Sundance Housing Co-op

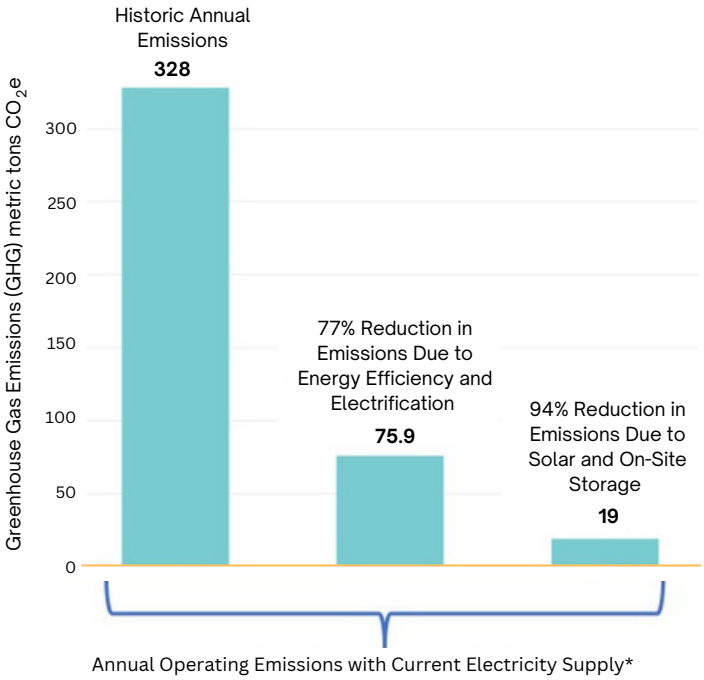
Edmonton, Alberta

Sundance Housing Co-op, located in Edmonton, Alberta, is a community-wide deep energy retrofit. The housing co-op features 59 affordable townhouses that are cutting their energy usage by 68 percent.

Sundance Housing Co-op townhouse during renovations.

The buildings are being outfitted with all-electric mechanical systems and wrapped in a new superinsulated exterior shell that combines prefabricated panels with site-built construction methodologies. With a newly reduced energy load, the site will be fully powered by renewable energy, eliminate fossil fuels altogether, and make Sundance Housing Co-op net zero energy in operations. Rooftop solar photovoltaic (PV) will serve 75 percent of the total annual energy load. The rest will be procured through external renewable energy purchases.

Deep Energy Retrofit Analysis



*Annual operating emissions are calculated using state-specific long-run marginal emission rates (LRMER) for electricity instead of average historical emissions rates. This method is justifiable when projecting emissions savings over longer periods of time, because LRMER more accurately reflect the current and future electric grid supply.

Without Solar

Anticipated energy reduction from energy efficiency and electrification	68 percent
Energy use intensity (EUI) before retrofit	77.6 kBtu/sf
Modeled EUI after retrofit	25.1 kBtu/sf
Anticipated greenhouse gas (GHG) emissions reduction with current electricity supply	77 percent

With Solar

Total load served by on-site renewables	75 percent
Total load served by off-site renewables	25 percent
On-site solar PV system	345 kW
Anticipated energy reduction with solar	100 percent
Modeled EUI with on-site solar	7.4 kBtu/sf
Anticipated GHG emissions reduction with solar with current electricity supply	94 percent*

*Assumes the Renewable Energy Credits (RECs) from on-site solar remain with the property and are not sold to a third party.

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Building Envelope Strategy

The architectural complexity across the 59 townhouses posed a significant design challenge to creating the new exterior insulated building envelope. Full panelization was not an option due to site restrictions, including mature landscaping, cantilevers, porches, tight inside corners, and member-built additions that required multiple façade solutions. Given the irregular site conditions, lessons learned from a partial retrofit pilot project in 2020 led to a successful strategy of combining prefabricated and on-site construction methodologies. Using multiple Lidar scans of the building facades, the team could identify and group panel dimensions and characteristics with exact geometry. With the digital data, it was possible to construct the panels off site with a high level of dimensional accuracy. However, to work around multiple façade dimensions, some on-site fitting and cutting was required. The prefabricated panel assembly includes 2x4 framing with sheathing, a 10 mm vented rain screen, a water-resistive barrier, and fiber cement siding. On site, 200 mm of cellulose insulation is blown into the top of the wooden panel frames. The panels are constructed with preinstalled triple-glazed fiberglass windows, although the doors are largely installed in their original rough openings and trimmed out on site. The team is now working on property-wide implementation by tackling two buildings at a time to account for the variations among buildings.

