatory-based actions. These actions are as follow:

- Adapt by-laws and support programs to improve energy efficiency and the resilience of all types of buildings. This is done by:
    - Upgrading by-laws related to energy efficiency

    - Improving by-laws governing resilience to climate change
    - Improving the AccèsLogis program, which finances social and community housing projects
    - Creating new renovation subsidy programs for owners of multi-rental buildings
        - Affordable Housing Reno Program is an example of existing programs.
    - Promoting energy efficiency and GHG emissions reduction programs offered by key partners
- Develop a funding program for building owners to support healthy and environmentally sound renovations, including loans that are accompanied by technical support

2.6.4. Market Impacts

As mentioned in the previous section, regulatory and incentive-based actions in the Climate Plan aim to accelerate energy efficiency projects. However, measures will be put in place to ensure these improvements do not put housing units beyond the ability of tenants to afford them. The action items that take equity into account are:

- Developing a collaborative approach to ensure respect for tenants' rights.
    - Protecting the affordable rental housing stock is also a key component of the City's five-year Housing Action Plan.
- Working with stakeholders to ensure a just transition for workers in all affected sectors

2.6.5. Benchmarking, Labelling, & Certifications

A key action in the Climate Plan is to improve the energy performance of large buildings via a rating and disclosure system. To do this, a rating and disclosure system for energy consumption and GHG emissions of buildings will be used to encourage property owners and tenants to improve their energy efficiency and reduce emissions.

This rating and disclosure system will gradually become mandatory, beginning with large commercial and institutional buildings. The City of Montreal and its partners will train a workforce specializing in assessing energy efficiency before that. The disclosure system will initially be used to rate buildings and firms. Performance benchmarks will eventually be imposed to attain the objective of making Montreal's building stock net-zero carbon.

2.6.6. Success Levers

The Quebec Regulation allows Montreal to adopt its own standards through land use planning and development bylaws for insulation, safety, sanitary conditions and strength of buildings, which may be more stringent than those foreseen in the most recent Construction Code or in a regulation issued by the Quebec government. Using this leverage, Montreal will update its bylaws and incentive programs to achieve its climate targets in the buildings sectors. The specific actions were mentioned in Section 2.6.3 (Enforcement & Incentivization).

The Action Plan also sets actions to provide incentives and a rating system that supports early adopters. These were mentioned in Sections 2.6.3 and 2.6.5.

Montreal also plans to expedite the market transitions by providing information and support through assistance centres to guide property owners in their construction or renovation processes.

Lastly, Montreal aims to take a climate leadership by the achieving following actions:

- Making 100% of the municipal building stock net-zero carbon
- Optimize the energy performance of municipal buildings
- Reduce GHG emissions linked to the use of refrigerants in municipal activities

- Pioneer clean technologies and innovations in electrification
- Conduct an inventory of GHG emissions resulting from consumption by the Montreal community

3. City of Calgary's Context

The first part of this section (Section 3.1) summarizes a high-level review of the City of Calgary's climate-related building policies and regulatory context. This information helped form the questions for the interviews with internal Calgary staff. The findings from the interviews are summarized in Section 3.2 (The full interview notes are provided in Appendix B.1).

The information collected and presented in this section was used to identify effective recommendations and next steps for Calgary, provided in Section 4.

3.1. Calgary's Actions to Date

Calgary's Climate Resilience Strategy (2018) contains the Climate Change Mitigation Plan and the Adaptation Plan. The Mitigation Plan outlines actions to manage Calgary's energy use and reduce carbon emissions. The Adaptation Plan focuses on reducing vulnerability to and preparing for climate change. While these two plans are not building-specific, there are building-related topics within each. A more detailed summary of the building-related content in these plans can be found in Appendix A.2.

Calgary City Council declared Climate Emergency in November 2021 and committed to achieving net-zero carbon emissions across all sectors by 2050. To reflect the new priorities and targets, Calgary is updating the Climate Resilience Strategy, which will be presented to the Council in Spring 2022.

