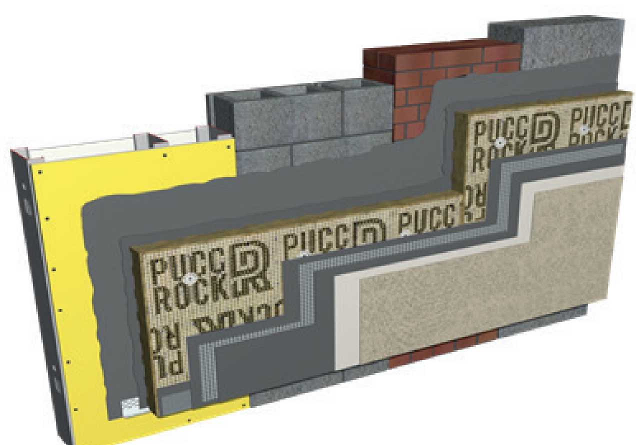
Retro housing retrofitted for the modern age

Case Study

Project Description

The Ken Soble Tower project sought to rehabilitate a post-war apartment in Hamilton, Ontario. The building was completely upgraded, inside and out, to achieve Passive House standard, reducing greenhouse gas emissions by an impressive 94%. The success of the Ken Soble Tower retrofit demonstrates a pathway to revitalizing similar aging building stock across North America through ultra-low energy retrofits. Additionally, it serves as an example of the positive impact such projects could have on the built environment and local communities, while improving occupant quality of life, reducing operating expenses, and contributing to overall carbon reduction in urban areas.



DuROCK PUCCS NC -
Non combustible Rainscreen EIFS used on the Ken Soble Tower

The Goal

Built in 1967 at 18 stories and 80,000 square feet, the Ken Soble Tower had been in a state of deterioration for some time as the oldest high-rise multi-residential building in CityHousing Hamilton's portfolio. The goal was to retrofit the building to achieve EnerPHit certification, a branch of the Passive House (PassivHaus) standard designed specifically for retrofits. The building overhaul would include nearly every facet of the building from the building envelope, mechanical systems, electrical, plumbing, and safety systems to interior upgrades to its 146 units to support aging in place, accessibility, comfort, and overall improvement of the occupant experience. As public housing, cost was a key consideration, and the team set out to complete the retrofit at a fraction of the cost of a new build.

The Challenge

The current building had significant challenges including a deteriorating envelope, lack of insulation, inadequate ventilation, and lack of thermal controls. While ERA Architects was originally going to re-clad the building with an entire wall assembly outside the existing brick, a visit to the ROCKWOOL booth at the Construct Canada exhibition changed everything.

The Solution

After introducing the architect to the DuROCK PUCCS NC EIFS system incorporating ROCKWOOL stone wool insulation, the entire plan for the building envelope was revised. The resulting cladding design includes a six-inch thick stone wool EIFS system. ERA Architects liked three main things about the system: first, and most obviously, the non-combustibility (important given the vulnerability of the senior-aged occupants); second, the excellent moisture control offered by the stone wool and the unique, built-in drainage layer cut into the back side of the insulation; and third, the liquid applied water resistive barrier (LAWRB). In all, 50,000 sq. ft. of ROCKWOOL stone wool insulation was incorporated into the new façade, helping to realize the R-38 effective R-value required to achieve EnerPHIT certification. The EIFS system fit the need for cost-effectiveness (the system helped reduce labour costs), ease of install, high-quality composition, a favourable sustainability profile as well the top-notch technical support, provided by ROCKWOOL and DuROCK. The upgraded building envelope with inorganic stone wool will also help contribute to better air quality, since mold was previously an issue. Additionally, it created a more resilient building, able to stand up to harsher conditions as a result of climate change in the region, effectively future-proofing the building and better protecting its senior residents. In fact, thanks in part to its tight and super-insulated building envelope, ERA Architects notes that Ken Soble Tower "demonstrates passive resilience to extreme conditions: In case of failure of active systems, the building will stay warm in winter for up to two days (compared to 2 hours in a typical building) and below dangerous heat levels in summer for up to four days (compared to half a day in a typical building)".

Overall, Ken Soble Tower will now provide residents with improved comfort and control of their indoor environments while substantially reducing energy demand. At its peak, the total energy needed to heat or cool each unit will be equal to the energy needed to run 3 incandescent light bulbs (100W). The retrofit now positions Ken Soble Tower as a true asset as well as a proud and prominent landmark in Hamilton's waterfront—fitting, as it now stands as one of the world's largest EnerPHit certified projects.

