Pathways to Net-Zero Embodied Carbon in Buildings: Barriers and Solutions to Effective Policies and Actions

PROJECT SUMMARY AND RECOMMENDATIONS FOR GOVERNMENTS

THE UNIVERSITY OF BRITISH COLUMBIA
Sustainability Hub

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AUTHORSHIPS

This report was prepared by the University of British Columbia (UBC) Sustainability Hub to summarize the activities and learnings of the Pathways to Net-Zero Embodied Carbon in Buildings project, which sought to build local and regional collaborations and partnerships to identify immediate barriers and challenges to implementing embodied carbon policies and actions in Canada. It provides an overview of the project activities and findings, as well as a set of considerations and recommendations for local, provincial, and national governments.

This report summarizes project activities that are described in greater detail in specific workshop and project reports, which are referenced here. Additional white papers and academic publications produced by partners and collaborators will be published during 2025.

The Pathways project summary and recommendations report were developed by UBC Sustainability Hub staff:

- Angelique Pilon, Acting Senior Director / Director, Urban Innovation Research
- Megan Badri, Research Manager
- Kah Mun Wan, Program Specialist
- Janani Rangarajan, Embodied Carbon Policy Analyst Assistant

UBC Student Research Assistants for the Pathways project:

- Mohini Singh, School of Public Policy and Global Affairs
- Najma Nizar, School of Public Policy and Global Affairs
- Nicole Balles, Department of Civil Engineering
- Savannah Li, Department of Civil Engineering
- Rojini Kathiravel, Department of Wood Science, Faculty of Forestry
- Shiyao Zhu, Department of Wood Science, Faculty of Forestry
- Simarjeet Nagpal, School of Community and Regional Planning
- Tanya Dawar, School of Public Policy and Global Affairs
- Taushifa Shaikh, Department of Political Science
- Viola Zhao, School of Architecture and Landscape Architecture

French translation of this report and other Pathways project publications was prepared by Mélanie Trottier, Embodied Carbon Analyst and BEAM Trainer, Builders for Climate Action.

The cover photo, looking skyward at UBC Evolve Passive House, is courtesy of Paul Joseph / UBC Brand & Marketing.

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PARTNERS AND COLLABORATORS

Pathways project partners:

- Athena Sustainable Materials Institute
- City of Vancouver
- UBC Campus + Community Planning
- BC Zero Emissions Innovation Centre (ZEIC)

In addition to the partners, a number of BC organizations were significant collaborators and contributors:

- UBC academic researchers from the Faculty of Applied Science, Civil Engineering, and Faculty of Forestry Wood Science: Drs. Omar Swei, Tony Yang, Haibo Feng, and their graduate students.
- UBC's Sustainability Scholars program and the city partners from Kamloops, Nelson, Richmond, Victoria and the District of Squamish.
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DISCLAIMER

Opinions, recommendations, and any errors in this report are those of the authors and do not necessarily reflect the views of municipal staff or the University of British Columbia.

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LAND ACKNOWLEDGEMENT

The Sustainability Hub office is located at the UBC Point Grey campus, situated on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam). As part of the larger UBC community, we are guests and settlers on the traditional, ancestral, and unceded territories of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), Seĺíl̓witulh (TsleilWaututh), and Syilx (Okanagan) Nations.

In our pursuit of sustainability, climate action, and climate justice, we understand that protecting human rights is indelibly woven into environmental protection and sustainability.

What are embodied carbon emissions, and why do they matter?

Embodied carbon emissions refer to the Greenhouse gas (GHG) emissions released across the life cycle of a building's material, from extraction, manufacturing, and use to disposal. Traditionally, policy and industry actions have focused on the emissions from a building's operation (e.g., lighting, heating, cooling, appliance use, etc.); however, with buildings becoming more energy efficient, embodied carbon emissions now account for the dominant share of the emissions.

Operational emissions from buildings currently account for 12% of Canada's total GHG emissions. Once embodied carbon is included, this figure could rise to 18%,[1] and by 2050, embodied carbon could represent over 90% of a new building's total emissions.[2] Canada is making embodied carbon emissions a strategic priority in the 2030 National Model Building Codes.[3]

Pathways to Net-Zero Embodied Carbon in Buildings project

The Pathways to Net-Zero Embodied Carbon in Buildings project (2023 to 2025) was led by the Sustainability Hub at the University of British Columbia with provided through the Environmental Damages Funds' Climate Action and Awareness Fund, administered by Environment and Climate Change Canada (ECCC). The objective was to identify challenges to reducing embodied carbon emissions in buildings and to provide recommendations to inform government actions.

The findings from the Pathways project drawn from engagement with over 140 Canadian experts from government, academia, NGOs, and the building industry, who contributed through interviews, precedent reviews, collaborative workshops and research. The results of the project are intended to inform the development of embodied carbon policy at the federal, provincial, and municipal levels, in alignment with current climate targets and upcoming changes to the national model building codes.

[1] Net-Zero Advisory Body (2023). Compete and Succeed in a Net Zero Future: First annual report to the Minister of Environment and Climate Change. https://www.nzab2050.ca/publications/compete-and-succeed-in-a-net-zero-future

[2] Canada Green Building Council (2021). Embodied Carbon: A Primer for Buildings in Canada. https://globalabc.org/resources/publications/2021-global-status-report-buildings-and-construction.

[3] Canadian Board for Harmonized Construction Codes (2025). Phase 1: Embodied GHG draft policy positions. https://cbhcc-cchcc.ca/en/phase-1-embodied-ghg-draft-policy-positions/. Accessed during the Pathways project summary report preparation in June 2025. Note: this consultation page may be updated or removed.

Key challenges of reducing embodied carbon emissions

The experts engaged in the Pathways project identified five interconnected policy and practice challenges.

- Lack of available, accurate, and comparable GHG emissions data, which limits the ability of building practitioners and policymakers to assess and compare emissions data with confidence.
- Difficulty integrating current carbon accounting tools into mainstream building design and construction software and workflows, leading to additional work and increased errors.
- Limited options for alternative low-carbon building products in Canada; Available low-carbon options are often more expensive, have longer procurement timelines or must be sourced internationally, increasing the real or perceived risks to project costs and schedules.
- Lack of coordinated embodied carbon regulations and incentives at the federal and provincial level, and limited authority at the municipal level, which leads to inconsistency and uncertainty within the building industry
- Complexity of incorporating embodied carbon emissions reduction practices into the building sector, which requires decisions by many stakeholders and must be balanced with other requirements like safety, costs, and even operational emissions. Gaps in capacity, training, and collaboration continue to slow progress.

Recommendations for federal, provincial, and local government in Canada

To support the implementation of the 2030 Model National Building Code changes and effectively reduce embodied carbon emissions in the building sector, Canada needs to develop a coordinated policy ecosystem to provide industry and policymakers with standard, verified, and consistent tools and information. Such an ecosystem requires collaboration across all levels of government and the building industry.

Federal government recommendations

The federal government should lead on the creation of a national embodied carbon policy ecosystem that is applicable and usable for the whole of Canada. Steps needed to create this ecosystem include:

- Develop a unified national standard for embodied carbon accounting through whole-building life cycle assessment (wbLCA), as well as educational guidelines.
- Create a national open-access database of verified Life Cycle Inventory (LCI) data and Environmental Product Declaration (EPD) data to be used in assessment and decision-making.
- Prepare and support the building industry and local government with financial incentives, training, and technical guidance to facilitate an industry transition through the adoption of low-carbon materials and construction practices.

To inform and implement this ecosystem and the code changes, the federal government must coordinate cross-sectoral collaboration to support industry readiness and enable effective regional adoption across Canada. There are also a number of international precedents that Canada can learn from.

Provincial government recommendations

Provincial governments, including BC, are already actively involved in the 2030 Model National Building Code development. In addition to connecting and aligning provincial activities with national efforts to develop an embodied carbon policy ecosystem, provincial governments should work to support and scale successful local embodied carbon reduction initiatives. Often, local government and industry are leading with creative and effective approaches to reduce embodied carbon, and provincial governments should engage with local governments and the building industry to prepare for code changes by developing guidelines, procurement incentives, and cross-sector working groups.

In BC, the provincial government should expand manufacturing and supply chains for low-carbon building materials, leveraging the province's clean electricity and existing natural resource economy. Government and publicly funded projects can also serve as real-world examples to showcase and pilot emissions reduction strategies, develop local skills and create markets for provincially sourced, low-carbon products.

Local government recommendations

Local governments are well-positioned to develop strategies to reduce embodied carbon emissions that are effective in their local contexts, even with limited authority, and many in BC have begun piloting innovative policies and approaches. This work demonstrates that embodied carbon considerations can be integrated into a variety of current municipal policies and plans, from emissions targets in overall community plans to carbon reporting in building permitting and approval processes. Local governments can also use municipal buildings to model and test low-carbon practices and policies, and support local education and awareness. Collaboration and knowledge sharing among local governments and local industry can also help to support local activities, offset staff capacity limitations, and advance regional initiatives.

The research and engagement activities that informed this report were conducted prior to the economic uncertainty of the US tariff changes in early 2025. Canada is now navigating an unprecedented shift in both national and global markets; however, many of the recommendations also support Canada's economic development, including growing the market for Canadian products, expanding production, improving cross-Canada trade, and accelerating housing development. Reducing embodied carbon emissions in buildings addresses both climate priorities and economic development priorities, and the learning from the Pathways project can inform these combined objectives. Critically, while pursuing economic aims, Canada must continue to respond to climate change and maintain its progress towards net-zero emissions by 2050.

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GLOSSARY OF TERMS

Bill of Materials (BOM): The list of product flow quantities included in the building model scope that make up the physical building.[4] In the context of a building's carbon emissions, BOM serves as input data for the assessment process.

Biogenic Carbon: Carbon sequestered from the atmosphere by living organisms—primarily through photosynthesis—and stored in organic materials (e.g., wood, plants, and other forms of biomass).[5]

Building Information Modelling (BIM): A digital representation that combines a 3D visual model with detailed data (e.g., materials, systems, dimensions, and performance) about the physical and functional characteristics of a building. BIM models are used to inform reliable decisions (e.g., planning, design, construction, operational management, etc.) throughout a facility's lifecycle, from conception to demolition.[6]

Circular Economy: A system in which materials that can normally become waste are repurposed. In this system, products, components, and materials are maintained and kept in use for as long as possible through reuse and repurposing. Also referred to as Circularity.[7]

Embodied Carbon Emissions: Total greenhouse gas (GHG) emissions from the manufacturing of building materials and products, in addition to the emissions from the construction, maintenance, and demolition of a built asset across part or all stages of its life cycle.[8]

Environmental Product Declaration (EPD): EPDs are third-party-verified documents that report on the environmental impacts of a product. They represent the impacts associated with raw material extraction, manufacturing, transportation, and distribution.[4]

Global Warming Potential (GWP): The potential climate change impact of a product, building, infrastructure or process as measured by an LCA. GWP is reported in units of carbon dioxide equivalent (CO_2e) and is the agreed-upon metric for tracking embodied carbon. This quantity is also commonly referred to as the carbon footprint.[9]

Life Cycle Inventory (LCI): An aspect of a Life Cycle Assessment (LCA) that involves data collection and quantification of the inputs and outputs (e.g., energy, raw materials, other physical inputs, and emissions to air, land, and water[10]) associated with a product or process throughout its life cycle.[4]

Low-Carbon Materials: Building materials that are designed, produced, and used with the goal of minimizing their embodied carbon, such as recycled materials, low-carbon concrete, or sustainably sourced timber.

Net-Zero Carbon: A term used to describe a building or product that balances its carbon emissions with carbon removal or offset, resulting in a net-zero contribution to atmospheric CO_2 levels over its lifecycle.

Operational Carbon: Total GHG emissions associated with the energy used to operate a building.

Up-Front Carbon: Emissions that have already been released into the atmosphere before a building is occupied or begins operation.

Whole Building Life Cycle Assessment (wbLCA): A Life Cycle Assessment (LCA) approach that is applied to a whole building.

[4] National Research Council Canada (NRC) (2022). National Guide for Whole Building Life Cycle Assessment. https://nrc-publications.canada.ca/eng/view/object/?id=f7bd265d-cc3d-4848-a666-8eeb1fbde910

[5] Intergovernmental Panel on Climate Change (IPCC) (2019). 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 2. https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html

[6] National Institute of Building Sciences. National BIM Standard – United States: FAQs. https://www.nibs.org/nbims/v4/faqs

[7] Geisendorf, S., & Pietrulla, F. (2017). The Circular Economy and Circular Economic Concepts — A Literature Analysis and Redefinition. https://doi.org/10.1002/tie.21924

[8] Azari, R., & Badri, N. (2021). Life Cycle Assessment a Research Approach Methodology for Estimating the Environmental Impacts of Buildings. https://doi.org/10.1007/978-3-030-73692-7_8

[9] Carbon Leadership Forum (2020). CLF Embodied Carbon Policy Toolkit. Embodied Carbon 101. Figure 1. https://carbonleadershipforum.org/embodied-carbon-101-v2/

[10] Rocky Mountain Institute (RMI) (2023). Driving Actions on Embodied Carbon in Buildings. https://rmi.org/insight/driving-action-on-embodied-carbon-in-buildings/

ABBREVIATIONS

Athena	Athena Sustainable Materials Institute
BIM	Building Information Model
C+CP	Campus + Community Planning
CAAF	Climate Action and Awareness Fund
CAP2030	UBC's 2030 Climate Action Plan
CBBIF	CleanBC Building Innovation Fund
CBHCC	Canadian Board for Harmonized Construction Codes
CEA	Community Energy Association
CECLA	Centre of Excellence in Construction Life Cycle Assessment
CGBS	Canada Green Buildings Strategy
CIC	Circular Innovation Council
CLF BC	Carbon Leadership Forum British Columbia
ECCC	Environment and Climate Change Canada
EEPN	Embodied Emissions Peer Network
EPD	Environmental Product Declaration
GHG	Greenhouse Gas
GWP	Global Warming Potential
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
MURB	Multi-Unit Residential Buildings
NRC	National Research Council Canada
NRCan	Natural Resources Canada
NMCC	National Model Code Committee
NZAB	Net Zero Advisory Body
OCP	Official Community Plan
PSPC	Public Services and Procurement Canada
TBS	Treasury Board of Canada Secretariat
UBC	University of British Columbia
wbLCA	Whole Building Life Cycle Assessment
ZEBx	Zero Emission Building Exchange
ZEIC	Zero Emission Innovation Centre

SECTION 1: PROJECT INTRODUCTION AND BACKGROUND

INTRODUCTION

Pathways to Net-Zero Embodied Carbon in Buildings was a two-year project led by the Sustainability Hub[11] at the University of British Columbia (UBC). It aimed to identify and respond to the challenges of reducing embodied carbon emissions in buildings and materials as part of Canada's path to net-zero greenhouse gas (GHG) emissions by 2050.

In Canada, buildings rank as the third-largest contributor to the country's total GHG emissions, accounting for 12% of national emissions.[12] However, this total only encompasses operational emissions and is expected to rise to 18% if embodied carbon emissions are included.[13] Embodied carbon emissions refer to the GHG emissions produced from the energy used for raw material extraction, manufacturing, transportation, installation, maintenance, and disposal of building materials.

The majority of a building's embodied carbon emissions are generated during the production of its materials and components, and during construction. Unlike operational carbon emissions, which can be reduced through post-construction efficiency updates, there is very limited opportunity to decrease embodied carbon emissions once the building is constructed.

Until recently, most policies and standards have focused on reducing a building's operational emissions. However, as buildings become more and more energy-efficient, embodied carbon emissions associated with the manufacture and use of materials are becoming a more significant proportion of total building-related emissions. Between 2022 and 2050, embodied carbon could represent over 90% of a new Canadian building's total emissions. [14]

EMBODIED CARBON ACCOUNTING

Life Cycle Assessment (LCA) is the primary methodology used to quantify and evaluate embodied carbon emissions, which are generally reported in terms of their global warming potential (GWP). A standardized scientific approach an LCA measures the environmental impacts of a product or system across its entire life cycle from raw material extraction to disposal. The most widely accepted standards for conducting LCAs use the International Organization for Standardization standards ISO 14040:2006 and ISO 14044:2006, which establish the framework and guidelines for ensuring consistency, transparency, and reliability in LCAs.

In the context of buildings, LCAs can be used to assess the GHG emissions and other environmental impacts associated with different life-cycle stages, including the product stage, construction process stage, use stage, and end-of-life stage. These assessments can provide critical insights for reducing embodied carbon emissions, helping design teams and policymakers make informed decisions about material selection and construction methods. An LCA conducted on an entire building or a significant portion of a building is referred to as whole-building life cycle assessment (wbLCA). An LCA can also be conducted on specific building assemblies or products at different life cycle stages. Figure 1 illustrates different stages of a building and the associated emissions.

[11] UBC Sustainability Hub. https://sustain.ubc.ca/

[12] Environment and Climate Change Canada (2022). 2030 Emissions Reduction Plan: Canada's Next Steps to Clean Air and A Strong Economy. https://www.canada.ca/en/environment-climate-change/news/2022/03/2030-emissions-reduction-plan--canadas-next-steps-for-clean-air-and-a-strong-economy.html

[13] Net-Zero Advisory Body (2023). Compete and Succeed in a Net Zero Future: First annual report to the Minister of Environment and Climate Change. https://www.nzab2050.ca/publications/compete-and-succeed-in-a-net-zero-future

[14] Canada Green Building Council (2021). Embodied Carbon: A Primer for Buildings in Canada. https://globalabc.org/resources/publications/2021-global-status-report-buildings-and-construction.

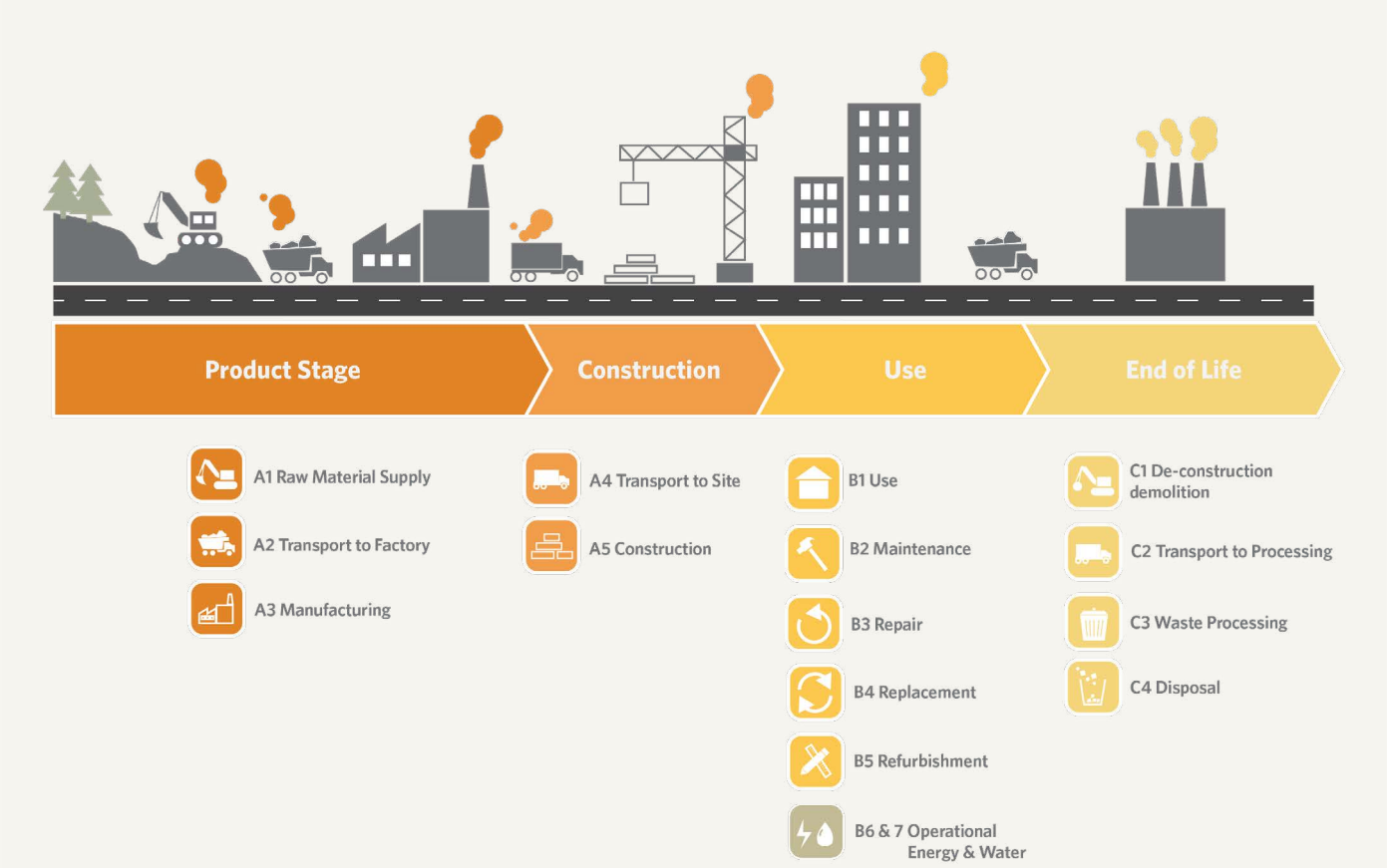

Figure 1: Embodied carbon and operational carbon across the life cycle stages of a building.[15]

Conducting a wbLCA requires access to reliable sources of data for both the types and quantities of building materials and their respective embodied carbon emissions. Building material quantities are extrapolated from project drawings and building models. Material carbon emissions data is typically sourced from third-party databases or through Environmental Product Declarations (EPD). EPDs are standardized documents that provide transparent and quantified environmental data for building products or services based on an LCA.

