MASS TIMBER CONSTRUCTION AT CANADIAN NUCLEAR LABS

Environmental Impact Study

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Canadian Wood Council
Conseil canadien du bois

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OUTLINE

- About Mantle and engagement with project team
- Overview of the carbon impact of buildings
- Benefits of mass timber construction
- Environmental and carbon analysis on CNL project
- Links to federal climate strategies and objectives

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Focus areas

- Net zero carbon strategies
- Green building certifications
- Low carbon construction materials / embodied carbon life cycle assessment
- Resiliency strategies

Ryan Zizzo, Founder & CEO

- Professional engineer
- 15+ years green building project management experience across Canada and Europe
- Working with governments across Canada on low-carbon construction policy
- CAGBC Zero Carbon Steering Committee Member (4 yrs)
- Advisory Board member for Carbon Leadership Forum

Toronto team
2022

Vancouver team
2022

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MANTLE'S ENGAGEMENT ON THE CNL CASE STUDY

Review reports, data, and articles completed by project partners, such as:

- WBLCA by Athena
- Sustainability and Wellness Performance memo by Integral Group

Hold multiple interviews with the following project stakeholders:

- CNL and AECL (owners)
- HDR (architects)
- LEA Consulting (structural)
- Nordic Structures (materials)
- Integral Group (mechanical/energy)
- Morrison Hershfield (code)

Combine operational and embodied carbon emission estimates from existing reports.

- Create comparisons and graphics to show total whole life carbon of Science Collaboration Center and Support Facility.

Compile existing documentation, findings and quotations from interviewed stakeholders, and emissions analysis into a final report.

- Pull out lessons and innovations making links to government priorities.
- Make project successes accessible and repeatable by others.

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SELECTED INTERVIEW QUESTIONS

- *Why was the integrated design process (IDP) used and how did it impact the project?*
- *How was sustainability approached and communicated throughout the project?*
- *How was the desired performance achieved in construction, envelope energy, etc.?*
- *What advice would you provide to someone in your role working on a similar project?*

