Why clean construction doesn't equal costly construction

Join us at **11am PT/2pm ET on May 21**
as one of Canada's leading climate think tanks is joined by experts in the field to offer informed insight on why clean construction doesn't have to mean costly construction.

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Building Toward Low Cost and Carbon

Webinar May 2025

Jana Elbrecht, Senior Policy Advisor

CLEAN ENERGY CANADA

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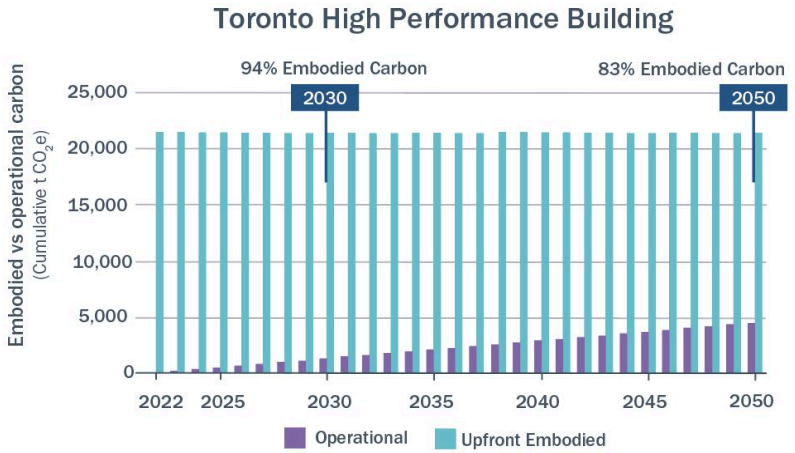
Embodied carbon

- Building out housing & infrastructure could lock in hundreds of megatonnes of emissions by 2030
- **Embodied carbon** = emissions from construction, materials we use to build
- Material industries (steel, cement) are heavy emitters



Source: CAGBC (2022). Embodied Carbon: A Primer for Buildings in Canada.[10]

Buy Clean

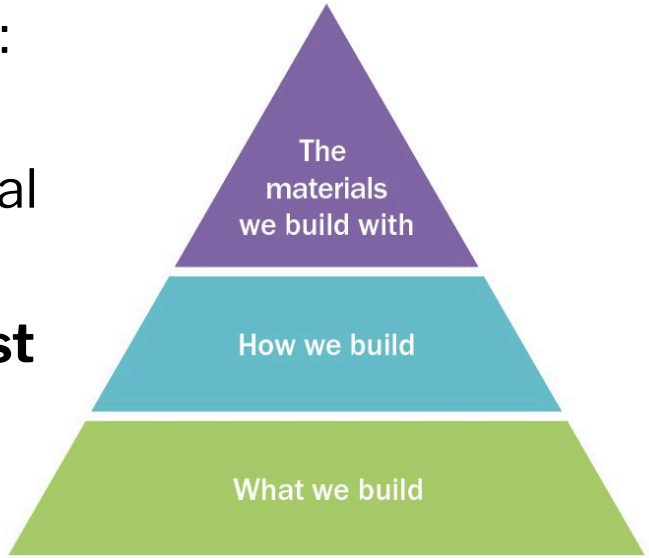
- Buy Clean = Governments buying clean construction materials & design
- Incentivizing the market to move to clean
- In Canada, public construction accounts for 32% of the cement and concrete, and 29% of construction steel

Studying the cost implications of reducing embodied carbon

Studying two of the main strategies for reducing the emissions embodied in buildings:

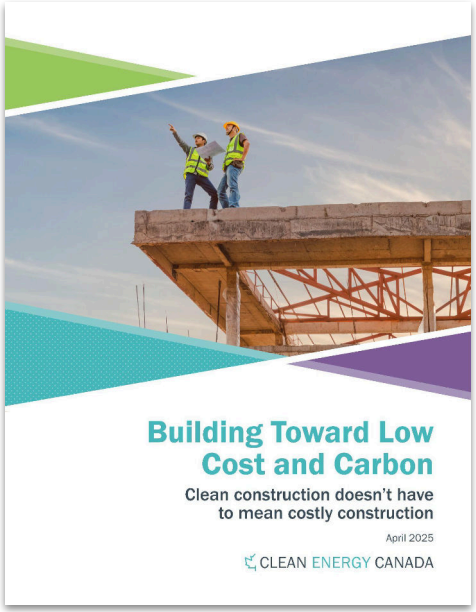
1) **The materials we build with**
   "like-for-like" swaps for concrete, structural steel, rebar, insulation and drywall