While LCAs can be done manually, practitioners generally use LCA software tools that allow the user to enter the material quantities, which the software then uses to calculate the total environmental impact by drawing on an associated database.

There is a range of both free and proprietary LCA tools available, including general LCA software (e.g., SimaPro), building-specific tools (e.g., Athena Impact Estimator and OneClick LCA), and plug-ins for building design and modelling software (e.g., Tally, which connects to Revit). While they follow ISO standards, each uses different methodologies, datasets, and boundaries that result in variation across the outputs they create.

[15] Figure from Carbon Leadership Forum (2020). CLF Embodied Carbon Policy Toolkit. Embodied Carbon 101. Figure 1. https://carbonleadershipforum.org/embodied-carbon-101-v2/ UBC Sustainability Hub. https://sustain.ubc.ca/

PATHWAYS TO NET-ZERO EMBODIED CARBON IN BUILDINGS PROJECT

Consistently ranked among the top five percent in the world, the University of British Columbia is committed to responding to global sustainability challenges, including climate action. The UBC Sustainability Hub, part of the VP Academic portfolio, functions as connector, curator, and facilitator of a wide breadth of sustainability programs, andclimate action initiatives across UBC, and supports partnerships across the region.

The Sustainability Hub has been an active partner in UBC's Campus as a Living Lab [16] projects, including Brock Commons Tallwood House, the first 18-story mass timber building in Canada. These projects bring together academic researchers, operational staff, and industry partners and support research and education initiatives that contribute to advancements in sustainable development in Canada.

As part of a Campus as Living Lab initiative [17] which focused heavily on the potential embodied carbon emissions and related implications on design, construction and supply chains of mass timber, UBC Sustainability Hub and Athena Sustainable Materials Institute (Athena) conducted detailed LCAs for Brock Commons Tallwood House to estimate its embodied carbon emissions and other environmental impacts.

Building on these experiences and with funding from Forestry Innovation Investment, the UBC Sustainability Hub embarked on a three-year Embodied Carbon Pilot [18] to assess existing LCA tools using real buildings from across BC as case studies, and to create educational materials to help inform and support practitioners. This work was done in collaboration with organizations such as the Zero Emissions Building Exchange (ZEBx, now the Zero Emissions Innovation Centre (ZEIC)), the City of Vancouver, Athena, and UBC Campus + Community Planning.

The Pathways to Net-Zero Embodied Carbon in Buildings project builds on this previous work and partnerships to engage with embodied carbon experts–from academia, industry, government and NGOs–to more broadly address embodied carbon policies and practices in BC and Canada.

Overview

The Pathways to Net-Zero Embodied Carbon Buildings project is one of a series of projects funded by the Government of Canada through the Environmental Damages Fund's Climate Action and Awareness Fund (CAAF) to support the development of a sustainable net-zero emissions economy by 2050. These projects were intended to inform the work of the Net-Zero Advisory Body (NZAB), a group of Canadian experts established under the Canadian Net-Zero Emissions Accountability Act to provide the Minister of Environment and Climate Change with independent advice on how Canada can achieve net-zero GHG emissions by 2050.

Led by UBC Sustainability Hub, the project was intended to build local and regional collaborations and partnerships to identify immediate barriers and challenges to implementing embodied carbon policies and actions while also developing solutions to advance the Canadian building industry along the pathway to net-zero. Key partners included the Zero Emissions Innovation Centre (ZEIC), Athena, the City of Vancouver and academic researchers and planning staff at the UBC. The project engaged over 140 individuals with expertise and experience in developing and implementing embodied carbon practices, plans and policies within their organizations. These included representatives from academia, the building industry, manufacturing, local, provincial, and national governments, professional organizations, and non-profits.

In addition, the Pathways project supported a number of research activities to inform policies, practices, and software tools to enable embodied carbon accounting with the ultimate intention of reducing embodied carbon emissions in the building sector. The activities included several municipality-led research projects to develop reduction strategies for their communities in collaboration with the UBC Sustainability Scholars program[19]; an assessment of a regional peer-to-peer knowledge sharing network as a model for advancing embodied carbon policies; a case study on a 50% embodied carbon emissions reduction feasibility assessment using a UBC development project; a LCA tool responding to new national guidelines; and two technical research projects exploring models to improve carbon accounting tools and practices.

[16] UBC Campus as a Living Lab. https://livinglabs.ubc.ca/

[17] UBC Campus as a Living Lab. https://livinglabs.ubc.ca/projects/brock-commons-tallwood-house

[18] UBC Sustainability Hub Embodied Carbon Pilot. https://livinglabs.ubc.ca/projects/embodied-carbon-pilot

[19] UBC Sustainability Scholars program. https://sustain.ubc.ca/teaching-applied-learning/ubc-sustainability-scholars-program

The Pathways project was comprised of the following phases: knowledge capture through conversations with regional government, practitioners, and researchers supplemented by a policy and literature review, facilitated workshops, a number of research and pilot projects, and knowledge mobilization. Across these phases, the team worked to:

- build local and regional collaborations and partnerships with those working on reducing embodied carbon emissions,
- identify immediate barriers and challenges to implementing embodied carbon policies and actions
- develop solutions such as policy changes, education and training, tools, and resources, and governance
- collect and share learning from the different phases to inform policy and practices across BC and Canada

This summary report provides details on the Pathways to Net-Zero Embodied Carbon in Buildings project activities and findings, as well as a consolidated set of opportunities and considerations for policies and actions at all levels of government.

A breakdown of the report sections is as follows:

- Section 2: Overview of current policies focused on embodied carbon emissions.
- Section 3: Summary of conversations, workshops, and partnerships of the Pathways project.
- Section 4: Overview of project efforts to advance municipal-scale policies and practices.
- Section 5: Description of research projects exploring tools and practices for embodied carbon accounting.
- Section 6: Summary of the challenges of developing and implementing embodied carbon policies and practices.
- Section 7: Key considerations and recommendations for local, provincial, and national governments.
- Section 8: Priorities for further research and policy development

While this report is intended for the Net Zero Advisory Body and Environment and Climate Change Canada, the results are being shared with other partners and audiences in local, provincial, and national government and other organizations actively involved in reducing embodied carbon emissions in Canada.

Figure 2: Timeline of the UBC Pathways project.

SECTION 2: OVERVIEW OF EMBODIED CARBON POLICY

GLOBAL TRENDS IN EMBODIED CARBON POLICY

As nations worldwide accelerate efforts to decarbonize the built environment, embodied carbon emission policies are emerging as a critical frontier in climate action. A review of international policies on embodied carbon in buildings reveals that, while approaches vary, there are prevailing trends in embodied carbon policy considerations around the world.

The information summarized below is drawn from the Embodied Carbon of Buildings: International Policy Review[20], a report prepared in March 2024 by the UBC Sustainability Hub, and Scius Advisory[21] for Forestry Innovation Investment.[22]

Establishing national embodied carbon policy ecosystems and resources

A number of countries are taking a comprehensive approach to the development of policies and building codes that regulate embodied carbon emissions in building projects. These are being supported by an ecosystem of aligned tools, databases, guidelines and other resources for the building industry. In many cases, these resources include additional financial incentives to address incremental implementation costs, providing foundational resources and guidelines (such as databases and procurement requirements), and facilitating training and educational initiatives. Netherlands sets a strong example by embedding embodied carbon requirements into its national Building Code Decree 2012 (Bouwbesluit 2012).[23] They support these requirements with a national emissions database and assessment methodologies tailored to the building sector. Belgium developed the Belgium EPD Programme[24] and a complementary LCA tool.

Some policies, such as European Union Directives,[25] which offer financial support to member states when their national regulations align with minimum performance requirements. The EU Renovation Wave[26] channels funding towards research, training, new job creation, and technical support to expand market opportunities in building renovations.

Connecting embodied carbon emissions reduction strategies with national climate action plans and complementary climate policies

Following the Paris Agreement, a number of countries developed national climate action plans, typically aligned with 2050 timelines, that include embodied carbon emissions reduction targets. Embodied carbon is also being included in complementary climate policies that address adaptation, resiliency, and operational GHG emissions in buildings and infrastructure. These policies connect embodied carbon with broader sustainability goals for buildings, seeking to meet emissions reduction targets and build resilience to future climate impacts.

For instance, Norway's 2021–2030 Climate Action Plan[27] advances fossil-free construction, promotes circular economy principles, and strengthens life-cycle emissions standards, while also supporting local manufacturing of low-carbon materials and increasing the use of wood in construction. Similarly, Sweden embedded embodied carbon emissions reduction into its Climate Act[28] through mandatory GHG emissions reporting for new buildings supported by a national construction product database and expanded requirements to include whole-building life cycle assessment (wbLCA) for new construction.

[20] Embodied Carbon of Buildings: International Policy Review (2024). https://sustain.ubc.ca/about/resources/embodied-carbon-buildings-international-policy-review

[21] Scius Advisory. https://sciusadvisory.com/

[22] Forestry Innovation Investment. https://www.bcfii.ca/

[23] Draft Building Decree (Bouwbesluit) (2012). https://technical-regulation-information-system.ec.europa.eu/en/notification/7312 (English Language)

[24] FPS Public Health (2022). The Belgian EPD Programme. https://www.health.belgium.be/en/belgian-epd-programme-b-epd

[25] European Union. European Union directives. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=legissum:l14527

[26] European Commission. Renovation wave. Energy. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

[27] Norwegian Ministry of Climate and Environment. (2021). Norway's Climate Action Plan for 2021–2030 (Meld. St. 13 (2020–2021)). https://www.regjeringen.no/contentassets/a78ecf5ad2344fa5ae4a394412ef8975/en-gb/pdfs/stm202020210013000engpdfs.pdf

[28] Swedish Environmental Protection Agency. Sweden's Climate Act and Climate Policy Framework. https://www.naturvardsverket.se/en/topics/climate-transition/sveriges-klimatarbete/swedens-climate-act-and-climate-policy-framework/

Notably, Sweden's LCA tool[29] ensures that embodied carbon emissions are assessed throughout the design and construction phases of large-scale infrastructure projects. It is deeply integrated with national regulations and policies for climate action and aligned with the country's broader climate goals, which makes it unique in its systematic and mandatory approach across multiple project stages.

Another example, New Zealand's Building for Climate Change Programme,[30] guides the building and construction sector in contributing to national net-zero emissions targets, while also preparing buildings for changing climate conditions. Similarly, Singapore's Green Building Masterplan[31] emphasizes energy performance, embodied carbon emissions reduction, long-term maintainability of building systems and materials, climate resilience, and healthier indoor environments.

Aligning procurement-based embodied carbon policies with green economic transitions

A number of governments have moved towards incentivizing or regulating the decarbonization of industrial processes and product manufacturing practices that reduce the carbon emissions of resource extraction and supply chains. In the US, the Buy Clean Initiative[32] promotes low-carbon materials and supports industrial decarbonization in government-funded projects. Similarly, France's Green Public Procurement policy,[33] which applies to public construction projects, mandates low-carbon products in line with its Circular Economy roadmap.

Promoting mass timber as a low-carbon building material

In many countries, the emergence of embodied carbon considerations is connected to growth in the use of mass timber products as a lower-carbon structural alternative to concrete and steel. For example, Germany's Charter for Wood 2.0[34] advocates using wood as a substitute for energy-intensive materials, while Netherlands' Green Deal Timber Construction[35] targets a 20% increase in timber construction by 2025, and the Timber in Construction Roadmap[36] set commitments for a long-term supply of domestic wood products to the UK building industry.

Progress on embodied carbon emissions reductions is also occurring at the sub-national level, with regional and local governments often leading the development of new policies and piloting innovative strategies. For example, the State of California recently updated its Green Building Standards Code[37] to mandate embodied carbon emissions reductions for large commercial and institutional buildings. And, the City of London introduced mandatory wbLCA and embodied carbon emissions reporting for developments under the London Plan 2021.[38]

In 2025, the United States implemented broad and shifting tariffs on its trading partners. These tariffs triggered retaliatory tariffs and other actions from other countries, and shifted free-trade agreements and economic alliances. These actions have significantly impacted global trade, supply chains, manufacturing and the building sector. The extent to which GHG emissions and other environmental impacts will be incorporated into new and changing policies and practices is not clear, nor are the implications of these changes on existing climate policies and targets.

[29] Swedish Transport Administration. (2018). Klimatkalkyl – Calculating energy use and greenhouse gas emissions of transport infrastructure from a life cycle perspective, version 5.0 and 6.0 (Report No. TRV 2018:115). https://bransch.trafikverket.se/contentassets/eb8e472550374d7b91a4032918687069/klimatkalky_report_v_5_0_and_6.0_english.pdf

[30] Ministry of Business, Innovation and Employment. (2020). Building for Climate Change: Transforming the building and construction sector to reduce emissions and improve climate resilience. New Zealand Government. https://www.mbie.govt.nz/dmsdocument/11522-building-for-climate-change

[31] Singapore Building and Construction Authority. (2022). Singapore Green Building Masterplan. https://www1.bca.gov.sg/docs/default-source/docs-corp-buildsg/sustainability/20220726_singapore-green-building-masterplan-booklet.pdf?sfvrsn=151fba03_8

[32] White House Council on Environmental Quality. Federal Buy Clean Initiative. Sustainability.gov. https://www.sustainability.gov/archive/biden46/buyclean/index.html

[33] Plastic Action Centre. Story 7: Green Procurement Policy in the National Action Plan in France Linked to a Regulatory Backdrop. https://plasticactioncentre.ca/directory/france-green-procurement-policy/

[34] Federal Ministry of Food and Agriculture (2021). Mitigating climate change. Creating value. Utilising resources efficiently. Charter for Wood 2.0. https://www.bmel.de/SharedDocs/Downloads/EN/_Forests/charter-for-wood-2.pdf

[35] Metropolitan Region Amsterdam (2024). Timber construction. https://www.metropoolregioamsterdam.nl/houtbouw/

[36] UK Department for Environment, Food & Rural Affairs (2023). https://www.gov.uk/government/publications/timber-in-construction-roadmap/timber-in-construction-roadmap

[37] Department of General Services Division of the State Architect. Overview - Title 24 Building Standards Code as Adopted by the Division of the State Architect. https://www.dgs.ca.gov/DSA/Resources/Page-Content/Resources-List-Folder/Overview-Title-24-Building-Standards-Code

[38] Greater London Authority (2022). Whole Life Cycle Carbo Assessment – London Plan Guidance. https://www.london.gov.uk/sites/default/files/lpg_-_wlca_guidance.pdf

EMBODIED CARBON POLICY IN CANADA

Under the Paris Agreement, Canada committed to reduce GHG emissions by 30% below 2005 levels by 2030. In 2022, Canada updated its target with the release of the 2030 Emissions Reduction Plan, aiming for a 40% to 45% reduction below 2005 levels by 2030 and net-zero emissions by 2050.[39] While the majority of the actions that pertain to the building sector focus on operational emissions, the plan also prioritizes reducing GHG emissions from building materials. Across Canada, momentum around embodied carbon emissions reduction is growing, with initiatives emerging at various levels of government and leadership action emerging from industry and non-profit organizations.

National Policy

To date, Canada has not established a national strategy to reduce embodied carbon emissions in the building sector. Updates to the 2030 Model National Building Code of Canada[40] are anticipated to include requirements related to do with embodied carbon emissions in buildings. Several federal agencies and departments play important roles in developing embodied carbon policy and practice in Canada, each contributing through research, policy development, code updates, or procurement standards. These includes:

- **National Research Council (NRC):** Conducts scientific research and technical development to support low-carbon innovations in construction. NRC's work informs standards and tools used by government, industry, and researchers to assess and reduce embodied carbon impacts.
- **Natural Resources Canada (NRCan):** Partners with industry and other levels of government to develop policies and programs that encourage the adoption of low-carbon construction materials and practices across Canada.
- **Canadian Board for Harmonized Construction Codes (CBHCC):** Oversees the development of the National Model Codes, which set performance requirements for new buildings. Recent efforts include incorporating provisions aimed at reducing life cycle GHG emissions.
- **Treasury Board of Canada Secretariat (TBS):** Establishes green procurement policies for federally funded projects, requiring disclosure and reduction of embodied carbon in large construction initiatives, thereby influencing public sector demand for low-carbon materials.

These organizations work with provincial and local governments, industry, and the non-profit sector to implement green procurement policies and building code updates, and support promotion of low-carbon construction and retrofits, and research and development (R&D) of tools and resources to help the industry decarbonize.

Updated in 2018, the Government of Canada's Green Procurement Policy[41] requires the integration of environmental considerations in government procurement processes to support sustainable development and environmental protection. The objectives are to leverage the government's purchasing power to promote environmentally preferable goods and services, create market demand, and reduce costs. By encouraging the adoption of efficient, low-toxicity, and durable products, the policy helps modernize operational practices, foster healthier indoor environments for workers, and enhance the resiliency of public infrastructure.

The Greening Government Strategy[42] introduced in 2017, aims to achieve net-zero emissions for government operations by 2050. This strategy focuses on transitioning to climate-resilient systems and reducing environmental impacts across government activities. It targets four key areas: mobility and fleets, property and workplaces, climate-resilient services and operations, and the procurement of goods and services. It includes a commitment to reducing embodied carbon in structural construction materials by 30% by 2025. Related, the Greening Government Fund[43] supports low-carbon retrofits in federal government-owned buildings.

[39] Minister of Environment and Climate Change (2022). 2030 Emissions Reduction Plan Canada's Next Steps for Clean Air and a Strong Economy. https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf

[40] Canadian Board for Harmonized Construction Codes (2025). Phase 1: Embodied GHG Draft Policy Positions. https://cbhcc-cchcc.ca/en/phase-1-embodied-ghg-draft-policy-positions/. Accessed during the Pathways project summary report preparation in June 2025. Note: this consultation page may be updated or removed

[41] Government of Canada (2022, November 14). Policy on Green Procurement. https://www.tbs-sct.canada.ca/pol/doc-eng.aspx?id=32573

[42] Treasury Board of Canada Secretariat (2024, May 29). Greening Government Strategy: A Government of Canada Directive. https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html

[43] Government of Canada (2025, March 31). Greening Government Fund. https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/greening-gov-fund.html

As part of the Policy on Green Procurement[44] and in alignment with the Greening Government Strategy, the Standard on Embodied Carbon in Construction[45] was established in 2022 to reduce embodied carbon emissions from government building projects. It establishes requirements for project teams to disclose and reduce by 10% the embodied carbon of structural materials on major government projects and outlines compliance pathways through the use of LCAs and EPDs during design and construction, as well as collecting project information through a standardized embodied carbon disclosure template.