3.1.1. Topics & Scope

The Climate Change Mitigation Plan identified five Themes, major areas of opportunity to reduce GHG emissions. One of these Themes is Buildings and Energy Systems. Programs are specified within each theme, which are initiatives to reduce emissions. Actions are listed within each Program, which are tactics and activities to move them forward. The Programs and Actions for Buildings and Energy Systems are focused on new and existing, commercial and residential buildings. They are as follow:

- Energy performance standards in new and existing buildings
    - Improve building performance requirements beyond current building code for new and existing buildings
    - Investigate policy approaches to provide monetary and non-monetary incentives
    - Enable innovative financing mechanisms to fund improved energy performance
- Energy consumption information
    - Develop a residential building labelling and a commercial building benchmarking program
    - Improve energy literacy and capacity building
- On-site and neighbourhood scale renewable and low carbon energy systems
    - Enable the implementation of onsite renewable and low-carbon energy systems, such as solar photovoltaics, combined heat and power, and district energy
    - Support alternative ownership models for renewable and low carbon energy systems, such as community ownership

The Climate Adaptation Plan also consists of five Themes, one of which is Infrastructure. The Programs are as follow:

- Backup power for critical infrastructure
- Design standards and practices for climate resilience

The second Program has four Actions, three of which focus on or include buildings:

- Improve energy code for buildings with additional focus on using renewable energy.
- Facilitate a cross-corporate working group to collaboratively update City design standards for buildings
- Update design guidelines and standards for City infrastructure, including buildings, to ensure resilience to extreme weather and chronic climate changes

3.1.2. Enforcement & Incentivization

As mentioned in the previous section, one of the key programs in Calgary's Climate Mitigation Plan is exploring the possibility of going beyond the current building code for performance requirements for both new and existing buildings. As the two largest cities in Alberta, Calgary and Edmonton are the only municipalities with a City Charter that gives them additional flexibility concerning provincial legislation and regulation as specified in Municipal Government Act (MGA).

The City Charter (2018, with amendments in 2019) allows the City to require public reporting and reduction of energy and carbon emissions of City-owned buildings (City Charter, Section 615.4, subsection (2)). The Charter does not specify whether the City can mandate similar requirements from private buildings but allows Calgary to include any provision and address any matters necessary or desirable in the climate mitigation plan to mitigate the effects of climate change (Section 615.4, subsection (3)). The Charter also allows the City to identify actions for adapting to the impacts of climate change on any matter the Council considers appropriate, including measures respecting asset management, stormwater management, flood preparedness, water and sanitation (Section 615.5, subsections (2) and (4)).

Calgary has a Sustainability Building Policy for the City-owned and City-financed buildings, ensuring sustainability and climate mitigation and adaptation measures are incorporated in planning, design, construction, management, renovation, operation, and demolition. The current requirements in the Sustainability Building Policy are summarized in Appendix A.2, under Topics Covered.

3.1.3. Market Impacts

Calgary commissioned the Economics of Low Carbon Development study, which looks into a wide range of measures Calgary can take across different sectors to reduce its carbon emissions. The study assesses the cost and carbon implications of these measures from industry, residential and commercial buildings, waste, and transport sectors. Deep energy retrofitting existing low-rise residential buildings and constructing high-performance commercial buildings are identified among the most effective solutions to reducing carbon emissions. The report acknowledges that low carbon measures can require significant investments and coordination between the public and private sectors. However, the analysis also shows that the benefits of many actions can far outweigh the costs when economic, employment, and social benefits are considered and climate mitigation benefits. This study is very high-level. More in-depth cost analyses are required to understand the costs associated with specific measures Calgary may want to include in its building-related standards.

The City of Calgary also commissioned an Equity Review of the City of Calgary's Climate Resilience Strategy. The review concludes that Calgary can strengthen its equity analysis and commitments through incorporating processes and tools such as working groups, consultations, vulnerability assessments, and surveys. These approaches make the Climate Resilience Strategy more inclusive and encourage more community participation. Integrating equity objectives and metrics into the Strategy monitoring, evaluation, and reporting will help ensure that the City continues to advance equity commitments over time.

3.1.4. Benchmarking, Labelling, & Certifications

As mentioned in Section 3.1.1, improvising energy consumption information through residential building labelling and commercial building benchmarking is one of the key Programs of Calgary's Climate Resilience Strategy.

The City already has a voluntary Commercial and Institutional Building Energy Benchmarking Program that encourages building owners and operators to report and disclose their energy use and emissions using ENERGY STAR Portfolio Manager. The City is also developing a voluntary Residential Labeling Program.

