

WINDERMERE FIRE STATION NO.31

Canada's first net-zero fire station features sweeping PV array

Windermere Fire Station No. 31 is located in southwest Edmonton in a rapidly expanding neighbourhood. The project is the City of Edmonton's first net-zero building, achieved through a comprehensive passive design approach and a combination of solar arrays, geothermal heating and cooling.

The 1,520 sq.m facility has bays for three fire engines as well as offices, sleeping quarters and dining areas for a crew of up to 12 firefighters. The post-disaster, non-combustible, sprinklered building will also act as a community centre in the event of an emergency. To underpin this role, it also has a dedicated room to support the many community drives in which the department is involved.



1. The station's distinctive form accommodates a large volume housing the apparatus bay and a smaller volume for the domestic quarters. The overall design conveys feelings of permanence, security, wellbeing, comfort, and longevity.

DESIGN APPROACH

As civic buildings, fire stations are highly functional and technical facilities, usually embedded in residential communities for citizen safety. At once practical and symbolic, contemporary fire stations serve a critical public service while conveying important civic values within a neighbourhood.

The design challenge was to create an expressive and engaging structure that would encourage community pride and incorporate technical advances in environmental performance.

The City of Edmonton requested a highly sustainable project that would generate on-site renewable energy equal to 100% of the total building energy demand. The facility must also have an energy performance that is 40% more efficient than NECB 2011, yield 40% less green house gas emissions than the baseline using NECB 2011, and operate at no more than 80 kilowatt-hours per square metre per year for heating needs.



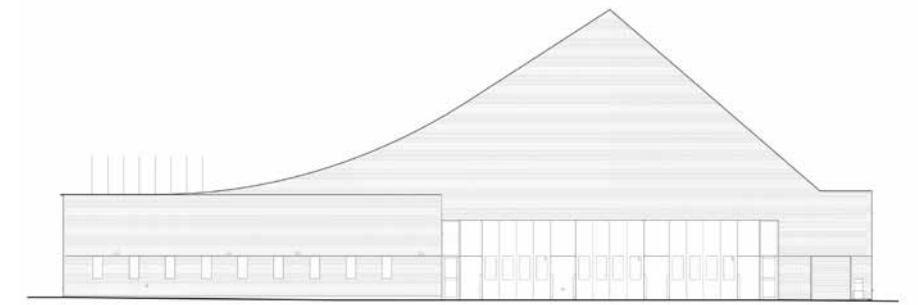
Site plan

1. Apparatus bay
2. Captain's office
3. Day room
4. Study
5. Kitchen
6. Fitness room
7. Patio
8. Dorms
9. Captain's dorm
10. Universal change room
11. Duty gear locker
12. Generator
13. Garbage/recycling
14. Bio-swales

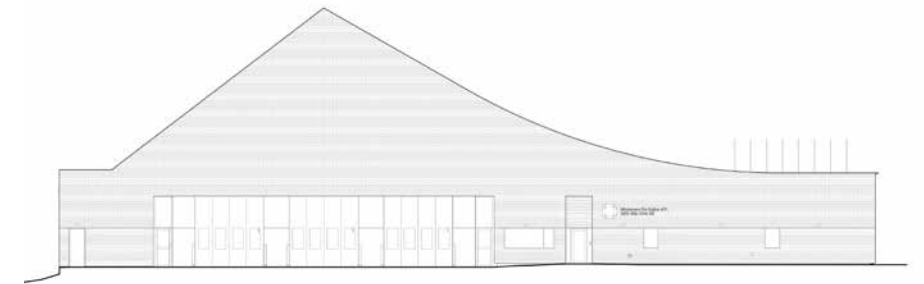
2. The facility has significantly fewer windows than the average building, and uses bi-folding and quick-closing apparatus bay doors to restrict heat loss from typical daily use.



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East elevation



West elevation

3. Windermere Fire Station's distinctive silhouette is defined by an expansive sloped roof covered in a PV solar array. The building form echoes the familiarity of a quintessential fire station, while also making visible this facility's contemporary sustainability mandate.