The Greening Government Strategy was updated in 2024,[46] with one of its key focuses being the reduction of environmental impacts from construction materials in federally owned buildings. Key actions include:

- Disclosure of embodied carbon in major construction projects using carbon intensity data or LCA.
- Mandating wbLCA for major projects by 2025.
- Reducing embodied carbon by 30% starting in 2025 through the use of recycled materials, material efficiency, and performance-based design.

The Canada Green Buildings Strategy (CGBS)[47] was first introduced in 2016 to improve energy efficiency in Canada's homes and buildings and has since evolved into a strategy to decarbonize residential, commercial, institutional, and federal buildings while supporting affordability, job creation and economic growth.

In 2024, it was further expanded with nearly $1 billion in new investments, including several targeted programs aimed at promoting retrofits in residential, commercial, and institutional buildings, offering a pathway to significantly reducing the embodied carbon emissions produced by the building sector. The Canada Greener Homes Grant and Loan programs[48] and the Deep Retrofit Accelerator Initiative[49] are two noteworthy examples of the programs that emerged from the new investments.

Between 2019 and 2023, NRC ran the low-carbon assets through life cycle assessment initiative[50] to develop resources to support the design and selection of low-carbon and cost-effective materials. This initiative supported the development of low-carbon EPDs for the concrete industry and the national guidelines for whole-building life cycle assessment[51] instructional document. This document provides instructions for the practice of LCAs on buildings with the aim of harmonizing the practices of wbLCA compliance with standards and interpretation of results.

Between 2023 and 2024, the NRC developed and launched the Platform to Decarbonize the Construction Sector at Scale[52] and instituted the Centre of Excellence in Construction Life Cycle Assessment[53] at the NRC's Construction Research Centre. Among other outcomes, the work of these initiatives will inform future updates to the Model National Building Code of Canada in 2030. Provinces will then review and adopt the model code for their own respective building codes.

[44] Government of Canada (2022, November 14). Policy on Green Procurement. https://www.tbs-sct.canada.ca/pol/doc-eng.aspx?id=32573

[45] Government of Canada (2022, November 14). Archived [2025-03-20] - Standard on Embodied Carbon in Construction. https://www.tbs-sct.canada.ca/pol/doc-eng.aspx?id=32742

[46] Treasury Board of Canada Secretariat (2024). Updated Green Government Strategy 2024. https://www.canada.ca/en/treasury-board-secretariat/news/2024/06/updated-greening-government-strategy-2024.html

[47] Natural Resources Canada (2025, January 7). The Canada Green Buildings Strategy: Transforming Canada's buildings sector for a net-zero and resilient future. https://natural-resources.canada.ca/energy-efficiency/building-energy-efficiency/canada-green-buildings-strategy-transforming-canada-s-buildings-sector-net-zero-resilient-future

[48] Natural Resources Canada (2025, April 9). Canada Greener Homes Initiative. https://natural-resources.canada.ca/energy-efficiency/home-energy-efficiency/canada-greener-homes-initiative

[49] Natural Resources Canada (2025, February 24). Deep Retrofit Accelerator Initiative. https://natural-resources.canada.ca/energy-efficiency/building-energy-efficiency/deep-retrofit-accelerator-initiative

[50] National Research Council Canada (2023, October 30). Low-carbon assets through life cycle assessment initiative. https://nrc.canada.ca/en/research-development/research-collaboration/programs/low-carbon-assets-through-life-cycle-assessment-initiative

[51] National Research Council Canada (2022). National guidelines for whole-building life cycle assessment. https://nrc-publications.canada.ca/eng/view/ft/?id=f7bd265d-cc3d-4848-a666-8eeb1fbde910

[52] Platform to Decarbonize the Construction Sector at Scale. https://nrc.canada.ca/en/research-development/research-collaboration/platform-decarbonize-construction-sector-scale

[53] National Research Council Canada (2024, November 4). The Centre of Excellence for Construction Life Cycle Assessment. https://nrc.canada.ca/en/research-development/research-collaboration/programs/centre-excellence-construction-life-cycle-assessment

Provincial Policy

The Province of British Columbia has not yet created policies or regulations to specifically reduce embodied carbon emissions in buildings. Provincial staff are currently involved in the development of the 2030 Model National Building Code, with the intention that embodied carbon emissions reductions will be included in future provincial code updates. In the meantime, provincial authorities, such as those listed below, are engaged in efforts that will contribute towards provincial-level policies.

- The Building and Safety Standards Branch of the Ministry of Housing and Municipal Affairs: This office is responsible for developing technical regulations and standards related to building and safety.
- The Mass Timber Implementation Office of the Ministry of Jobs, Economic Development: Guided by the Mass Timber Action Plan of 2022,[54] this office has been building partnerships with local governments and industry to advance the use of mass timber to maximize climate benefits, such as by reducing embodied carbon emissions.
- The Built Environment Branch of the Ministry of Energy and Climate Solutions: This office has been working on energy efficiency and retrofits, and has played a role in connecting organizations interested in building decarbonization.
- Provincial Health Services Authority: This organization is building new hospitals in British Columbia and using targeted material selection and LCA reports to reduce associated embodied carbon emissions.

To date, the province has focused on increased production and use of mass timber structural components and low-carbon procurement practices as the means to reduce embodied carbon in buildings. They have enacted this through the 2022 Mass Timber Action Plan,[55] which was created to develop the mass timber industry as part of the StrongerBC Economic Plan[56] with the goal of expanding mass timber education, preparing a new workforce, and catalyzing construction sector innovation using mass timber.

Originally launched in 2018, CleanBC is the provincial plan to lower GHG emissions by 40% in 2030 in collaboration with industry, local governments, and Indigenous communities. The CleanBC Roadmap to 2030[57] builds on it with stronger measures to meet the 2030 targets. These are augmented by the BC Climate Preparedness and Adaptation Strategy.[58] Through these initiatives, the provincial government implements changes to policy and regulations to address climate change in BC, and provides resources and support for province-wide actions, including improving performance across the building sector.

BC is working with California, Oregon, and Washington through the Pacific Coast Collaborative on the Vision and Action Plan for Low-Carbon Pacific Coast Construction Sector,[59] a coordinated regional effort on the western coast of Canada and the US.

As part of the Canadian-wide response to the evolving US tariff situation that emerged in the first quarter of 2025, the BC government is implementing economic policies and actions to protect internal industries, support increased interprovincial trade, establish new trading partners, and advance economic relations. These actions may impact the advancement of embodied carbon emissions policy and regulations.

[54] Government of B.C (2022). B.C.'s Mass Timber Action Plan. https://www2.gov.bc.ca/gov/content/industry/construction-industry/mass-timber/mass-timber-action-plan

[55] Government of British Columbia (2022). BC's Mass Timber Action Plan. https://www2.gov.bc.ca/assets/gov/business/construction-industry/bc_masstimber_action_plan_2022.pdf

[56] Government of British Columbia (2023). StrongerBC for Everyone. Future Ready Action Plan. https://strongerbc.gov.bc.ca/app/uploads/sites/602/2023/04/Future-Ready-May2023.pdf

[57] Government of British Columbia (2021). CleanBC Roadmap to 2030. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

[58] Government of British Columbia (2024, December 11). Climate preparedness and adaptation. https://www2.gov.bc.ca/gov/content/environment/climate-change/adaptation

[59] Pacific Coast Collaborative (2024). Vision And Action Plan for a Low-Carbon Pacific Coast Construction Sector. https://pacificcoastcollaborative.org/wp-content/uploads/2024/01/PCC-Low-Carbon-Construction-Vision-and-Action-Plan-011124.pdf

From Ontario's purchasing desks to Alberta's cement kilns, provinces across Canada are finding ways to reduce embodied carbon emissions in buildings by rewriting procurement rules, championing low carbon materials, and investing in cleaner construction technology. For example:

- Ontario's Climate Change Strategy directs provincial procurement that worth billions each year to favour products and building methods with the lowest life cycle emissions;[60]
- Under the 2030 Plan for a Green Economy, the province of Québec encourages wood and other low-carbon materials in new buildings[61] and pairs that push with the Policy for the Use of Wood in Construction, while equipping designers with Gestimat 2.0 software, a free LCA tool that compares the embodied GHG emissions of wood, steel, and concrete designs.[62]
- Alberta's Emissions Reduction and Energy Development Plan, the province is evaluating clean tech options and low-carbon materials for buildings, promoting the use of timber in the building sector, and scaling carbon capture in cement production to bring genuinely low-carbon concrete to market.[63]

First Nations

First Nation communities play a key role in reducing emissions from buildings—as landowners, policymakers, developers, builders, and actors along every step of the supply chain. Developed by the First Nations Leadership Council, the BC First Nations Climate Strategy and Action Plan[64] Outline actions to empower First Nations' leadership in climate response, address community vulnerabilities, and ensure indigenous knowledge, law and rights are upheld in climate decisions.

The plan outlines, among many things, actions to guide GHG emissions assessments and reduction, transformation of resource extraction, and guidelines to establish green infrastructure, clean energy, and low-carbon economic development.

Indigenous strategic leadership is paving the way for transformative projects with the potential to influence development practices across the country. A prime example is the Seńáḵw[65] project, led by the Squamish Nation in Vancouver. This large-scale, net-zero operational carbon housing development was designed with a focus on reducing embodied carbon. By using 45,000 square feet of mass timber construction, the project aims to achieve a 50% reduction in embodied carbon compared to traditional concrete construction.

[60] Government of Ontario (2015). Ontario's Climate Change Strategy. https://docs.ontario.ca/documents/4928/climate-change-strategy-en.pdf

[61] Government of Québec (2020). 2030 Plan for a Green Economy. Framework Policy on Electrification and the Fight Against Climate Change. https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-economie-verte-2030-en.pdf

[62] Government of Québec (2020). Policy for the Use of Wood in Construction. https://cdn-contenu.quebec.ca/cdn-contenu/forets/documents/entreprises/PO_wood_construction_MRNF.pdf

[63] Government of Alberta (2024). Alberta Emissions Reduction and Energy Development Plan. https://open.alberta.ca/dataset/7483e660-cd1a-4ded-a09d-82112c2fc6e7/resource/75eec73f-8ba9-40cc-b7f4-cdf335a1bd30/download/epa-emissions-reduction-and-energy-development-plan.pdf

[64] The First Nations Leadership Council (2022). BC First Nations Climate Strategy and Action Plan. https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf

[65] Westbank Projects Corp. The Seńáḵw Project Page. https://senakw.com/

Municipal Policy

Cities are at the forefront of climate change policies, including reductions in embodied carbon emissions. In Canada, the City of Vancouver Building By-laws[66] requires all large residential, commercial, institutional, and industrial buildings (Part 3 buildings per the BC Building Code[67]) submit a wbLCA and demonstrate emissions reductions against a defined baseline or meet an absolute carbon intensity value. The City of Toronto Green Standard v4.0[68] sets whole-building caps for up-front embodied carbon emissions on city-owned buildings, following the CaGBC Zero Carbon Building Standard[69] methodology.

These municipal-scale approaches are also serving as pilots that can help inform national and provincial level efforts. In British Columbia, a handful of small and mid-sized cities are also in the process of developing embodied carbon policies more tailored to their needs and capacity. Example include:

- The District of North Vancouver's Climate Ready Rezoning Policy[70] requires that all large buildings (part 3 as defined in the BC Building Code) include a preliminary embodied carbon calculation with the rezoning permit application. The application also needs to indicate the strategies that have been incorporated to reduce embodied carbon emissions during the building design phase, and submit a wbLCA to be receive at the building permit stage. Public buildings must meet either the CAGBC Zero Carbon Building Design Standard[71] or the Passive House Standard.[72]
- The City of Port Moody requires developers to complete a Sustainability Report Card,[73] which is a checklist-based report required for rezoning, heritage alteration, and some development permits. The report card focuses on aspects such as the reuse of building materials and voluntary LCA reporting, and encourages the use of wood frame structures and low-carbon concrete.
- The City of Victoria is integrating embodied carbon considerations into the Official Community Plan (OCP) and Climate Leadership Plan, and is exploring LCA submittal or emissions criteria as part of the permitting process.

Other major landholders are also implementing emissions requirements. The UBC Whole Building LCA Guidelines[74] require that institutional buildings achieve a 10% reduction in embodied carbon from a UBC-defined baseline. This target will increase to a 50% reduction in institutional buildings[75] and a 40% reduction in residential buildings by 2030.[76]

Major cities across Canada are rolling out ambitious embodied carbon requirements that act as test beds for future provincial and federal standards.

- The City of Edmonton's 2021 C627 Climate Resilience Policy[77] requires new municipal facilities to be emissions neutral, and mandates an embodied carbon analysis as well as directing designers to favour low-carbon materials.

[66] City of Vancouver (2019). Vancouver Building By-law. Section 10.4. Low Carbon Materials and Construction. https://free.bcpublications.ca/civix/document/id/public/vbbl2019/1069567153

[67] British Columbia Building Codes. https://www.bccodes.ca/index.html

[68] City of Toronto. Toronto Green Standard Version 4. https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/

[69] Canada Green Building Council (2024). Zero Carbon Building Design Standard Version 4. https://www.cagbc.org/wp-content/uploads/2024/07/CAGBC_Zero_Carbon_Building%E2%80%93Design_Standard_v4.pdf

[70] Corporation of the District of North Vancouver (2022). Climate Ready Rezoning Policy for New Part 3 Buildings. https://docs.dnv.org/documents/climate-ready-rezoning-policy.pdf

[71] Canada Green Building Council (2024). Zero Carbon Building Standards v4. https://www.cagbc.org/our-work/certification/zero-carbon-building-standard/

[72] Passive House Canada. About Passive House. https://www.passivehousecanada.com/about-passive-house/

[73] City of Port Moody. Sustainability Report Card. https://www.portmoody.ca/en/business-and-development/sustainability-report-card.aspx

[74] University of British Columbia (2023). UBC Whole Building Life Cycle Assessment Guidelines v1.1. Guide to calculating embodied carbon and other environmental impacts in buildings at UBC. UBC Campus and Community Planning. https://planning.ubc.ca/sites/default/files/2023-07/UBC%20WBLCA%20GUIDELINES%20v1.1%20June%2029_0.pdf

[75] University of British Columbia (2021). UBC Vancouver Campus Climate Action Plan 2030. Bold ambi-tion. Collective action. https://planning.ubc.ca/sites/default/files/2021-12/UBCV_CAP2030_FINAL.pdf

[76] University of British Columbia (2024). Neighbourhood Climate Action Plan. https://planning.ubc.ca/sites/default/files/2024-06/Neighbourhood%20Climate%20Action%20Plan_FINALforweb.pdf

[77] City of Edmonton. (2023, August 28). C627 – Climate resilient design and construction of City buildings: Administrative procedure. https://www.edmonton.ca/sites/default/files/public-files/assets/PDF/C627_Climate_Resilient_Design_and_Construction_of_City_Buildings_Administrative_Procedure.pdf

- The City of Calgary's 2004 Sustainable Building Policy[78] ties green building certification and net zero by 2050 goals to clear embodied carbon and energy efficiency expectations for all municipal-funded projects.
- The City of Montréal's 2020-2030 Climate Plan[79] and by law 21 042[80] combine circular economy principles, low carbon material requirements, and compulsory annual energy/embodied carbon disclosure for large buildings.
- Toronto Green Standard v4,[81] updated in 2022, limit embodied carbon emissions performance for new buildings. It sets limits of 350 kg CO_2e/m^2 for mid- to high-rise, non-residential buildings and City-owned facilities, and 250 kg CO_2e/m^2 for mid- to high-rise and non-residential buildings. These limits are enforced through life cycle assessment and reporting requirements.
- Halifax's climate action plan, HalifACT 2050[82] outlines a framework to require embodied carbon reporting in new construction starting in 2026 and introduces a values-based carbon offset approach to help reach net zero by 2050.

[78] City of Calgary (2021). Sustainable Building Policy. https://www.calgary.ca/content/dam/www/ca/city-clerks/documents/council-policy-library/cs005-sustainable-building-policy.pdf

[79] City of Montréal (2025, May 5). Montréal Climate Plan: Objective carbon-neutral by 2050. https://montreal.ca/en/articles/montreal-climate-plan-objective-carbon-neutral-2050-7613

[80] City of Montréal (2024, September 9). By-law concerning GHG emission disclosures and ratings of large buildings. https://montreal.ca/en/articles/law-concerning-ghg-emission-disclosures-and-ratings-large-buildings-20548/. See also BOMA Québec (2022). Presentation: Overview and Application of The City of Montreal By-Law 21-042 on The Disclosure and Rating of GHG Emissions of Large Buildings https://portail-m4s.s3.montreal.ca/pdf/vdm_visual_support_by-law_21-042_2022.pdf.

[81] Toronto Green Standard Version 4. https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/

[82] Halifax Regional Municipality (2020). HalifACT 2050: Acting on Climate Together. https://cdn.halifax.ca/sites/default/files/documents/about-the-city/energy-environment/HRM_HaliFACT_vNew%20Logo_.pdf

SECTION 3: CONVERSATIONS, PARTNERSHIPS, AND WORKSHOPS

One of the primary objectives of the Pathways project was to engage with people working in government, industry, non-profits, and academia to solicit information on their experiences in developing and implementing embodied carbon emissions reduction policies and practices. The aim was to develop a more comprehensive understanding of the barriers and challenges in doing this work, and to solicit input and suggestions for realistic and meaningful solutions to advance Canada's progress towards net-zero embodied carbon emissions in the building sector.

The early phases of the project included extensive conversations with experts and those with expertise in embodied carbon emissions reductions. These conversations shaped the early workshops and ongoing engagement with an expanding list of participants and continued to inform the Pathways project activities throughout the two-year timeline.

CONVERSATIONS AND ENGAGEMENT

The Pathways project team undertook two rounds of conversations. The first round included dozens of meetings with academics, policymakers, and building professionals to gain insights into their understanding of embodied carbon emissions and the challenges associated with emissions reductions in their work. These conversations structured the Challenge-to-Solution Workshop series—a set of collaborative sessions aimed at identifying key barriers and co-developing practical strategies for implementing embodied carbon into policy. All of the people interviewed were invited as participants.

The second round of conversations continued throughout the rest of the project timeline and included a mix of consultations that informed the direction of additional workshops and research projects, and outreach to share the learnings with a range of government staff, practitioners and others. Staff from a number of organizations, such as the National Research Council and the BC Ministry for Environment, engaged quite closely with the project team and provided connections with others in their networks.

These conversations were held with over 70 representatives from different levels of government and over 70 building experts in industry, non-profits, and academia.

Local Government

Participants: The City of Nelson, City of Burnaby, City of New Westminster, City of Port Moody, City of Vancouver, City of Victoria, City of Coquitlam, District of North Vancouver, District of Squamish, City of Vernon, District of West Vancouver, City of Kamloops, City of Richmond, City of Abbotsford, District of Saanich, District of Sechelt, Village of Cache Creek, Metro Vancouver, plus UBC's Campus and Community Planning.

Conversations with thirty-four representatives from local government in British Columbia produced a wealth of information about how cities, districts and villages are approaching the reduction of emissions in their buildings. While the City of Vancouver has developed its own rezoning requirements and bylaws, many other communities are beginning to move ahead with policy mechanisms and practical strategies Many municipal policymakers identified that implementation can be more challenging than developing embodied carbon emissions policies, but noted that limited authority, limited technical education, and staff capacity (especially in smaller communities) were barriers to action. Participants also noted challenges resulting from the lack of policy from higher levels of government and variation in approaches at the municipal level as prohibiting changes to practices within the local building industry.

Province of British Columbia

Participants: The Climate Partnerships and Engagement Branch of the Ministry of Energy and Climate Solutions; the Building and Safety Standards Branch of the Ministry of Housing and Municipal Affairs; The Mass Timber Implementation Office of the Ministry of Jobs, Economic Development; the Built Environment Branch of the Ministry of Energy and Climate Solutions; and the Provincial Health Service Authority.

Twenty-two representatives from the BC Provincial Government shared information about their existing relevant work to reduce embodied carbon emissions through building policy, procurement practices, and financial support programs. Some measures are already in place for government-held building assets, while broader regulatory efforts are expected to align with the 2030 update to the Model National Building Code—which is anticipated to introduce embodied emissions requirements and accounting practices, and will require corresponding updates to the province code.

These changes are expected to affect public sector projects and may influence provincial policies, standards, and funding programs across the building sector. In the meantime, provincial staff are contributing technical expertise to national code development and developing internal strategies to support implementation, including funding mechanisms and pilot initiatives.

