CELC Knowledge Series:

Applying Circular Economy Strategies to Extend the Life of Existing Buildings

The What, the Why, and the How

Webinar

October 24, 2023 | 9:30am-10:45am PT / 12:30-1:45pm ET

Opening Remarks from CELC

Paul Shorthouse

Managing Director

CIRCULAR ECONOMY LEADERSHIP CANADA

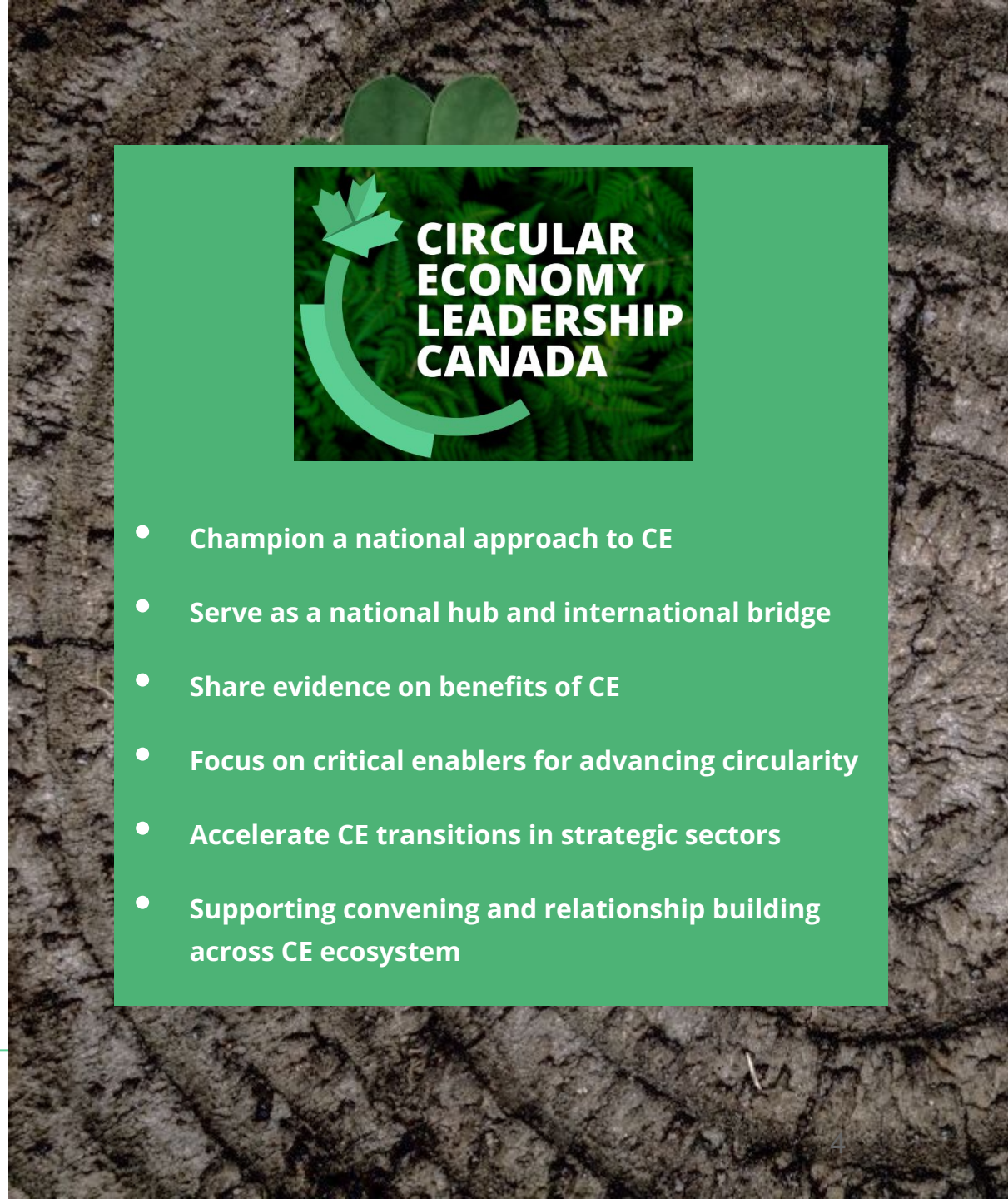
Land Acknowledgement

While we meet today virtually, we would like acknowledge that our participants are joining us today from the traditional and unceded Indigenous lands and territories right across Canada. We would like to thank the Indigenous Peoples for allowing us to live, work, and play on their lands, and for the opportunity to share in their stewardship.

About CELC

Circular Economy Leadership Canada (CELC) is working to connect Canada's circular economy community and serves as a bridge to similar networks around the world.

We provide **thought leadership**, **technical expertise**, and **collaborative platforms** for accelerating systems change and the transition to a low carbon, circular economy in Canada.



- **Champion a national approach to CE**
- **Serve as a national hub and international bridge**
- **Share evidence on benefits of CE**
- **Focus on critical enablers for advancing circularity**
- **Accelerate CE transitions in strategic sectors**
- **Supporting convening and relationship building across CE ecosystem**

Knowledge Series:

Applying Circular Economy Strategies to Extend the Life of Existing Buildings in Canada: The what, the why, and the how

- This webinar shares the outcomes from a 12-month research project with industry and government partners, led by CELC in collaboration with CSA Group.
- Research produced **2 technical reports** (published by CSA Group) exploring the:
    - Business case for applying circular strategies to extend the life of existing buildings (i.e., commercial office)
    - Benefits of applying circular strategies to existing buildings, including climate by preserving embodied carbon

Opening Remarks from CSA Group

Ivica Karas

Strategic Initiatives Manager,
Construction & Infrastructure Standards


CSA GROUP
HOLDING THE FUTURE TO A HIGHER STANDARD
Impact of Standards

CSA Group

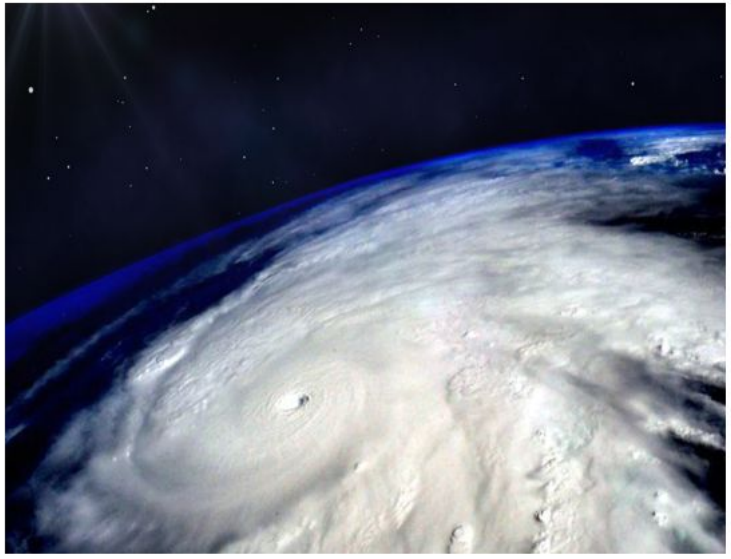



+11,000	+3,000	12	+1,000
Dedicated members	Standards	Areas of focus	Committees

Emerging Areas

Climate Change Adaptation

- Buildings and Infrastructure
- Communities
- Wind, snow and flood resistance



Modular Construction

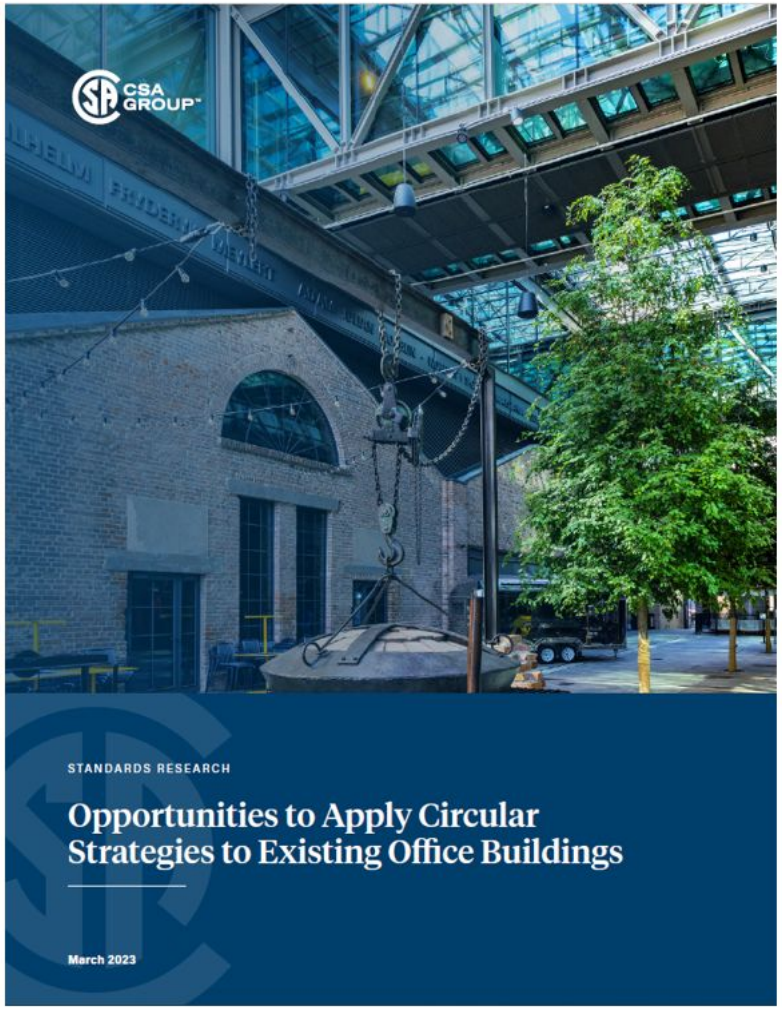
- Processes
- Design
- Regulatory Approvals