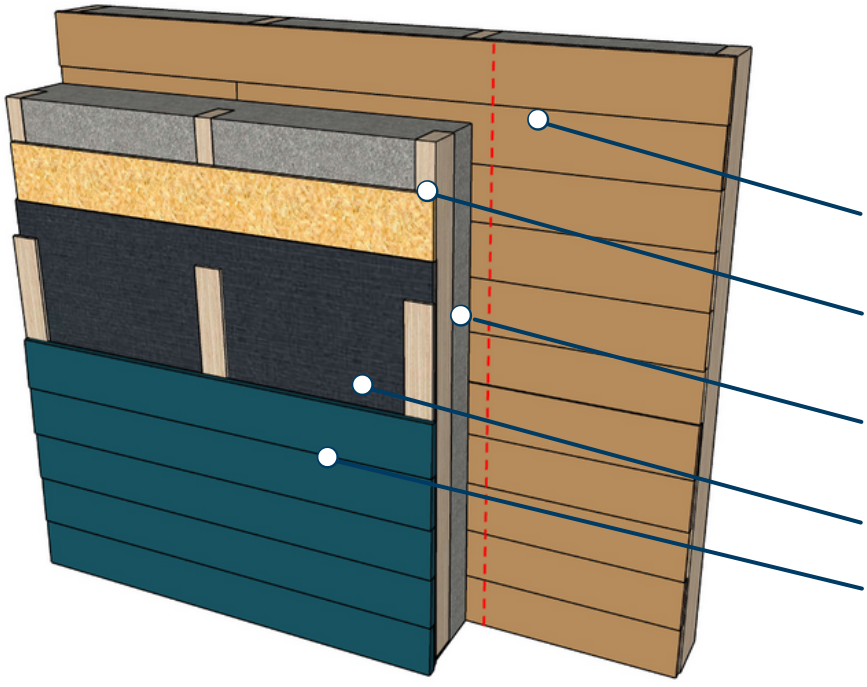
Building Overview

Project name	Sundance Housing Co-op
Building type	Multifamily residential
Location	Edmonton, Alberta
Year built	1976
Status of renovation	Under construction; 2023 completion
Number of stories	2
Number of apartments	59
Floor area	55,000 square feet
Certifications	N/A

Building Team

Building owner	Sundance Housing Co-op
Design builder	ReNu Engineering
MEP engineer	ReNu Engineering
Structural engineer	Andy Smith, P.Eng
Building scientist	ReNu Engineering
Construction manager	Butterwick Projects Ltd.

New Insulated Building Envelope (R-40 effective)



Existing 2x6" wooden frame with stud bay insulation and siding (R-15 effective)

Prefabricated 2x4" wooden-framed panel and sheathing

8" cavity site-filled with dense-packed cellulose insulation (R-26 effective)

Vapor open air- and water-resistive barrier

Rainscreen, furring, and James Hardie siding

Exterior Insulation Wall System

Wall Insulation	
R-value before	R-15
R-value after	R-40
Roof	
R-value before	R-28
R-value after	R-76
Windows	
U-value before	U-0.40
U-value after	U-0.18
Solar heat gain coefficient (SHGC) before	0.70
SHGC after	0.16
Target Airtightness	0.75 ACH50

To support the new building envelope, structural adjustments are being made to the foundation. Using a hydrovac system to excavate around the building from the footing to about eight inches below finished grade, the foundation is examined, five inches of graphite-infused EPS is installed, primer is rolled on, and a peel and stick membrane is applied. To support the two stories of panels and the extended roof overhang, a 2x10 ledger is nailed and bolted to the foundation to carry the weight. To avoid a thermal bridge, the ledger is a mineral-wool-filled, pressure-treated panel support box (R-28). New prefabricated scissor trusses are installed over the existing roof and finished with highly efficient, insulated roof panels.