At the time of our conversations in 2025, it was apparent that many of the ministries were shifting to focus on affordability and a clean economy—an approach that supports low-carbon industries. This move may create new opportunities to advance embodied carbon emissions reductions in buildings through procurement guidelines that encourage the use of Canadian products, and support for local BC industries, including mass timber production and the use of reclaimed wood.

Federal Government

Participants: The Low Carbon Built Environment Research Program of NRC, the Low Carbon Regulatory Framework Program of NRC, the Construction Sector Digitalization and Productivity Program of NRC; the initiatives of NRCAN; Canada Mortgage and Housing Corporation; the Buyers for Climate Action group and Treasury Board Secretariat; Public Service and Procurement Canada; and the Canada Green Building Council (CaGBC).

Thirteen staff from various national agencies participated in repeated conversations and consultations with the Pathways project team to share their ongoing efforts to reduce embodied carbon emissions in the building sector. These agencies play a foundational role in developing resources and requirements for future regulatory requirements around embodied carbon emissions accounting and reductions. Staff at these agencies spoke of the need to engage the building industry and LCA practitioners in the development of guidelines tools and resources. They identified challenges around collecting accurate emissions data from material and product manufacturers, especially from international supply chains. Broadly, staff also noted the importance of creating specific standards and incentives for sourcing building materials from within Canada for use in Canadian projects.

Industry

Participants: Acton Ostry Architects, Carbon Wise, DIALOG, EllisDon, HDR, HCMA, Equilibrium Consulting, Heatherbrae Builders, IBI Group, Introba, LaFarge Canada, Patkau Architects, Perkins&Will, Public Architecture, reLoad Sustainable, Scius Advisory, Third Space, Vancouver City Savings Credit Union (commonly known as Vancity), and ZGF Architects.

Thirty-one participants, including architects, LCA analysts, structural engineers, and other professionals from the building industry were consulted by the Pathways project team to better understand how embodied carbon emissions are being addressed in design and construction practices. The participants emphasized that, to maximize emissions reductions, LCAs should be performed at every phase of building design and construction, including at the planning, rezoning, and permit stages, as well as during and after construction. They shared that they currently rely on a combination of international, national, and/or municipal guides, along with their internal company resources, to navigate the LCA process. They also heavily rely on various LCA tools such as Athena IE, Tally, OneClick LCA, and EC3. However, they noted that inconsistencies in methodologies and incomplete databases make it difficult to compare.

Nearly all the professionals we interviewed highlighted the need for educational materials. Some companies and non-profits have started addressing this need; for example, the ZGF's Low Carbon Concrete Guideline,[83] which provides simple and cost-effective design strategies to reduce carbon emissions from new concrete buildings. Participants also noted the need to embed LCA education into architectural curricula. With broader access to such education, the participants were hopeful that this awareness LCA and its value would grow, and help to shift conversations with project clients and decision-makers away from debating material choices and toward reducing overall material consumption.

Lastly, the designers among the participants emphasized the difficulties associated with a limited supply chain for alternative low-carbon materials (especially wood).

[83] ZGF (2023). Research: ZGF Releases Low Carbon Concrete Guidelines. https://www.zgf.com/ideas/5476-research-zgf-releases-low-carbon-concrete-guidelines

Non-Profits

Participants: Athena Sustainable Materials Institute, the Community Energy Association, Seattle chapter of the Carbon Leadership Forum, British Columbia chapter of the Carbon Leadership Forum

Ten individuals from non-profit organizations working in the building industry or climate action shared how their work supported policymakers and industry practitioners in advancing embodied carbon reductions. They have been instrumental in producing useful tools, such as the Carbon Leadership Forum's Embodied Carbon Policy Toolkit,[84] Model Embodied Carbon Specifications,[85] Low-Carbon Material Sourcing Guide,[86] and other resources used to inform standards, guides and municipal government policies.

While non-profits played an important role in raising awareness and supporting local governments in developing embodied carbon policies, several challenges have made implementation difficult. Many non-profits faced the challenge of limited staff capacity and funding. As such, they can only offer essential, minimum-level support, which affects its ability to provide sustained guidance, tailored resources, or in-depth technical assistance.

They noted that in the absence of clear mandates or standardized requirements at the provincial or federal level, such as embodied carbon targets or accounting methods, local governments often struggle to prioritize these efforts within their broader planning processes. As a result, non-profits are frequently left to fill critical gaps in policy development and coordination. This lack of top-down direction places a disproportionate burden on non-profits with limited capacity, leading to uneven levels of engagement and slower policy progress across jurisdictions.

Academia

Participants: Faculty and researchers at the University of British Columbia, the University of Victoria, and the BC Institute of Technology.

The objective of these conversations was to understand how post-secondary educators and researchers engage with the topic of embodied carbon emissions, and the associated challenges and issues they encountered through research and teaching. Academics acknowledged they are seeing more discourse on embodied carbon, but that it is still a relatively new topic, and the information isn't fulsome enough to undertake meaningful analysis in the classroom context. They noted the need for stronger integration of embodied carbon-related resources into formal curricula, as well as continued education options for current practitioners.

However, these conversations took place early in the Pathways project term, and since then, several valuable professional education courses have been developed, for example, .BCIT's Whole-Building Life Cycle Assessment Professional Microcredential[87] and CAGBA's courses on low embodied carbon designs and materials.[88]

On the research side, many participants described their research conducted in collaboration with industry and practice, often focused on applied problems such as improving data accuracy, evaluating materials performance, or informing policy. These collaborations help to conduct research that is grounded in real-world challenges, increases the likelihood of results that can be adopted into practice.

PARTNERSHIPS

Over the years, UBC Sustainability Hub's work on embodied carbon emissions in buildings has been done in collaboration with local organizations, including Athena, the City of Vancouver, UBC Campus and Community Planning (C+CP) and ZEBx. These organizations continued as partners of the Pathways project and contributed their expertise and experience to workshop facilitation, pilot projects, technical feedback, and facilitating regional networking.

Athena Sustainable Materials Institute

The Athena is a Canadian non-profit research and public service organization with a focus on life-cycle cost analyses for buildings and products. Their work includes development of LCA methodologies, tools, and datasets to assess and reduce the environmental impact of construction materials and buildings, including GHG emissions.[89]

[84] Carbon Leadership Forum. Embodied Carbon Policy Toolkit. https://carbonleadershipforum.org/clf-policy-toolkit/

[85] Carbon Leadership Forum. Model Embodied Carbon Specifications. https://carbonleadershipforum.org/model-embodied-carbon-specifications/

[86] Carbon Leadership Forum British Columbia (2025). Low-Carbon Material Sourcing Guide. https://clfbritishcolumbia.com/low-carbon-material-sourcing-guide/

[87] BCIT School of Construction and the Environment. Whole-Building Life Cycle Assessment Professional. https://www.bcit.ca/programs/whole-building-life-cycle-assessment-professional-microcredential-part-time-0830cm/.

[88] CAGBC's Low Embodied Carbon Designs and Materials Bundle. https://portal.cagbc.org/ProductDisplay?iProductCode=ODC_CC_LECBUN

[89] Athena Sustainable Materials Institute. https://www.athenasmi.org/

Athena served as a key partner in the Pathways project. Staff supported engagement with government and industry, moderated workshop sessions and provided technical feedback on pilot projects, in addition to furthering the development of the wbLCA tools and databases. They played a key role in connecting the Pathways project team with relevant national initiatives at the NRC and Treasury Board, and helped identify key challenges and potential solutions related to national embodied carbon policies and the state of the LCA industry in the building sector across Canada.

City of Vancouver

The City of Vancouver[90] is at the forefront of developing municipal embodied carbon emissions reduction policies and targets; while these policies are primarily focused on the City's own context, they are ground-breaking and increasingly being referenced by other local and national jurisdictions and governments to inform their polices and guides. City of Vancouver staff participated in workshops and connected the Pathways project team with others in local government. The insights from their experience developing and implementing municipal policy, the challenges they faced, and their expert feedback were particularly helpful to the Pathways project team in shaping the early engagement and workshops.

UBC Campus and Community Planning (C+CP)

C+CP is UBC's planning and development office. Staff oversee the creation of plans and policies that shape the campuses[91] and set ambitious targets for net-zero campuses, including embodied carbon emissions reductions and low-carbon construction projects. Like the City of Vancouver, C+CP staff provided the Pathways project with technical insights into policy development and implementation, with the added perspective of a long-term institutional and residential building owner and operator.

Staff participated in workshops and engagement with local industry and governments, and provided access to a feasibility study on a new UBC Vancouver campus building that was used as a test case to explore theoretical design scenarios and wbLCAs to reduce embodied carbon emissions in alignment with UBC's stringent reduction targets (e.g., 50% reduction for institutional buildings by 2030).

Zero Emissions Innovation Centre

The Zero Emissions Innovation Centre (ZEIC)[92] was established through a federal endowment from the Government of Canada and the Federation of Canadian Municipalities to enable zero-carbon communities and economies. It now includes local programs, such as Zero Emissions Building Exchange (ZEBx) and the BC chapter of the Carbon Leadership Forum (CLF BC).[93]

Staff from ZEBx and CLF served as workshop moderators and supported the Pathways project team with knowledge mobilization and connections with local governments and regional practitioners. The primary mechanism for these connections was the Embodied Emissions Peer Network (EEPN)[94]—an existing forum developed in collaboration with the BC Community Energy Association (CEA)[95] for local government staff to share, learn, and collaborate on policy and program innovations to reduce embodied carbon emissions and to coordinate with the province on building decarbonization. The Pathways project used EEPN to run a workshop with local government staff, recruit municipal partners for pilot projects, and solicit input and communicate learning from the Pathways project activities. Working with ZEIC and CEA staff, the Pathways project team also performed an assessment of the EEPN to explore its potential as a replicable mechanism for supporting policy development, understand its strength and challenges, and identify opportunities to strengthen the network.

[90] City of Vancouver. https://vancouver.ca/

[91] UBC Campus and Community Planning. https://planning.ubc.ca/

[92] Zero Emissions Innovation Centre. https://zeic.ca/

[93] Carbon Leadership Forum British Columbia. https://clfbritishcolumbia.com/

[94] Embodied Emissions Peer Network. https://clfbritishcolumbia.com/embodied-emissions-peer-network/

[95] Community Energy Association. https://www.communityenergy.ca/

WORKSHOPS

Workshops helped to further discussions about the opportunities for and challenges of advancing embodied carbon emissions reductions in the building sector. These workshops built on one another and engaged representatives from government, industry, non-profits, and academia.

Climate Leadership Symposium-Pathways to Net-zero Embodied Carbon in Buildings Working Session

Date: October 2023 (in person)

Participants: Staff from local government and public sector organizations across British Columbia.

Objective: To understand the opportunities and challenges of reducing embodied carbon emissions in buildings within local governments and public organizations.

Structure: The Pathways project team was invited by the Province of BC to run a working session that took place during the Climate Leadership Symposium.[96] The symposium was hosted by the BC Government and the Ministry of Environment and Climate Change Strategy, in partnership with the City of Kamloops and Thompson River University. During the working session, participants worked in groups to discuss the primary challenges and immediate strategies most relevant to reducing embodied carbon emissions.

Learnings and Outcomes: Participants highlighted the lack of awareness and understanding of embodied carbon accounting and practices, and the lack of standardized, credible emissions data for materials as key challenges. They also noted limited supply and high initial costs of low-carbon materials, risks associated with the adoption and scaling up of new materials, and the need for financial incentives to support this transition. To address these challenges, participants suggested raising awareness and improving education, developing more strict regulations, expanding the use of emissions monitoring and evaluation tools, and ensuring the supply of low-carbon materials.

Additionally, the participants recommended several private and public organizations working in British Columbia that should be invited to participate in the Pathways project.

Challenge-to-Solution Workshop Series[97]

Date: November 10, November 15, November 21, November 29, December 5, 2023 (Zoom)

Participants: Federal, provincial, and municipal staff, industry professionals, academics, and community advocates.

Objective: To explore the current challenges of implementing embodied carbon actions and policies in BC and identify potential short and long-term solutions. The overarching challenges were framed at the product-scale (the availability of data and access to low-carbon building products), the building-scale (conducting whole building carbon emission assessments and the integration of carbon assessment tools into the building design, delivery process, and workflow) and the policy-scale (developing and implementing policies and regulations to mainstream low embodied carbon products and buildings.

Workshop Series Structure: The Pathways project included a five-part virtual workshop series, held over Zoom, and designed to explore key challenges and solutions related to integrating embodied carbon in the building sector and policy. The series was built on earlier consultations with experts from government, industry, non-profits, and academia, and was structured around three central themes:

1. Challenges with low-carbon products and product data challenges,
2. Challenges with building-scale data and integrating carbon assessment tools into building workflows,
3. Challenges with policy and regulations.

The first three workshops were each dedicated to identifying challenges within one of the core themes above. These sessions brought together participants to surface practical barriers and share on-the-ground experiences. The fourth workshop built on these discussions to identify solutions for addressing data-related challenges at the product and building scale. The fifth workshop explored how to adapt and implement successful embodied carbon policies across different government levels.

[96] Government of B.C. Annual Public Sector Climate Leadership Symposium. https://www2.gov.bc.ca/gov/content/environment/climate-change/public-sector/resources#symposium:~:text=offset%20portfolio.-,Annual%20Public%20Sector%20Climate%20Leadership%20Symposium,-A%20wide%20range

[97] UBC Sustainability Hub (2024). Pathways to Net-Zero Embodied Carbon in Buildings: Barriers and Solutions to Effective Policies and Actions. Challenge-to-Solution Workshop Series Report. https://livinglabs.ubc.ca/sites/default/files/2025-05/UBC-Pathways_Challenge-to-solution_UBCWorkshopReport_EN_1.pdf

Learnings and Outcomes: The participants emphasized the challenges associated with finding reliable data, that current tools did not match real-world requirements, and fragmented regulations, which forced them to adapt and modify their practices frequently. As solutions, they recommended creating an effective embodied carbon policy ecosystem at the national level; increasing access to comparable and consistent databases and LCA tools that are user-friendly and provide transparent and up-to-date product data; and incentivizing low-carbon materials and low-carbon building development. Additionally, they recommended focusing on training and education to foster embodied carbon expertise in the building industry and with policymakers, and to test pathways to net-zero embodied carbon in buildings through government and public projects to showcase best practices and explore the effectiveness of different regulatory strategies.

Challenge-to-Implementation Workshop[98]

Date: July 18, 2024 (Zoom)

Participants: Representatives from cities with active or developing embodied carbon emission reduction policies. These include the City of Vancouver, City of Nelson, UBC Campus and Community Planning, City of Victoria, District of Squamish, District of North Vancouver, and City of Port Moody as well as staff from the ZEIC.

Objectives:

1. Review Policies: Gather the latest information on BC municipal policies for measuring, reporting, and reducing embodied carbon in construction, including current and upcoming requirements.
2. Identify Challenges and Successes: Understand challenges and successes in implementing embodied carbon emissions reduction policies, as well as lessons learned.
3. Explore Solutions: Discuss solutions to key challenges, identify support and resources needed by local government staff, and develop strategies for effective implementation in other municipalities across BC.

Structure: Before the workshop, the participants shared information on major policies related to embodied carbon emissions reduction. This information was used to shape the workshop agenda so that the discussion could focus on successful approaches and challenges to implementation. Two activities encouraged the participants to discuss the development of these policies and the successes and challenges in their implementation. Participants then engaged in an in-depth discussion focused on potential solutions and strategies to address these challenges.

Learnings and Outcomes: Participants shared strategies for engaging the public, suppliers and designers on the concept of embodied carbon emissions and their reductions, as well as increasing the use of low-carbon materials and wbLCAs on local projects. They noted the importance of educational materials, guidelines and other resources to help their own policy implementation and the need for feedback from local industry, public and their own governments.

Many municipalities face implementation challenges due to limitations in staff training and capacity, shortages of low-carbon materials and supply chains in Canada, a lack of leadership and support from provincial and federal governments, and hesitation from both the general public and the local building industry to adopt new embodied carbon policy and practices. To address these challenges, they suggested focusing on educating the public, early involvement with the building industry, coordination among municipalities, and identification of opportunities for sharing resources and staff.

Collaborate-to-Innovate Workshop

Date: September 11, 2024 (Zoom)

Participants: The workshop was held during one of the sessions of the Embodied Emissions Peer Network (EEPN) and conducted in collaboration with the CEA and ZEIC. Participants were from local governments, including the City of Vancouver, City of Burnaby, City of Nelson, City of Victoria, District of Squamish, District of West Vancouver, City of Port Moody, City of Vernon, City of Richmond, and City of Kamloops.

Objectives:

1. Identify opportunities: Gather information on current municipal collaborations to do with embodied carbon emissions reductions in BC, and suggest further collaborative opportunities.

[98] UBC Sustainability Hub. (2024). Pathways to Net-Zero Embodied Carbon in Buildings: Barriers and Solutions to Effective Policies and Actions. Challenge-to-Implementation Workshop Report. https://livinglabs.ubc.ca/sites/default/files/2025-06/UBC-Pathways_Challenge-to-implementation_UBCWorkshopReport_EN-2.pdf

2. Develop strategies: Identify early solutions for municipalities to execute identified opportunities, including details regarding stakeholders, resources, and timelines.
3. Identify synergies: Coordinate the developed strategies with each other and identify roles for the provincial and federal governments.

Structure: The workshop was designed as a direct follow-up to the Challenge-to-Implementation workshop held in July. The workshop activity involved participants in a discussion about how municipalities could respond to challenges through various types of collaboration. This was followed by a second activity during which participants outlined possible steps (including identification of possible stakeholders, as well as resource and support requirements) to implement these collaborations.

Learnings and Outcomes: The participants identified specific opportunities for collaboration: (i) creation and sharing of educational materials to expand technical expertise in government and industry, and to help familiarize local communities with embodied carbon concepts, (ii) coordination of circular economy initiatives to create regional markets for reclaimed building materials, and (iii) formation of a centralized advisory group of subject matter experts or experienced policymakers who municipalities could connect with for precedents and advice on policy development and implementation. Collaboration and shared resources could help municipalities address limited staff capacity, streamline policy approaches across the region, and accelerate the adoption of embodied carbon emissions reduction practices.

Embodied Carbon Workshops: Reduce your Embodied Emissions (led by Carbon Wise)

Date: January 31 and June 25, 2024 (in person)

Location: Vancouver, BC

Participants: BC-based planners, developers, builders, mechanical engineers, architects, suppliers, LCA consultants, sustainability analysts and researchers.

Objective: To explore strategies to reduce embodied carbon emissions in construction projects with a focused on large- and small-scale buildings (i.e., Part 3 and Part 9 of the BC Building Code).

Structure: This two-part workshop was organized by Carbon Wise with support from Vancity. The Pathways project team supported the workshop with note-taking and by conducting pre- and post-workshop participant surveys. The workshops included a mix of project and policy presentations, breakout sessions and discussions.

Learnings and Outcomes: Workshop participants identified the challenges of integrating embodied carbon emissions accounting into building design processes; sourcing and using low-carbon materials; insufficient data and documentation for mechanical, electrical and plumbing systems, and refrigerants; the limitations of embodied carbon emission calculations; and discrepancies in EPD data. Participants also highlighted the importance of broader use of low-carbon construction approaches such as by limiting underground parking and reducing the number of parking levels to mitigate the volume of concrete used, prioritizing renovations and reuse of materials over new builds, and sourcing local products to reduce transportation emissions.

Participants pointed out the need for incentives and education as motivational factors to address the challenges and additional work that often result from embodied carbon policies, as well as the importance of having access to reliable EPDs and increased availability of new low-carbon products.

LEARNING HIGHLIGHTS

The conversations, workshops, and engagement opportunities with representatives from different levels of government, the building industry, non-profits, and academia enhanced the general understanding of the current state of policies and practices that target embodied carbon emissions reduction in buildings. The following seven priority areas emerged from these discussions.

Need for engagement and education on embodied carbon emissions: Through the conversations, participants highlighted a general lack of knowledge and awareness as barriers to the development and implementation of effective embodied carbon emissions reduction strategies. While a growing number of educational resources and new training programs in higher education have become available, this educational information is not necessarily required or broadly disseminated to students, mid-career policymakers or industry professionals. Relatedly, there's both a need and an opportunity for greater engagement on new policies and practices with the general public, policymakers at all levels of government, and the building industry.