2) **Optimizing design for low carbon and cost**
   Case studies showcasing design interventions that can reduce



Research approach

- Cost is a common concern for Buy Clean policies
- Analysis based on case studies
- Material swaps: like-for-like
  - Costing by Chandos Construction
- Design: how can we build differently to save cost and carbon
  - Research consortium led by Ha/f Climate Designs
- Interviews with experts



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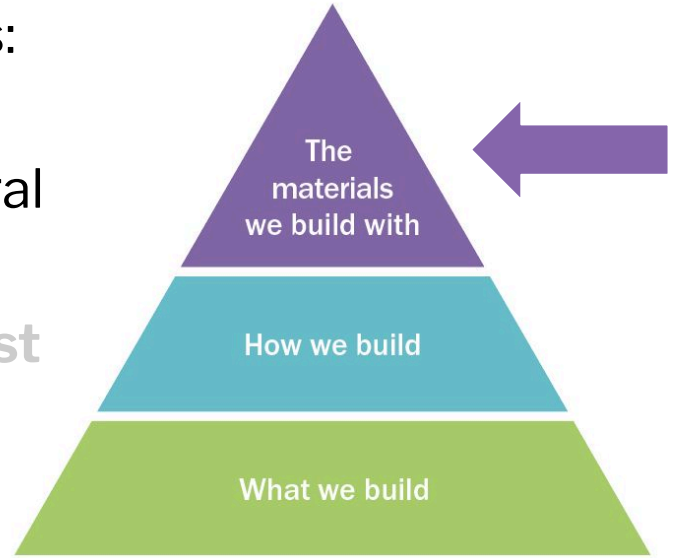