3.2. Calgary's Priorities, Challenges, and Opportunities

The key priorities, challenges, and opportunities to successfully achieve Calgary's climate-related targets for buildings are listed in the following three subsections. These were identified through interviews with a select group of staff from the City of Calgary's internal departments. The name of interviewees and their departments are listed in Section 1.2 (Methodology). The full interview notes can be found in Appendix B.1.

3.2.1. Key Priorities

The key priorities identified through the internal interviews are as follow:

- Incentive-based approaches are not sufficient. It is essential to set and pursue a target for 2030 to ensure Calgary will achieve its 2050 net-zero emissions target. The City of Calgary should expedite its efforts to explore the feasibility of using legislative leverages to move ahead of the provincial building code. These regulatory approaches must be explored for both climate change mitigation, e.g. requiring low-carbon new construction of residential and commercial buildings, and adaptation, e.g., rainwater management.
    - The updated national model code manuals for buildings, including the 2020 National Energy Code, was recently published in March 2022. The updates include more stringent energy performance requirements, with 4 tiers to provide a framework for achieving higher levels of energy efficiency. Alberta Building Code will likely adopt these model codes by 2030. Given the urgency of responding to climate change, Calgary has to act ahead of the Province to expedite the market transition to high-performance and low-carbon buildings within this 8-year window of time. Additionally the National Energy Code specify energy reduction targets and not carbon targets, which are more effective in helping Calgary achieve its climate action targets.
    - Mandatory requirements are essential for expediting measures that do not have a short investment return but are crucial for achieving climate targets.
- A simple and clear framework should be developed to specify ambitious yet achievable interim targets for each building type that increase over time (a tiered or step system).

    - A collective organizational strategy should be created based on this framework, so different departments of the City of Calgary work together to achieve the targets, rather than working in silos.
    - The framework should provide clarity to the industry about the upcoming requirements. With the framework's certainty, the industry can plan and prepare ahead of time.
- Calgary staff should identify and remove the barriers developers face throughout the permitting process.
    - It is important to make the City of Calgary's expectations consistent and clear to the developers. One way to do it is embedding guidelines, specifying performance and reporting requirements, within the land-use bylaws. That way the applicants would be aware of the expectations prior to preparing the documents for their Land Use Amendment (LOC) or Development Permit (DP). Additionally, the expectations would not vary per applicant depending on the city planner who is in charge of the project.
- While Calgary would like to develop a mandatory building performance standard, two other key steps can support data collection and prepare the industry for the transition:
    1. Energy and emissions disclosure and labelling programs
    2. Financial and process incentive programs
- With the time pressure for urgent climate action, Calgary does not have time to address some targets and introduce others later. For instance, Vancouver and Toronto started with new buildings and added existing building actions later. However, these cities began decades ahead. Calgary could develop a comprehensive framework to address all areas of the building industry with significant emissions and potential for reduction. However, the City of Calgary can phase in the actions with different timelines to allow the industry to prepare and build capacity.
- There is a need for a reliable verification and compliance review process to ensure buildings perform the same as they claim.
    - This can be done through mandatory energy use reporting for new buildings after they are completed.
        - The City can require carbon offsetting if the performance requirements are not achieved during the operation of the building.
- There is a need for more education and capacity building across the City staff and the industry.
    - Staff across different departments, involved in the permitting processes including policy development, planning, building regulation, and ispec tion, need further education to understand and efficiently process climate-change requirements across external development applications and City-owned assets.
    - The industry would benefit from more education and knowledge sharing on cost-effective solutions that result in noticeable carbon emission reduction.
- It is crucial to ensure equity and affordability impacts of the policies, regulatory requirements, and incentive-based programs are taken into account.
- More in-depth and building-specific studies are needed to assess the first and total cost of ownership of high-performance buildings. This helps better understand the impact on the community as well as the budget required for financial incentive programs.

3.2.2. Key Opportunities

The key opportunities identified through internal interviews are as follow:

- The current City Council strongly supports and have asked the staff to develop and implement effective and expedited climate action. This can provide political support and mandate that help bring internal and external stakeholders together to identify the best

way to respond to the council's mandate, instead of discussing whether actions need no be taken..