Concerns about the capacity required for change: The development of new embodied carbon emissions targets and reporting requirements for building projects requires additional expertise for government staff as well as project teams. While larger municipalities such as the City of Vancouver and the City of Toronto have been able to develop their own regulatory requirements and approval processes, many smaller municipalities lack the authority and the capacity to replicate these approaches. Even at the provincial level, staff are working on multiple mandates and priorities with limited capacity to expand their scope of work.

Importance of funding and financial incentives: Funding and financial incentives are a needed element to facilitate the transition to low-carbon in the building industry. This support could manifest in many ways, including subsidies or incentives to use low-carbon materials and reduce embodied carbon emissions at the building scale; and publicly funded pilot projects to showcase the feasibility and benefits of these approaches. Support should also extend to funding research, development and commercialization of new low-carbon building materials, and the expansion of low-carbon product supply chains in Canada.

Challenges with emissions data: One of the primary challenges with embodied carbon accounting is the lack of consistent, accurate and standardize emissions data. Currently, emissions data comes from product-specific or industry-average EPDs and from third party databases. The lack of national standards or requirements make it challenging to compare or consistently evaluate emissions reduction potentials. Similarly, while there are a number of LCA and carbon accounting tools, there are notable differences in their calculations and emissions data sources, making design and procurement decisions and benchmarking more challenging.

Low-carbon material supply chain: Participants noted the limited availability of low-carbon building materials and products in the Canadian market. Internationally sourced products often have greater GHG emissions from transportation and manufacturing that can be harder to document or verify. There is an opportunity for Canada to develop internal and export markets for low-carbon products through increased research and development, and expansion of manufacturing and national supply chains.

Low-carbon design strategies: Participants also noted that procurement and use of low-carbon products are one strategy to reduce the embodied carbon emissions of buildings. Other opportunities include approaches that favour renovation of existing buildings rather than new construction projects, increasing the opportunities to reclaim and reuse material from deconstructed buildings, electrification of construction equipment and sites, and reducing the footprint of carbon-intensive structures such as by eliminating or minimizing underground parkades.

Regional policy alignment and intergovernmental collaboration: Significant embodied carbon emissions policy work is taking place in BC at the municipal level in the absence of national or provincial regulation. Municipal approaches reflect the needs of the specific community. Greater collaboration and knowledge sharing can help municipalities learn from each other, draw on common resources and align policies regionally. Participants also emphasized the importance of local, provincial and national collaboration, recognizing that each level of government has a different capacity and authority to advance policies to reduce embodied carbon emissions in buildings.

SECTION 4: SUSTAINABILITY SCHOLARS MUNICIPAL PROJECTS

SUSTAINABILITY SCHOLARS PROGRAM

The UBC Sustainability Scholars Program is an innovative paid internship program that matches UBC graduate students with on and off-campus sustainability partners to work on applied research projects that support the advancement of sustainability and climate action. The program offers students the chance to gain practical experience while addressing real-world challenges and providing valuable insights, research, and innovative solutions that can be implemented to drive sustainability across the region.

The Pathways project supported a cohort of Sustainability Scholars in summer 2024 to work with municipalities in British Columbia to address embodied carbon emissions policies and practices. The municipal partners were recruited through the Embodied Emissions Peer Network (EEPN) and other local contacts, and included staff in the process of developing embodied carbon emissions strategies and approaches for their own community. Each city partner scoped their own Sustainability Scholars project to inform specific gaps in policy and implementation relevant to their municipality's unique context.

A more detailed description of the UBC Sustainability Scholars Program is available on the program website.[99] The reports produced by Sustainability Scholars can be viewed in the program's project library.[100]

Scholars Project Descriptions

In 2024, between May 1 and August 31, five UBC Sustainability Scholars undertook embodied carbon-related research projects for the City of Kamloops, City of Nelson, City of Richmond, City of Victoria, and District of Squamish. The following is a summary of their work.

City of Kamloops: Contractor Toolkit for New Homes

City Partner: Community Energy Specialist, City of Kamloops

Scholar: David Owolabi, PhD candidate in the Department of Wood Science, Faculty of Forestry

Project report: Research to Develop a Contractor Toolkit to Reduce Embodied Carbon in New Home Construction[101]

The project with the City of Kamloops provided background information to inform a toolkit for general contractors, outlining opportunities to reduce embodied carbon emissions in single-family residential construction projects. The Scholar first conducted a review of literature and case studies addressing embodied carbon emissions' reductions in construction projects located in jurisdictions of similar size to the City of Kamloops. Then, he surveyed and interviewed designers, material suppliers, tradespeople, and energy advisors to assess their familiarity with embodied carbon emission concepts.

The results showed that local industry was interested in shifting to low embodied carbon products for some materials (such as insulation, cladding, and interior surfaces), but there remained a strong preference for carbon-intensive cement due to challenges associated with the dry climate. To reduce concrete use, recommendations included that industry integrates building design into the local landscape; incorporates radiant heating and cooling systems; and refer to the CLF Low-Carbon Material Sourcing Guide.[102] The Scholar recommended that policymakers adopt a phased approach to the following policy initiatives: creating educational campaigns to address concerns around costs, hosting workshops on design strategies, developing voluntary sustainability checklists for developers, and offering permit fee rebates for projects that met reduction targets.

This project is informing the City of Kamloops's Official Community Plan update of 2025.[103] Moreover, the city has shared the findings of the project with a few from the industry and is at the final stages of developing a two-page toolkit for broader distribution.

[99] UBC Sustainability Scholars Program. https://sustain.ubc.ca/teaching-applied-learning/ubc-sustainability-scholars-program

[100] UBC Sustainability Scholars Program Project Library. https://sustain.ubc.ca/programs/sustainability-scholars-program/project-library

[101] Owolabi, D. (2024). Research to develop a contractor toolkit to reduce embodied carbon in new home construction. https://sustain.ubc.ca/about/resources/research-develop-contractor-toolkit-reduce-embodied-carbon-new-home-construction

[102] Carbon Leadership Forum British Columbia (2025). Low-Carbon Material Sourcing Guide. https://clfbritishcolumbia.com/low-carbon-material-sourcing-guide/

[103] City of Kamloops. KAMPLAN: Updating Kamloops' Official Community Plan. https://letstalk.kamloops.ca/kamplan

City of Nelson: Procurement Guide

City Partner: Low Carbon Building Specialist, City of Nelson

Scholar: Christine Lee, UBC master student in the Department of English Language and Literatures, Faculty of Arts

Project report: Guide to Reducing Embodied Carbon Emissions in Municipal Procurement[104]

The project for the City of Nelson resulted in the development of a guide for municipalities and public sector organizations to reduce embodied carbon emissions in capital-building projects through procurement decisions. The scholar reviewed existing procurement policies and legal frameworks at the City of Nelson; identified and analyzed sustainable procurement policies in 24 Canadian jurisdictions; interviewed municipal policymakers across Canada in charge of procurement; and researched existing sustainable procurement resources, such as purchasing groups and online materials developed by non-profits and government bodies.

The project developed a procurement guide with three sections that outlined steps the City of Nelson could take to create a guide and associated policies, including sustainable procurement strategies, high-impact opportunities, and recommendations for procedures and materials to support project decision-making and reporting.

This project informed the City of Nelson's Official Community Plan's design intent #2.[105] Additionally, the findings from the project were used to help develop a resource called Local Government Guide to Sustainable Procurement: A Lifecycle Approach, which offers a range of options that local governments can use to support and streamline their procurement processes.[106] The project continues to shape policy updates and sustainability integration in the City of Nelson's procurement practices.

City of Richmond: Advancing Circularity

City Partner: Circular Economy Program Manager, City of Richmond

Scholar: Yumna Jilani, UBC Master student in Public Policy and Global Affairs, Faculty of Arts

Project report: Research to Update the Demolition Bylaw for the City of Richmond[107]

This project for the City of Richmond informed an update to the city's demolition bylaw with an emphasis on reducing embodied carbon emissions in the construction industry. The scholar conducted a scan of municipal policies across Canada and prepared a literature review to identify best practices in embodied carbon emissions reductions. They also interviewed municipal staff across British Columbia to learn more about local recycling and salvage bylaws.

The report recommend several actions the City can take, such as setting higher recycling and diversion requirements for construction, renovation, and demolition waste (e.g., diverting 100% of clean wood and 85% of other materials from landfill); including multi-family dwellings and industrial, commercial, and institutional buildings in the next update; developing local reuse hubs to make salvaged materials more easily available to builders; and implementing better data collection and tracking systems to monitor construction material use. The project also highlighted the importance and success of Richmond's industry engagement plan and feedback loops with community members.

This project is informing the City of Richmond's update on its Official Community Plan.

[104] Lee, C. (2024). Guide to Reducing Embodied Carbon Emissions in Municipal Procurement. https://sustain.ubc.ca/about/resources/guide-reducing-embodied-carbon-emissions-municipal-procurement

[105] City of Nelson (2013). City of Nelson Offical Community Plan. https://nelson.civicweb.net/filepro/document/1022/Official%20Community%20Plan%20Bylaw%20No.%203247,%202013%20(Consolidated).pdf

[106] City of Nelson (2025). Local Government Guide to Sustainable Procurement: A Lifecycle Approach. https://www.nelson.ca/DocumentCenter/View/9446/Local-Government-Guide-to-Sustainable-Procurement---A-Lifecycle-Approach?bidId=

[107] Jilani, Y. (2024). Research to update the demolition bylaw for the City of Richmond. https://sustain.ubc.ca/about/resources/research-identify-opportunities-update-demolition-bylaw-city-richmond

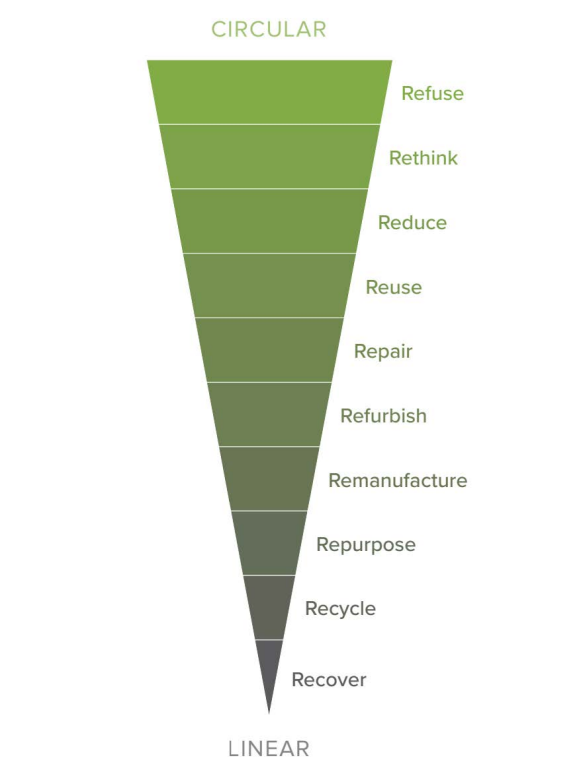

Figure 4: Illustration of a circularity ladder from the City of Richmond's Circular City Strategy.[108]

City of Victoria: Policy Options for New MURBs

City Partner: Senior Energy Specialist, City of Victoria

Scholar: Simarjeet Nagpal, UBC masters student in the School of Community and Regional Planning, Faculty of Applied Science

Project report: Policy Options to Reduce Embodied Carbon in New Multi-Unit Residential Buildings[109]

This project for the City of Victoria identified opportunities for municipal governments to reduce embodied carbon emissions in new multi-unit residential buildings (MURBs) and assessed how these strategies could be adapted for the City of Victoria. The scholar consulted with LCA experts from industry and academia to understand the factors influencing embodied carbon emissions and conducted a scan of municipal policies and practices across North America.

The report highlights the importance of considering embodied carbon emissions early in the housing permit process alongside other factors such as cost, schedule, etc. The recommendations included: implementing embodied carbon reporting requirements in the early phases of development to maximize opportunities for reductions; updating off-street parking policies to discourage building underground parking in order to reduce concrete use; prioritizing carbon-efficient building typologies such as wood-frame construction for mid-rise residential buildings in the 2025 Official Community Plan Update; implementing a corporate low-carbon purchasing policy for the City; setting higher waste diversion thresholds; and adjusting regional landfill tipping fees to encourage deconstruction.

This project informed the Urban Structure Map[110] in the Victoria 2050 Emerging Policy Framework,[111] and the City of Victoria's 10-year Official Community Plan update.[112] Furthermore, the project supported the ongoing update of the Climate Leadership Plan,[113] as well as other policy developments related to embodied carbon currently in progress.

District of Squamish: Updating the Community Action Plan

City Partner: Manager of Sustainability & Climate Change, District of Squamish

Scholar: Juan Luis Rivera Espinosa, UBC masters student in the School of Architecture and Landscape Architecture, Faculty of Applied Science

[108] City of Richmond (2023). Richmond Circular City Strategy. Page 8 Figure 1. The figure illustrates the city's prioritized circular strategies. The ladder represents a hierarchy, with the top actions, such as "Refuse," "Rethink," and "Reduce" being the most ideal and possible approaches for advancing circularity. https://www.richmond.ca/__shared/assets/circularcitystrategy202366556.pdf

[109] Nagpal, S., (2024). Policy Options to Reduce Embodied Carbon in New Multi-Unit Residential Buildings. https://sustain.ubc.ca/about/resources/policy-options-reduce-embodied-carbon-new-multi-unit-residential-buildings

[110] City of Victoria. Downtown Core Area Plan. https://www.victoria.ca/media/file/dcap-urban-structurepdf

[111] City of Victoria (2024). 2050 Emerging Policy Framework for OCP updates. https://engage.victoria.ca/38461/widgets/175596/documents/124956

[112] City of Victoria. One City. One Plan. 10-Year Official Community Plan Update. https://engage.victoria.ca/ocp

[113] City Of Victoria (2018). Climate Leadership Plan. Strategies and Actions for A Prosperous, Low Carbon Future. https://www.victoria.ca/media/file/climate-leadership-plan

Project report: Research to Inform Embodied Carbon Requirements in the District of Squamish's Community Climate Action Plan[114]

The project for the District of Squamish investigated the best approaches to integrate embodied carbon emissions reductions into the next iteration of the District of Squamish's Community Climate Action Plan. The scholar reviewed Squamish's 2020 Community Climate Action Plan and internal documents, as well as 18 other climate action plans to identify measures of success and opportunities to incorporate Scope 3 emissions into the plan's existing structure. Scope 3 emissions are indirect GHG emissions from upstream and downstream activities over the value chain of businesses or organizations.

Based on this research, the scholar's report recommended integrating Scope 3 considerations and metrics throughout all the Community Climate Action Plan's existing priority areas ("Big Moves"), rather than creating any additional categories. Specific recommendations included integrating a Circularity Index into the existing Circular Economy Roadmap to better illustrate and understand materials flows throughout the region, developing specific key performance indicators for each Scope 3 strategy listed in the action plan, and drawing on existing emissions data and estimates from local government and Metro Vancouver guides (e.g., Community Energy Association (CEA)'s Local Government Guide[115]) instead of creating a city-specific consumption-based emissions inventory.

The report also suggests the following three guiding strategies when drafting policy for the new Community Climate Action Plan: avoid the assignment of embodied carbon to only specific sectors; employ systems-thinking; and invest in capacity-building and education for all stakeholders, including vulnerable populations.

This project informed the language in the District of Squamish's Community Climate Action Plan Update[116] in 2024, and expanded its scope to consider estimates of embodied carbon emissions in the plan. It also introduced a range of activities and strategies that reduce embodied emissions through new construction, retrofits, and the community food and products waste streams, as well as those that create a circular economy in Squamish.

[114] Espinosa, J. L. R., (2024). Research to inform embodied carbon requirements in the District of Squamish's Community Climate Action Plan. https://sustain.ubc.ca/about/resources/research-inform-embodied-carbon-requirements-district-squamishs-community-climate

[115] Community Energy Association (2022). Local Government Guide - Policies, Programs, and Incentives to reduce Embodied Emissions in the Built Environment. https://docs.communityenergy.ca/wp-content/uploads/Embodied-Emissions-Guide_Final.pdf

[116] District of Squamish. Community Climate Action Plan Update. https://letstalksquamish.ca/ccap-update

HIGHLIGHT OF LEARNINGS FROM THE SUSTAINABILITY SCHOLARS PROJECTS

Following the completion of the Scholars projects, the Pathways project team undertook a detailed review of the final reports to better understand the common themes, challenges, and approaches taken by each municipality and gain insights into the lessons and best practices that could be shared across the region.

A summary of the five Embodied Carbon Sustainability Scholars projects can be found in the report: Advancing Embodied Carbon Knowledge and Policy in Municipalities: Research Findings of UBC Sustainability Scholars published in December 2024.[117] Highlights of the learnings are below:

Benchmarking methods, data collection, and mapping: Local government or property holders can create simple mechanisms to gather information on local buildings and materials. For example, checklists included in building permit applications can solicit information regarding sourcing, manufacturing, transportation, packaging, and disposal of construction materials. This data can be aggregated to inform and set life-cycle assessment benchmark targets to lower embodied carbon emissions. However, the tools and efforts to collect and manage this information can have financial implications for both the project and the municipality.

Financial incentives: Policymakers can offer incentives such as rebates on permit fees for new construction, retrofits, and demolition projects that have shown reductions in embodied carbon emissions. These incentives can be tailored to specific communities and determined based on the amount of locally sourced or reused materials, use of low-carbon materials, use of LCAs in design and purchasing decisions, waste diversion percentages, and other choices.

Low-carbon materials: Municipal staff can provide information to help increase awareness and encourage local use of low-carbon materials. Staff can help to share EPDs for products available locally and resources such as the City of Nelson's Material Carbon Emissions Guide with developers and builders to inform material choices. These resources and associated engagement can help local communities work toward low-carbon purchasing policies, such as requirements for recycled content or shadow pricing for carbon emissions on projects as part of costing, scheduling, and other considerations.

Circular economy: Municipalities are in a position to enforce minimum recycling requirements to reduce landfill disposals and encourage innovation to expand the disassembly of buildings and reuse of materials on local projects. The circular economy policy and actions are more likely to result in reduced embodied carbon emissions in buildings. Related, local collaborations on developing and maintaining a circularity index or asset map can inform local or regional implementation of circular economy practices.

Public engagement: Engagement and educational activities, such as community workshops, question and answer sessions, and low-carbon material trade shows can help to build public awareness and engagement with local industry, and provide feedback on the effectiveness of local policies. These also help community members, industry, and government staff develop connections, and share knowledge and experiences, which is particularly helpful for low carbon suppliers and builders to attract more business.

Regional policy alignment: The lack of national or provincial regulations or guidelines on embodied carbon emissions was a common issue across municipalities. It has resulted in fragmented local efforts to reduce embodied carbon, which can cause confusion for regional developers and builders. To increase consistency in their regions, some neighboring local governments have started to collaborate with each to exchange knowledge and inform policy updates. These collaborations are often most valuable for cities in close proximity or with similar makeup and challenges. For example, smaller cities with significantly less staff capacity can collaborate to develop educational materials and draft policy language.

[117] UBC Sustainability Hub (2024). Advancing Embodied Carbon Knowledge and Policy in Municipalities. Research Findings of UBC Sustainability Scholars. Pathways to Net-Zero Embodied Carbon project. https://livinglabs.ubc.ca/sites/default/files/2025-05/UBC-Pathways_AdvancingEmbodiedCarbonMunicipalities_EN_1.pdf

SECTION 5: PRACTICE AND TOOL RESEARCH PROJECTS

Through conversations and workshops, policymakers and industry practitioners identified challenges to the successful implementation of embodied carbon policy and practices. One of the most critical challenges was the lack of sufficient tools, methods, and data for measuring and accounting for embodied carbon emissions.

To begin addressing the challenge, test potential solutions, and explore potential strategies, the Pathways project supported a series of short-term research projects aimed at advancing the development of data, tool, and methods. These included an assessment of a peer-education network in collaboration with Zero Emissions Building Exchange (ZEBx) and Community Energy Association (CEA), advancement of whole-building life cycle assessment (wbLCA) tools and supporting software in collaboration with Athena, two research projects exploring different aspects of embodied carbon accounting methods with UBC academic research in Civil Engineering and Wood Science, and a case study of a theoretical feasibility study of 50% embodied carbon emissions in collaboration with UBC Campus and Community Planning.

