carbon wise
sustainable innovation

Life Cycle Assessment and Costing Study

West 42nd Ave

March 2025

Project Overview

This case study was commissioned to assess the feasibility and cost implications of achieving a 10% reduction in embodied carbon for a high-rise residential building in Vancouver. The target aligns with the project target reduction of the City of Vancouver's embodied carbon policy, which allows projects to demonstrate compliance through either the Intensity or Baseline pathways.

This 19-storey residential building in Vancouver, currently at building permit stage, achieves a low embodied carbon intensity of 334 $kgCO_2e/m^2$. This reflects a 12% reduction in emissions, meeting the 10% target, with total embodied carbon estimated at 4,054 tCO_2e.

Building Type	Residential
Location	Vancouver
Gross Floor Area (without parkade in m^2)	12,122
Building Height (m)	59
Number of floors above grade	19
Number of floors below grade	1.5
Design Stage	Design Development
Assessment Stage	Building Permit
Residential category	Market Rental Primary
Total Embodied Carbon (tCO_2e)	4,054
Embodied Carbon Intensity ($kgCO_2e/m^2$)	334
Meets the 10% Embodied Carbon target?	Yes
Reduction in Embodied Carbon	12%

Rendering Credit: Urban Solutions Architecture

Dual Pathway Success

Achieving 17% Reduction in Embodied Carbon - Intensity Path

This pathway sets a **fixed benchmark** for embodied carbon intensity. Under the project target reduction, the Intensity target would be 360kgCO_2e/m². This project achieves an Embodied Carbon Intensity of 334 kgCO_2e/m², surpassing the target with a **17% reduction**.

In the City of Vancouver's embodied carbon policy, the **Intensity path** sets a **fixed embodied carbon intensity limit** for new buildings against which all projects are measured.

Achieving 12% Reduction in Embodied Carbon - Baseline Path

By comparing the proposed design to a **functionally equivalent baseline** building, the project achieved a **12% reduction** in embodied carbon, exceeding the 10% reduction required under the project target reduction.

In contrast, the baseline path lets projects create a **similar reference version** of the building and then show a required **percentage reduction** in embodied carbon compared to that version.

Only one of the two paths is needed for compliance, but the example below shows how the project meets and exceeds the requirements for both.

By successfully meeting and exceeding the reduction targets under both the Intensity and Baseline pathways, this project highlights the flexibility of achieving embodied carbon reductions through either compliance path.

Embodied Carbon Reduction Strategies

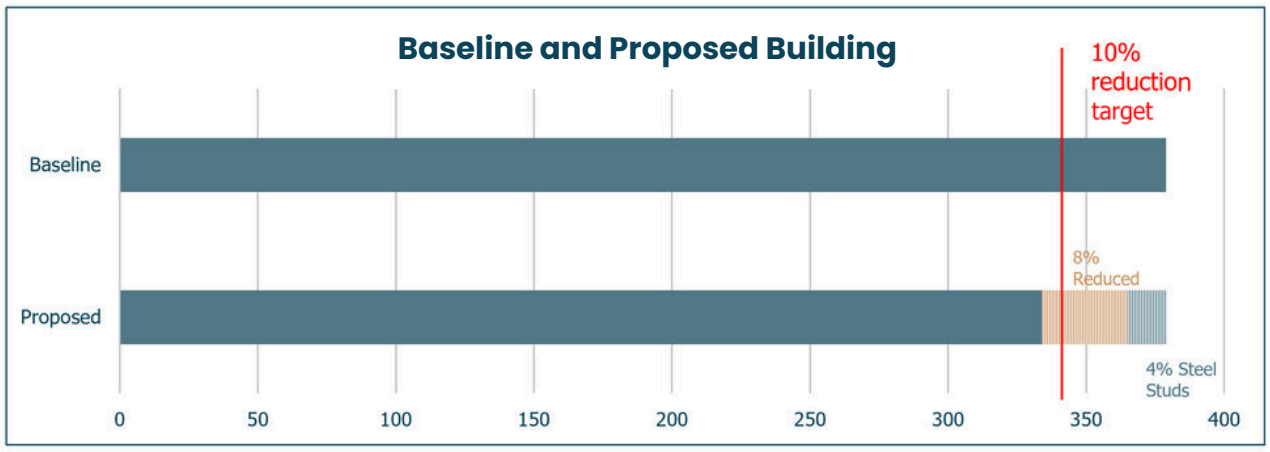
Reducing embodied carbon begins with **intentional design choices** that minimize material use and favor low-impact solutions. Key strategies include simplifying the building form to reduce structural complexity, avoiding or minimizing transfer slabs (often a major source of concrete) and optimizing structural grids to avoid oversized beams and columns. A compact, stacked layout, for instance, can lead to significant reductions in concrete and steel, as was the case from the outset on this project.

The proposed building implemented **two key strategies**:

1. It reduced the underground parking from three (3) levels to one and a half (1.5) levels, significantly cutting emissions associated with concrete.

2. It replaced the curtain wall system with a steel stud wall, lowering the embodied carbon of the building envelope.

The graph below compares the total Global Warming Potential (GWP) intensity of the baseline and proposed designs, highlighting the combined impact of the two key strategies. Through targeted design optimizations, the proposed building not only met but surpassed the reduction targets, proving that **thoughtful design decisions** can lead to substantial embodied carbon savings.



Cost Savings

These strategic design choices not only enabled the project to meet - and exceed - Vancouver's proposed embodied carbon targets, but also delivered meaningful cost savings, as illustrated below.

Strategy	% Reduction from baseline	GHG reduction (tCO_2e)	Costs Savings ($)*
Baseline	0%	4,595	0
Changing the curtain wall to steel studs	-4%	-165	-1,100,000
Reducing Parking to 1.5 levels	-8%	-376	-600,000
Proposed Total		4,054	
Proposed Reduction	-12%	-541	-1,700,000

Overall cost savings were calculated by comparing material and installation costs, specifically for steel studs and curtain walls, as these were the only materials that changed. All other materials are evaluated based on **material costs alone, since their installation remained unchanged. While steel studs have a higher material cost, curtain walls incur greater installation expenses, making steel studs the more cost-effective option. This approach ensures a strategic balance between financial savings and CO_2 reduction.*

Methodology

This study assessed life cycle stages from cradle to grave, focusing on the structure and envelope of the building. A 60-year lifespan was assumed, and the Bill of Materials (BoM) was developed through manual quantity takeoffs from the architectural and structural drawings. The analysis was conducted using Athena Impact Estimator, without any major deviations from default assumptions, following the City of Vancouver Embodied Carbon Guidelines.

It's important to highlight that detailed thermal performance, durability, and maintenance were not evaluated beyond the assumptions embedded within the software for the purposes of this study.

Cost savings were estimated by a professional estimator using locally sourced data, reflecting the most accurate material and pricing information available from suppliers at the time.