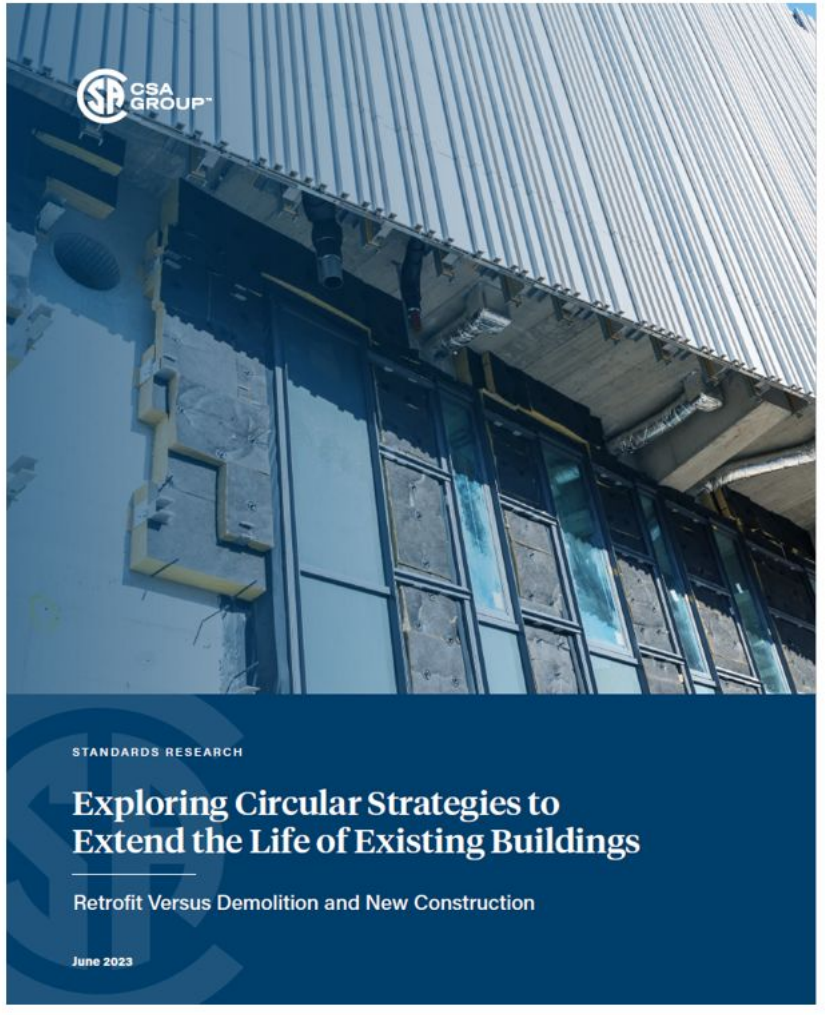
Circular Construction

- Design for Disassembly
- Durability
- Deconstruction

CSA GROUP™

CSA Group Research in support of CELC's guide





NEW Guide for Industry:

ADVANCING CIRCULAR ECONOMY STRATEGIES FOR EXISTING BUILDINGS IN CANADA

ADVANCING CIRCULAR ECONOMY STRATEGIES FOR EXISTING BUILDINGS IN CANADA

A GUIDE FOR CANADA'S COMMERCIAL REAL ESTATE SECTOR

OCTOBER 2023

CIRCULAR ECONOMY LEADERSHIP CANADA

Contents

Webinar Objectives

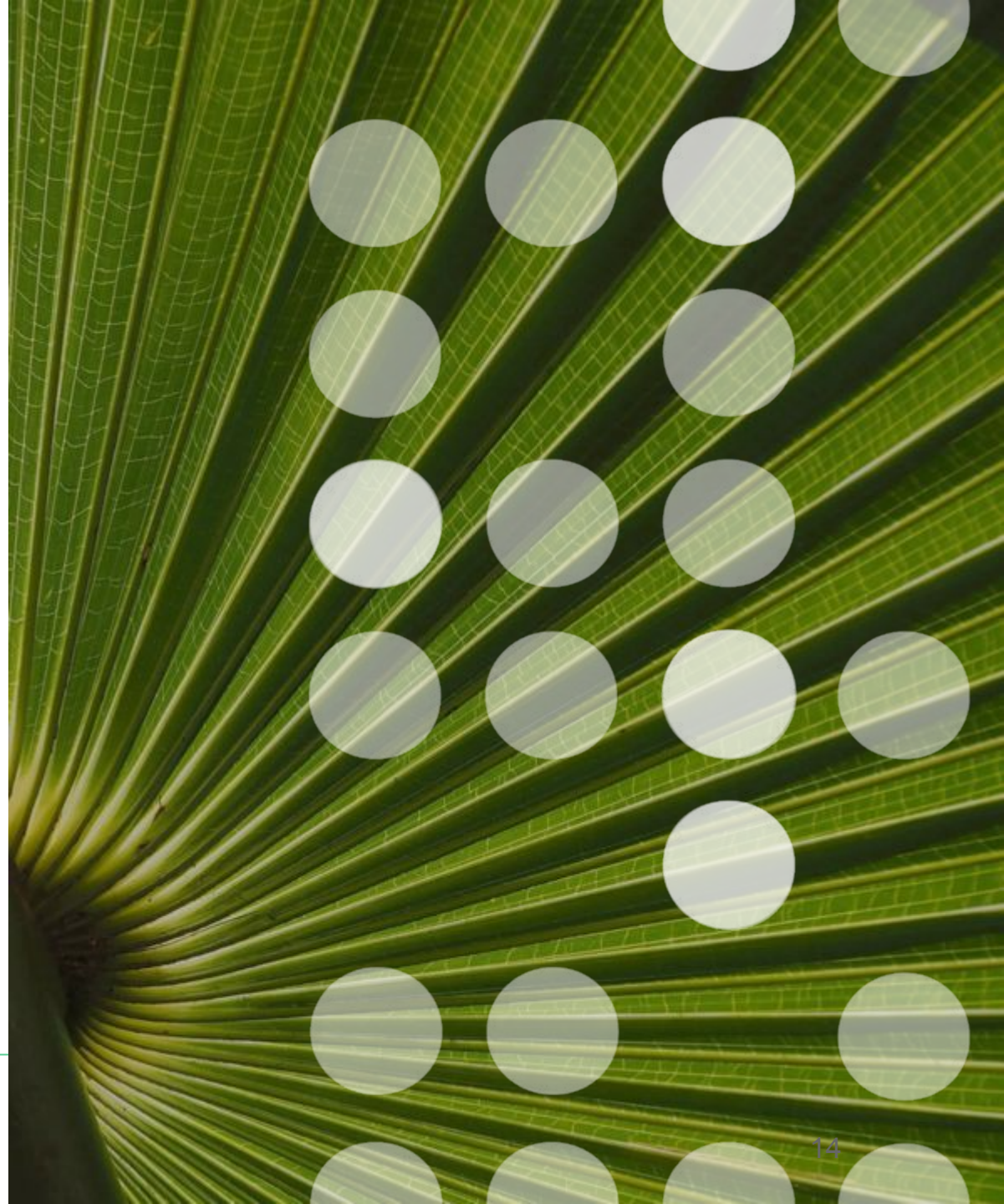
1. **Learn WHAT circular strategies can be applied to office buildings / commercial real estate** based on a number of examples and case studies
2. **Learn WHY circular strategies applied to existing buildings are important** in terms of the environmental, social, and economic benefits
3. **Learn about the life cycle carbon and GHG emission benefits** of extending the life of existing buildings through retrofit over demolition and building new
4. **Learn HOW circular strategies can be implemented**, including making the business case for action

CIRCULAR ECONOMY LEADERSHIP CANADA

CSA GROUP

Today's Agenda

Time (ET)	
12:30pm	**Welcome & Opening Remarks**
12:40pm	**Speaker Presentations** • **Helen Goodland**, Scius Advisory • **Ryan Zizzo**, Mantle Developments
1:05pm	**Panel Reflections & Discussion** • **Hazel Sutton**, JLL • **Jolene McLaughlin**, EllisDon • **Enlai Hooi**, Schmidt Hammer Lassen (SHL) Architects
1:30pm	**Audience Q&A**
1:43pm	**Closing Remarks**



Speaker Presentations

Helen Goodland

Scius Advisory

Opportunities to Apply Circular Strategies to Existing Office Buildings

October, 2023

SCIUS Advisory

Cellophane House

Opportunities to Apply Circular Strategies to Existing Office Buildings

- What are the opportunities to extend the lives of office buildings in Canada?
- Examples of circular strategies being applied in Canada and internationally
- Review of standards, programs and practices
- Technical report and guide

What's inside

- Overview of the Commercial Office Market in Canada
- Circular Strategies to Extend the Life of Existing Office Buildings
  - Circular Design Strategies
  - Circularity in the Field
  - Closing the Loop – Strategies for Product and Material Reuse
  - Under-utilized Circular Strategies
- Policies & Standards
  - Civic and Regional Policies
  - Economic Measures
  - Regulations
  - Information-based and Voluntary Approaches
  - Standards
- Economic & Environmental Considerations and Trade-offs