Material swap results

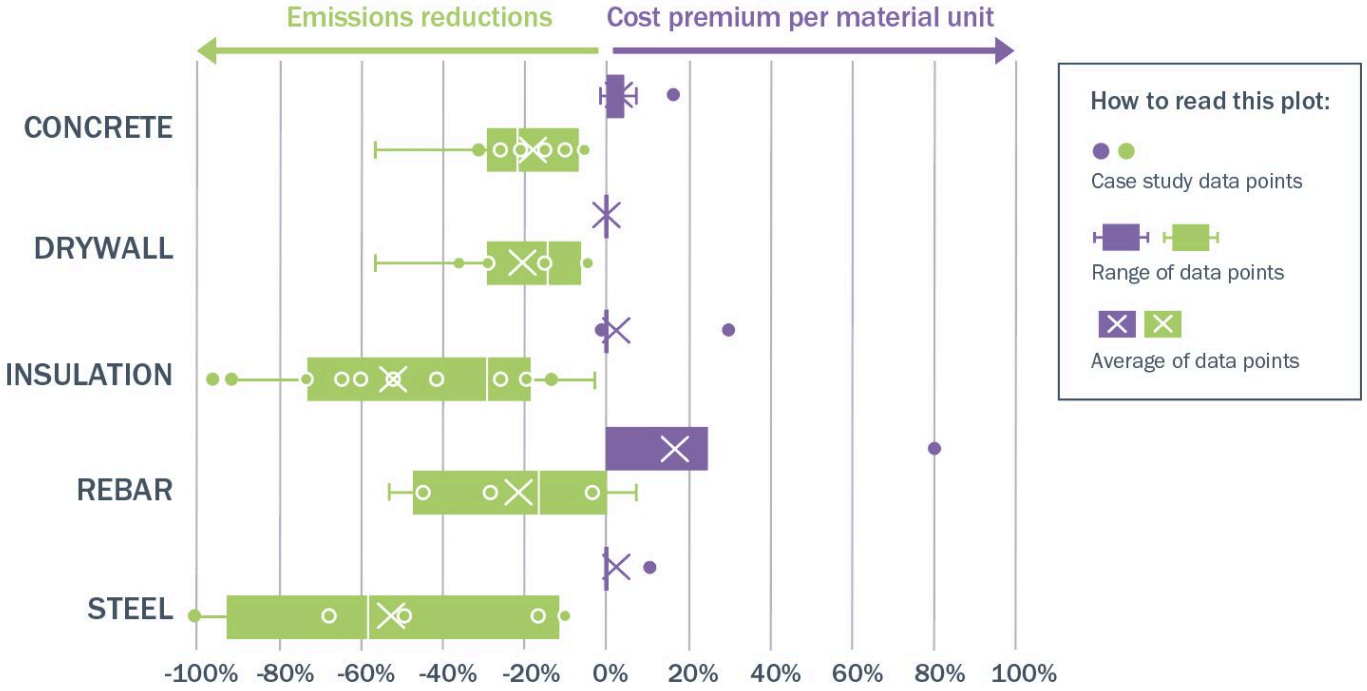
	CONCRETE	STRUCTURAL STEEL	REBAR	DRYWALL	INSULATION
					
Emissions reduction	3% to 32%	10% to 100%	3% to 53%	4% to 55%	2% to 98%
Cost increase per material unit	**Generally 0%;** Some premiums between 1-16%	**Generally 0%;** Instances of a 5-25% premium	**Variable from 0% to 25%;** one outlier of 80% premium	**Consistently 0%**	**Generally 0%;** Instance of a 30% premium
Cost increase as share of budget	0% to 0.035% of budget	0% to 0.16% of budget	0% to 0.41% of budget	0% of budget	0% to 0.006% of budget

Material swap results

Emissions reductions available at market rates

Cost premiums, if any, came to less than $3,000 in most projects, a rounding error for multi-million dollar construction projects

Costs fall well within the variances the industry already deals with on a daily basis



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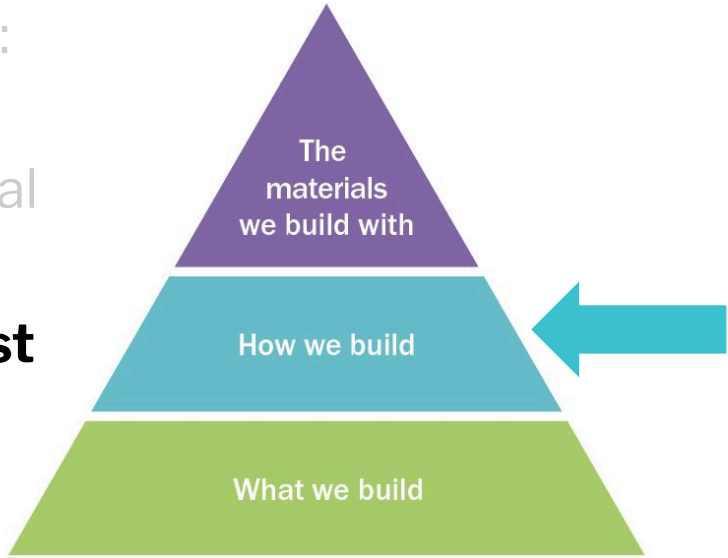


Low-rise design case study

-27%
11 tCO_2e
Whole Building Reduction

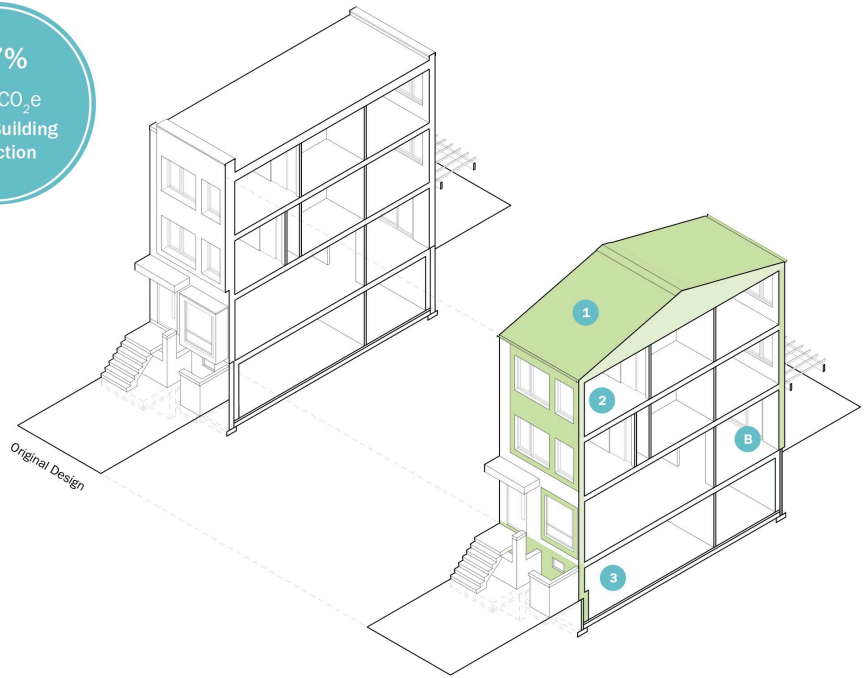
1. **Urban Design: Roof Form**
   - 337 $kgCO_2e$
   1% Reduction

