



# Embodied Carbon Strategies for City of Charlottetown

Theory and Practice of Island Research  
Summer 2023



## Embodied Carbon

### Manufacturing Emissions

(extraction through manufacturing of building product)



# What Is Embodied Carbon?

- Embodied carbon refers to the carbon dioxide (CO<sub>2</sub>) emissions associated with the production, transportation, and disposal of materials used in various sectors, including construction, manufacturing, and transportation.
- While operational carbon emissions (emissions that occur during the use of buildings) receive significant attention, embodied carbon often accounts for a significant portion of the overall carbon footprint. It is estimated that embodied carbon is responsible for nearly 11% of global greenhouse gas emissions.

# Measurement and Assessment Methods for Embodied Carbon

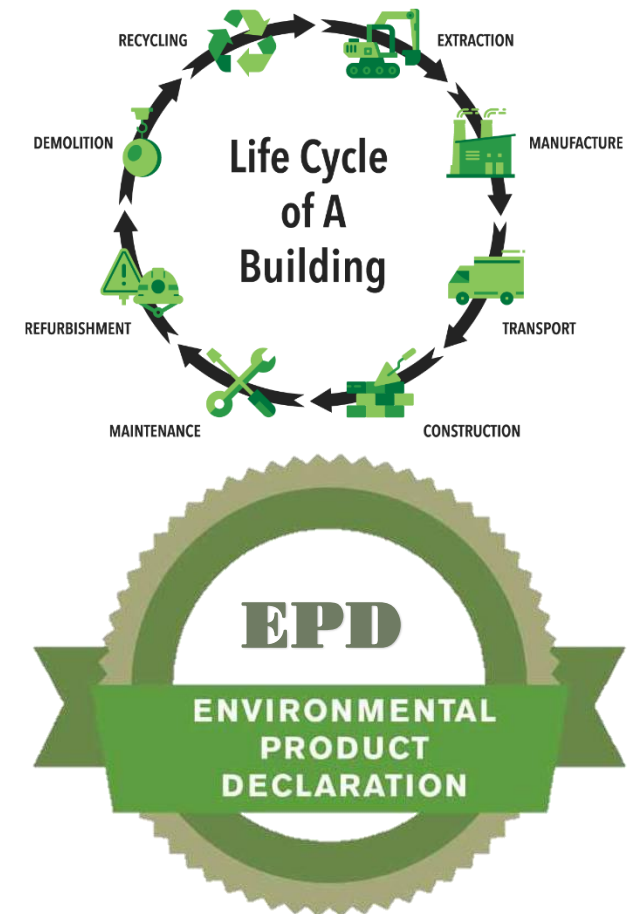
## ✓ Life Cycle Assessment (LCA)

A comprehensive methodology that quantifies the embodied carbon of a product or system throughout its life cycle.

## ✓ Environmental Product Declarations (EPDs)

Standardized information about the environmental performance of products, including embodied carbon, enabling comparisons between different products in terms of their environmental impacts.

**These methods help stakeholders in the construction industry make informed decisions regarding material selection, construction practices, and design strategies to minimize embodied carbon and promote sustainable development.**



## Factors Contributing to Embodied Carbon in the Built Environment

- Material Selection
- Construction Techniques
- Transportation
- Energy Input

## Embodied Carbon Reduction Strategies

- Low-carbon materials
- Material minimization
- Material reuse and recycling
- Local sourcing of materials and components
- Construction strategies



# Literature Review of Embodied Carbon

- Try to draw attention from operating carbon to embodied carbon
- Pay attention to embodied carbon in different scales:
  1. Architecture and Construction Scale (Embodied carbon or Life Cycle Assessment of buildings from design phase to construction)
  1. Urban Design and Urban Planning Scale (including methodologies in decision and policy making, and implementation of strategies)

# International Efforts to Address Embodied Carbon

- United Nations Framework Convention on Climate Change (UNFCCC)
- Intergovernmental Panel on Climate Change (IPCC)
- World Green Building Council (WorldGBC)
- International Energy Agency (IEA)



## Case Study I: Copenhagen, Denmark



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### Targets:

Become Carbon Neutral  
by 2025

Be a leading global  
example of sustainable  
urban development

## Embodied Carbon Reduction Strategies of Copenhagen:

- Promotion of Low-carbon construction materials
- Innovative architectural and engineering solutions
- Collaborative efforts between stakeholders
- Integrated design approach
- Green procurement and public tendering
- Data monitoring and evaluation
- Research and innovation funding