Big Changes for Canada's 309.8M m² (3.3B sf) Office Sector

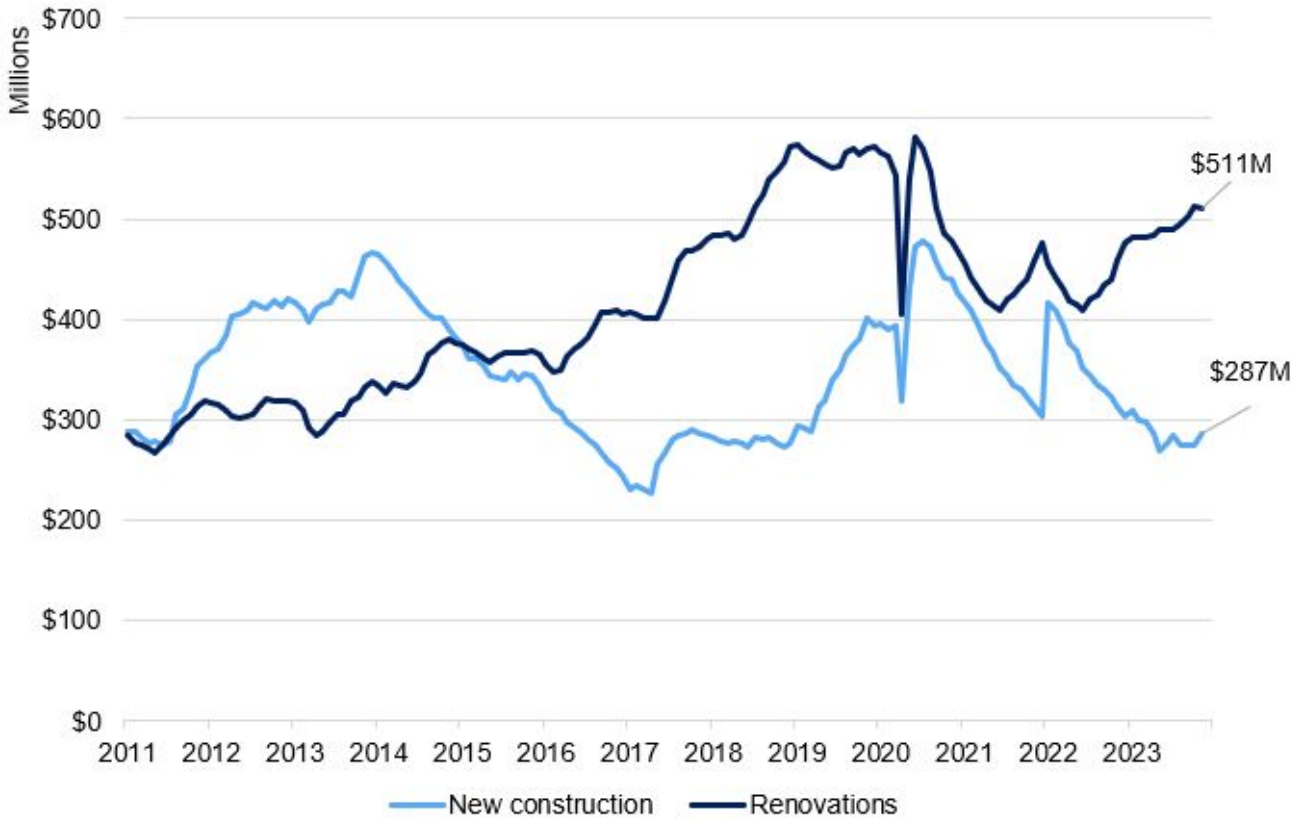
Investor & Tenant Expectations?

Vacancies, downtown v suburban - Canada

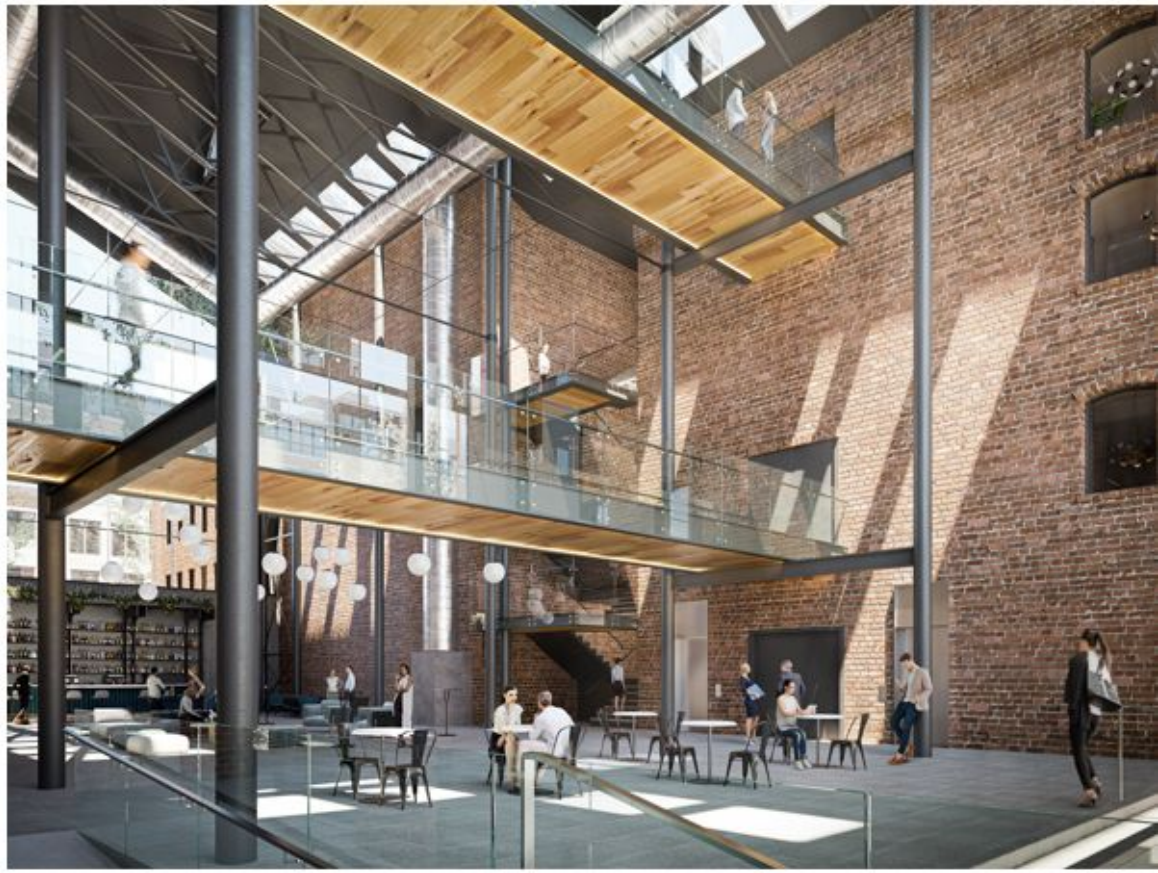
Source: CBRE Research, Q2 2023.

Dramatic increase in spending on office renovations and retrofits

Monthly investment in office building construction in Canada ($ millions), 2011 – 2023



Source: Statistics Canada. Table 34-10-0175-01 Investment in Building Construction



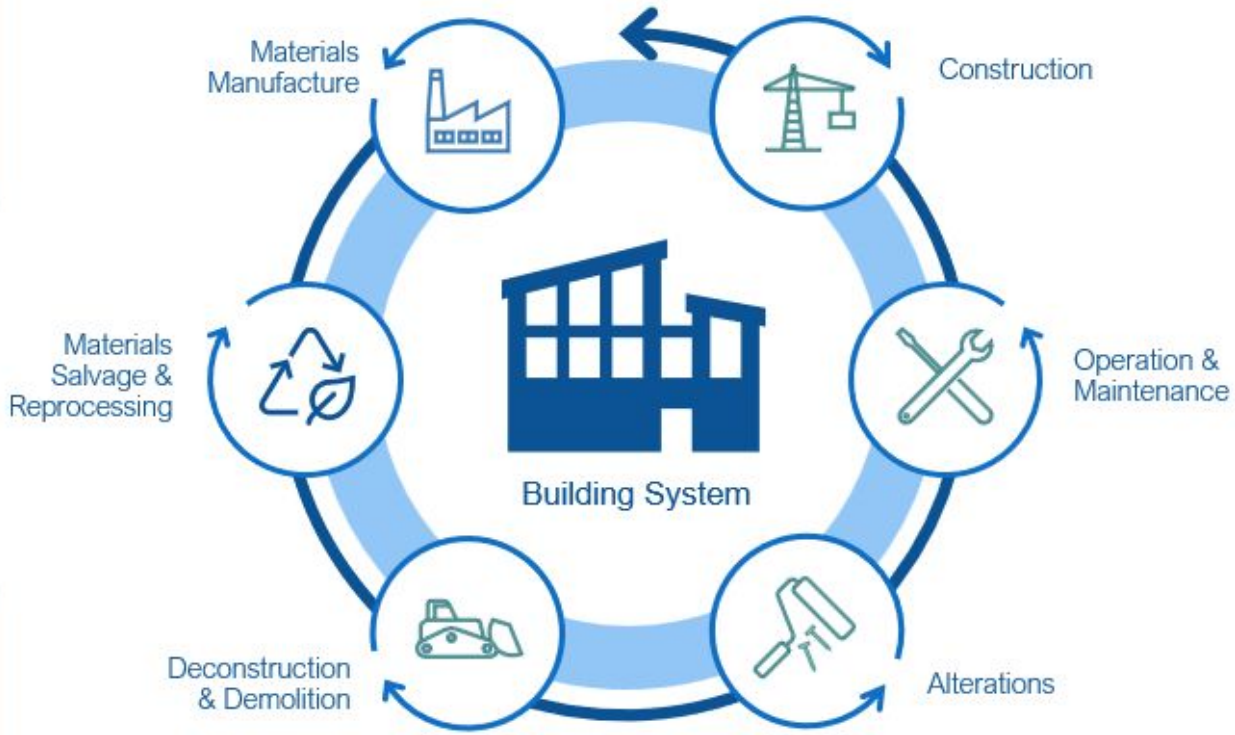
Revillon Boardwalk Building, Edmonton

Business Cases for Circularity

Create	Reduce	Engage	Distinguish	Align	Adapt	Mitigate	Spur
Create additional revenue from existing products and processes	Reduce operating costs	Engage customers and employees	Distinguish from competition	Align with corporate strategy or mission	Adapt business models and value chain relationships	Mitigate linear risk exposure	Spur innovation of new products and services