- The core team can lead the climate targets and overall directions. For the specific actions, they can engage all departments to use their input and expertise to develop the details of initiatives and processes that lead to achieving the targets.
    - Other departments should not feel the climate change requirements are imposing additional burdens on them. Instead, they should receive support and coordination from the core team but lead or provide direction on the details of the climate change requirements that their department is responsible for implementing.
- The staff should look into the whole development process and identify opportunities where high-performance building measures can be encouraged or required.
    - Area Structure Plans (ASP) and Area Redevelopment Plans (ARP) can be impacted but may be too early to have tangible results.
    - Land use and rezoning bylaws and requirements for specific geographical boundaries can be most effective as they can target projects with higher budgets and be imposed early enough to have an impact on the projects' design process.
    - Clear guidelines should be available to applicants to develop their development permit (DP) documents according to the high-performance building requirements. Once they have already developed the design for DP, it may be too late to ask for change. The DP review stage can be a good stage to check whether the performance requirements are incorporated into the design.
- When developing the standards and requirements, it is essential to identify and work closely with the external stakeholders to ensure their expertise, resources, and concerns are considered and incorporated. These stakeholders include:
    - Local industry representatives, such as BILD Calgary,
    - Different levels of federal, provincial, and local governments
    - Utility and energy suppliers and Alberta Utilities Commission
    - Non-profit organizations
    - Research and educational institutes
- The City of Calgary should advocate for the federal and provincial governments to take leadership in large-scale initiatives such as a home energy labelling program, building energy use and emissions reporting, and decarbonizing the electricity grid.
- The City of Calgary's legal team should explore how to take advantage of the City Charter to set performance requirements ahead of the Province (see section 3.1.2). This can include setting requirements through land-use, zoning and rezoning policies and development approval processes. Given the ambiguity in legislative leverage the Charter gives to Calgary, its limits need to be tested.
    - Some industry representatives, such as BILD Calgary (Building Industry and Land Development Association), have supported mandatory requirements to level the playing field.
- The City of Calgary can use City-owned and City-financed buildings to pilot mandatory energy and carbon emissions disclosure and low-carbon building solutions and technologies. This allows testing the feasibility of proposed standards and requirements and resolving potential issues before expecting them from the private sector.
    - Sustainability Building Policy can be updated to set more performance-based requirements for the City-owned and City-financed buildings that match or surpass the City's net-zero 2050 target.
- Calgary has already started successful voluntary and incentive-based programs that they should expand or build on to catalyze building capacity in the industry. The requirements defined for these programs can become mandatory as the industry

capacity grows. The mandatory requirements can be phased in, starting with larger commercial and institutional buildings.
    - Examples of these initiatives include:
        - Commercial and Institutional Building Energy Benchmarking Program
        - Residential Labeling Program for detached homes
        - Clean Energy Improvement Program for energy performance improvement in homes
        - Net Zero Priority Stream Pilot
        - New community development proposals are encouraged to submit a GHG assessment as part of their business case submissions. The reporting can become mandatory over time and be used as an assessment factor for choosing the winning proposal. This information can eventually be used to set a carbon budget for these community developments.
    - Calgary can streamline the criteria of incentive programs to be based more directly on energy and carbon emissions performance.
    - When defining the incentive program criteria, synergies and co-benefits between climate change adaptation and mitigation targets and priorities can be considered—for instance, requiring green roofs and resiliency and durability of roofs against climate disasters like storms.
    - The City of Calgary can amplify its incentive programs by aligning or bundling them with other incentive programs from federal and provincial governments and utilities. One challenge is the lack of certainty about how long these other programs will be available.
    - Calgary's budget is insufficient to catalyze market transition through financial incentives exclusively. The City can focus on process-based incentives in the early development permit stages, including floor to surface ratio (FSR) and density increase or expedited permitting.

3.2.3. Key Challenges

The key challenges identified from the internal staff interviews include:

- Building high-performance buildings in Calgary's climate is much more challenging and costly than in Vancouver and Toronto, as those cities have milder weather. This has caused more internal and external resistance against higher performance requirements.
    - Passive House-level products that meet the building code requirements are not readily available in Calgary's market, e.g., Passive House windows in a non-combustible framework.
- Alberta's electricity grid is heavily fossil-fuel dependent. Therefore, electrification of heating and hot water systems would not yield the same emissions reduction results as other municipalities like Vancouver and Toronto.
    - The City of Calgary should also focus on expanding clean energy supply by working with the municipal and federal governments and utility suppliers, supporting and expanding district energy systems, facilitating and incentivizing on-site renewable energy generation and saving, and potentially purchasing carbon offset.
- The City of Vancouver and Toronto have the option to use their legal authority to mandate higher energy and carbon performance (See section 2.1.6 and 2.2.3). Whereas, the City of Calgary's staff does not have a consensus on whether Calgary's City Charter has given them similar legal leverage as the language is debatable (see section 3.1.2).
    - Some Calgary staff members argue that Alberta MGA does not allow municipalities to pass acts or bylaws that contradict the Alberta Building Code, (this may include any energy performance above minimum requirements).