Architect:
ERA Architects

Contractor:
PCL Construction

Passive House Consultant:
JMV Consulting

Location:
500 MacNabb St. – Hamilton, ON

Year:
Spring 2021

Project Size:
18 stories, 146 units, > 80,000 sq. ft

ROCKWOOL Product & Application:
6" ROCKWOOL Stone wool insulation - 50,000 sqft of 6x24x48" as part of the DuROCK PUCCS NC Exterior Insulated Finish System (EIFS)

ROCKWOOL
8024 Esquesing Line
Milton, ON L9T 6W3
Tel: 1 800 265 6878
rockwool.com

Ken Soble Tower

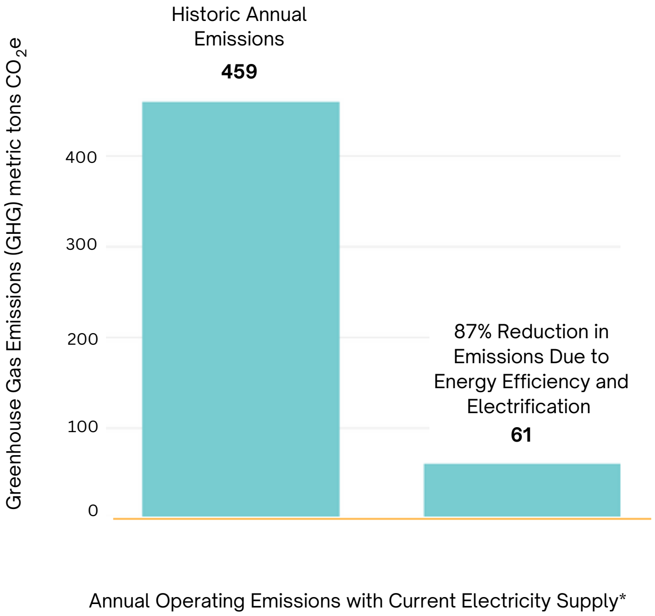
Hamilton, Ontario

Ken Soble Tower, after renovations.

Ken Soble Tower, located in Hamilton, Ontario, is a deep energy retrofit of a 1967 tower. In 2020, this 18-story, affordable senior housing property underwent a passive house deep energy retrofit. This 80,000-square-foot public housing building is currently the world's largest residential EnerPHit passive house retrofit project and has cut its energy use by 76 percent.

Achieving this involved a new electric mechanical system, wrapping the building in a new super-insulated shell using an exterior insulation finishing system (EIFS) with mineral wool insulation, new windows, and additional batt insulation on the interior.

Deep Energy Retrofit Analysis



*Annual operating emissions are calculated using Ontario based emissions factors for natural gas and electricity.

Energy reduction from energy efficiency and electrification	76 percent
Energy use intensity (EUI) before retrofit	138.5 kBtu/sf
EUI after retrofit	22.3 kBtu/sf
Greenhouse gas (GHG) emissions reduction with current electricity supply	87 percent

Image: ERA Architects.

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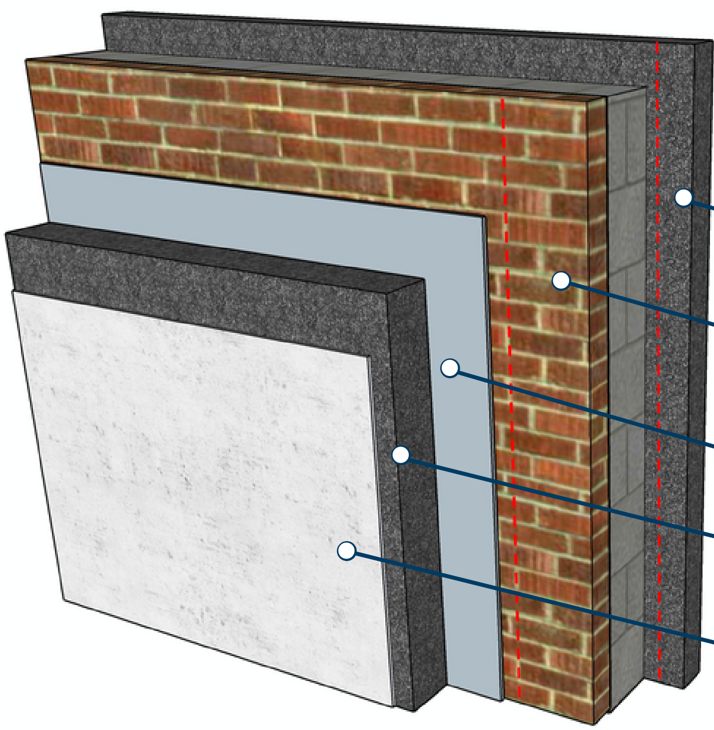
Building Envelope Strategy

Like many mid-century buildings, the existing exterior wall was concrete block with a brick veneer with limited mineral wool insulation. The building was experiencing deteriorating balcony slab edges, windows, and roof from water penetration over the years. The building was unoccupied at the time of the renovation since the interior drywall and insulation had to be removed due to mold. For this building and the site conditions, the most effective envelope strategy involved insulating both the interior and exterior sides of the walls. The interior was insulated with four inches of mineral wool (R-16.8), and the exterior of the building was wrapped with six inches of mineral wool insulation (R-25.2) and an EIFS treatment. Mineral wool was selected as the insulation to keep embodied carbon modest and combustibility risk low. At the time of construction, Ken Soble Tower was the first retrofit in Canada to use mineral wool EIFS on the façade, a patented system developed by DuROCK with exceptional fire resistance.