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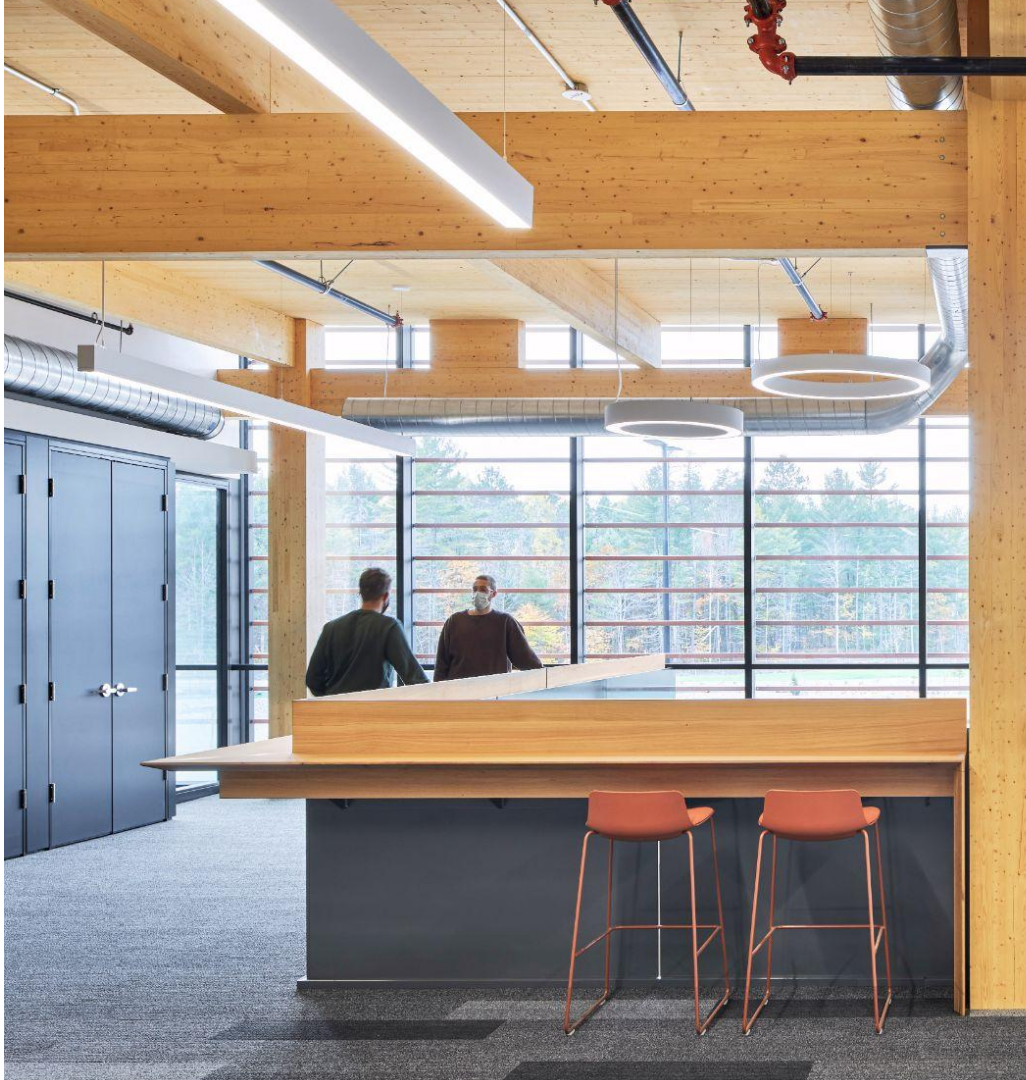