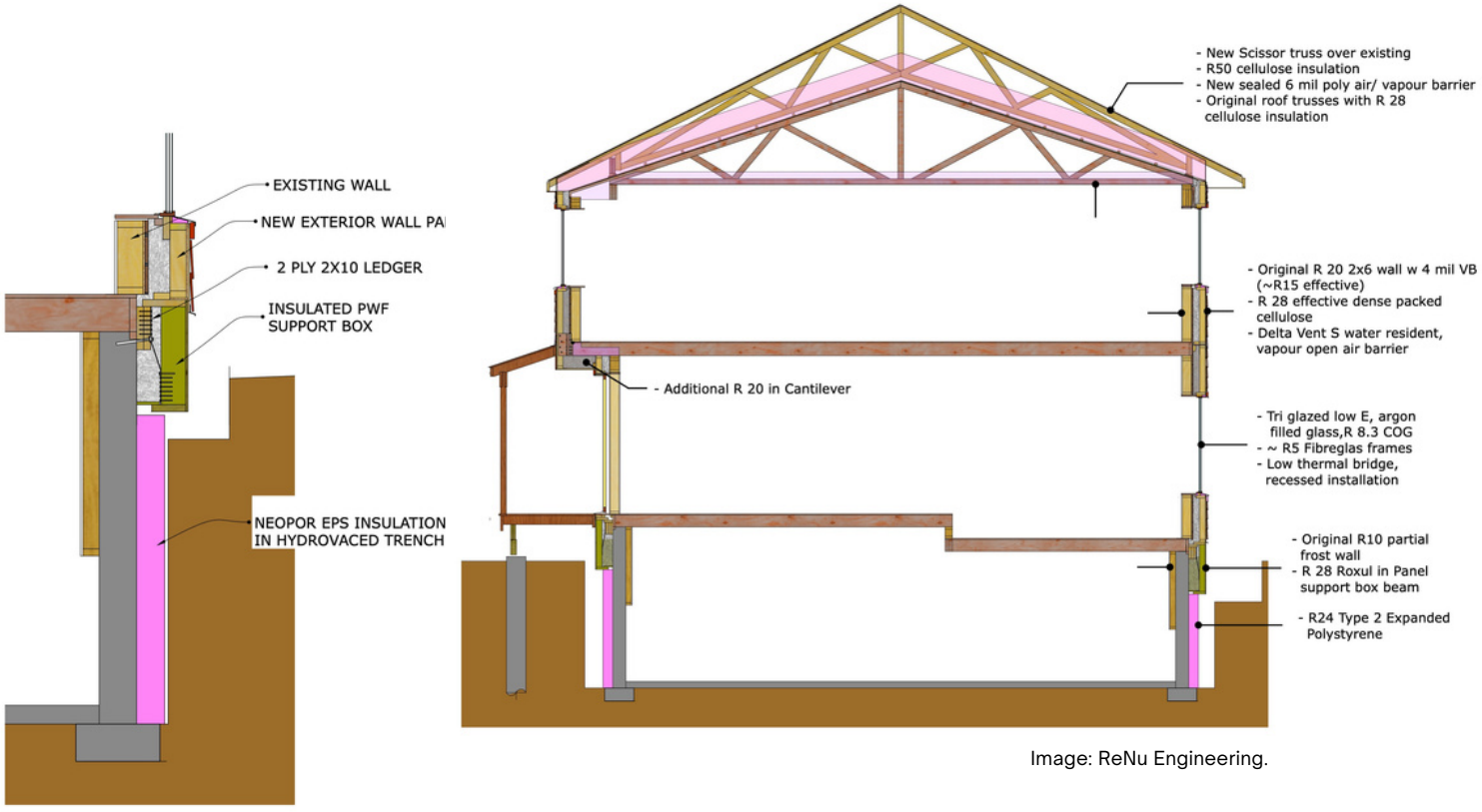


Image: ReNu Engineering.

Full scope of exterior envelope insulation (right) with foundation and panel support detail (left).