   Over the entire lifespan of the building, this increases to: - 1,156 $kgCO_2e$

2. **Architecture: Envelope Efficiency and Materiality**
   - 4,694 $kgCO_2e$
   9% Reduction

3. **Engineering: Basement Structure**
   - 5,894 $kgCO_2e$
   15% Reduction

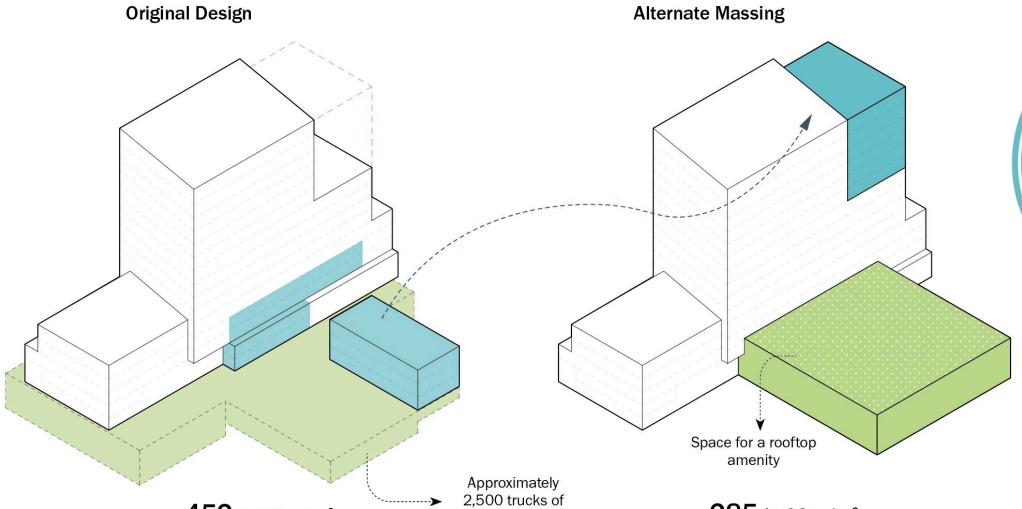
B. **Interior Finishes: PVC Removal**
   - 632 $kgCO_2e$
   2% Reduction



Material savings:
Flattening facade saves:
- Steel framing (0.03 m^3 per unit)
- Wood panels (0.1 m^3 per unit)
- Carbon-intensive spray-foam and XPS insulation products

Basement structure saves:
- 12.7 m^3 cast-in-place concrete (replaced by additional 10.9 m^2 of brick cladding)