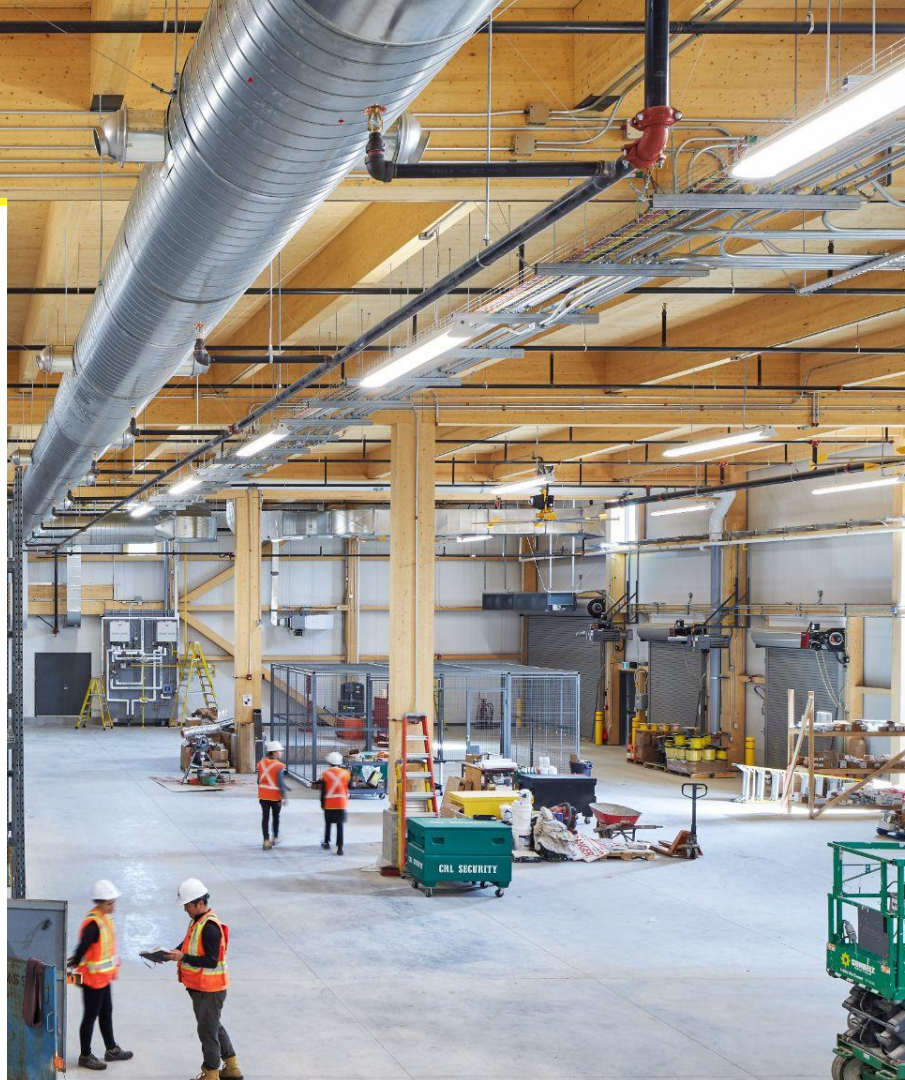
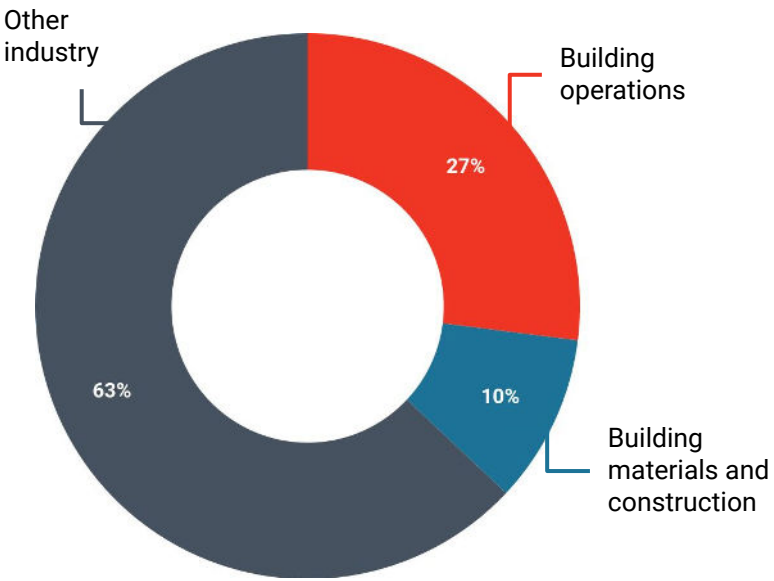