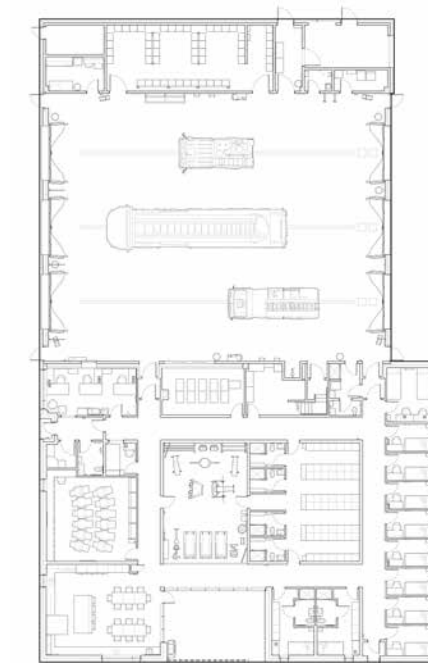
4. The traditional fire hall hose and bell tower form - now redundant - are reimagined with a gently curving, south-facing roof.



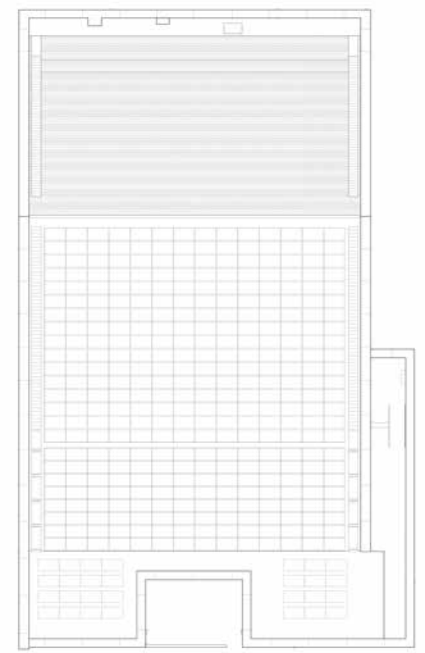
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Upper floor plan



Roof floor plan



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PROJECT CREDITS

CLIENT City of Edmonton
DESIGN ARCHITECT gh3* (Toronto)
PRIME CONSULTANT S2 Architecture, (Edmonton)
STRUCTURAL ENGINEER RJC Engineers
MECHANICAL/ELECTRICAL ENGINEERS Smith and Andersen
SUSTAINABILITY Ecoammo
CIVIL ENGINEERING AND LANDSCAPE DESIGN
 gh3* and Urban Systems
INTERIORS gh3* and S2 Architecture
GENERAL CONTRACTOR PCL Construction
PHOTOGRAPHER Raymond Chow/ gh3*

PROJECT PERFORMANCE

ENERGY USE INTENSITY (PROJECTED) 94 kWh/m²/year.
 With solar panels operational, EUI will be 0 kWh/m²/year.
WATER USE INTENSITY (PROJECTED) 104 m³/m²/year



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The domestic area is organized around a corridor circuit, with the change rooms and fitness centre in the middle, and the sleeping areas, kitchen, lounge, and offices around the perimeter.

The landscape design similarly strives to balance functional demands with aesthetic rigour - the site is planned around a bioswale stormwater management system that integrates subtly with staff and visitor parking, fire truck entry and exit aprons, and other landscaped areas.

This is architectural firm gh3's sixth completed project for the City of Edmonton. It demonstrates a shared commitment to sustainable methods of constructing and operating public buildings and infrastructure, and to the creation of a healthier and more sustainable future for its citizens.

EDITED BY SABMAG EDITOR JIM TAGGART FROM MATERIAL CREATED BY THE PROJECT TEAM.

The project site was unbuilt and unremarkable – essentially a blank slate. The station's form was derived from a desire to underscore both the iconic image of a fire station as a community anchor, and a contemporary imperative for sustainable citizenship. A typical fire station might have been characterized by familiar signatures such as a pitched roof, large fire truck doors, a hose and bell tower, and solid and heavy load-bearing walls.