Scope of Work

Exterior Insulation (Walls)

- Above-grade walls
  - Lightly framed 2x4 stand-off panel with dense packed cellulose insulation and integrated windows (R-28 effective)
  - Cosella Dorken Delta-Vent S or Majvest vapor open, water-resistive barrier
  - James Hardie siding
- Exposed basement down to footing
  - Mineral-wool-filled pressure treated panel support box (R-28)
- 5” graphite-infused EPS (R-25)
- Peel and stick weather-resistive barrier

Exterior Insulation (Roof)

- New sealed 6 mil poly air/vapor barrier
- New scissor truss over existing roof trusses
- Cellulose insulation (R-50)

Mechanicals

- Heating and cooling: Unitized 1.5-Ton Daikin Skyair air source heat pumps with integrated 5kW Daikin back-up electric resistance heat for temperatures below -30°C
- Ventilation: Unitized Lifebreath 267 Max heat recovery ventilation (HRV) units
- Domestic hot water: AO Smith FPTU-50 air source heat pumps

Solar PV

- Rooftop 345 kW solar PV system

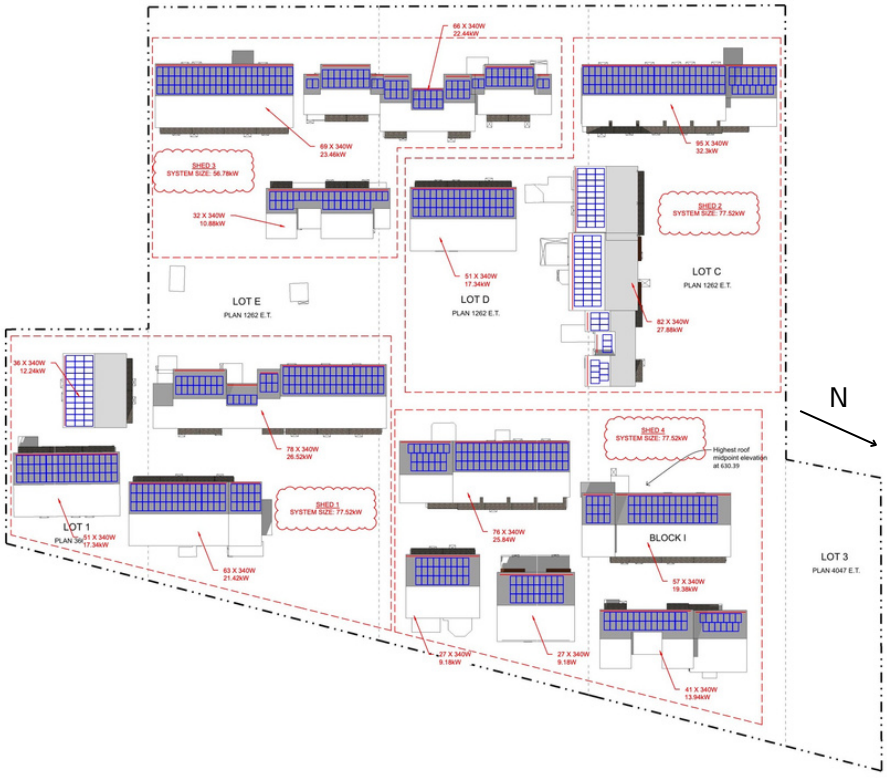
HVAC Strategy

Existing gas furnaces are being replaced with air source heat pumps, while the domestic hot water systems are being replaced with air source heat pump hot water heaters. To be prepared for Alberta’s severe cold weather, when outside temperatures drop below -30°C (-22°F), the heating system will switch over to electric resistance heat. Electrifying the buildings requires an electrical service upgrade and excavation for new lines. For ventilation and heat recovery, HRV units are being installed in the unfinished basements of each apartment. The removal of the older B Vent chimney creates optimal ducting space leading straight to the attic, allowing for supply and exhaust ductwork to the second floor. Old furnace ducting will be used to distribute fresh, temperate air to the first floor, and new exhaust ducting will be installed for the first floor. With these combined upgrades, Sundance Housing Co-op anticipates a 68 percent reduction in energy load.

Images: ReNu Engineering.

Renewables

Rooftop solar will supply about 75 percent of the reduced energy load, while the remaining 25 percent will be powered by off-site renewable energy purchases. Siting solar was complicated by mature vegetation and building orientation.



Images: ReNu Engineering.

Cost Breakdown*

Anticipated hard construction cost of deep energy retrofit	$4,538,215
Cost per square foot of floor area	$83
Cost per apartment	$76,919
Total cost of exterior insulated envelope assembly (wall and roof)	$1,827,172
Installed exterior envelope assembly cost per square foot of exterior wall and roof surface area	$25
Installed exterior envelope assembly cost per apartment	$30,969

Image: ReNu Engineering.

*Costs originally provided in Canadian dollars and converted to US equivalency based on September 2022 currency exchange rate of 1.00 CAD=0.73USD.

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