STAKEHOLDER INTERVIEW THEMES

- IPD approach was key for the mass timber design and beneficial for interdisciplinary learning and collaboration. For some, IPD set the precedent for future project delivery.
- The benefits of mass timber go beyond environmental performance - it enforces a strong connection with nature and enhances the project's aesthetic.
- Need to apply holistic costing to mass timber projects due to factors that can be overlooked such as fewer finishes and shorter schedule.
- The project was considered a success among all stakeholders interviewed.



CARBON IMPACT OF BUILDINGS



2021 Global Status Report for Buildings and Construction, Global Alliance for Buildings and Construction (2021)

The carbon impact of buildings is often focused on **operational emissions** but the **emissions from material production and construction** (“embodied emissions”) contribute significantly (~10%).

To decarbonize the built environment, buildings need to use less energy, use lower carbon energy sources, and be constructed from low carbon (ideally carbon-storing) materials.

As demonstrated by the projects at CNL, the adoption of construction practices like mass timber can be part of the solution.

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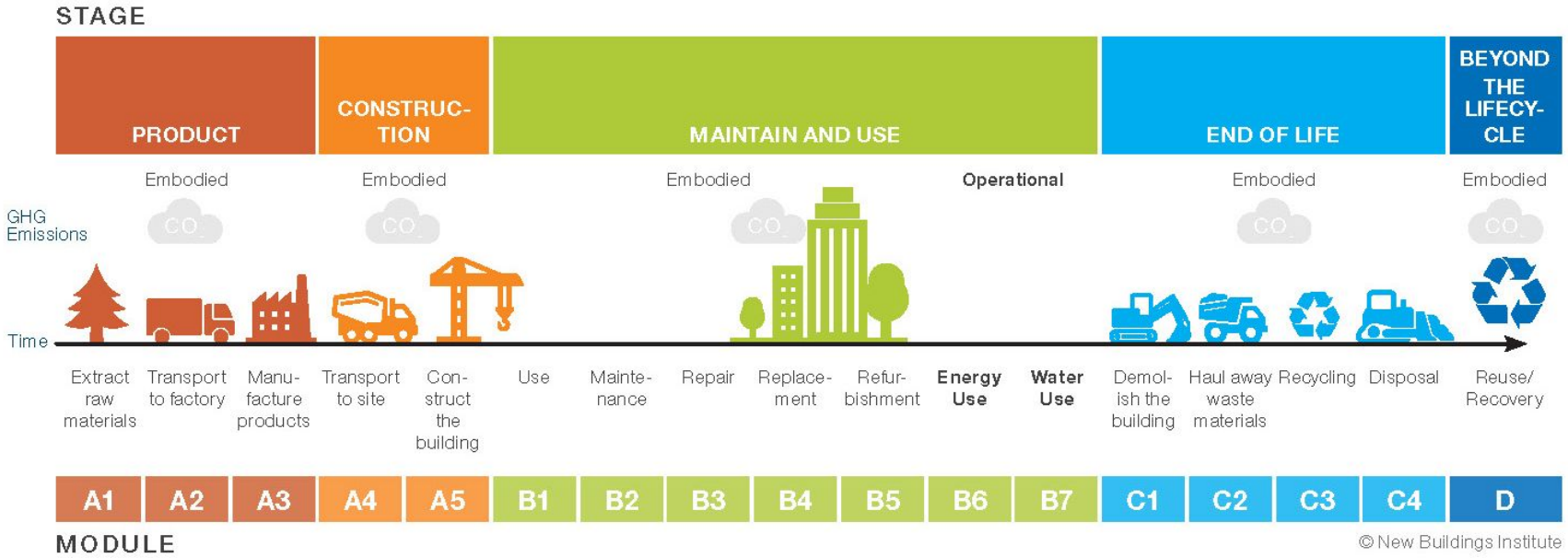
EMISSION SOURCES

Whole Life Emissions = Operational Emissions + Embodied Emissions
(energy model) ***(life cycle assessment, LCA)***



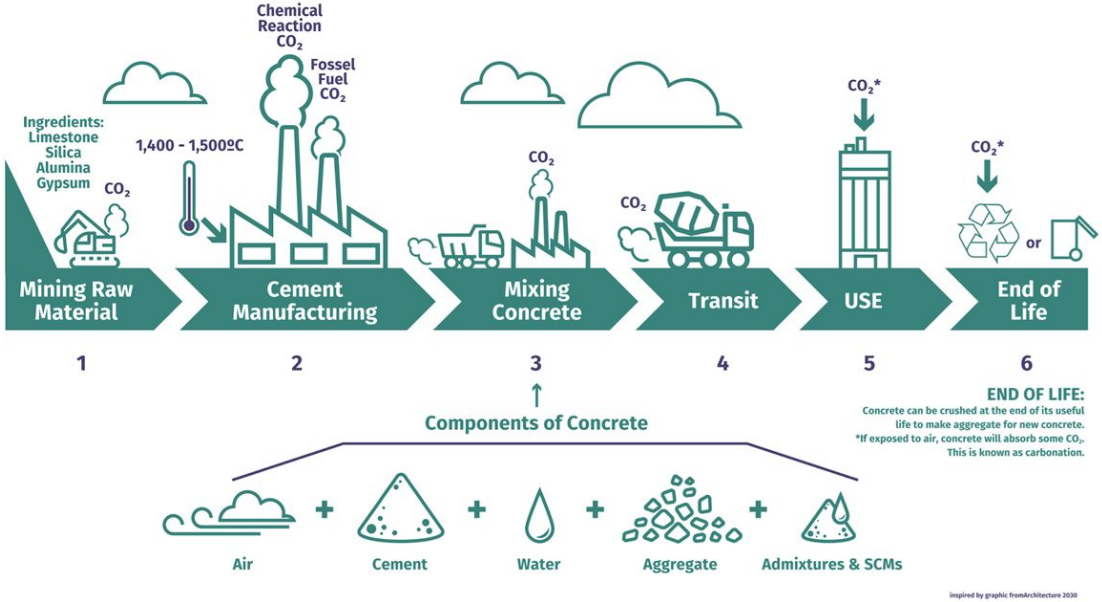
New Buildings Institute, Embodied Carbon (2021)

EMBODIED EMISSIONS IN TRADITIONAL CONSTRUCTION

The majority of building embodied emissions (70-90%) occur before occupancy, known as “upfront embodied emissions”.