    - Vancouver's land use re-designation or rezoning process allows conditions to be attached to the rezoning permit. They have amended zero-emissions building guidelines as a condition to rezoning. In Calgary, the Council can accept or reject the land-use change but cannot attach any conditions. Direct Control Districts could be leveraged as technical means to "require" specific building performance at the land use redesignation stage, but it is recommended that this approach is reviewed internally before it gets implemented.
- Calgary may receive strong opposition against mandatory performance requirements. Allowing enough time for the industry to understand, accept, prepare, and adapt to the requirements can slow down the process.
    - The development industry in Calgary has a strong lobbying arm that may fight back with regulatory mandates if they are not aligned.
- A significant amount of the City of Calgary's budget and staff time investment is required to develop programs, standards, and policies.
    - Identifying and updating the value of financial incentives to ensure they are effective is a challenge given the constant market fluctuations.
    - Identifying the timeline to phase in different components of the building-related climate change actions and programs is challenging, e.g. new vs. existing buildings, embodied vs. operational emissions, and mitigation vs. resiliency.
    - Federal and provincial support is crucial to scale up these efforts, including voluntary and incentive-based programs, development of policies, standards and guidelines, and educating and training internal and external stakeholders.
- Historically, there has been a lack of will, coordination, and collaboration across different municipal departments, which inhibited decisive actions at a scale that can effectively address climate change concerns.
- More data on buildings' current energy use and emissions is required to set realistic requirements for existing buildings. Calgary is currently mining modelled building performance data. However, the City still needs to collect actual usage data for benchmarking and setting retrofit performance requirements for existing buildings. There are barriers to mandatory energy and emissions disclosure and benchmarking. The challenges to reporting include:
    - Sufficient outreach to build industry awareness on the benefits of measuring and tracking energy consumption data.
    - Availability of data, due to privacy and administrative barriers
        - Currently utilities are not mandated to provide data to the City of Calgary and, to protect customer privacy, they are hesitant to share data. Therefore, Calgary needs permission from owners to access whole-building data even if the data is aggregated for the whole building.
        - Existing processes for handling data requests are manual and not reasonably scalable. They do not utilize market-proven automation technologies through ESPM Web Services and impose fees for aggregation services on a per-request basis.

4. Recommendations

This section provides a list of recommendations to address the key priorities, opportunities, and challenges identified in Section 3.2. The strategies provided here are geared toward Calgary's geographical, social, and political context. These strategies contributed to other municipalities' success, as identified in Section 2.

1. **Set science-based climate mitigation targets and establish a clear and phased timeline for implementing emissions reduction requirements to meet these targets starting with major building archetypes.**

Sub-topics: Topics & Scope; Timeline; Enforcement & Incentivization; Market Impacts; Success Levers

To achieve its net-zero 2050 commitment, Calgary would require to define stepped carbon emissions reduction interim targets for residential and commercial buildings. All researched municipalities faced initial aversion and resistance from major stakeholders, including developers, energy utilities, trades, and product manufacturers. However, ongoing collaboration with stakeholders to set targets and improve processes, decisive and signalling well in advance, and progressive roll-out are crucial in allowing the industry to adapt, accept, and support the policy directions (see recommendation 4 for stakeholder engagement).

- **Decisive and early signalling**
  For municipalities like Vancouver and Toronto, science-based emissions reduction targets were established and signalled the industry well in advance. Building standards were designed to align with these targets, creating opportunities for the industry to align and identify economic opportunities.

- **Progressive roll-out**
  Successful municipalities have introduced standards in stages, transitioning from voluntary to mandatory requirements for different construction types, building types, and building sizes. The studied cities started with the most significant reduction opportunities or opportunities that the industry was most equipped and was the path of least resistance. In the meantime, they would support pilot projects and research on more challenging sections. With more data and local case studies, the standards evolved based on the evidence and actual project performances.