TOOL RESEARCH PROJECTS

While Canada is moving forward with the development of policy and codes, there are still technical gaps in the handling of emissions data and assessment tools that hinder the successful implementation of these policies and the assurance that the new regulations are delivering real reductions in GHG emissions.

Whole-building LCA is typically practiced within the scope of building design and construction by architects, engineers and other consultants. Conducting wbLCAs require access to tools and data that have not traditionally been part of building design, which has led to the creation of simplified tools for the building industry. However, a lack of wbLCA standards and Canadian data means that there is a high degree of assumptions and variability in these methodologies. This lack of consistency can lead to differences in embodied carbon calculations, making it challenging to compare results across projects, assess the true environmental impact of materials, and develop reliable benchmarks for policy and industry adoption.

Under the Pathways project, three research projects were conducted to address some of these challenges with wbLCA tools.

The research projects included:

1. the development of a free web-based wbLCA tool by Athena to support embodied carbon policy,
2. a probabilistic framework for simplified LCA to improve early-stage decision-making, and
3. an investigation into the gaps and challenges of using Building Information Modeling (BIM) for embodied carbon emissions accounting. Each of these projects provided insights into the current limitations of existing tools and proposed solutions to enhance the integration of LCA in sustainable construction practices.

Athena: A Free Web-Based Tool for wbLCA

Project: Advanced whole-building LCA software to support embodied carbon policy

Researcher: Athena

Objective: Develop a web-based wbLCA tool to improve embodied carbon assessments, support policies, enhance accessibility, and enable real-world testing for net-zero strategies.

Findings: The pilot project identified critical gaps in Canada's embodied carbon policy ecosystem and developed a web-based wbLCA tool that enhances transparency, consistency and policy alignment, with public release and further testing planned for 2025.

Organization Description and Connection to Embodied Carbon: The Athena Sustainable Materials Institute[118] is a Canadian non-profit specializing in LCA for construction materials and buildings. As a leader in LCA research and advocacy for over 25 years, Athena develops methodologies, tools, and datasets to support net-zero embodied carbon strategies. Athena operates several software tools and databases, allowing construction industry professionals to compare alternate design scenarios and incorporate environmental considerations beginning at the conceptual stage of a project. For example, the Impact Estimator for Buildings is a widely used LCA tool that evaluates the environmental footprint of different material choices and core-and-shell system options.

[118] Athena Sustainable Materials Institute. https://www.athenasmi.org/

This tool provides a cradle-to-grave life cycle inventory (LCI) profile for a whole building.

Athena was a key partner in the Pathways project and was actively involved in the planning and running of the workshops, as well as connecting with a variety of experts working in LCA and aligning directions with national initiatives and efforts. Athena staff also provided insights and guidance to the research and pilot projects.

Project Description and Rationale: While Canada is starting to move forward in developing embodied carbon policies, there are still technical gaps in the tools and databases, as well as a lack coordinated efforts and clear implementation methodologies. Specifically, the push for embodied carbon emissions reduction is hindered by difficulties in validating actual carbon savings, managing uncertainty in wbLCA results, and ensuring access to accurate data for policymaking and for conducting wbLCAs. Additionally, the limited availability of free, policy-compliant tools creates barriers for both designers and policymakers in implementing embodied carbon emissions reduction strategies.

Athena has been developing an updated software tool for wbLCA, it is more advanced than their first-generation software and that specifically responds to technical gaps and challenges identified through the Pathways project. This tool is compliant with ISO and EN precedent standards, as well as the new Canadian National Guidelines for Whole-building LCA, published by NRC. As an early adopter, it serves as a pilot test of the National Guidelines. As part of this pilot, Athena is addressing the lack of standards for bill of materials, material taxonomy and nomenclature, benchmarking and comparison, and reporting and creating initial versions of a digitization schema and benchmarking database. The development process followed a structured, multi-phased approach, including expert workshops, pilot integration of national standards, software re-development, and the creation of a benchmarking database based on real-world bills of materials.

Outcomes: Athena developed a beta-version of the new tool, following an internal software testing phase that completed in September 2024, and initiating an invite-only external testing phase in April 2025. This tool was designed to align with the 2022 Canadian National Guidelines for Whole-building LCA,[119] aiming to provide a transparent and consistent approach to embodied carbon assessments and support compliance with emerging policies.

Additionally, the real-world testing was conducted to ensure the tool's effectiveness and applicability in the building sector, contributing to a better understanding of the role of LCA in policy development. In parallel, Athena has been compiling a bill of material database that will be included as a benchmarking library, with process to create custom benchmarking models.

Athena plans to publicly release the new tool in mid-2025, accompanied by a broad engagement strategy to encourage adoption and gather feedback from industry stakeholders as de facto pilot testers. The work described above will be made public through a white paper summarizing key findings, insights, and recommendations to inform future LCA policy and industry adoption, also planned for release in mid- 2025.

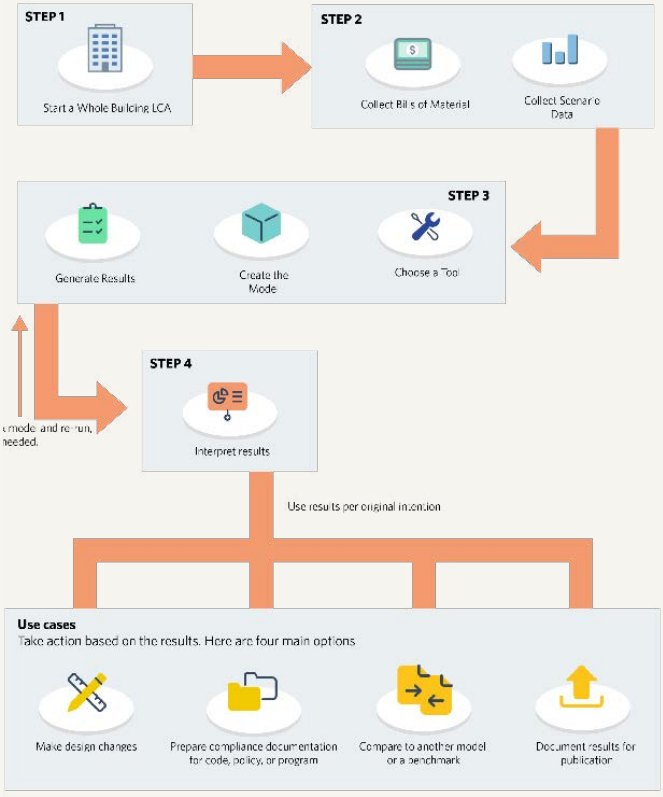

Figure 4: Schematic presentation of wbLCA workflow.[120]

[119] National Research Council Canada (2022). National Guidelines for Whole-uilding Life Cycle Assessment. https://nrc-publications.canada.ca/eng/view/object/?id=f7bd265d-cc3d-4848-a666-8eeb1fbde910

[120] Figure 1 from Summary report: Athena Institute participation in the UBC "Pathways to Net-zero Embodied Carbon in Buildings" (Athena Sustainable Materials Institute, 2025, unpublished report, prepared for UBC Sustainability Hub).

Simplified LCA Research: A probabilistic framework

Project: A Probabilistic Framework to Support the Selection of Low-Embodied Carbon Building Designs

UBC Researcher: Dr. Omar Swei (Civil Engineering), Alex Mannion (Master of Applied Science candidate), and Neng Zhao (Master of Applied Science candidate)

Objective: The project explores a model to streamline the wbLCA process for early-stage building design choices, with a focus on reducing uncertainty and improving embodied carbon emissions estimation through a Monte Carlo simulation framework.

Findings: The methodology effectively provides timely environmental impact estimates, reduces uncertainty through clustering past project data, and identifies key drivers of uncertainty in wbLCA, which help decision-makers to prioritize data collection for more accurate models in the future.

Relationship and Role in the Pathways Project: Dr. Swei is an Associate Professor in UBC Civil Engineering. Broadly, his work centres on research methods to improve the design and maintenance of infrastructure systems, the economic performance and environmental sustainability of infrastructure assets. Dr. Swei participated in the Pathways project workshops providing technical and research expertise. This research project developed a simplified LCA framework to enable early-stage decision-making regarding embodied carbon, addressing key barriers such as data complexity, high costs, and lack of accessible material data for initial design phases. It translated some of the work Dr. Swei has done with large-scale infrastructure projects into the realm of buildings.

Project Description and Rationale: Traditional wbLCA methods are complex, data-intensive, and often applied too late in the building design process to effectively influence material and design choices. Key challenges include high complexity and cost, limited early-stage material data, and uncertainty in results, which delay decision-making. This research project explored these issues by developing a Python-based probabilistic model that integrates past project data, practitioner feedback, and LCI data to improve material estimates and account for uncertainty.

By modelling a more accessible and efficient LCA process, this research aimed to make it easier for practitioners to consider embodied carbon early in the building design process, and yield more accurate results of the emissions impacts of material selections.

The researchers created a Monte Carlo simulation framework that responds to two common forms of uncertainty in LCAs: the quantity of materials and the associated environmental impact of each material. Monte Carlo simulation is an analytical method to estimate the probability distribution of a set of outputs by randomly sampling the distribution of the model's inputs. To estimate material intensity, the researchers used an approach based on reference class forecasting that commonly used in project management to estimate time and costs, and based on a reference library of past projects. To estimate environmental impacts, the researchers developed materials hierarchies based on building assemblies and used a pedigree matrix approach assess applicability and uncertainty in the materials' associated environmental impact from standard database (in this case, EcoInvent).

Outcomes: The probabilistic model was applied to a simplified case study: a 6-story, 5,500 m^2 residential building, utilizing data from 153 historical projects and running 10,000 Monte Carlo simulations to assess embodied carbon impacts using ReCiPe 2016 software for the life cycle impact assessment (LCIA) and EcoInvent LCI database. Findings showed that the proposed probabilistic method improved accuracy, reducing the expected GWP by nearly 60% for the proposed building design, with concrete identified as the largest source of uncertainty.

The results demonstrated that the model was effective in providing a timely estimate of the environmental impact of the building structure, reduced uncertainty in the estimate and identified key drivers of uncertainty in the wbLCA (information which could help tool and database developers to prioritize areas of future data collection).

Next Steps and Publications: The next phase of the Simplified LCA research will focus on enhancing material intensity data by expanding the material dataset, addressing uncertainties in other life-cycle stages, and incorporating industry feedback to refine the tool for broader practical application. The results of the project will be published as a peer-reviewed journal article in 2025.

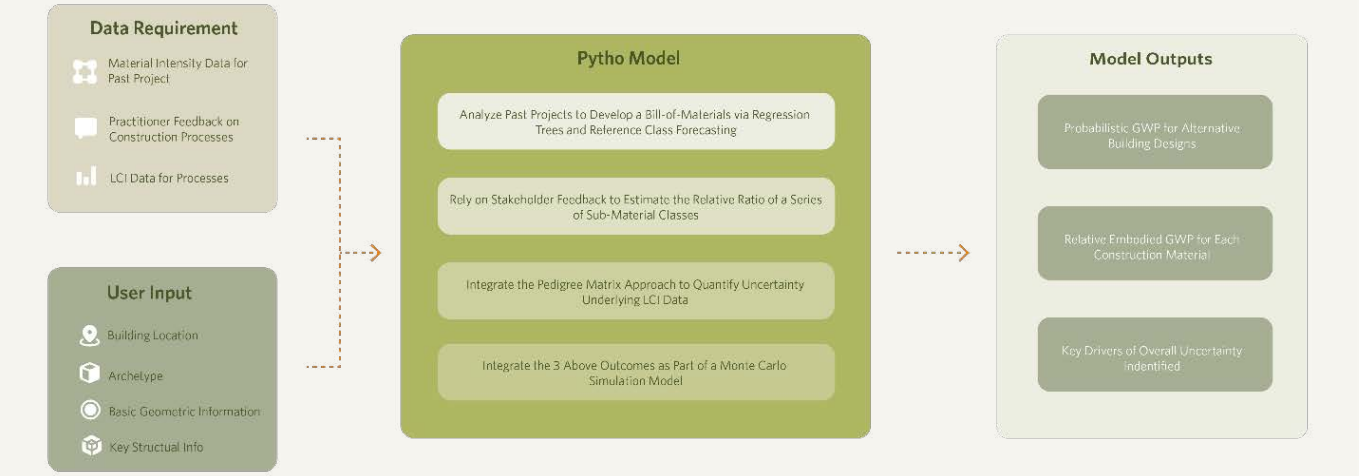

Figure 5: Proposed research methodology of the Simplified LCA research.

Use Building Information Modeling (BIM) for Embodied Carbon Accounting[121]

Project: Identifying Gaps and Challenges of Using BIM for Embodied Carbon Accounting

Researchers: Dr. Tony Yang and Fan Xie, PhD candidate, from the UBC Smart Structures Lab[122] in UBC Civil Engineering; and Dr. Haibo Feng and Rojini Kathiravel, PhD candidate, from the Sustainable Built Environment Lab[123] in UBC Wood Science.

Objective: To understand and assess current practices, specific gaps and challenges faced by building professionals when using BIM to inform embodied carbon accounting through wbLCA. The study focused on identifying systemic issues within BIM-to-LCA workflows and aimed to develop targeted recommendations for improving efficiency, accuracy, and adoption of these practices.

Findings: Several barriers were identified in current BIM-LCA workflows, including issues with interoperability, data quality, and regulatory support. These challenges, along with possible solutions, were further explored through research and stakeholder engagement to develop well-informed recommendations for improving BIM-based embodied carbon assessments.

Relationship and Role in the Pathways Project: Dr. Yang is a professor in structural and earthquake design in UBC Civil Engineering, with research focusing on innovations in performance-based design, simulation and testing, including high performance, carbon-neutral and resilient infrastructure. Dr. Feng is an Assistant Professor in Wood Science, with a research focus on green building, LCA and energy performance, and the integration of innovative technologies into sustainable building design with the consideration of emissions, social and economic impacts. Drs. Yang and Feng, and their student participated in the Pathways project workshops. This research project explores the current barriers and challenges in the use of BIM for embodied carbon accounting in building projects and identify potential solutions. The research was divided into two phases:

1. a literature review and a series of interviews to identify current barriers in BIM-LCA workflows, and
2. a collaborative stakeholder workshop to explore these challenges in depth and worked towards developing practical, cross-sector solutions.

[121] UBC Sustainability Hub (2025). Identifying Gaps and Challenges of Using Building Integrated Modelling (BIM) for Embodied Carbon Accounting. Workshop Report. Pathways to Net-Zero Embodied Carbon Buildings project. https://livinglabs.ubc.ca/sites/default/files/2025-05/UBC-Pathways_Identifying%20Gaps%20and%20Challenges%20of%20Using%20BIM%20for%20Embodied%20Carbon_EN_1.pdf

[122] UBC Smart Structures Lab. https://smartstructures.civil.ubc.ca/

[123] UBC Sustainable Built Environment Lab. https://sbelab.forestry.ubc.ca/

Project Description and Rationale: BIM is a software tool for representing the physical and functional characteristics of a building and can be used to inform decisions and enable collaboration during design, construction and operation. While the use of BIM has been increasing globally and in Canada, it is not a required process or tool for Canadian building projects. BIM can be a useful addition to wbLCA as it can provide easy and relatively accurate material quantities (depending on the level of development of the model). Broadly, there are three types of BIM-integrated wbLCAs: (i) BIM data and LCA data are input into a third-party application to assess environmental impacts; (ii) LCA data is imported into a BIM model via plugins, and (iii) BIM data is imported into LCA software via specialized tools or manual calculations.

This research project assessed the current state of practices in the use of BIM and wbLCA in Canada, including regulations, tools and methods. Researchers then explored the current challenges, successes and gaps of using BIM software to support embodied carbon accounting in the construction industry and identified potential solutions and better integration of carbon assessment tools into BIM software and processes.

Outcomes: The researchers identified several challenges in current BIM and wbLCA practices and workflows that are impeding their use for effective reductions in embodied carbon emissions in buildings. These include inconsistent information and gaps in data on the embodied carbon emissions of building materials, the complexity of integrating LCA data into BIM models, which can require highly specialized knowledge and tools, and issues with interoperability and limitations on compatibility among the available BIM and wbLCA software platforms, making it difficult for practitioners to exchange data and incorporate BIM and LCA into the project workflows in an efficient and meaningful way.

Through the stakeholder workshop, the researchers engaged industry professionals, governmental staff and other subject matter experts to explore the challenges and potential solutions.

Broadly, these included the need to standardize data formats and improve the data exchange protocols between BIM and LCA software, to expand LCA databases and tools through integration with current BIM software platforms (noting that this would require close collaboration between software developers, industry practitioners and researchers), and to develop of building policies that incentivize and support the use of BIM-integrated wbLCAs on projects as well as create more training and education programs for practitioners.

Next Steps and Publications: The next phase of the project will focus on early-stage BIM models and biogenic carbon calculations, with the goal of driving policy improvements, refining practices, and sparking innovation in sustainable construction. The results of this first phase of research will be published as a peer-reviewed journal article in 2025

FEASIBILITY STUDY OF 50% EMBODIED CARBON EMISSION REDUCTIONS [124]

The Pathways project team worked with UBC Campus and Community Planning to develop a case study describing a theoretical feasibility study conducted on one of UBC's new development projects to understand options for reducing a building's embodied carbon emissions by 50%–a target of UBC's Climate Action Plan.

Case Study: Exploring theoretical design options and challenges to achieve 50% reduction in embodied carbon emissions: a case study of UBC Sauder School of Business Expansion Project.

Objective: The case study describes a feasibility study into achieving a 50% reduction in embodied carbon emissions on the Sauder School of Business Expansion project, conducted by UBC Campus and Community Planning and the Sauder Expansion project team.

Findings: The study found that selecting low-carbon materials and products, especially zero-carbon cement, could reduce the estimated embodied carbon emissions by 50% below a baseline; however, cost increases, supply chain limitations, and regulatory constraints posed significant challenges to this approach.

[124] UBC Sustainability Hub (2025). Exploring Theoretical Design Options to Achieve 50% Reduction in Embodied Carbon Emissions: A Case Study of the UBC Sauder School of Business Powerhouse Expansion Project. Pathways to Net-Zero Embodied Carbon Buildings project. https://livinglabs.ubc.ca/sites/default/files/2025-06/UBC-Pathways_CaseStudyofUBCSauderExpansionProject_EN.pdf

Case Study Description: UBC is committed to reducing GHG emissions on its campuses and has set a goal to reach net-zero GHG emissions for its campuses by 2035. A number of policies and action plans support this effort, which includes explicit targets and pathways for reducing embodied carbon emissions from buildings:

- UBC's 2030 Climate Action Plan (CAP2030)[125] set a 2030 target to reduce embodied carbon emissions in new building designs and major renovations by 50% below a UBC 2010 baseline.
- UBC's Whole Building Life Cycle Assessment Guidelines[126] provides guidance for project teams on conducting wbLCAs for UBC building projects on both the Vancouver and Okanagan campuses.

The Sauder School of Business Expansion project will build an 11-story academic building in the center of the Vancouver campus, which is scheduled to be completed in 2027. While the actual building project will only reduce embodied carbon emissions by 10% against a baseline (per the current requirements), UBC Campus and Community Planning worked with the project team to conduct a theoretical exercise to assess the feasibility of reducing the embodied carbon emission to 50% below the baseline.

The project team developed six alternative structural designs, all derived form the 50% Design Development drawings but using different materials combinations, including concrete with zero-carbon cement, steel, mass timber, and BubbleDeck concrete. For each of these structural alternatives, the project team conducted a wbLCA for an industry-average version and a specifically low-carbon version, using emissions data from product Environmental Building Declarations and LCA tool databases. Additionally, the construction manager created a high-level Class D cost estimate (+/- 20%) and schedule estimate for each alternative.

Outcomes: Since the project team based their alternative off of the design of the Sauder Expansion at 50% Design Development, they focused on combinations of materials choices to reduce the embodied carbon emissions, rather than purposefully redesigning the whole building.