Traditional construction materials like **concrete and steel are the largest source of embodied emissions in construction**.

Concrete has significant embodied emissions due to the production of cement.



Inspired by Architecture 2030, Carbon Smart Materials Palette (2021)

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REDUCING EMBODIED EMISSIONS

Strategies to reduce embodied emissions include minimizing the total volume of materials used and selecting materials with lower global warming potential (GWP).

CNL used low carbon concrete mixes and materials with high recycled content.

BENEFITS OF MASS TIMBER CONSTRUCTION

Mass timber buildings typically have **lower upfront embodied emissions** than typical concrete or steel buildings.

Wood products also have the unique benefit of sequestering and storing carbon.

Carbon that is stored in a material is called “*sequestered carbon*”. When in bio-based materials, it is called “*biogenic carbon*”.

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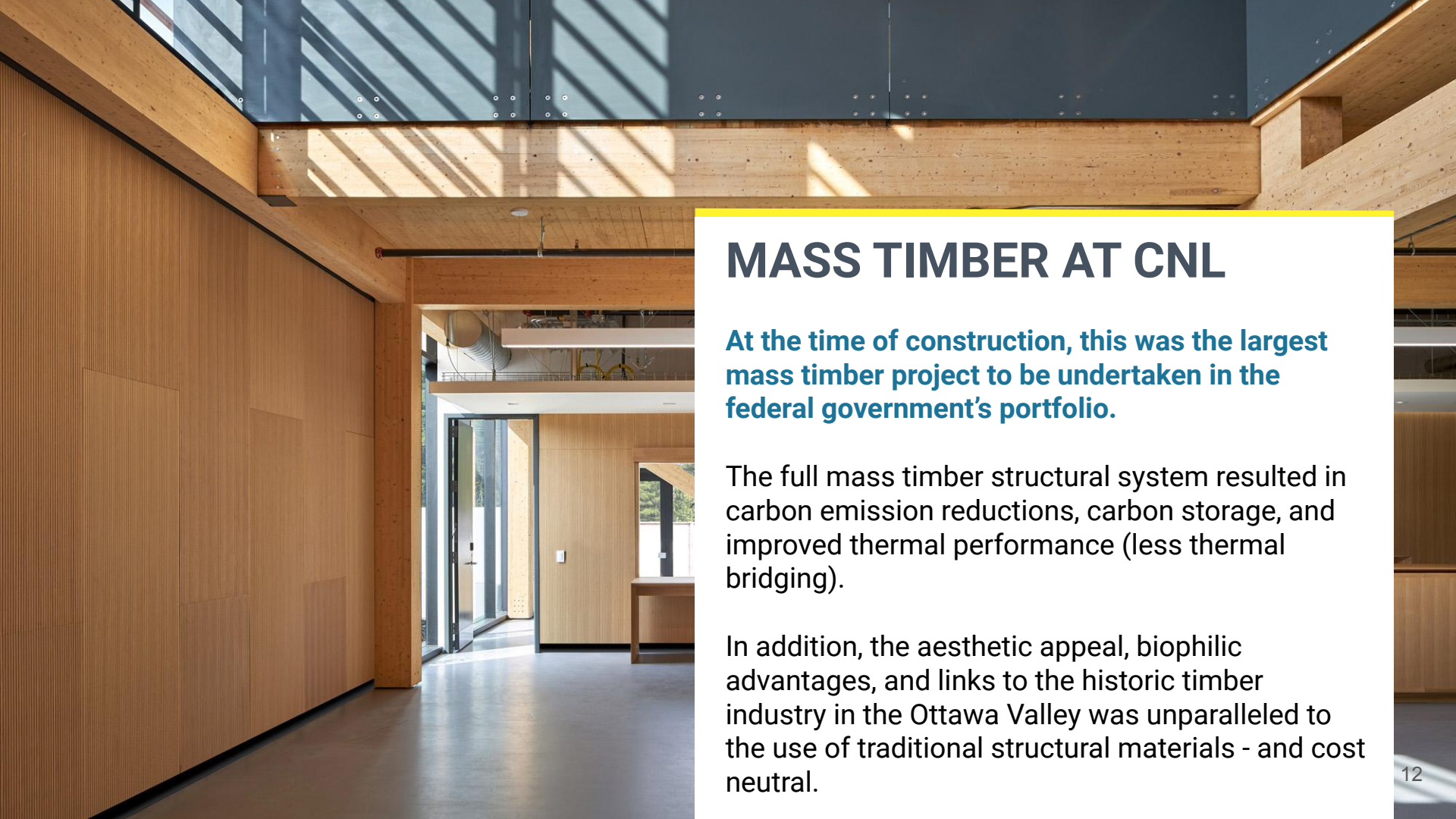