  - **Voluntary to mandatory**
    Like Toronto Green Building Standard, most investigated standards have tiers or steps, initially introduced as voluntary with defined timelines on when they will shift to mandatory. With this transition, the market continuously evolves and grows capacity, which may even allow municipalities to expedite the initial timeline of the phased approach (See recommendation 8 for capacity building).

  - **Construction type**
    The studied cities started by introducing net-zero emissions standards for new buildings because their processes are better understood and more cost-effective than deep-emissions retrofits. The experience from new construction buildings and standards informed the deep-emissions retrofit solutions and standards. While building industry capacity through new building requirements, the interviewed cities are exploring leverages to mandate emissions reporting and labelling in existing buildings. This data will be used to create benchmarks and targets for existing buildings and retrofit projects.

  - **Building type**
    Standards are typically enforced on larger commercial, institutional and market multi-unit residential buildings, with communications that smaller buildings would soon have to follow similar requirements. This is because the project teams for these buildings typically have more technical and financial capacities to explore innovative approaches. Lessons learned from these projects help build capacity in smaller projects.

- **Operational and embodied emissions**
  Municipalities prioritize operational carbon emissions, but leading cities like Vancouver, Toronto, and Edmonton have begun incentivizing or requiring embodied carbon emissions reporting for new buildings. Reporting embodied carbon is necessary to build industry capacity and knowledge and create a baseline for future embodied carbon reduction targets.

2. **Develop the details of climate-related policies, standards, and requirements in close collaboration with internal departments to ensure effective implementation and alignment of priorities.**

Sub-topics: Enforcement & Incentivization; Success Levers

The sustainability and climate response teams in cities with successful climate policies standards worked closely with other internal departments. The core team identifies the overall climate change priorities, targets, timeline, and best practice policy and technical solutions. However, the departments responsible for changing the current processes and implementing the new requirements either directly develop them if they have the capacity and expertise within the department or collaborate closely with the climate response team and potentially external consultants.

Internal expert groups with senior leadership representatives from key internal departments can be created for ongoing input. These processes allow identifying and aligning priorities of different internal groups and maximizing co-benefits of policies and standards. The internal working groups can also identify areas where there is a need for education and capacity building among the city staff to prepare them before the policy rollouts.

3. **Work with the internal legal department and other local governments, like Edmonton, to identify legal tools to expedite the market transition.**

Sub-topics: Enforcement & Incentivization; Success Levers

Calgary's climate leadership team should consider working with the internal municipal legal counsel to identify feasible opportunities to use the legal authorities provided in the City Charter to expedite the rollout of climate-related building standards.

A key challenge for Calgary is that Alberta's Municipal Government Act does not allow municipalities to pass acts or bylaws that contradict the Alberta Building Code (which may include energy performance requirements above the minimum provincial building code requirements). However, the City Charter may enable Calgary to integrate carbon emissions (GHG) reduction requirements into the land use and development bylaws and approval processes.

The City of Calgary and Edmonton are the only municipalities in Alberta with a City Charter that gives them additional authority and flexibility for complex regulatory issues. Given the similar legal context, this is an area Calgary benefits from close collaboration with the City of Edmonton. The legal teams of the two cities can consult with the lawyers of the City of Toronto and Vancouver. An example of a similar successful collaboration is the City of Ottawa's lawyers, who worked with Toronto's legal team.

4. **Create structures for ongoing industry stakeholder engagement and feedback. Through this process, Calgary can identify ambitious yet achievable timelines, effective and efficient incentives, and enforcement measures that the industry supports.**

Sub-topics: Enforcement & Incentivization; Market Impacts; Success Levers

The reviewed cities identified and engaged with the key external stakeholders in the early stages of developing climate-related standards and requirements. These stakeholder groups include industry leaders, General industry representatives, other governments, energy utility providers, and vulnerable and equity-deserving communities.

- **Industry leaders**
  Input from industry leaders with experience building high-performance buildings is essential to identify ambitious yet achievable targets, timelines, and solutions. They can also provide insight on developing effective incentives and removing permit process barriers for early adopters.