CBE Strategies

Under-utilized Circular Strategies
- Embedding Life Cycle Thinking into Real Estate Decision-making
- Digitalization of Design and Construction
- Innovative Leasing Models



Circular Design Strategies
- Upgrades and Renewals
- Tenant Fit-outs
- Circular Strategies for Whole Building Upgrades
- Versatile Design and Planning for Future Interventions
- “Up-classing”
- Industrial Prefabricated Solutions for Building Renovations
- Additions, Expansions, and “Parasitic” Architecture
- Changes of Use and Conversions
- Planning for Future Disassembly

Closing the Loop – Strategies for Product and Material Reuse
- Circular Input Strategies
- Secondary Materials Markets
- Working with Salvaged and Recycled Products and Materials

Circularity in the Field
- Sustainable Materials Management
- Lean Project Delivery
- Zero Waste Renovations on Site
- Deconstruction

Integral's Zero Waste Fit-Out, Calgary

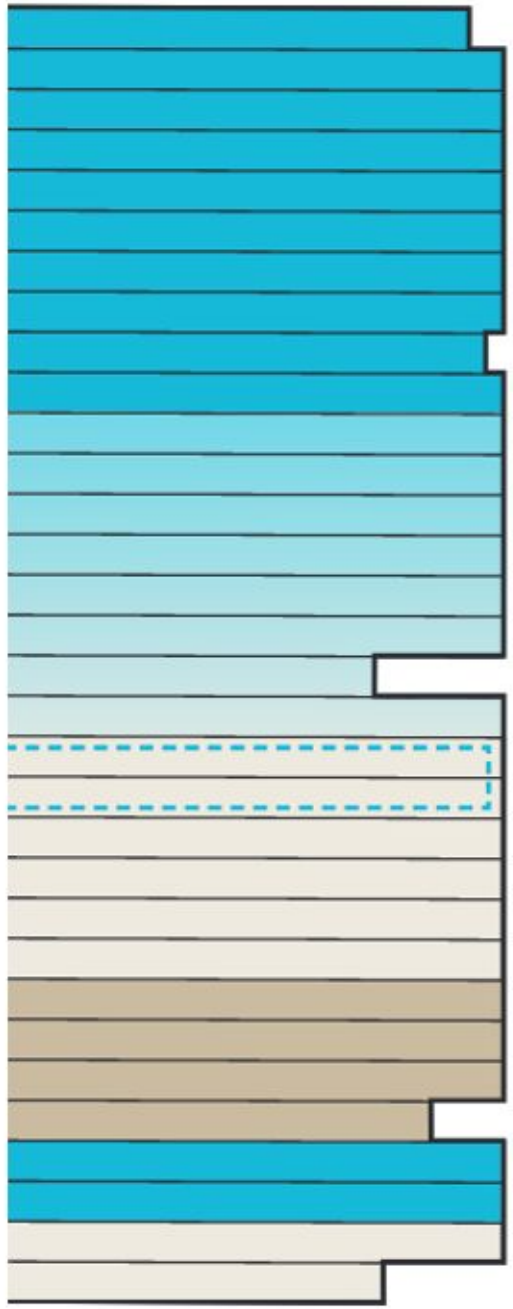
Le Phenix
Lemay's Zero Carbon Class C Upgrade, Montreal

Westley Hotel Office Conversion, Calgary

80 M
108,000sf Low Carbon Addition, Washington DC

SunCorp. Australia - Innovative Leasing

- **“Co-working spaces”** - “move-in ready” spaces with short term leases
- **“On demand space” -** allows tenants to rent individual components
- **“Precincts”** - buildings that work together



Suncorp, permanent floors
Designed as a standalone space if other floors are removed.

Suncorp, contraction strategy
Floors that can be released at set times in the lease. Designed to be taken over by another tenant with minimal changes.

Suncorp, expansion strategy

Other tenants

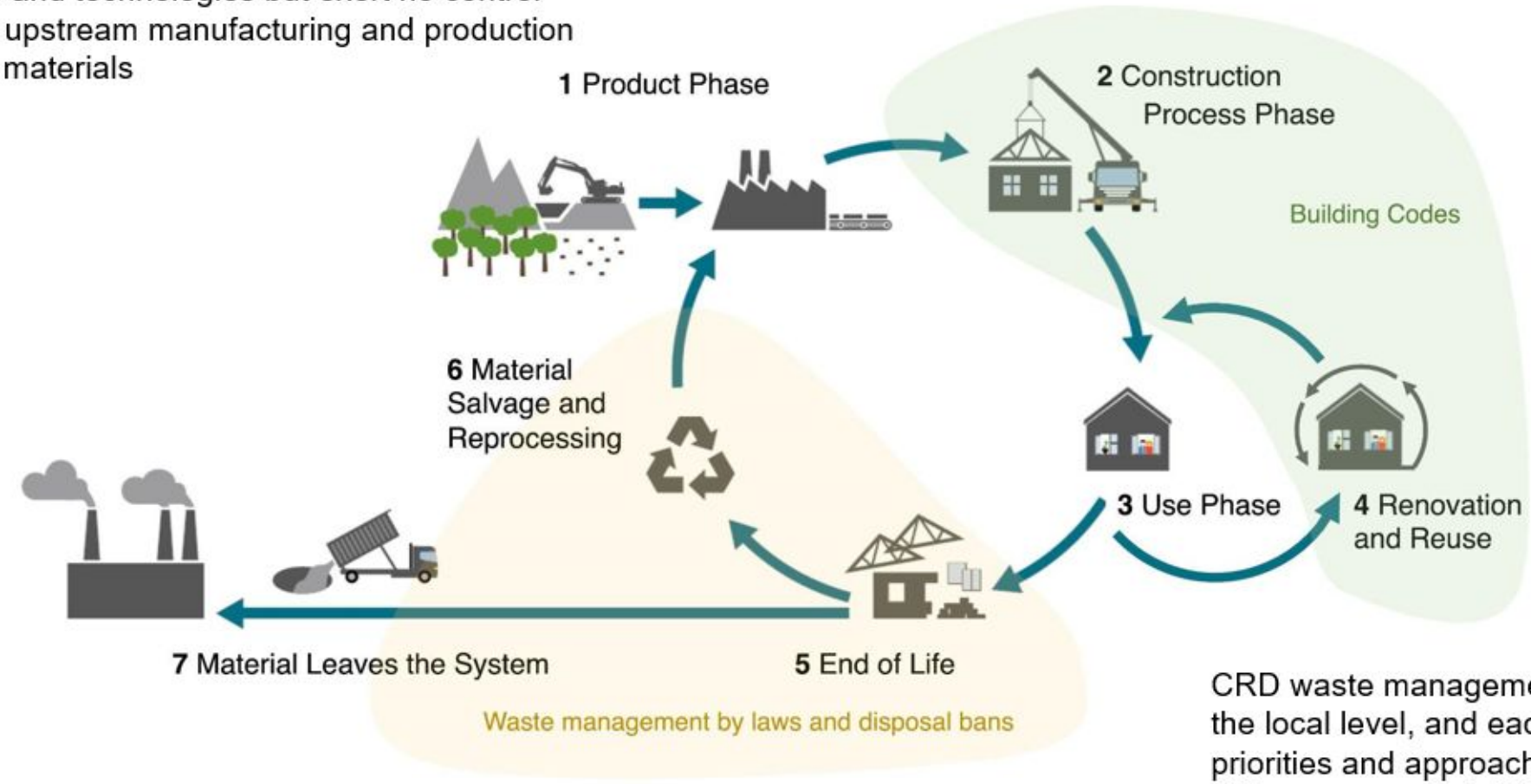
Coworking
Suncorp has pre-agreed access the space.

Suncorp, permanent floors

Retail

Regulatory Environment in Canada

Building codes can stipulate permissible building products and technologies but exert no control over the upstream manufacturing and production of those materials



CRD waste management is primarily regulated at the local level, and each region has its own priorities and approaches resulting in a range of different scopes, definitions, and activities.