Mid-rise design case study: re-massing



452 $kgCO_2e/m^2$
7,945 tCO_2e

285 $kgCO_2e/m^2$
6,078 tCO_2e

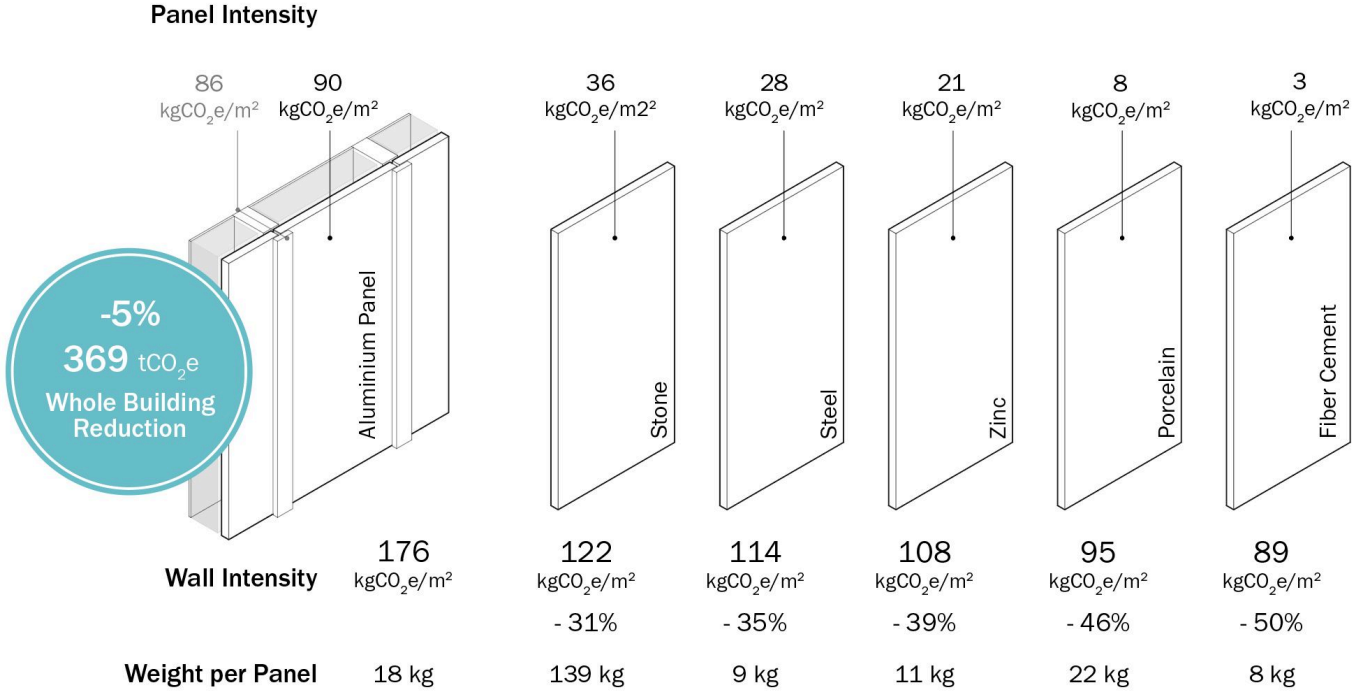
Housing Area	1,309 m^2 (Townhouses Removed)	1,371 m^2 (Upper Floor Units Added)
Parking Spaces	116	125
Total Floor Area (incl Parking)	22,869 m^2	22,310 m^2

-23%
1,866 tCO_2e
Whole Building Reduction incl. Shoring

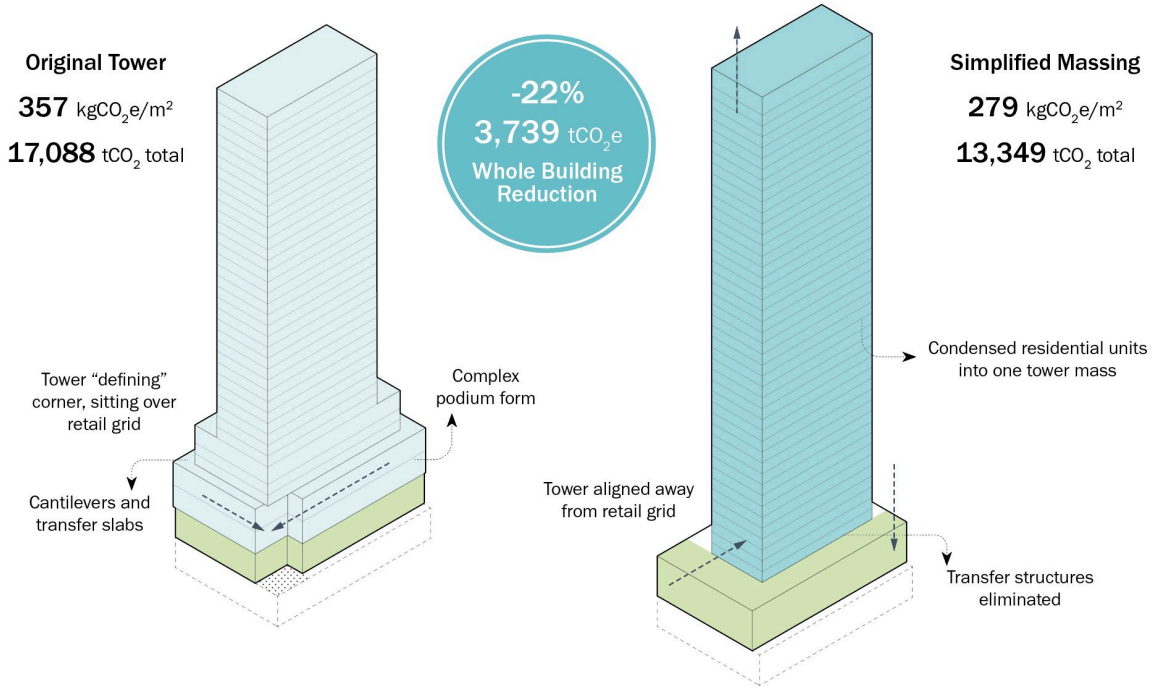
Material savings:
Removing transfer slab saves:
- 3% of the building's concrete volume → $101,500
- 4% of the building's rebar weight → $212,000