## Case Study II: Vancouver, Canada



## Case Study II :

### Vancouver, Canada

#### Targets:

Achieve 40% reduction in embodied carbon by 2030

Set a goal of zero embodied carbon by 2050

## Embodied Carbon Reduction Strategies of Vancouver:

- Change the Rules: Policy and Regulation
  1. Green Building Policy
  2. Building Codes and Standards
  3. Life Cycle Assessment
- Change the Market: Remove Barriers and Provide Incentives
- Change the Culture: Capacity Building and Industry Transformation
  1. Knowledge Sharing
  2. Education and Awareness Program
- Change the Context: Complimentary Strategies and Actions such as green operations, green economy, and zero waste

# Vancouver's Road Map for Embodied Carbon:

YEAR	ACTION
2020	<ul style="list-style-type: none"> <li>Embodied Carbon Strategy approved by City Council.</li> </ul>
2021	<ul style="list-style-type: none"> <li>City staff begin work to update policies and regulations, provide incentives, build industry capacity, and integrate embodied carbon efforts with other City strategies.</li> </ul>
2021	<ul style="list-style-type: none"> <li>Introduce our first reduction target(s) in updated rezoning policy, to begin reducing embodied emissions in new construction.</li> </ul>
2021/22	<ul style="list-style-type: none"> <li>Rezoning updates come into effect for new rezoning applications.</li> </ul>
2022–2025	<ul style="list-style-type: none"> <li>City staff seek approvals of various actions to support transition to low embodied carbon construction and begin implementation of approved changes.</li> </ul>
2023	<ul style="list-style-type: none"> <li>Possible first changes to the Building By-law to include embodied carbon come into effect, such as material-specific requirements or changes for single-detached homes.</li> </ul>
2025	<ul style="list-style-type: none"> <li>Review and update of Embodied Carbon Strategy for Council.</li> <li>Adopt the targets and other requirements from the 2021/22 rezoning policy, and possibly those from incentive programs, into the code.</li> <li>Increase reduction targets in the rezoning policy to be consistent with the 40% reduction target set by Council.</li> </ul>
2025/26	<ul style="list-style-type: none"> <li>Updated embodied carbon reduction requirements come into effect for new rezoning applications and building permit applications.</li> </ul>
2026–2030	<ul style="list-style-type: none"> <li>City staff seek approvals of further actions to support transition to low embodied carbon construction, and begin implementation of approved changes</li> </ul>
2030	<ul style="list-style-type: none"> <li>Adopt the targets and other requirements from the 2025/26 rezoning policy into the code, consistent with the 40% reduction target set by Council.</li> <li>Introduce new targets in the rezoning policy that go beyond 40%, taking a step toward net zero carbon construction.</li> </ul>

## **Comparison of Vancouver's Approach of Embodied Carbon with Copenhagen**

While both Vancouver and Copenhagen share a commitment to sustainability and reducing embodied carbon, there are differences in their approaches.

- Vancouver's focus is mostly on strategies such as green building policies and LCA
- Copenhagen places significant importance on collaborative efforts and innovation.

Comparing Vancouver and Copenhagen's approach can provide insights for other cities seeking to address embodied carbon and advance their sustainability.





## Conclusion and Recommendations Charlottetown, Canada



# Background of Sustainability and Climate Change research (City of Charlottetown)

**In 2019**, the City of Charlottetown declared climate change an emergency and completed studies such as:

- Climate Risk and Resilience Assessment (2019)
- Community Energy Plan (2019)

**In 2023**, the development of a Climate Action Plan provides strategic direction to support climate change goals. This plan includes nine focus areas including:

Municipal Governance	Adapted Infrastructure	Resilient Food System
Land Use Planning	Sustainable Transportation	Nature and Green Infrastructure
Building and Energy	Community Health	Water and Flooding