Emerging Policies and Voluntary Programs

Emerging Policies

BC Energy Step Code

Toronto Green Standard

Vancouver Green Building Policy

GHG Emissions Disclosure Policies

Low Carbon Materials Policies

Voluntary Programs

Green Building Programs

Green Procurement

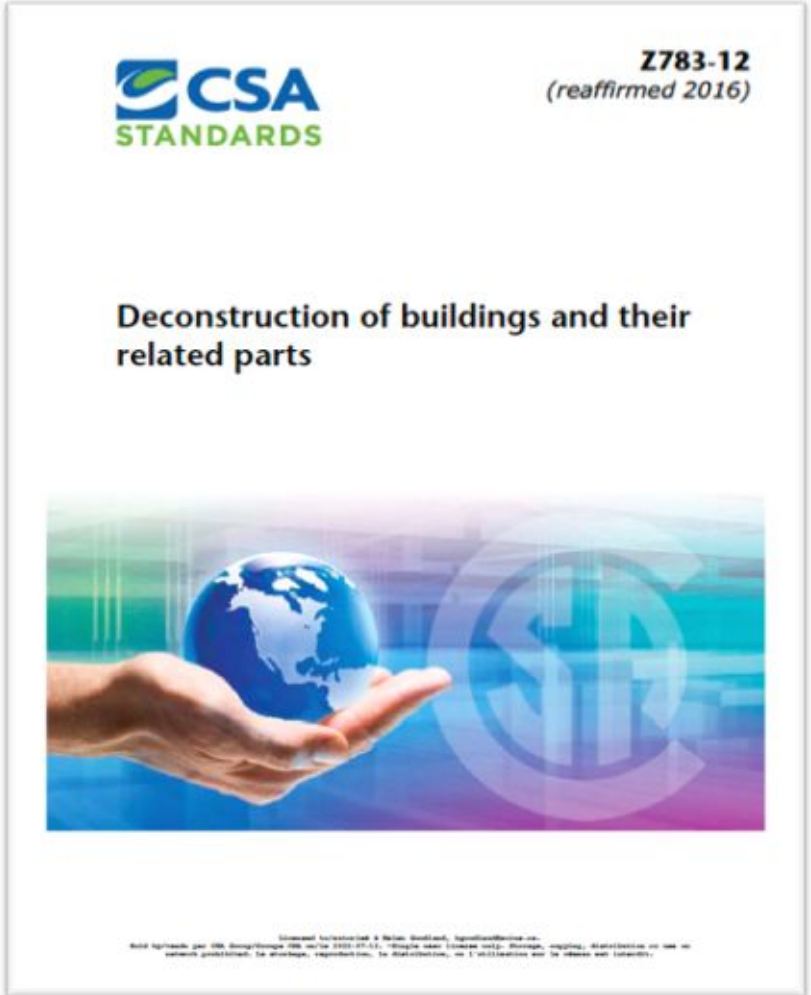
Market Mechanisms

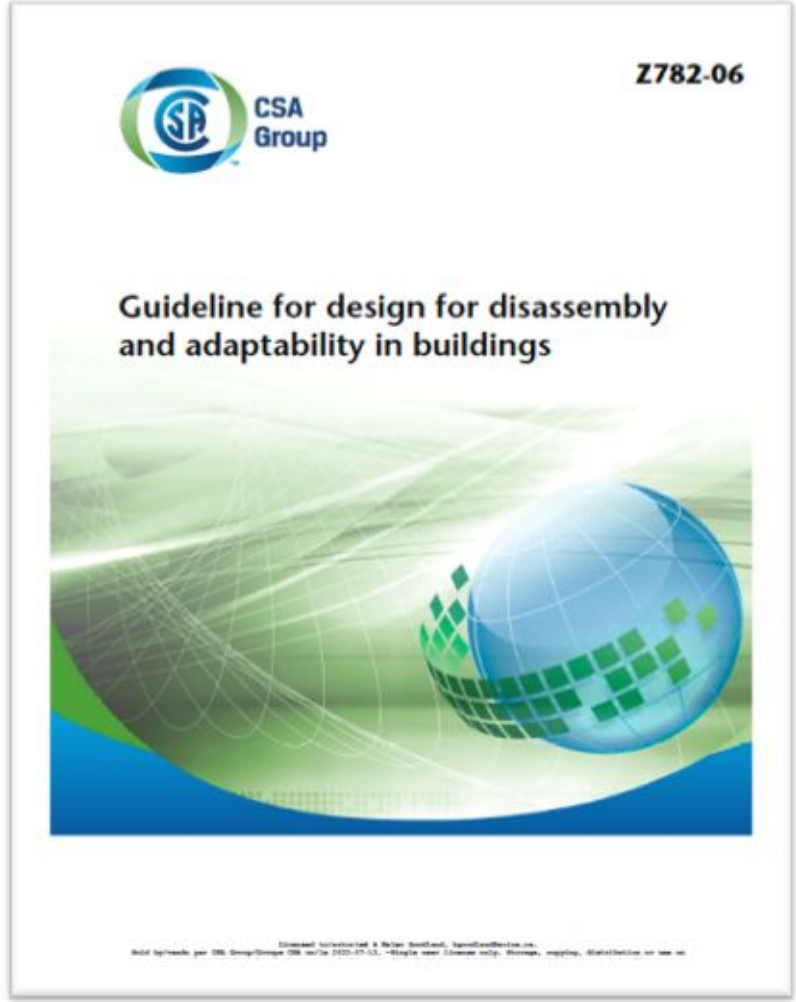
Marketplaces

Financial incentives

Technical assistance

Standards


CSA
STANDARDS
Z783-12
(reaffirmed 2016)
Deconstruction of buildings and their related parts


CSA
Group
Z782-06
Guideline for design for disassembly and adaptability in buildings

C22.2 NO. 236-15 Heating and cooling equipment
CSA A440:22 North American Fenestration Standard/Specifications for windows, doors and skylights
CSA A277-16 Procedure for Certification of Prefabricated Buildings, Modules, and Panels
CSA Z240 MH Series-16 Manufactured Homes
CSA A660-10 (R2019) Certification of Manufacturers of Steel Building Systems
CSA Z250-21 Process for delivery of volumetric modular buildings
BES 6001, Responsible Sourcing of Construction Products
IEC 63092, Photovoltaics in buildings
CAN/CSA-ISO 14025:07 Environmental labels and declarations — Type III environmental declarations
ISO 22057:2022, Sustainability in buildings and civil engineering works – Data templates for the use of environmental product declarations (EPDs) for construction products in building information modelling (BIM)
ISO/CD 59040 Circular Economy — Product Circularity Data Sheet

ASHRAE 189.1: International Green Construction Code
ISO/TC 323 Circular Economy
ISO/WD 59020 Circular Economy – Measuring circularity framework
ISO/CD 59004 Circular Economy- Terminology, Principles and Guidance for Implementation
ISO/CD 59010 Circular Economy — Guidance on the transition of business models and value networks
ISO/CD 59014 Secondary materials — Principles, sustainability and traceability requirements
ISO/WD 59020 Circular Economy – Measuring circularity framework

National Building Code of Canada
National Master Specification
CSA O86:19, Engineering Design in Wood
CSA S16:19, Design of Steel Structures
CSA A23.3:19, Design of Concrete Structures
CSA A3000-18 Cementitious materials compendium
CSA S269.1 (2016), Falsework and Formwork
CSA S304-14 Design of Masonry Structures
ASHRAE 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential
CSA SPE-17:22 HVAC Guide for Part 9 Homes
CSA-F326-M91 Residential Mechanical Ventilation Systems
CSA C873 SERIES:15 (R2020), Building energy estimation methodology
ANSI/ASHRAE Standard 228, Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance
CAN/CSA-ISO 14040:06 (R2021), Environmental management - Life cycle assessment
CAN/CSA-ISO 14044:06 (R2021), Environmental management - Life cycle assessment
EPA Framework for the Assessment of Environmental Performance Standards and Ecolabels for Federal Purchasing
ISO 21931-1:2022 Sustainability in buildings and civil engineering works — Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment
ISO 14090:2019, Adaptation to climate change — Principles, requirements and guidelines
ISO 15392:2019, Sustainability in buildings and civil engineering works
ISO 15686, Buildings and constructed assets — Service life planning
CSA Z762-95 (R2016), Design for the Environment (DFE)
BS EN ISO 19650, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling
ISO 20887:2020, Sustainability in buildings and civil engineering works – Design for disassembly and adaptability – Principles, requirements and guidance
ISO 21929-1:2011 Sustainability in building construction — Sustainability indicators
ISO 21930:2017, Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
ISO 10845, Construction procurement
Zero Carbon Building Standards

CSA Z5001-2020 Existing building commissioning for energy using systems
ASTM WK82996 Guide for Property Resilience Assessment
CSA S478:19, Durability in Buildings
ISO 16745-1/2:2017 Sustainability in buildings and civil engineering works — Carbon metric of an existing building during use stage
ISO 55000:2014, Asset management -- Overview, principles and terminology
ISO 50001:2018, Energy Management
PAS 2080:2016, Carbon management in infrastructure

SPE-890-15 A Guideline for accountable management of end-of-life materials

CSA Z782-06, Guideline for Design for Disassembly and Adaptability in Buildings
CSA Z783-12 – Deconstruction of buildings and their related parts

Legend
Standards in common use in Canada
Standards in development or limited use in Canada

CBE Standards Ecosystem

On the Horizon

- Updates to National Model Codes to enable the regulation of operational and life-cycle carbon emissions
  - operational GHG emissions technical requirements be introduced in 2025
  - embodied GHG emissions technical requirements be introduced in 2030
  - this work will inform the application to alterations to existing buildings, which will follow. A national retrofit code is expected in 2030
- A low-carbon guideline that considers life-cycle carbon emissions in federally funded projects.
- Revitalizing the National Master Construction Specification (NMS) to include low-carbon solutions.
- Enabling the digitalization of the National Model Codes and the NMS.

