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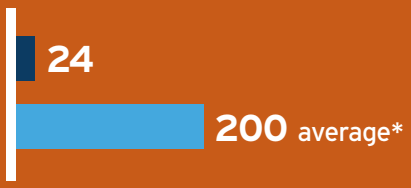
Case Study: Zero House

This project set out to answer a few important questions: Can a house combine zero operational AND embodied carbon? Can a house avoid ALL toxic materials? Can a house be FULLY built for disassembly, from structure to finishes? Can a house produce NO waste? And can all of this be achieved AFFORDABLY? Zero House was able to provide an answer of "Yes" to all of these questions.

Embodied Carbon

Cradle-to-gate, kg CO_2e/m^2



*Average based on report from 2022.

Reduction Strategies

- Helical pier foundation eliminates concrete from design
- Design for disassembly eliminates waste when building is updated and at end of life
- Offsite panelization simplified use of carbon storing insulation

Carbon Storage

- Straw insulation (half of first floor walls)
- Recycled juice-box structural sheathing
- Cellulose insulation (roof, walls & floors)
- Wood fiberboard continuous insulation

14 tons of CO_2 stored

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Simple, low-cost offsite panelization makes it easier to create carbon-storing, healthy and efficient housing.

Chris Magwood, Former Executive Director, Endeavour Centre

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Operational Carbon | Zero House was designed to exceed Canada's Tier 5, net zero ready codes. The fully electric building is very airtight (1.0 ACH/50), highly insulated and incorporates passive solar strategies. 3.5 kW of roof-integrated solar covers ~70% of annual electrical loads.

Airtight building (1.0 ACH50)

Fully electric building

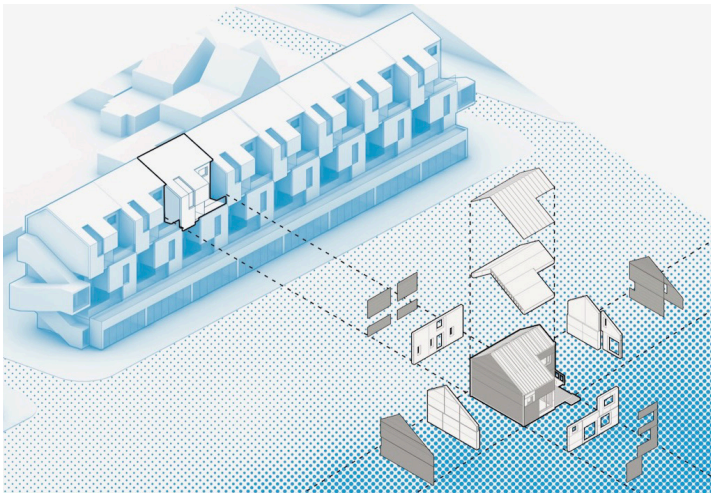
Roof-integrated solar panels

Zero House was an ambitious project, attempting to merge concerns about climate impacts, material health, affordability, panelization and design for disassembly. Added to this mix was a desire to create a building design that could function as a single-family home but that could, with only minor modifications, become a duplex, a triplex or stacked row housing, helping to address the need for "missing middle" housing typologies.

We focused on design for disassembly as a way to address waste reduction at the end of the building's life, but also as an important aspect of affordability. By creating a design in which every part of the building is removable without damaging the material, design for disassembly reduces the cost of repairs, modifications and upgrades in the future and enables the owner to sell materials that are being replaced.

Design for disassembly also helps to ensure that the lifespan of the building's carbon-storing materials can extend beyond the lifespan of the building itself, reducing the likelihood of the stored carbon being released for the forseeable future.

All of these theories were put to the real-world test of building, dismantling and rebuilding the home three times, which we were able to do successfully.



Lessons Learned

1. Design for disassembly works! The building was built and dismantled three times with all materials reused and no waste.

2. Offsite panelization can be straightforward and doesn't require a "factory".

3. It is possible to combine efficiency, carbon storage and occupant health.

Project Information

Project name: Zero House
Location: Ontario, Canada
Builder: Endeavour Centre
Year built: 2017
Typology: Single-family, but designed as stackable row house
Size: 840 SF
Cost: $250,000 -$350,000