MASS TIMBER AT CNL

At the time of construction, this was the largest mass timber project to be undertaken in the federal government's portfolio.

The full mass timber structural system resulted in carbon emission reductions, carbon storage, and improved thermal performance (less thermal bridging).

In addition, the aesthetic appeal, biophilic advantages, and links to the historic timber industry in the Ottawa Valley was unparalleled to the use of traditional structural materials - and cost neutral.

FEDERAL GREENING GOVERNMENT STRATEGY

Transition to net-zero emissions and climate-resilient operations by 2050

Embodied Emissions

- Disclose embodied carbon from structural materials of major construction projects by 2022.
- 30% reduction in the embodied carbon emissions of structural materials in government projects by 2025.
- Complete a whole building life cycle assessment for major buildings and infrastructure projects by 2025.

Operational Emissions

- Absolute reduction of direct and indirect operational emissions by 40% by 2025 and 90% by 2050 from a 2005 baseline.
- Government departments will use 100% clean electricity by 2022, where available. By 2025, produce or purchase renewable electricity.
- Government-owned buildings over 1,000 m^2 and considered to have "significant energy consumption" require energy metering by 2022.
- Net-zero operational emissions by 2050 for all government-owned and leased real property.

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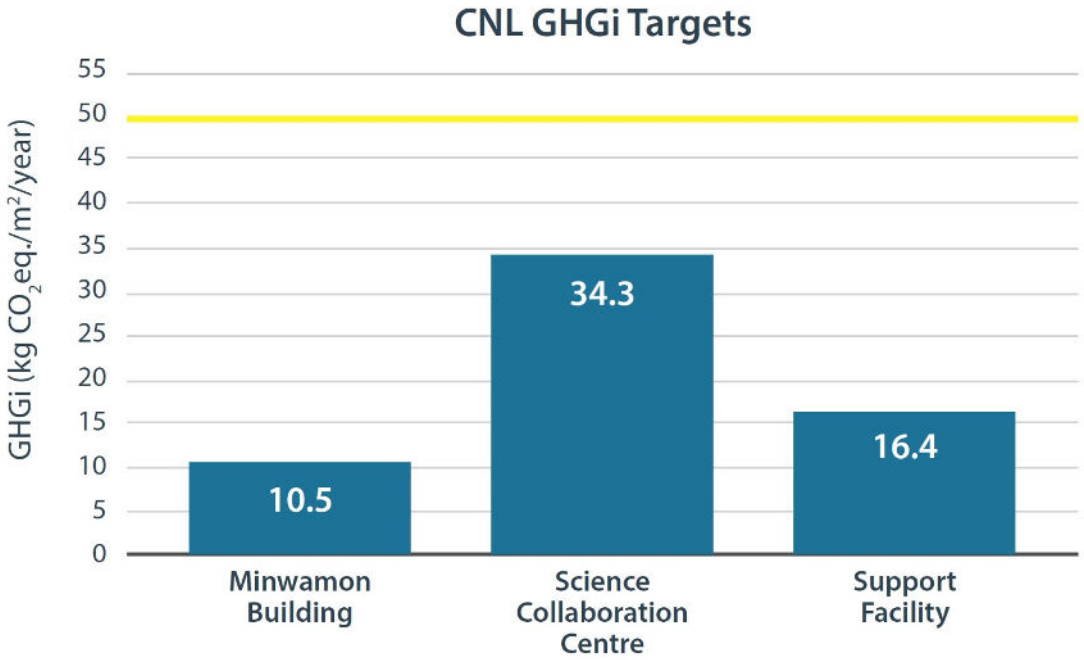
OPERATIONAL CARBON IMPACT



80% reduction from CNL's 2005 emissions

- All three buildings meet the Greening Government Strategy to reduce absolute GHG emissions by 40% by 2025.
- The Minwamon Building and Support Facility also surpassed the Canadian government's 2050 reduction target to reduce GHG emissions by 90% below 2005 levels.