Windermere adheres to those principles, however, it re-imagines the hose and bell tower form - now redundant elements - with a gently curving, south-facing roof, outfitted with an extensive array of photovoltaic panels.

Other strategies to increase environmental performance include the building's southern orientation which reduces energy demand by improving the quality of light received in the workplace. A geothermal heating and cooling system is also incorporated. The building is extremely well-insulated and includes high-performance windows and exterior doors.

Roof assembly:

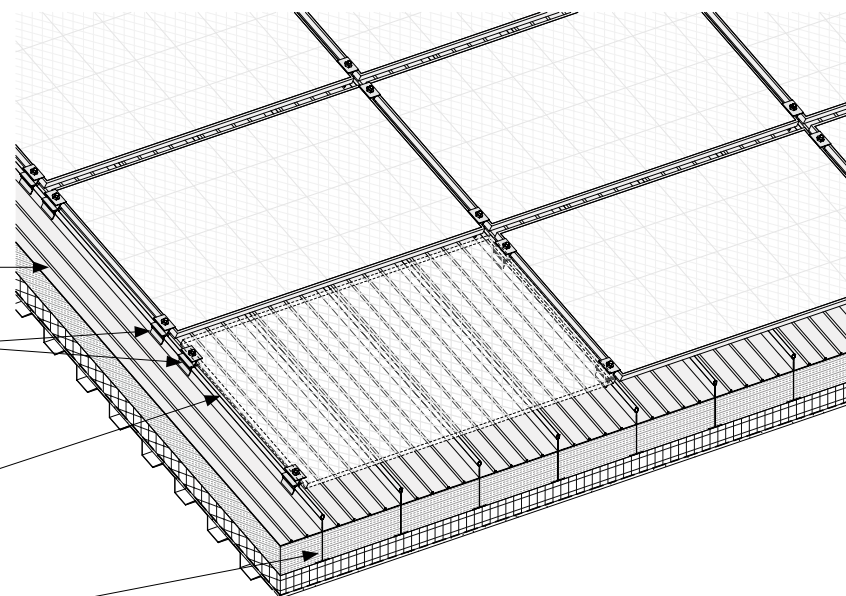
- Prefinished standing-seam metal roofing with thermally-broken clip system
- 150mm semi-rigid mineral wool insulation
- 100mm high-compression rigid insulation
- Fully-adhered waterproofing & vapour barrier membrane
- 13mm exterior gypsum sheathing
- Structural steel deck
- Structural steel roof framing

PV panel mounting system:

- Standing seam metal roof clamp with two way pv panel attachment

PV panel (shown transparent for clarity)

Thermally-broken roof clip system



TECHNICAL CHALLENGES

The highest priority for a fire station is to meet its operational requirements, most important of which is to achieve the fastest possible response times. This in turn requires the large equipment bay doors to open quickly and smoothly to facilitate rapid deployment of the fire trucks. This poses a significant challenge in a net zero building, where the conservation of energy is also critically important.

This challenge was addressed by creating a new door system. Instead of one slow moving overhead door, two sliding doors meet in the middle, reducing opening and closing times to a few seconds. This conserves warm air in winter and cool air in summer. It also improves safety, as drivers have better visibility to the sides than over their heads.

The rooftop photovoltaic array includes 380 modules, each capable of generating 375W. Although the building is required to have back up systems, the panels generate a substantial amount, given Edmonton's annual average of 325 sunny days and 2,345 hours of bright sunshine.

As noted, the facility also includes a geothermal field, with 35 boreholes drilled 70 metres deep under the parking lot adjacent to the building. The stable earth temperature at this depth enables the ground source heat pump to provide heating in winter and cooling in summer.

To achieve the greatest benefit from this renewable energy, the building envelope (including below the ground slab) is heavily insulated. Inside, the apparatus bay is painted in a white colour, increasing interior daylight levels and promoting a healthy working environment.



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5. The roof is outfitted with an extensive array of photo voltaic panels.
 6. The apparatus bay interior is bright white to maximize the feeling of natural light, promoting a healthier work environment.
 7. Full-height corridor glazing draws daylight from an exterior courtyard to the central fitness room.