Thank You

Helen Goodland
Principal
hgoodland@sclus.ca

SCIUS
Advisory

Ryan Zizzo
Mantle Developments

APPLYING CIRCULAR ECONOMY STRATEGIES TO EXTEND THE LIFE OF EXISTING BUILDINGS IN CANADA

Key Findings from Report #2 (LCA analysis)

Ryan Zizzo, Founder & CEO
Mantle Developments

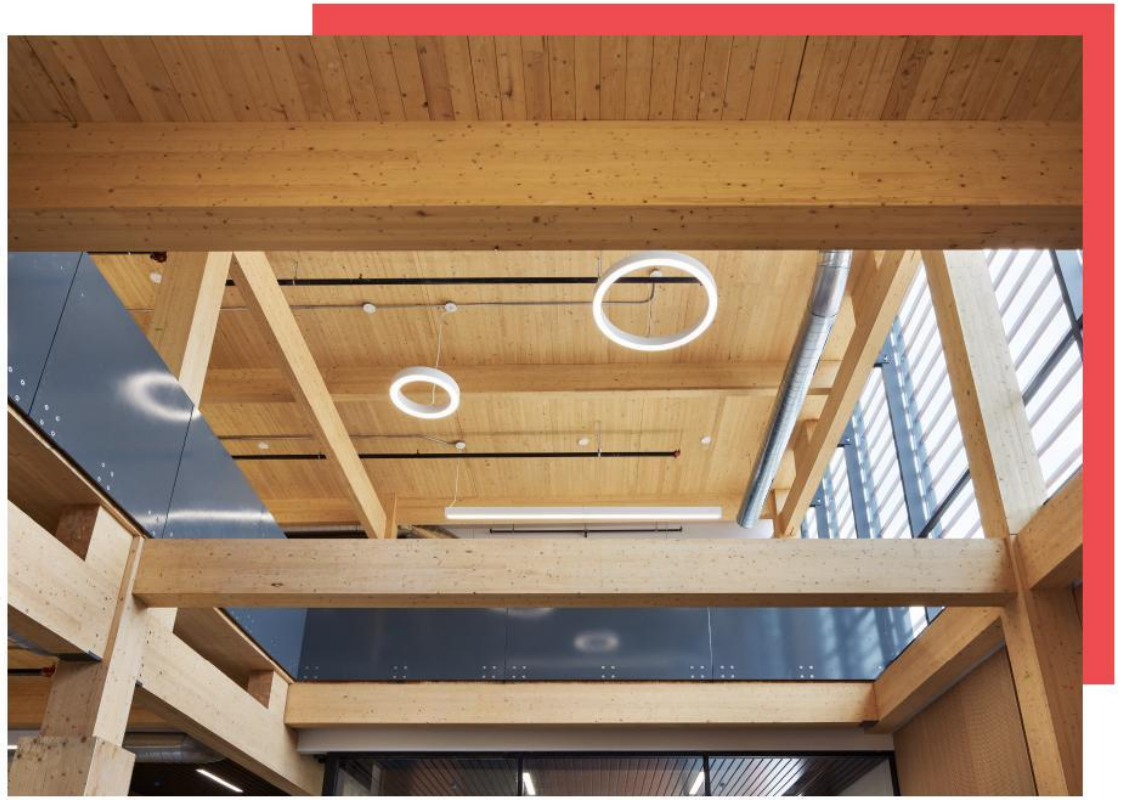
October 24, 2023

MANTLE DEVELOPMENTS

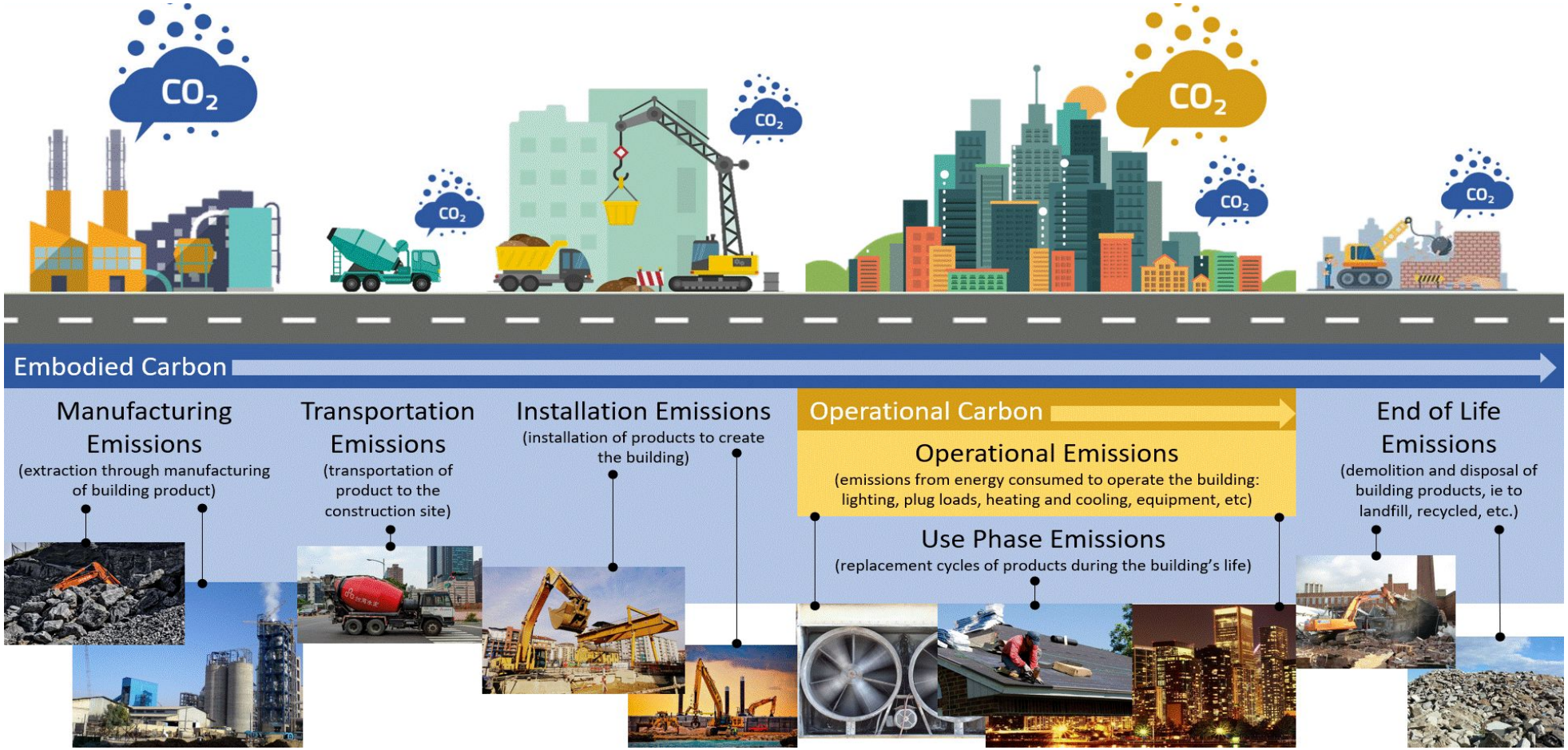
Net-zero Carbon and Climate-resilient Developments

Introduction to Mantle / our services

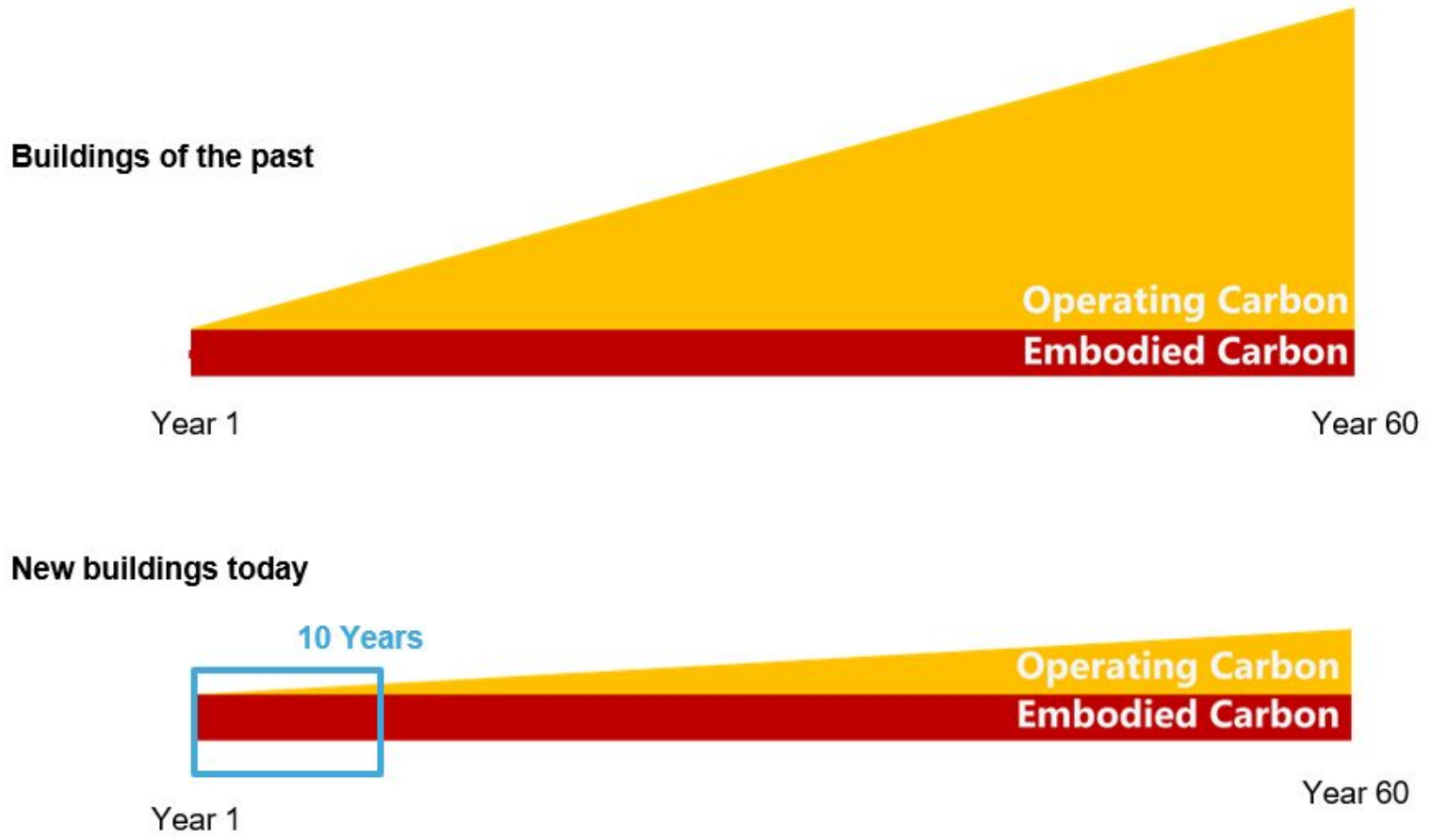
- Net-zero construction, embodied carbon and whole-life carbon management
- Product and material Life Cycle Assessment (LCA) and certified Environmental Product Declarations (EPDs)
- Climate resilient construction
- Low-carbon construction and certification
- Policy development and research
- Education and training