New Insulated Building Envelope (R-38 effective)



Building Overview

Project name	Ken Soble Tower
Building type	Multifamily residential
Location	Hamilton, Ontario
Year built	1967
Status of renovation	Completed 2021
Number of stories	18
Number of apartments	146
Floor area	82,369 square feet
Certifications	EnerPHit

Building Team

Building owner	City Housing Hamilton
Architect	ERA Architects
Mechanical engineer	Reinbold Engineering
Electrical engineer	Nemetz
Building scientist	Entuitive
Construction manager	PCL Constructors
Passive house consultant	JMV Consulting

Exterior Insulation Wall System

Wall Insulation	
R-value before	R-8.8
R-value after	R-38
Roof	
R-value before	R-10
R-value after	R-63
Windows	
U-value before	U-1.50
U-value after	U-0.12
Solar heat gain coefficient (SHGC) before	Unknown
SHGC after	0.32
Target Airtightness	0.23 ACH50

New triple-paned windows were set in the existing window openings and thermal bridging was eliminated at the existing balconies by removing them and creating “juliette” balconies. With oversized windows on the building exterior, the building team installed interior blackout blinds to reduce solar heat gain in the summer months. Resident education on how to operate the renovated homes and maximize energy efficiency has been especially important to achieving operating savings.

Image: ERA Architects.

Image: ERA Architects.

Construction on the exterior envelope including window and "Juliette" balcony installation (right). Interior view after construction (left).

Scope of Work

Interior Insulation (Walls)	Exterior Insulation (Walls)	Exterior Insulation (Roof)	Mechanicals	Solar PV
• 4 inch mineral wool (R-16.8)	• Cementitious air barrier • 6 inch mineral wool (R-25.2) • EIFS treatment	• Fluid applied polyurethane roof membrane • 400mm (4 layers of 100mm) extruded polystyrene (XPS) rigid insulation • Filter fabric • Riverstone gravel ballast	• Heating and Cooling: Central LG Multi V5 and VS air source heat pumps with electric resistance heat boost (on demand), in-suite electric variable air volume (VAV) systems • Ventilation: Central Swegon ERV system • Domestic Hot Water: Gas-fired system	• N/A

HVAC Strategy

Before the deep energy retrofit, Ken Soble Tower was uninhabitable because of deterioration, mold, and asbestos-laden materials. The new central systems include three large, electric Swegon units, one located at each the base of the building, the roof, and the annex building, all powered by heat pumps. This new HVAC system replaced an ineffective ventilation system that provided make-up air to the central corridors and then to individual apartments via an undercut of the apartment doors. Tempered, fresh air is provided to each apartment through the central system, with in-suite electric VAVs allowing for more variable demand control. Electric resistance is used as an additional heat boost. Unfortunately, due to an aging utility-owned transformer, the building could not support an all-electric domestic hot water system as the added load would have surpassed the transformer's peak capacity.