  In the early stages of policy and standard development, the interviewed municipalities consulted with a smaller group of industry leaders who have demonstrated expertise in specific climate-related subject matters. This can be through small group meetings or working groups. For example, Vancouver worked closely with a group of developers for 18 months, gathering feedback and addressing concerns on the introduction and implementation standards.

  Industry leaders can also be very impactful in advocating and communicating the policies and standards with their industry peers. Given their shared experiences, their support of climate-related actions can be very impactful in getting the broader industry's acceptance.

- **Industry representatives**
  Once early drafts of policy and standards are ready, the leading municipalities typically solicit feedback from a larger group of industry leaders through recurring feedback sessions. Holding these workshops with key industry representatives strongly signals City's directions to address the climate crisis. Representatives also can raise their industry's concerns and advocate for their needs.

5. **Prioritize envelope improvement in new and existing buildings in short and medium-term policies and standards.**

Sub-topics: Topic and Scope

For municipalities like Vancouver and Toronto, where the electrical grids are predominantly hydroelectric powered, the hallmark of their strategy is prioritizing electrification. The shift towards electrification is not as effective in Calgary as the electrical grid still relies heavily on fossil fuels. The electrical grid's future is outside of municipal jurisdiction and is not expected to change significantly in the short to medium-term. Therefore, in the short and medium-term, Calgary's low-carbon building standards can prioritize building-level energy usage reductions through envelope improvements for both new construction and retrofit projects.

Building envelope improvements can cause an increase in the first cost. However, more detailed modelling is required to identify the total cost of ownership and the overall economic cost/benefits of this approach (see recommendation 8). In addition, innovative financing options

can be explored to cover the first cost premiums. Examples include Green Banks and Credit Enhancements that Toronto is looking into (See Section 2.1.3).

Building envelope improvements could also provide co-benefits for Calgary's climate adaptation targets. For instance, buildings that meet Passive House standards achieve 48-72 hours of passive survivability. This means if such a building loses electricity and heat through an outage during an extreme weather event, it can maintain an acceptable level of thermal comfort to keep occupants safe for a longer time.

6. **Use existing voluntary standards with proven performance like Passive House to develop the City-led standards and accept these voluntary standards as alternatives to alleviate the burden on municipal staff.**

Sub-topics: Topics and Scope, Success Levers

Utilizing pre-existing standards as a starting point can help reduce workload for City of Calgary staff in the standard's development. The City of Vancouver described the Passive House standard as a reliable and transformative tool. Projects that are certified to Passive House are proven to meet the performance level estimated in the design stage. Vancouver does not mandate certifying to Passive House standard but accepts it as an alternative pathway to meet the zero-carbon building requirements.

Passive House US standard could be a strong starting point for Calgary as it is developed to respond to similar climate zones in certain Midwest states in the US. City of Calgary can require Passive House US certification or other equivalent standards as the requirement for its incentive programs.

Similar to Vancouver, Calgary can set the top performance requirements of Calgary's standard to be slightly less stringent than the Passive House (US) requirements with additional GHG limits. Calgary can also accept certifying to the Passive House as an alternative pathway without requiring meeting the GHG limits.

7. **Plan for the future grid and address the carbon intensity of the electrical grid through partnerships with the provincial government, federal government, other Albertan municipalities, energy utilities, and private partners.**

Sub-topics: Topics & Scope, Success Levers

While Calgary focuses on reducing energy demand through envelope improvements, it should not lose sight of a future clean grid's opportunities in long-term strategy developments. For instance, Calgary can incentivize and accept electrification as a long-term solution for areas that expect to have a district energy system or other sources of clean energy in place.

The City of Calgary could focus on expanding clean energy supply by working with the municipal, provincial, and federal governments and utility suppliers. Calgary can support and expand district energy systems, facilitate and incentivize on-site renewable energy generation and storage (such as ground source heat pumps and solar PVs) and potentially purchasing carbon offset.

Planning and advocating for grid decarbonization is another area for partnership with other local Albertan municipalities, like the City of Edmonton.

8. **Build capacity by showing leadership, supporting research and knowledge capture, supporting early adopters, and sharing learning with the broader industry.**

Sub-topics: Topics & Scope; Timeline; Enforcement & Incentivization

Before moving to mandatory requirements, Calgary needs to ensure the industry has developed the capacity to respond to the requirements. This can be done by showing leadership through City-owned assets, supporting industry leaders and early adopters, supporting research and analysis of early projects to capture learnings, and expanding knowledge sharing and education among the industry. Capacity-building initiatives and programs are other areas that Calgary can benefit from collaborating, partnering, and sharing resources with other local governments, especially Edmonton.