“Whole Life Carbon” = Operational Carbon + Embodied Carbon



Embodied Carbon is Increasingly Important as Operational Carbon is Reduced (Eliminated?)



New buildings are increasingly energy efficient, and energy is increasingly lower-carbon

Embodied Carbon is Becoming a Major Priority

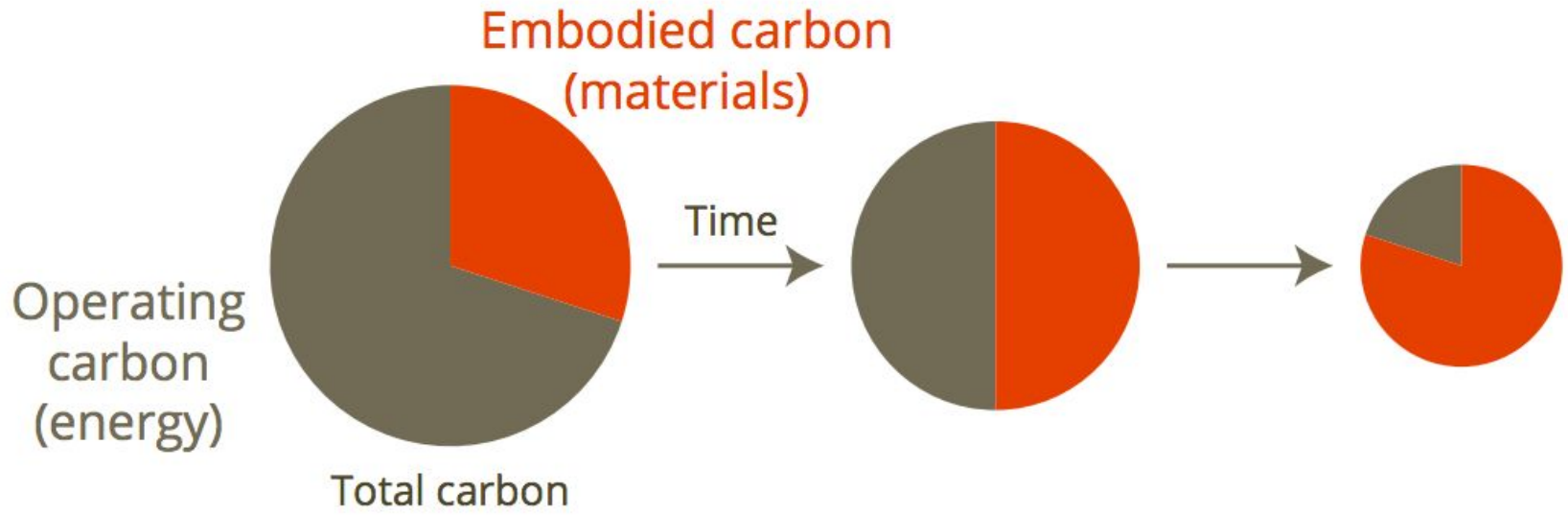


Figure 1. Growing importance of embodied carbon as building operational energy decarbonizes

More Material Reuse (& Renovation) = Less Embodied Carbon

Get **more** of our construction materials from here

Get **less** of our construction materials from here

New Report

available at www.mantledev.com/publications

Quantification Approach: Life Cycle Assessments (LCAs)

LCA Modelling Assumptions and Tools

Reference Buildings	**Mid-rise Office, Toronto**	**High-rise Office, Toronto**
Life Cycle Stages	Demolition/Removal, Product, Construction, Replacement, Operational Energy, & End-of-Life, Beyond Building Life	
Elements Included	Structures (if new building) + Envelope, Mechanical, Electrical, Plumbing, Interior, Finishes	
Lifetimes	**Buildings:** 60 years	**Elements:** As per industry guidance (One Click LCA)
Modelling	**Embodied & Refrigerants:** As per industry guidance (One Click LCA)	**Operational*:** Based on municipal green building requirements

** Electricity grid carbon intensity projections estimated from Environment and Climate Change Canada Data, "Canada's Greenhouse Gas Emissions Projections"*

MANTLE DEVELOPMENTS

LCA System Boundary

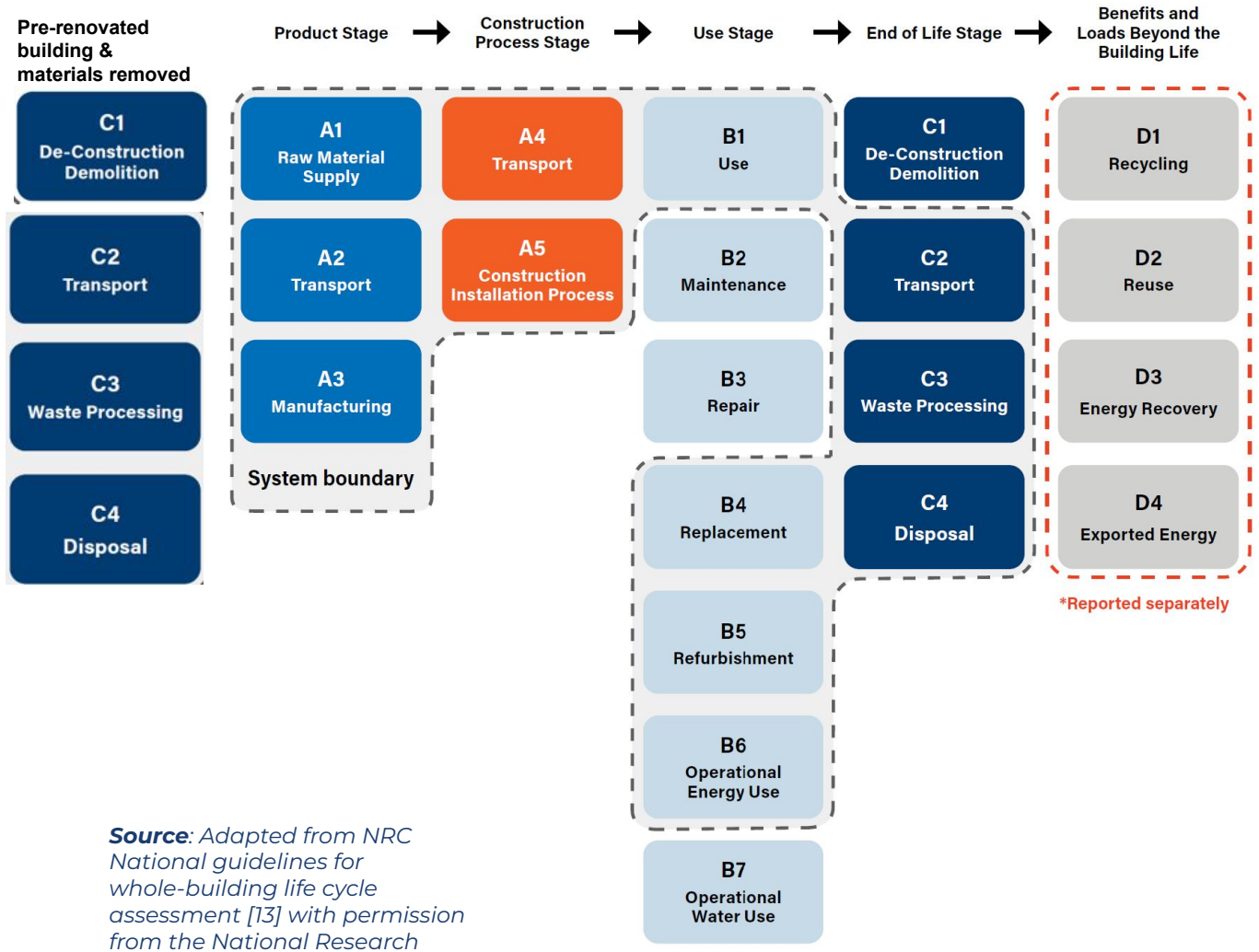
Demolition & new construction

- Emissions from the demolition of the existing building were assumed to be the same as end-of-life (C1-C4).