This constraint influenced how the structural materials were used and their associated emissions and construction costs. For example, using mass timber products in a concrete building design requires larger beams and more frequent columns, than if the building was designed with a mass timber structure from the beginning – the greater volume of material increases both embodied carbon emissions and costs.

Among the alternatives, the only one to achieve the 50% embodied carbon emissions reduction target was the concrete structure using zero-carbon cement, as well as other low-carbon products, including rebar and windows. The estimated construction costs were about 15% higher, and the construction timeline was longer than the baseline, due to the current higher costs of low-carbon products and the extended curing time of low-carbon cement. The embodied carbon emissions of the low-carbon versions of the steel and BubbleDeck concrete structures were 37%-44% lower than the baseline, illustrating that significant emissions reductions can be achieved through selection of low-carbon materials and product. The low-carbon versions, however, generally had higher construction costs and were limited by the availability of low-carbon products on the market.

[125] University of British Columbia (2021). UBC Vancouver Campus Climate Action Plan 2030. Bold ambition. Collective action. https://planning.ubc.ca/sites/default/files/2021-12/UBCV_CAP2030_FINAL.pdf

[126] University of British Columbia (2023). UBC Whole Building Life Cycle Assessment Guidelines v1.1. Guide to calculating embodied carbon and other environmental impacts in buildings at UBC. UBC Campus and Community Planning. https://planning.ubc.ca/sites/default/files/2023-07/UBC%20WBLCA%20GUIDELINES%20v1.1%20June%2029_0.pdf

Figure 6: Rendering of the UBC Sauder School of Business Powerhouse Expansion project.[127]

ROLE OF A PEER NETWORK IN EDUCATION AND PRACTICE

Project: Assess how the Embodied Emissions Peer Network (EEPN) supports education, coordination, and knowledge exchange among practitioners.

Collaborators: EEPN co-hosts (staff from Community Energy Association (CEA) and Carbon Leadership Forum British Columbia (CLF BC)).

Objectives: Evaluate the effectiveness of EEPN's approach in fostering embodied carbon emissions reduction policy planning, city-to-city collaboration, and complementing policy development, as a potential model for regional or national networks.

Findings: Network members thought that the EEPN was a valuable resource for local governments in BC, offering crucial support in raising awareness and developing strategies for reducing embodied carbon emissions. It provides a model for other provinces and regions in in capacity building and inform opportunities to enhance collaborative policymaking at the local government level

Description: EEPN is a group of local government staff and elected officials across BC in learning, coordinating efforts and sharing experiences related to embodied carbon emissions reductions. Network membership and events are coordinated by staff from CEA and CLF BC, with co-chairs from the local government selected annually. Co-chairs run the specific meetings and facilitate topics for discussions.

This assessment included member surveys and interviews conducted by the co-hosts, serves as a pilot study to evaluate how members perceived the effectiveness of EEPN's structure and approach, and weather the model supported their work in reducing embodied carbon emissions within their communities.

The evaluation revealed that network members believed that the EEPN was a valuable resource for local governments in BC. While members appreciate the network's role in fostering collaboration and sharing resources, challenges such as limited staffing, budget, and a lack of clear direction from higher-tier governments make it difficult for municipalities to prioritize embodied carbon emissions reduction efforts. Recommendations to improve the network include establishing subcommittees—such as one for senior leaders and another for emerging leaders new to the field—creating targeted resources for BC-based local government staff, and fostering greater coordination among local governments and industry partners. Additionally, applying lessons learned from the EEPN to a national network could enhance collaboration and advocacy, promoting consistent policies and clearer communication between different levels of government.

[127] Image courtesy of Acton Ostry + Patkau Architects, Rendered by Mute Images.

HIGHLIGHTS OF LEARNINGS FROM THE RESEARCH AND PILOT PROJECTS

Each of the research and pilot projects addressed a specific topic and generate learning and recommendations within that area. However, there were often common themes of issues, challenges and recommended solutions across multiple projects. Below is a highlight of learnings from across these projects:

Data quality and standardization: Researchers observed that limited accessibility to environmental impact data creates significant challenges for policymakers, industry professionals, and researchers. They emphasized the importance of improving data reliability and availability to support informed decision-making and advance industry practices. Additionally, to address inconsistencies in LCAs and databases, standardized LCA frameworks and metrics must be developed and shared, along with the necessary education and training, as a means to promote consistency across the industry.

Ensure access to policy-compliant wbLCA tools: Researchers noted the absence of a single free, standardized wbLCA tool that fully aligns with both national and international guidelines. This gap presents obstacles for industry professionals striving for compliance with sustainability regulations. Researchers identified the need to develop or adopt a national LCA tool (or tool standard) for Canada, ensuring that it accurately incorporates region-specific materials, construction practices, and environmental conditions to enhance the credibility and applicability of LCA assessments.

Greater alignment of LCA and building-design tools: New software is being developed to advance both building design and construction processes and GHG emissions accounting. Additionally, projects teams and researchers have access to other technical modelling tools that can augment decision-making process. However, the adoption and use of this software tools is not evenly spread across the building industry, there is no standardization or regulatory guidance on the accuracy or functionality of these the tools, and they often require specialized education or training to operate. Specifically, many LCA tools are not aligned with building design tools, processes or decisions.

Policy and regulatory integration: The projects highlighted the lack of embodied carbon considerations in building codes, which hinders progress toward sustainable design and construction. Additionally, inconsistencies in carbon assessments and a general lack of industry confidence in current methodologies highlight the necessity for a central federal agency to coordinate embodied carbon efforts. Researchers emphasized the importance of developing improved assessment tools to standardize practices and enhance regulatory compliance.

Early integration of embodied carbon goals: The projects reinforced that embedding embodied carbon emissions reduction strategies early in a building design process allows for more effective and cost-efficient solutions, even though there is greater uncertainty at that stage. Adding carbon reduction measures later in the design development introduces constraints that limit potential emissions savings and increase project costs. Integrating embodied carbon goals from the beginning and verifying the most effective tools for the specific project enables greater flexibility in material selection, structural design, and procurement strategies, ultimately leading to more impactful reductions.

Market availability of low-carbon materials: The pilot study identified limited availability and high costs of low-carbon materials as key barriers to achieving deep embodied carbon emissions reductions. Researchers noted that sourcing low-carbon materials often requires procurement from distant suppliers, increasing transportation-related emissions. They emphasized that expanding the market supply and standardizing material specifications would help reduce costs and improve feasibility for widespread adoption.

SECTION 6: SUMMARY OF CHALLENGES

Through the conversations and workshops with policymakers, non-profit organizations, industry practitioners, and academics, the Pathways project team gained valuable insights into the challenges of reducing embodied carbon emissions in Canada. These engagements revealed a range of systemic, technical, and institutional barriers that limit progress in both the development of effective policies and the practical application of low-carbon building practices and products. This section presents the key challenges identified across sectors and jurisdictions.

Lack of available, accurate, and comparable emissions data in Canada

Current embodied carbon accounting and LCA practices rely on emissions data for products and materials, typically sourced from either LCI databases or EPDs. However, while there are ISO standards for conducting LCAs, there are no national or industry-wide regulations or standardization for either the development of EPDs or the information included within databases. As a result, data varies widely, including factors such as material origin, electricity mix, manufacturing processes, and transportation. These inconsistencies make it difficult for practitioners to compare or assess the carbon intensity of materials with confidence.

Standardized embodied carbon emissions data is also a fundamental element needed to track and set performance requirements or benchmarks for net-zero policies targeting embodied carbon emissions in buildings. The lack of national or provincial requirements or guidance for building-scale emissions reporting has led to variations across jurisdictions, which in turn creates inconsistencies in building-scale data that limit its usefulness in informing policy targets and industry practices or in assessing progress towards net-zero targets.

Difficulty integrating carbon accounting tools into building design software and workflows

Currently, embodied carbon accounting requires users to conduct LCAs manually or to use dedicated LCA software. These LCA software tools rely on generic product and material databases that are not fully compatible with current building design software (e.g., BIM) or with the typical project workflow and design decision-making.

The software incompatibility forces users to manually adjust or re-enter data, which is time-consuming and prone to error. Furthermore, these generic databases may not reflect specific building designs or local conditions, making the outputs less useful or reliable. As a result, early-phase carbon estimates, which are typically based on conceptual models, rarely align with more detailed LCAs done later in the project lifecycle. These early-phase estimates have a high degree of uncertainty, even while the project decisions at that stage often have the most significant potential to influence a building's embodied carbon emissions. Because the process is cumbersome and the results often unreliable, many practitioners do not see value in conducting early-stage embodied carbon assessments as they do not meaningfully support low-carbon design decision-making.

Limited market availability of low-carbon building products in Canada

Another challenge is the limited supply and demand of low-carbon building products. There are still comparatively few materials available on the market produced via low-carbon supply chains. These options are often more expensive and have longer procurement timelines due to limited production. In Canada, many of these low-carbon options are sourced from international suppliers, adding extra costs and logistical challenges, and complicating cross-boundary emissions ownership. While reclaimed materials tend to have a lower carbon footprint, there are still limits to acceptable reuse, as well as issues with supply and costs. On the demand side, building practitioners tend to stick with familiar, often more carbon-intensive materials, because of the real or perceived risks to costs and schedules, and because there is little incentive to switch.

Lack of coordinated embodied carbon regulations and incentives

In Canada, existing building regulations mainly focus on operational emissions. Regulations for embodied carbon are less mature, as reflected in the absence of embodied carbon in the model national or provincial building codes. Because of this, local municipalities–often the organization responsible for oversight of development and construction–have limited authority or mechanisms to effectively reduce embodied carbon in their building sector. Some exceptions exist, such as the cities of Vancouver and Toronto, but they are limited to large-scale urban governments.

Furthermore, while some groundwork exists, there are still no national or provincial-level requirements for standardized LCAs at either the building or product scale. The lack of requirements for emissions data from products along the supply chains compounds the challenges of conducting LCAs, which rely on material or product information for their assessment. Without these mandates, the quality and scope of LCAs vary widely, resulting in inconsistent emissions data, which makes establishing regulations and meaningful reduction targets even more difficult.

Along with a lack of coordinated regulation is a lack of policy incentives and support for industry change. Financial assistance or other benefits help to encourage new practices, such as LCAs and carbon accounting, offset the costs associated with the creation and use of new products and low-carbon supply chains, and support education and training across industry, helping to stimulate both market demand and supply for low-carbon construction. While some local governments provide incentives within their local industry, the impacts are limited without broader coordination across multiple scales of government.

Complexity of incorporating embodied carbon emissions reduction into the building sector

The building sector is large and complex, with many different actors in industry and government, as well as existing policies and longstanding practices. Reducing the embodied carbon emissions of buildings will necessitate changes in policies and practices, must navigate other issues including building safety, resiliency, construction processes, transportation and manufacturing practices, and energy supply. Even reducing operational emissions often requires strategies that increase the insulating volume of materials in a building and thereby the embodied emissions.

Industry and government decision-makers often lack the knowledge, capacity, or authority to adequately address these challenges and complexities of these, sometimes competing, goals. Current educational pathways often fall short, and there are limited options or encouragement for mid-career professionals to acquire new learning and training as needed. Similarly, there are limited incentives to share strategies and approaches based on case studies and pilot projects. Barriers to collaboration among different government agencies and industry disciplines hinder the development of effective policies or changes to practice.

SECTION 7: CONSIDERATIONS FOR FEDERAL, PROVINCIAL, AND LOCAL GOVERNMENTS

The Pathways team developed these recommendations based on insights gathered from conversations with policymakers and experts, as well as through policy reviews, workshops, and short-term research studies conducted over the two-year course of the project. These recommendations recognize the need to create a comprehensive Canadian policy ecosystem for embodied carbon emissions measurement, reporting, and reductions. Such an ecosystem requires collaboration across all levels of government and the inclusion of industry stakeholders.

2030 Model National Building Code and Governments' Role in Embodied Carbon Regulation

As Canada works toward its 2050 net-zero emissions target, a strategic priority for the 2030 National Model Codes is the development of requirements to address embodied GHG emissions in the building sector.[128] To meet the target of incorporating embodied carbon requirements into the National Model Codes, different levels of government will need to interact and collaborate closely.

The federal government plays a leadership and coordination role in ensuring that the National Model Codes (including the National Building Code of Canada) are developed as comprehensive, non-legally binding frameworks that form the basis for building regulations within provincial and territorial jurisdictions. The Canadian Board for Harmonized Construction Codes (CBHCC)[129]—composed of representatives from provincial, territorial, and federal public services—is a federal government body that oversees the development of Canada's National Model Codes. The CBHCC works through a system of committees to approve the content of the National Model Codes and provides oversight and advice, and develops proposed changes.

The NRC's Codes Canada group[130] publishes the code and provides administrative, financial, and technical support for the overall code development and maintenance process.

Once the Model National Building Codes are finalized, provincial governments adopt or adapt the codes, or use them to supplement current building regulations that govern construction within their jurisdictions. All provinces, including British Columbia, are committed to supporting the harmonization of building codes across Canada to decrease construction costs and lower barriers related to manufacturing, inspection, training, and operations.[131] In 2019, BC signed the Construction Codes Reconciliation Agreement which aims to harmonize building, plumbing, fire, and other construction codes across the country. At the same time, this agreement acknowledges the need for regional flexibility and allows each province to pursue distinct policy goals. In BC, this includes the adoption of code variations such as the BC Energy Step Code and the Zero Carbon Step Code, as well as enhanced accessibility standards, and use of mass timber construction.

At the municipal level, local governments enforce the codes through permitting, inspection, and other compliance mechanisms. Municipalities may also introduce additional requirements to address local conditions or policy goals; however, their requirements must align with or exceed provincial standards. In British Columbia, there are already several active municipalities reporting and reducing embodied carbon emissions from buildings and product levels.

[128] Canadian Board for Harmonized Construction Codes (2025). Phase 1: Embodied GHG Draft Policy Positions. https://cbhcc-cchcc.ca/en/phase-1-embodied-ghg-draft-policy-positions/ Accessed during the Pathways project summary report preparation in June 2025. Note: this consultation page may be updated or removed.

[129] Canadian Board for Harmonized Construction Codes (2023). About the CBHCC. https://cbhcc-cchcc.ca/en/about-the-cbhcc/

[130] Codes Canada. https://nrc.canada.ca/en/certifications-evaluations-standards/codes-canada

[131] Regulatory Reconciliation and Cooperation Table (2023, July 16). Construction Codes Reconciliation Agreement (2019). https://rct-tccr.ca/agreement/construction-codes-reconciliation-agreement-2019/

Current Progress Toward Embodied Carbon Policy in Canada

Several initiatives are underway to support the introduction of embodied carbon emissions into the 2030 National Model Codes cycle. The NRC of Canada is leading a large portion of R&D work to develop effective policy instruments and resources (such as embodied carbon guides, standards, and tools), address technical challenges, and coordinate existing policies and practices.

NRC's Construction Research Centre,[132] has created a platform to decarbonize the construction sector at scale,[133] with several key research initiatives, including:

- Low-carbon built environment challenge program[134] consists of collaborative research projects that support the development of carbon accounting tools, products, datasets, and services for a low-carbon construction.
- The Construction Sector Digitalization and Productivity Challenge program[135] includes collaborative research projects that support modernization and digitalization of construction sector processes and practices, and
- The recently established Centre of Excellence for Construction Life Cycle Assessment (CECLA),[136] which is a specialized R&D hub to provide expertise in LCA for Canadian buildings, infrastructure, and other associated materials.

NRC has also published National Guidelines for Whole-Building Life Cycle Assessment,[137] and the National Whole-building Life Cycle Assessment Practitioner's Guide[138] to support the reporting of embodied carbon emissions from buildings.

Other policies and actions continue to emerge at the federal level. The Canadian Greening Government Strategy[139] now requires that large federally funded new buildings reduce their embodied carbon emissions by 30% starting in 2025.[140] These federal projects serve to demonstrate the feasibility of meeting the reduction target, explore different strategies to achieve it, and test processes for accounting and reporting embodied carbon emissions. Public Services and Procurement Canada (PSPC),[141] in partnership with the Circular Innovation Council (CIC)[142] is developing a Green Products Database[143] to support the procurement of environmentally preferable and clean products by PSPC and its client departments.

At the provincial level, most existing provincial policy adoption are planned for after 2030 when the embodied carbon accounting requirements are integrated into the National Model Building Codes. However, the Province of BC is already contributing expertise and policy perspectives to a federally-led group in this space. In addition, the BC government is reviewing how to approach the integration of the upcoming 2030 National Model Codes requirements into existing provincial code systems.

[132] Construction Research Centre. https://nrc.canada.ca/en/research-development/research-collaboration/research-centres/construction-research-centre

[133] National Research Council Canada (2025). Platform to Decarbonize the Construction Sector at Scale. https://nrc.canada.ca/en/research-development/research-collaboration/platform-decarbonize-construction-sector-scale

[134] National Research Council Canada (2024). Low Carbon Built Environment Challenge program. https://nrc.canada.ca/en/research-development/research-collaboration/programs/low-carbon-built-environment-challenge-program

[135] National Research Council Canada (2024). Construction Sector Digitalization and Productivity Challenge program https://nrc.canada.ca/en/research-development/research-collaboration/programs/construction-digitalization-productivity-challenge-program

[136] National Research Council Canada (2025). The Centre of Excellence for Construction Life Cycle Assessment. https://nrc.canada.ca/en/research-development/research-collaboration/programs/centre-excellence-construction-life-cycle-assessment

[137] National Research Council Canada (2022). National guidelines for whole-building life cycle assessment. https://nrc-publications.canada.ca/eng/view/object/?id=f7bd265d-cc3d-4848-a666-8eeb1fbde910

[138] National Research Council Canada (2024). National Whole-Building Life Cycle Assessment Practitioner's Guide. Guidance for Compliance Reporting of Embodied Carbon in Canadian Building Construction. https://nrc-publications.canada.ca/eng/view/ft/?id=533906ca-65eb-4118-865d-855030d91ef2

[139] Treasury Board of Canada Secretariat (2024, May 29). Greening Government Strategy: A Government of Canada Directive. https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html

[140] The federal strategy is described here: https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/strategy.html#toc3-1

[141] Public Services and Procurement Canada. https://www.canada.ca/en/public-services-procurement.html

[142] Circular Innovation Council. https://circularinnovation.ca/

[143] GPPT. https://canada.ecomedes.com/

The CleanBC Roadmap to 2030[144] outlines BC's commitments to developing a low-carbon building materials strategy, setting embodied carbon reduction targets for public sector buildings by 2030, and creating methods to quantify and analyze embodied carbon in the built environment. Provincial-level efforts to promote low-carbon materials include increasing the use of mass timber and low-carbon construction practices through the Mass Timber Action Plan[145] and investment in innovative wood products through the Wood First program.[146] Additionally, the CleanBC Building Innovation Fund (CBBIF)[147] supports the development of low-carbon building materials, technologies, and systems by BC manufacturers.

Local governments have varying levels of regulatory authority and capacity, which influences their ability to implement embodied carbon emissions reduction policies. Some municipalities with greater policy authority have introduced embodied carbon reporting and reduction requirements or limits (for example Vancouver's Building By-laws[148] and Toronto's Green Standard[149]). However, many local governments are constrained in their regulatory powers and resources. Despite these limitations, many municipalities have demonstrated leadership by piloting innovative policies, often in collaboration with the local building industry.

Caveat: 2025 Economic Outlook

The Pathways to Net-Zero Embodied Carbon in Buildings project took place between April 2023 and June 2025. The recommendations and considerations outlined above are sourced from the conversations, workshops, research, pilot projects, and other engagement conducted as part of this project. Most of this work, including all of the workshop engagement, was completed before the implementation of the US tariffs and other trade issues in 2025, which have led to unprecedented shifts in Canadian and global economies.

However, many of the recommendations also support Canada's economic development, including growing markets for Canadian products, expanding production, improving cross-Canada trade, and accelerating housing development. Reducing embodied carbon emissions in buildings addresses both climate priorities and economic development priorities, and the learning from the Pathways project informs these combined objectives. Critically, while pursuing these economic aims, Canada must continue to respond to climate change and maintain its progress towards net-zero emissions by 2050.