Avoiding shoring saves:
- 1,466 m^3 of concrete → $365,000
- 39,985 kg of steel
- 2500 trucks of excavation volume

Mid-rise design case study: window-wall systems



High-rise design case study: re-massing

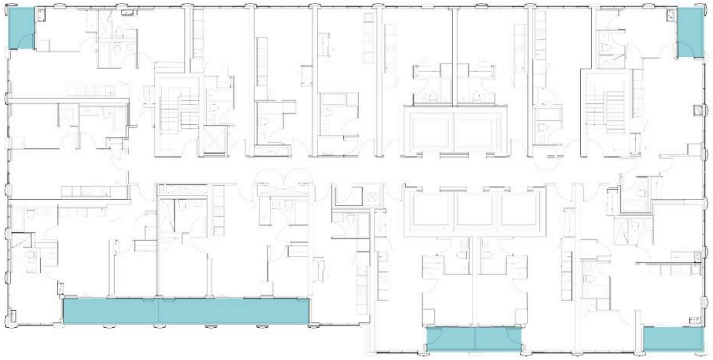


Material savings:
Structure material savings:
- 22% of concrete (**$1.6 million**)
- 13% of rebar (**$1.6 million**)

Envelope material savings:
- 12% of aluminum
- 12% of glass
- 7% of brick
- 8% of precast concrete
- 9% of insulation (**$260,000**)

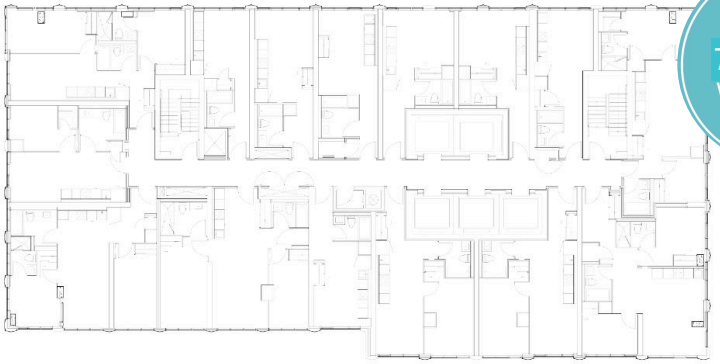
High-rise design case study: envelope

Original Design



Building Floor Area	47,826 m²	**VFAR***	61%
Linear Facade per Floor	4,725 m		

Alternate Massing



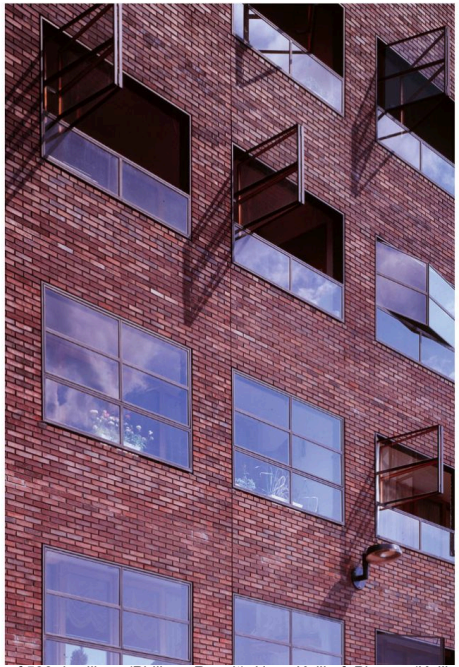
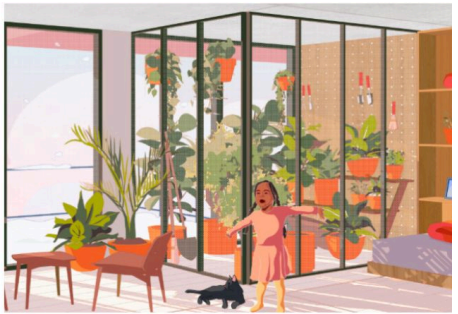
Building Floor Area	49,671 m²	**VFAR***	51%
Linear Facade per Floor	4,965 m		