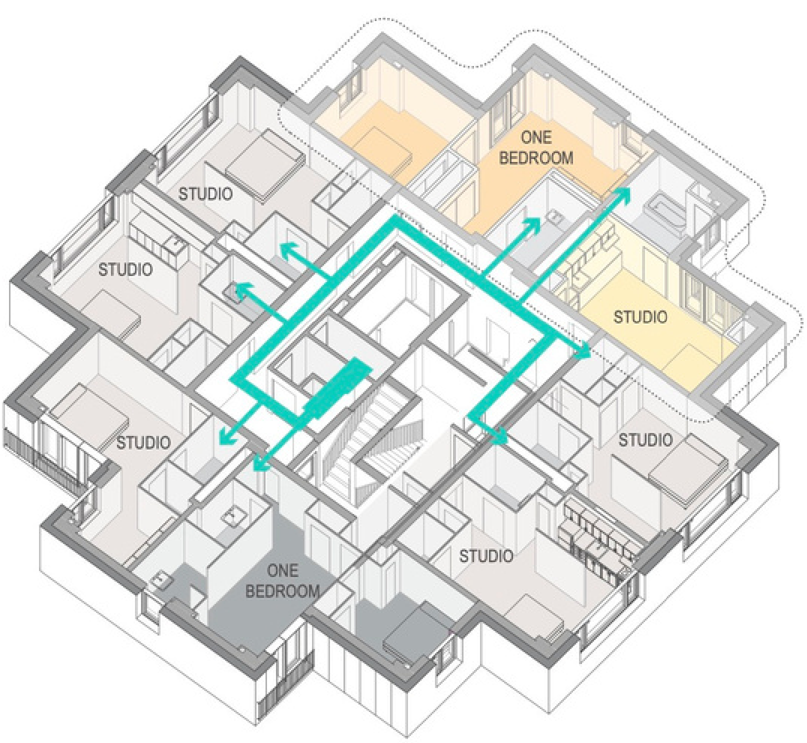
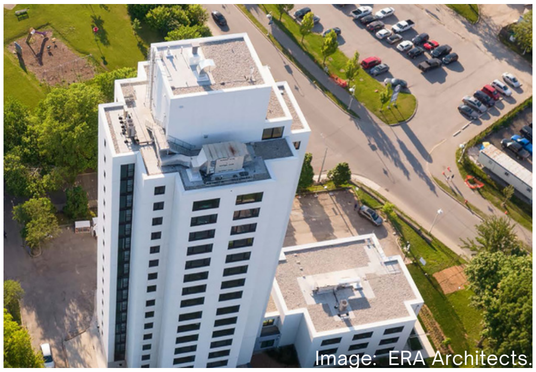


Diagram showing central ventilation supply design.



Tenant Engagement

A portion of the energy savings depends on Ken Soble Tower residents. Residents control the heating and cooling of their units through their thermostat, operable windows, black out blinds, and ceiling fans. The property management team is working to educate residents on low-energy strategies to heat and cool their apartments efficiently. A large part of this working dynamic focuses on managing resident expectations through transparency and communication on project operations.

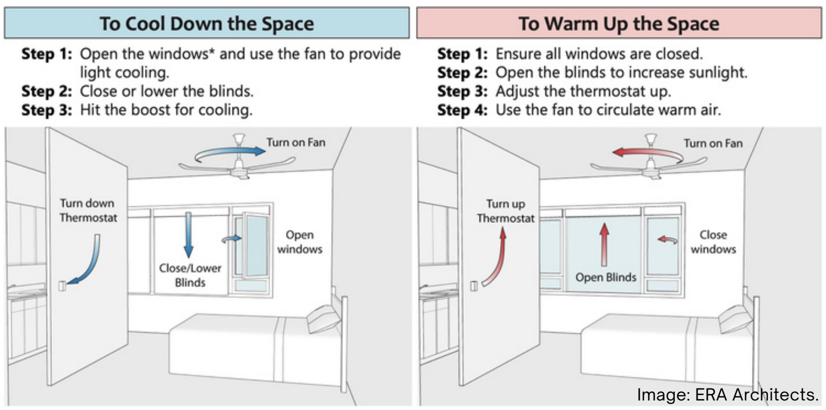


Image: ERA Architects.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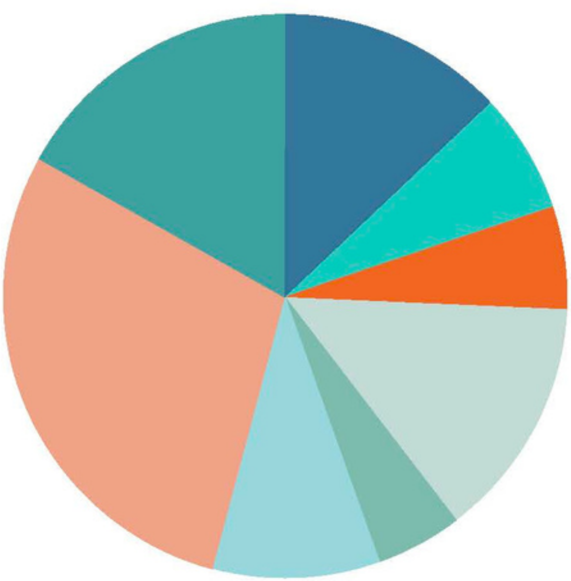
Cost Breakdown

Specific cost data was not available for this case study, however, the graphic below summarizes cost categories and their percent share of overall construction costs.



Objective	Percentage of Cost
Energy Efficiency	13.1%
Passive House Premium	7.1%
Accessibility and Social Inclusion	5.8%
Interior Fit Out	13.9%
Life Safety	4.8%
Mold and Asbestos	9.3%
State of Good Repair	29.3%
General Conditions and Fees	16.7%

Graph: "Ken Soble Tower Transformation" by Tower Renewal Partnership.

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