CNL - Sustainability and Wellness Performance Memo, Integral Group (2021)

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EMBODIED CARBON IMPACT

Athena Sustainable Materials Institute completed two whole-building life cycle assessments (LCAs) calculating the embodied carbon impacts per floor area over 60 years (excluding recycling and biogenic carbon).

The scope of the assessment for both buildings was the cradle-to-grave impacts from the foundations, structure, and exterior envelope.

An LCA for the Minwamon Building was not available during the writing of this case study.

Support Facility
Embodied carbon intensity: 174 kg $CO_2eq./m^2$

Science Collaboration Centre
Embodied carbon intensity: 283 kg $CO_2eq./m^2$

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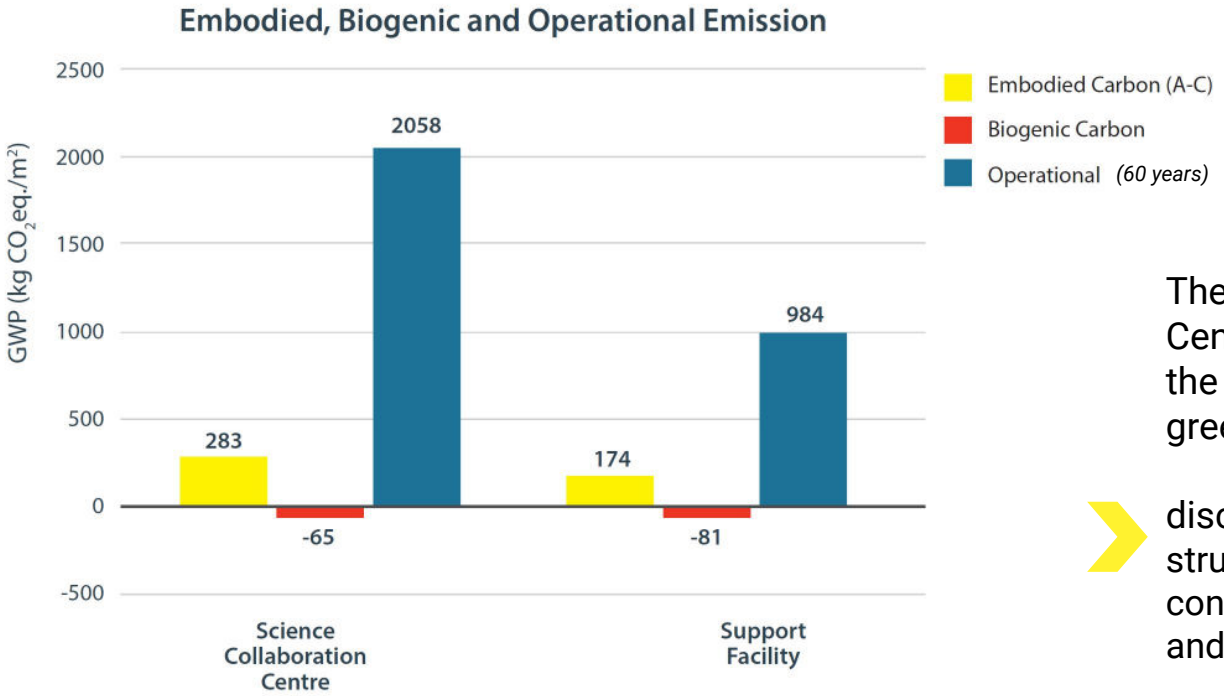
WHOLE-LIFE CARBON EMISSIONS IMPACT



The Science Collaboration Centre and Support Facility met the Canadian government's greening strategies to:

- disclose embodied emissions of structural materials of major construction projects by 2022 and,
- complete whole-building LCAs of major infrastructure by 2025.

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THANK YOU

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