[144] Government of British Columbia (2021). CleanBC Roadmap to 2030. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

[145] Government of British Columbia (2022). BC's Mass Timber Action Plan. https://www2.gov.bc.ca/assets/gov/business/construction-industry/bc_masstimber_action_plan_2022.pdf

[146] Government of British Columbia (2024). Wood First Initiative. https://www2.gov.bc.ca/gov/content/industry/forestry/supporting-innovation/bio-economy/wood-first-initiative

[147] Government of British Columbia (2023). CleanBC Building Innovation Fund. https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/energy-efficiency-conservation/programs/cleanbc-building-innovation-fund

[148] City of Vancouver (2016). Zero Emissions Building Plan. https://vancouver.ca/green-vancouver/zero-emissions-buildings.aspx#zero-emissions-building-plan

[149] City of Toronto (2021). Toronto Green Standard Version 4. https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/

RECOMMENDED POLICY INTERVENTIONS FOR EACH LEVEL OF GOVERNMENT

This section outlines recommended policy actions for federal, provincial, and local governments. The recommendations draw from the two years of research, engagement and knowledge created through this project. These recommendations aim to support the acceleration and harmonization of policy efforts to address challenges in reducing embodied carbon emissions in Canada. The following subsection provides targeted actions for government levels.

Recommendations for Federal Government

The Canadian federal government has a stated goal to incorporate embodied carbon emissions reduction requirements into the 2030 update of the National Model Building Code. However, implementing changes in building design and construction practices requires a national-level embodied carbon policy ecosystem comprised of coordinated standards, tools, databases, and other policy support mechanisms.

Develop a national standard for wbLCA calculations

To support the consistent and credible measurement of embodied carbon emissions in buildings, the federal government should lead the development of a national standard for calculating and reporting emissions using whole-building life cycle assessment (wbLCA) methodologies. NRC has already published two foundational guides that can be expanded to inform this standard:

- National Guidelines for Whole-building Life Cycle Assessment[150] A general methodology guide for the practice of wbLCA following international standards using ISO and EN precedents. This guide is intended for use by broad and general audiences, such as policymakers, design professionals, and LCA software developers.
- National Whole-building Life Cycle Assessment Practitioner's Guide[151] A detailed technical guide for conducting wbLCAs on large building projects to demonstrate policy compliance with embodied carbon requirements. This guide is intended for use by building practitioners, such as engineers and architects.

A comprehensive unified national wbLCA standard can be based on these existing documents and expanded to include more substantive direction on the processes and information required to conduct wbLCA to assess a building's embodied carbon emissions. Developing the standard would support education and use across the building industry and enable more effective decision-making and future policy development. The two aspects of the standard should include:

1. Methods and guidance on conducting wbLCAs and rules to unify practices across the Canadian building industry. In addition to the technical instruction that already exists in both guides, the standard could include:
    - Expand the current construction classification system and nomenclature to ensure consistent naming protocols for building materials. This, in turn, will ensure consistent emissions data in product databases, thereby improving the comparability and usability of LCA and wbLCA analyses.
    - Standardized requirements for wbLCA reporting and benchmarking. Standardization will help practitioners interpret and compare results, inform decisions, verify the accuracy of the reports, and assess whether the building meets emissions targets.
    - Consistent methods for generating building material lists (Bills of Materials). A standard system for compiling, labelling, and organizing bills of materials supports integration with other design software, as well as improving the comparability and accuracy of results.
2. Requirement for data and the structure of wbLCA inputs. To conduct a wbLCA, three main types of information are needed: a bill of materials outlining the types and quantities of materials in the buildings; scenario data describing how materials are transported, maintained, and disposed of over time; and environmental impact data, including GHG emissions, for each material or process. A national wbLCA standard should clearly define clearly define standards for sources of and the types of data collected and reported to ensure results are consistent, complete, and comparable.

[150] National Research Council Canada (2022). National guidelines for whole-building life cycle assessment. https://nrc-publications.canada.ca/eng/view/ft/?id=f7bd265d-cc3d-4848-a666-8eeb1fbde910

[151] National Research Council Canada (2024). National Whole-Building Life Cycle Assessment Practitioner's Guide. Guidance for Compliance Reporting of Embodied Carbon in Canadian Building Construction. https://nrc-publications.canada.ca/eng/view/ft/?id=533906ca-65eb-4118-865d-855030d91ef2

Create a national database of Life Cycle Inventory data and EPDs

A wbLCA standard should be backed by national databases that provide reliable and up-to-date emissions data and information for use in the Canadian building industry. These databases need to be maintained by trusted organizations and ensure that they contain verified information that is easily accessible to building industry practitioners, manufacturers and policy-makers. A centralized open-access database should include:

- Life Cycle Inventory (LCI) which captures information about material use, energy consumption, and GHG emissions. This includes scenario data on transportation, maintenance, end-of-life, and other stages that is essential for estimating impacts across a building's full life cycle.
- EPDs which provide standardized and third-party verified environmental impact data for building products. This data is key for linking building materials to their associated GHG emissions and other environmental impacts.

Once this database is established, it can serve as an authoritative source of consistent, accurate, and regionally specific energy, materials, and emissions data that can support supply-side and demand-side stakeholders. Federal and national efforts are already underway to collect and develop relevant databases. However, to support the 2030 Model National Building Code update and subsequent provincial Building Code changes, federal government agencies like NRC and PSPC should coordinate to align priorities, avoid duplication, and accelerate progress.

Prepare industry and lower levels of government for embodied carbon policy transition

The federal government should offer targeted financial incentives to support the transition to low-carbon construction. This includes funding programs for manufacturers to develop and scale the production of low-carbon materials, as well as providing financial support for developers, builders, and design professionals to adopt wbLCA tools and practices. These incentives will help reduce up-front costs, encourage innovation, and accelerate market adoption of low-carbon solutions.

In addition, to build capacity across the construction sector and local governments leading the shift toward low-carbon practices, the federal government should invest in education and training programs on embodied carbon emissions. This includes developing technical guidance, preparing online learning resources, providing hands-on training for professionals, municipalities, and permitting authorities, and partnering with educational institutions and professional development organizations. Raising awareness and improving technical skills will help ensure that all stakeholders are prepared to implement and comply with future embodied carbon requirements.

Federal leadership can also lay the groundwork for broader market development for low-carbon construction materials. This can be achieved by updating public procurement policies, supporting demonstration projects, and working with provinces and municipalities to build regional markets. By using public projects to showcase low-carbon innovation, the government can help increase demand and strengthen the supply chain for climate-resilient building materials.

Coordinate cross-sectoral collaboration to support 2030 readiness

As part of a broader effort to prepare for the 2030 National Model Code, the federal government must coordinate more cross-sectoral collaborations with those already working on tools and strategies to reduce embodied carbon emissions. These organizations—in industry, government, non-profits, academia and other sectors—can provide valuable insights, feedback and support for federal initiatives and development of an embodied carbon policy ecosystems. The experience these organisations bring to the table is critical to ensuring the work is practical, technically sound and aligned with the regulatory needs at other levels of government. It will be even more critical in the years following after 2030, as the provinces adopt embodied carbon into their own building codes. Early steps to form such a collaboration appear to be underway; however, to meet the 2030 target this work needs to accelerate for successful, prompt, and timely development and implementation of key components, like the national wbLCA standard, data infrastructure, compliance pathways, and guidance for code adaptation.

Learn from international precedents

An embodied carbon policy ecosystem requires a combination of standards, databases, and tools. While new for Canada, these types of policies and support systems exist in other countries, mostly in Europe. France's INIES[152] and Netherlands' Nationale Milieudatabase[153] are examples of European LCI and EPD databases that can inform the federal government on how such systems are structured and operated. The federal government can accelerate progress by drawing on existing resources and adapting successful models to the Canadian context.

Recommendation for Provincial Government

This section presents recommendations primarily directed to the Government of British Columbia, with relevance to other provinces in Canada. The BC government is in the early stages of preparing for the expected 2030 National Model Building Codes change to include embodied carbon emissions into its provincial building codes. The following section is a list of recommendations largely informed by the lessons learned through the Pathways project over the past two years. It is important to note that these recommendations are intended for combined efforts across different BC ministries and are not department-specific, as intergovernmental collaboration is key to achieving BC-wide progress on embodied carbon emissions reduction.

Connect and align with federal efforts to develop an embodied carbon policy ecosystem.

Prior to the 2030 Model National Building Codes update, the provincial government should engage with the federal government—not only to participate in the development of the new code, but also to help shape the supporting infrastructure, including standardized calculation methods, guidance documents, and national data sources for embodied carbon reporting. These tools are essential to enable consistent and effective implementation of the upcoming code changes. At the same time, BC should begin developing its own implementation pathways for embodied carbon requirements, using federal resources—such as the NRC's wbLCA guides—as a foundation.

Prepare BC local governments and the building industry for embodied carbon emissions regulations

The BC government should begin to implement a combination of procurement guidelines, financial incentives, and support strategies to promote the use of low-carbon products and wbLCA calculation in both public and private development projects. These voluntary initiatives can encourage participation and help prepare the BC government and industry to adopt and implement the embodied carbon emissions regulations. In addition, the province could establish a working group dedicated to reducing embodied carbon emissions in BC, and facilitating collaboration, knowledge sharing, and innovation. This group would bring together key decision-makers and stakeholders from different sectors, including local and provincial government, building industry, manufacturing, financial industry and academia to work together on advancing policies and practices.

Support and scale local embodied carbon initiatives

Several BC municipalities and local governments have already pioneered approaches to reducing embodied carbon emissions in their jurisdictions. Without provincial involvement, however, these efforts may end up being fragmented and create more challenges for the local industry. While the City of Vancouver has developed embodied carbon requirements in the Vancouver Building By-Law (VBBL), most other municipalities are pursuing non-regulatory strategies that are designed to complement future changes to provincial building codes. These approaches, such as establishing development targets in community plans or developing skills and knowledge within the local building industry, can be expanded to help prepare communities and industry across BC. There are also several emerging initiatives, such as developing markets for reclaimed materials and adapting circular economy principles to construction practices. In some cases, these initiatives need to operate at a regional scale, which requires an upper body of government provide guidelines or ensure success.

[152] INIES, the reference environmental and health database for building and RE2020. https://www.inies.fr/en/

[153] The Stichting NMD databases. https://milieudatabase.nl/en/database/

Expand manufacturing and supply chains for low-carbon building materials

With a largely hydro-powered energy grid and expansive natural resources BC is well-positioned to manufacture low-carbon building materials. The provincial government should draw on existing tools, such as the CleanBC Building Innovation Fund (CBBIF),[154] to provide targeted funding to local manufacturers and suppliers of low-carbon materials to support the expansion of a regional supply chain. On the demand side, BC can develop procurement guides that encourage the use of low-carbon products in new construction and major renovations, or consider financial incentives for private sector projects that commit to using certified low-carbon materials as a strategy for growing the low-carbon market. The province can also promote and expand resources such as the Carbon Leadership Forum British Columbia (CLF BC)'s Low-Carbon Material Sourcing Guide,[155] which is regularly updated with the provincially available low-carbon building products.

Use government and publicly funded projects as pilots

Provincial and publicly funded building projects can serve as early adopters and testing grounds for innovative approaches to reducing embodied carbon. These projects provide opportunities to pilot new tools, guidance, and resources, helping to refine and validate elements of the broader embodied carbon policy ecosystem. The project teams assess the tools and then pass the learning on to the policymakers to inform their work. Mandating wbLCAs on public projects can help to spread the adoption of these practices within the regional building industry, developing familiarity and expertise, and create a portfolio of project emissions data that can inform future policy targets or benchmarking. Similarly, government can mandate the use of low-carbon materials through procurement guides can help to build a market for local manufacturing. The province can also pair procurement guidance with reporting requirements, such as those in the federal Standard on Embodied Carbon in Construction,[156] which mandates the disclosure and reduction of embodied carbon in federally owned construction projects furthering the alignment between provincial and national efforts.

Recommendations for Local Government

In Canada, local governments are at the forefront of policy efforts to reduce embodied carbon emissions in buildings. Their close connection to local industries and insight into community-specific needs, opportunities, and challenges position them well to drive effective and locally tailored solutions. Although local governments across Canada have varying levels of regulatory authority and capacity, a growing number of municipalities, particularly in BC, have demonstrated leadership by piloting innovative policies in a wide range of forms. Many of these municipalities participated in the Pathway's project, and the following considerations draw heavily on their experiences.

Integrate embodied carbon considerations into current municipal policies and plans.

Local governments can incorporate embodied carbon emissions into their policies and plans that are either in development or being updated. These can include varied approaches such as broad development goals in land-use plans or overall community plans, incorporation of embodied carbon emissions in their GHG inventories, setting emissions targets for rezoning approvals, and demolition bylaws that reduce construction waste and encourage reuse. Local policies can then be adapted or expanded as needed to address changes in provincial and federal regulatory requirements. Through policy development and implementation, local governments should prioritize education for both the general public and the building industry to familiarize them with the concepts of embodied carbon emissions and the importance of emissions reductions.

Leverage building permitting and approval processes.

Local governments can embed embodied carbon emissions reduction targets and strategies into the building permitting process. For example, they can encourage or require projects to conduct a wbLCA or provide emissions reporting as part of submitting rezoning, development, building or occupancy permits. This information generates localized data for benchmarking building sector emissions and informing future policy.

[154] Government of British Columbia (2023). CleanBC Building Innovation Fund. https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/energy-efficiency-conservation/programs/cleanbc-building-innovation-fund

[155] Carbon Leadership Forum British Columbia (2025). Low-Carbon Material Sourcing Guide. https://clfbritishcolumbia.com/low-carbon-material-sourcing-guide/

[156] Government of Canada (2022, November 14). Archived [2025-03-20] - Standard on Embodied Carbon in Construction. https://www.tbs-sct.canada.ca/pol/doc-eng.aspx?id=32742

Local governments can also incentivize low-carbon design and construction practices by offering accommodations or financial benefits for projects that demonstrate measurable reductions in embodied carbon emissions or that pilot innovative low-carbon strategies. Incentives can also help offset costs and encourage more widespread adoption of new practices.

Use municipal buildings as pilots to model low-carbon practices and policies.

Local governments can lead by example by using city-funded projects as pilots to demonstrate the feasibility and benefits of low-carbon construction, and model approaches for reducing embodied carbon emissions. Local low-carbon procurement requirements can outline strategies for purchasing low-carbon products and influence emissions reductions throughout the supply chain by requiring suppliers and manufacturers to disclose carbon footprint data associated with their products. Local governments can also develop design and purchasing guides that are tailored to local conditions for comparing materials not only by cost and performance, but also according to their carbon impact.

Knowledge sharing Learning and collaboration between local governments and industry.

Local governments face significant challenges due to limited funding for hiring, limited technical expertise and limited capacity of existing staff. To address this, municipalities can explore opportunities for regional collaboration to maximize resources, reduce duplication of efforts and share their knowledge and experiences. This sharing can be through formal networks or working groups that connect best practices, data, and technical expertise, or simply learning from the precedents and resources created by their peers. For example, the City of Nelson's Local Government Guide to Sustainable Procurement: A Lifecycle Approach[157] outlines a range of options and entry points for municipalities to integrate embodied carbon considerations into their purchasing decisions and processes.

No matter the approach, municipalities must also prioritize early engagement with building practitioners through consultation, workshops, or other activities. In addition to gathering input and feedback on their plans and policies, municipalities can also benefit from using resources developed by the industry as references. For example, ZGF's LCA calculator[158] provides suggestions for reducing embodied carbon by adjusting the composition of concrete materials.

[157] City of Nelson (2025). Local Government Guide to Sustainable Procurement: A Lifecycle Approach. https://www.nelson.ca/DocumentCenter/View/9446/Local-Government-Guide-to-Sustainable-Procurement---A-Lifecycle-Approach?bidId=

[158] ZGF LCA Calculator Reduces Concrete's Embodied Carbon. https://www.zgf.com/ideas/2493-lca-calculator-reduces-concrete-s-embodied-carbon

SECTION 8: OTHER PRIORITY AREAS FOR FUTURE STUDY

During the two years of the Pathways project, a number of topics were raised during the conversations, workshops, research project, and knowledge sharing that warrant additional study. These topics are important for the successful development and implementation of the embodied carbon policy and practices, but were unable to be addressed due to the limited timeline of the project. They represent opportunities for future research and engagement.

Embodied carbon education

There is an emerging need to build capacity and knowledge around embodied carbon topics (e.g. terminology and definitions, emissions reduction strategies, software tools and data) within government, building industry, manufacturers and the general public. This is necessary to develop and implement policies and practices that will lead to meaningful reductions in embodied carbon emissions in the building sector. Opportunities for additional study include:

- Engagement strategies and educational materials to increase awareness among the general public, build acceptance of new policies and support for changing building practices.
- Opportunities for training and education among current policymakers and mid-career practitioners who are experienced in their fields but relatively new to the concept of embodied carbon and emissions reductions.
- Development of curriculum and practicum for students and those new to the building industry that incorporates embodied carbon emissions into standard bodies of knowledge.
- Cross-disciplinary knowledge exchange within the building industry to increase understanding of emissions impacts along the supply chains.

Circular economy policy and practices

Throughout the Pathways project conversations and workshops, there was a growing discussion around developing a circular economy for building materials, including reusing materials, prioritizing retrofits, designing buildings for deconstruction, and relocating houses.

While these concepts have long been part of building practice and an aspect of sustainable or green buildings, these current discussions have focused more on developing systems and supply chains to facilitate the exchange of materials with greater ease and within the current economic markets. To develop this circular economy, additional study is needed to support:

- Developing regional markets for reclaimed building materials and methods for valuing and tracking the availability and use of salvaged and reused materials.
- Methods to easily assess the quality of reclaimed materials and their performance against regulatory requirements, as well as how to effectively implement these strategies at scale.
- Decision support for owners considering retrofit and renovation versus new builds, including pilot projects and feasibility studies to illustrate opportunities.
- Integration of circular economy practices within existing policies and ensuring they contribute meaningfully to embodied carbon emissions reductions, as well as other social and environmental impacts.

Relationship between embodied carbon and other policy priorities

Reductions of embodied carbon emissions in building is one part of the pathways to net-zero in Canada, and one aspect of building design and construction. Further study is needed to better understand the intersection of policies targeting the reduction of embodied carbon emissions with other policy areas to identify opportunities for alignment and navigate potential conflicts. These include:

- Reconciliation of significant housing demand and GHG emissions reduction targets, and approaches to scale low-carbon construction practices.
- Understanding how and where embodied carbon policy can reinforce policies related to building resiliency and adaptation, and vice versa.
- Alignment of embodied carbon emissions reduction strategies with operational carbon targets to avoid unintended trade-offs.

Performance of low-carbon materials

Another critical area of study is the performance of new low-carbon materials. For widespread adoption, it's essential to ensure that new low-carbon products perform as well as or better than conventional options in terms of critical characteristics such as fire resistance and life safety. Other performance characteristics, such as acoustic dampening, thermal insulation, and even structural, need to be clearly understood and communicated so that designers and builders can adapt building design and construction processes. Areas of study include:

- Review of existing regulations and the potential applications of emerging low-carbon materials.
- Exploration of performance-based pathways for biogenic or renewable materials to comply with the regulatory requirements and be allowable in certain situations.
- Methods for building trust and familiarity with new materials within the building industry.

Broader engagement with Indigenous communities

While the Pathways project engaged a large number of building industry decision-makers, due to time limitations, it largely focused on building designers, government staff, local non-profits and agencies working in BC. Embodied carbon emissions in buildings are as broad and complex as the building industry itself. Additional engagement is needed with more stakeholders and decision-makers, including product manufacturers along the supply chains, as well as different resource and manufacturing sectors.

However, a critical area of engagement is Indigenous communities, who are an important part of sustainable development and decarbonization efforts and are active in all aspects of building industry, natural resources and manufacturing in Canada. Indigenous leadership, representation, knowledge and practices are critical to achieving Canada's net-zero goals, including reducing embodied emissions in buildings. Engagement on the Pathways project was constrained by the time and scope, and an area of future study should include respectful and community-specific engagement with and leadership by Indigenous communities in different aspects of the building industry and materials supply chains.

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THE UNIVERSITY OF BRITISH COLUMBIA
Sustainability Hub

2260 West Mall
Vancouver BC, V6T 1Z4
sustain.ubc.ca