-4%
766 tCO_2e
Whole Building Reduction

Material savings in the envelope:

- 17% of precast concrete panels (in addition to 8% savings from remassing)
- 16% of insulation boards
- glass, brick, copper panels, and aluminum by similar shares

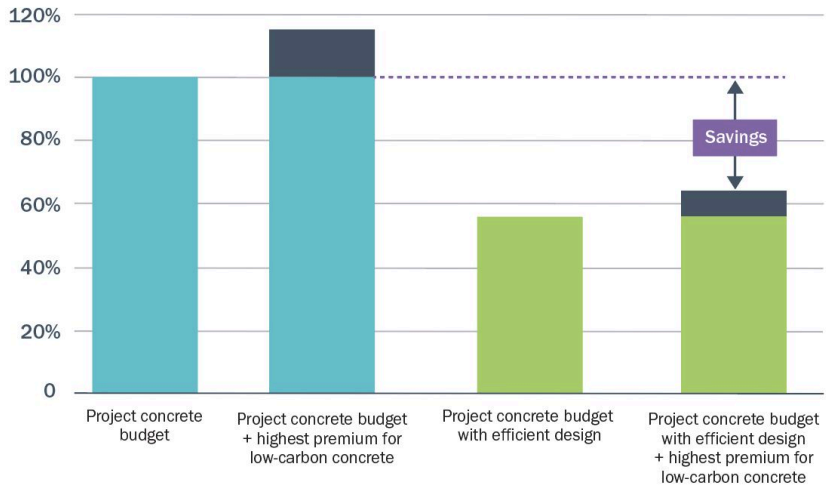
Reimagining balconies

Photos, clockwise from upper left: Lacaton + Vassal, Transformation of 530 dwellings (Philippe Ruault), Hans Kollhof, Piraeus (Kollhof + Pols), BDPQ in Canadian Interiors (Quadrangle), Alvaro Siza Vieira + Peter Brinkert, Wohnhaus Schlesisches Tor (Esra Ackan), Hans Kollhof, Piraeus (Miriam Palmer).

How materials and design interact

- Savings best achieved through a combination of material choice and design
- Lower-carbon materials available at market rates
- But design savings can make room for near-zero materials even if these come at a premium



Beyond Material Costs

- **Schedule impacts**
  - Efficient design is fast as well as clean
- **Cost of measuring carbon**
  - Government assistance on data has helped
- **Operational vs. embodied carbon tradeoffs**
  - Need to take a lifecycle approach
- **Expertise & project planning**
  - No major problems for construction crews
  - Early planning & communication is key, especially with concerns around risk assumption
- **Urban design guidelines and building codes**
  - Prescriptive requirements on parking, floor plate sizes and setbacks can prevent low-carbon design options
  - Centre outcomes instead

Recommendations for policymakers

- **Implement Buy Clean policies with both material-specific and whole-building requirements**
- Ensure Buy Clean requirements are **predictable, performance-based, and ramp up over time**
- **Build flexibility into material-specific requirements** to account for variable markets, e.g. exempt a project if a certain premium is exceeded (2% of the structure budget)
- **Re-evaluate building codes, zoning, and urban design guidelines** to unlock lower-carbon design opportunities
- **Provide financial support for data development (EPDs)**
- **Provide capacity building and implementation guidance**

Recommendations for project managers

- **Take a carbon budgeting approach to projects**: emissions as a metric of success, provide time and mandate for project partners to think about the most accessible, low-cost solutions to reduce embodied carbon
- **Engage all project partners early on**, from designers and structural engineers to the general contractor, to avoid material waste, optimize designs, and plan for the effective implementation of low-carbon materials
- **Encourage creativity in design:** may also mean allocating more of the budget to improved design in order to save on budget for materials

Questions?

Each Monday we publish the Clean Energy Review, a free weekly digest of must-read climate and clean energy stories from across Canada and around the world.

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