- **Show leadership through higher requirements for City-owned buildings.**
  The municipalities studied show leadership and build industry capacity by setting higher requirements for City-owned and City-financed buildings. Lessons learned from City-owned projects can inform future policy requirements.

  Municipalities can influence these projects much easier and faster. Moreover, the city assets can include various building archetypes, e.g., civic centers, recreational centers, offices. These buildings create an ideal testbed to pilot low-carbon construction, retrofit, and emissions reporting requirements and pathways. Given the exploratory nature of these pilot projects, the cities allow some flexibility if the requirements are proven to be not feasible technically, financially, or operationally.

- **Support early adopters through removing the barriers and providing financial and process-based incentives.**
  Due to the learning curve premium, early adopters face financial challenges and risks. They also face barriers throughout the permitting and development processes. Leading municipalities work closely with these industry leaders and focus on removing the barriers in addition to incentives.

  Incentives can be through means that do not create a financial burden on the municipality. For instance, in return for constructing to lower-carbon emissions, cities have provided bonus floor space, floor area and site exemptions, leniency on street setbacks, and breaks in the Development Cost Levy.
    - Given the high value of land in Vancouver, 15-19% floor area bonus for low-rise buildings and a 5% increase for high-rise buildings has been highly effective incentives in Vancouver .
    - Monetary incentives are primarily used for the top level of exemplary performance, such as Metro Vancouver's NearZero initiative which grants up to $22,500 to Passive House projects or projects that meet B.C. Energy Step Code's Step 4 and 5 levels and use heat pumps.
    - Expedited permits can be effective but proven to be challenging because permit submissions need to have no issues in other aspects. Otherwise, there will be delays in the review process due to resubmission requirements.
    - Rezoning policies can also provide an opportunity to make a higher density contingent on meeting a low-carbon performance. This is an area that the legal team of Calgary can further explore (See recommendation 3).

- **Support on-going technical and economic studies and models that inform policies, standards, and communication with the City Council and other stakeholders.**

Most municipalities have conducted these studies through external consultants. Some have funded these studies through provincial or federal funding or worked with research institutes and benefited from academic research funding.

Calgary should support or lead regionally-specific studies on pathways to low-carbon and net-zero buildings and studies on the economic implications of these pathways. Actual projects, including the City-owned and early adopter projects, are crucial to providing real-world information and data for these studies.

- **Support knowledge sharing and educational programs and initiatives.** Successful municipalities have supported knowledge sharing and educational initiatives, programs, and non-profit groups that prepared the industry for the upcoming requirements. A key partner in this area can be Alberta Ecotrust, which hosts Climate Innovation Fund, the fund from Low Carbon Cities Canada (LC3) network. The fund is intended to provide climate change leadership and programming in Calgary and Edmonton.

9. Prioritize climate equity and reconciliation with the indigenous communities through seeking input and implementing measures that address the concerns and needs of vulnerable and equity-deserving communities.

Sub-topics: Enforcement & Incentivization; Market Impacts; Success Levers

The municipalities interviewed regularly engaged with representatives and advocates of vulnerable, equity-deserving, and indigenous communities. For instance, Vancouver has a Climate and Equity Working Group developing a Climate Justice Charter to ensure equity is integrated and supported through climate actions.

Specific equity-focused measures areas Calgary can consider are:

- To ensure housing affordability and rental units are not impacted, exempt non-market and rental housing from performance requirements in early phases.
- Ensure incentives, educational, and support programs reach the communities that need them the most.
- Support and partner in pilot and demonstration projects focused on non-market housing that otherwise cannot afford it.
    - Given the tight budgets in these projects, these projects can be a strong case for the feasibility of low-carbon building solutions.
- Engage with communities that will be impacted in a language and format that is accessible to them.

Appendix A Best Practice Policy Review

Appendix A.1 Six Major Canadian Municipalities

See the matrix here.

Appendix A.2 City of Calgary

See the matrix here.

Appendix A.3 Supporting Graphs and Tables

The appendix is attached.

Appendix B: Interview Transcripts

The appendix is attached.

Appendix B.1 Internal Interviews

Appendix B.2 External Interviews