Retrofit

- Emissions from the removal of elements (to be replaced) were assumed to be the same as end of life (C2- C4, upfront).

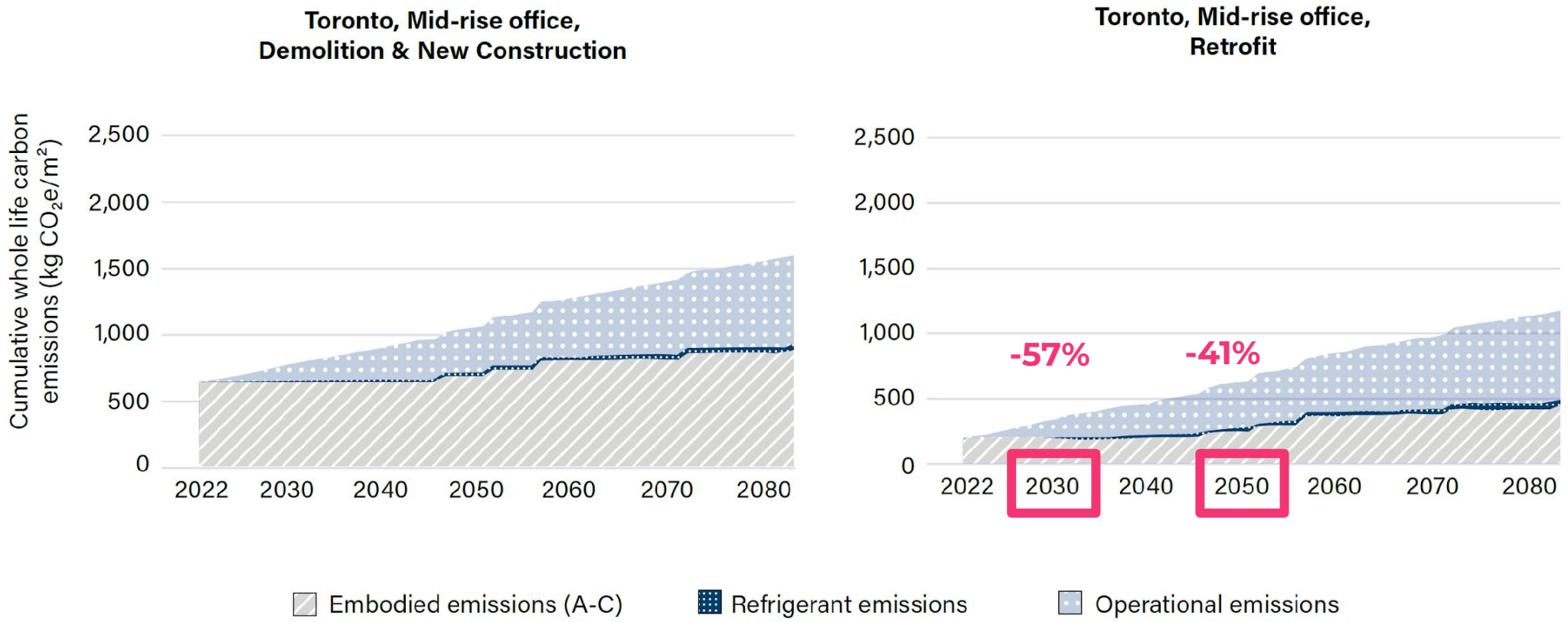
- Emissions from the demolition of the retrofitted building at the end of life were assumed to be the same as end-of-life (C1-C4, end-of-life).



***Source**: Adapted from NRC National guidelines for whole-building life cycle assessment [13] with permission from the National Research Council of Canada.*

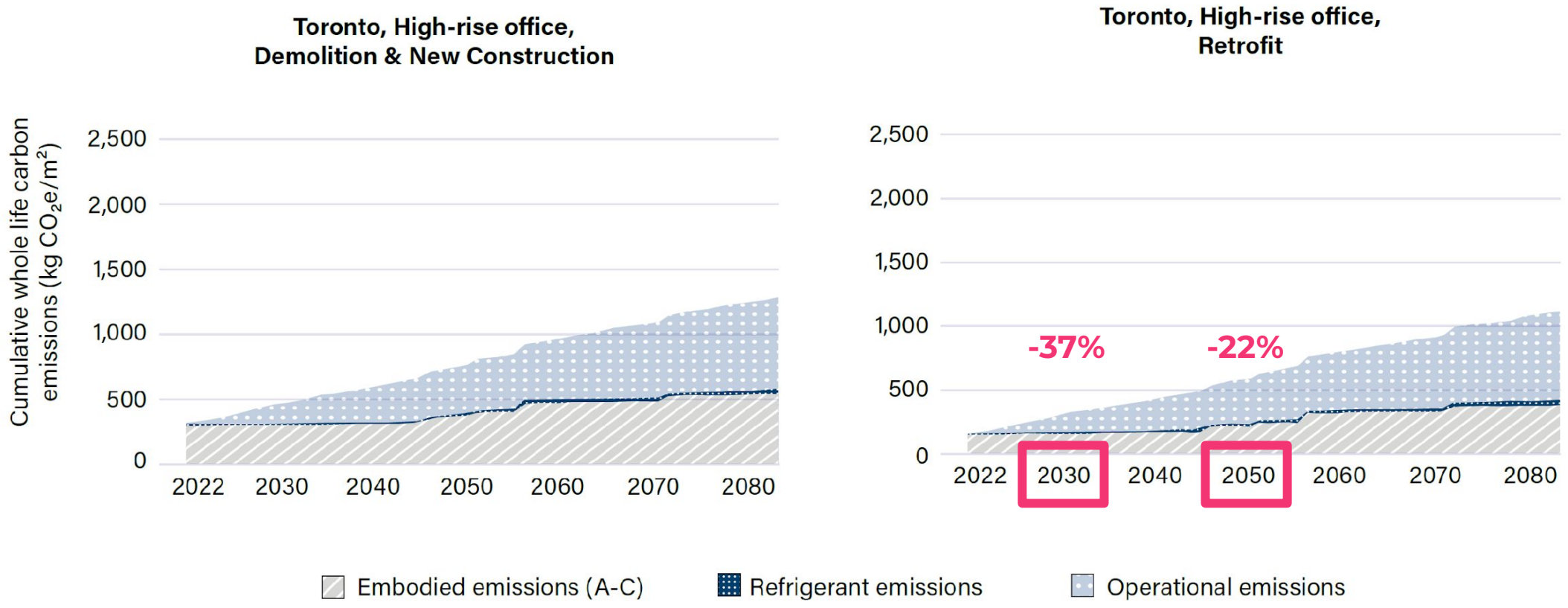
Cumulative Carbon Emissions: Toronto Mid-rise Office

Upfront carbon emissions are 69% lower for retrofit vs. demolition & new construction
Whole-life carbon emissions are still >40% lower in 2050 for retrofit vs. demolition & new construction



Cumulative Carbon Emissions: Toronto High-rise Office

Upfront carbon emissions are 52% lower for retrofit vs. demolition & new construction
Whole-life carbon emissions are still >20% lower in 2050 for retrofit vs. demolition & new construction



Key Findings & Recommendations

1. Deep carbon retrofit of existing buildings can significantly reduce the overall whole-life carbon emissions of a building compared to demolishing and rebuilding.

It is the lower carbon option <u>in all cases</u>, regardless of location or building type.

Depending on building type and location, renovation is lower carbon by:

- 51-76% during the construction phase,
- 11-58% by 2050, and
- 5-21% over total 60-year building life.

Regions with greener electricity have larger carbon % savings from structure reuse (reuse of structure makes up a smaller portion of carbon savings when operations are dirty).

Key Findings & Recommendations

2. If new construction is required, use low-carbon concrete and steel, and bio-based materials such as wood.

(Accounting for biogenic carbon storage in a mass timber building can lead to similar whole-life carbon as retrofits. More analysis for calculating biogenic carbon is required.)

Lessons Learned & Data Gaps

- More whole building (and product) LCAs are needed.
- Very little data exists on LCA of demolition (not required currently in Canada)
- More standardized and product-specific data on LCA stages B, C, and D are needed.

  ISO 21930:17 is the current standard for generating building product EPDs in North America. This version only mandates the inclusion of the product stage (stages A1-A3). The updated version of the equivalent European standard, EN 15804+A2:2019, provides more specific guidance and mandates the inclusion of stages C and D.

- wbLCAs should include interiors, mechanical, electrical, and plumbing elements.

Thank you!

Questions?

160 Bloor Street E, Suite 1010
Toronto, Ontario
ryan.zizzo@mantledev.com
mantledev.com
647 648 3961

Panel Discussion

Hazel Sutton
JLL Canada

Enlai Hooi
Schmidt Hammer Lassen (SHL) Architects

Jolene McLaughlin
EllisDon

Panel Discussion

Audience Q&A

Closing Remarks

- Big **THANK YOU** to our presenters!
- Sign-up for CELC's Monthly Newsletter
- Join CELC's Partner network
- Join us November 1-2 in Vancouver for the Zero Waste Conference

CIRCULAR ECONOMY LEADERSHIP CANADA

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CSA GROUP™

www.csagroup.org

CONTACTS

Paul Shorthouse
Managing Director,
Circular Economy Leadership Canada
pshorthouse@circulareconomyleaders.ca

Ivica Karas
Strategic Initiatives Manager,
CSA Group
ivica.karas@csagroup.org