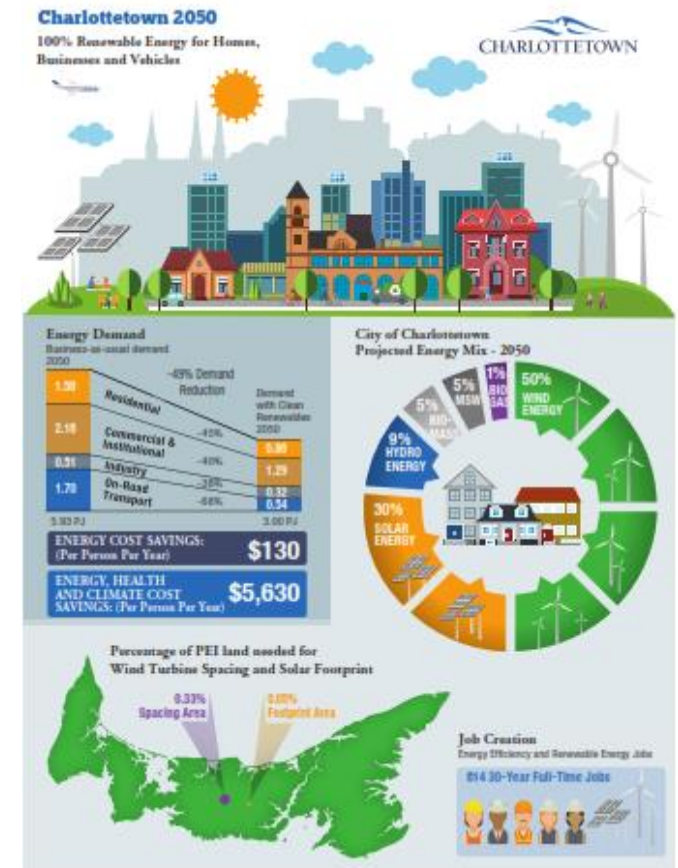
**Embodied Carbon Reduction** is one of the potential enhancement of Climate Action Plan for City of Charlottetown

# Recommendations and Strategies for the City of Charlottetown (Based on Successful Practices of Vancouver and Copenhagen)

## ✓ Set Targets for Embodied Carbon Reduction

Like Vancouver and Copenhagen, the City of Charlottetown should consider a clear target for embodied carbon policies.

Based on **Charlottetown Community Plan**, the Charlottetown's targets for operational carbon is to reduce GHGs in operations to **40% by 2030**, and strive to be **100% carbon neutral by 2050**.



# Recommendations and Strategies for the City of Charlottetown (Based on Successful Practices of Vancouver and Copenhagen)

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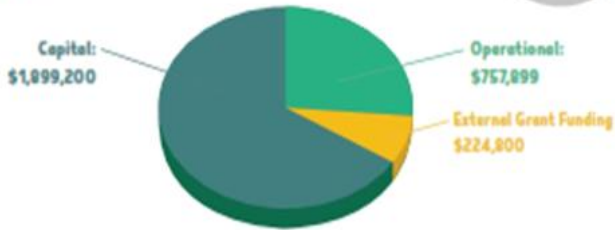
- ✓ **Develop and Implement Green Building Policies**
- ✓ **Incorporate Life Cycle Assessment (LCA) in Decision-making**
- ✓ **Foster Collaboration and Knowledge-sharing**
- ✓ **Support Innovation in Construction Methods**
- ✓ **Engage the Community**
- ✓ **Monitor and Evaluate Progress**
- ✓ **Incentive and Financing Mechanism**
- ✓ **Research and Development Funding**

Based on the **Community Sustainability Plan of City of Charlottetown** in 2010 and its review in 2017, leadership, collaboration to share knowledge , innovation, and action are some strategies to support sustainability plan of this city.

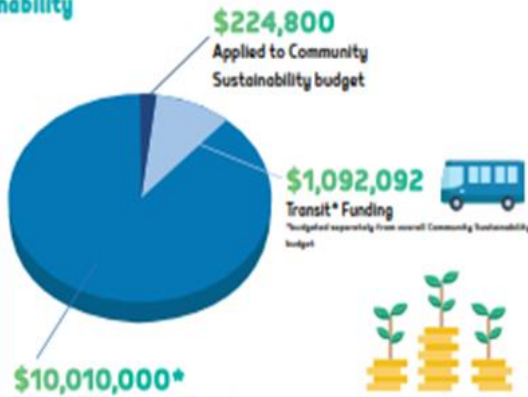


## City of Charlottetown Community Sustainability Budget and Funding Totals

**Total Community Sustainability Budget:**  
**\$2,881,899**



**Total Community Sustainability External Funding:**  
**\$11,326,892**



Thank you to the following funding partners for their contributions:

- Government of PEI
- Intact Public Entities & Intact Financial Corporation
- Federation of Canadian Municipalities
- PEI Alliance for Mental Wellbeing
- Canadian Infrastructure
- PEI Active Transportation

**\$10,010,000\***  
\*Capital base of 0% with a grant to cover 40% of total base amount (PEI Community Efficiency Financing Fund, multi-year funding scheduled in 2027)



## Conclusion

Obviously, embodied carbon reduction strategies needs budget and funding to be implemented successfully, and with drawing insights from the case studies of Vancouver and Copenhagen, City of Charlottetown can create a roadmap towards a low-carbon and environmentally responsible environment, contributing to the global efforts to mitigate climate change and sustainable future.