Case Study #10 Kų Kàtthe Ä'ą

SUMMARY: This profile features a triplex in the Takhini River subdivision built by Habitat for Humanity Yukon (HFHY) in partnership with the Champagne and Aishihik First Nations (CAFN).

The design involved building external structural walls spaced away from a second mechanical service wall on the inside. The cavity was filled with mineral wool insulation and 2 lb. spray foam insulation. This system enabled high insulation values and allowed as much volunteer labour as possible without concern for the impact on air/vapour barrier detailing. The triplex is heated with electric baseboards to simplify maintenance costs.

Figure 1: SuperGreen House, Whitehorse, Yukon

Why SuperGreen[1]? Builder, Occupant Comments:

HFHY has committed to building SuperGreen to provide affordable living for their clients. CAFN advocates for environmental conservation by utilizing energy-efficient building techniques and technologies that promote sustainability. This partnership was based on achieving common goals.

One objective of CAFN's Leadership is to promote self-reliance through home ownership and trades-related training. This SuperGreen house, named *Kų Kàtthe Ä'ą*, meaning "First House", was a collaborative project bringing together many different organizations.

The Chief of CAFN strongly supported the collaboration, saying "This project is based on the traditional values of our people who used to help each other survive. That kind of co-operation is a value that has been eroded over the years, and I think *Kų Kàtthe Ä'ą* will help to bring it back."

Location: This SuperGreen house is located in the Takhini River Subdivision 50 km east of Whitehorse, Yukon.

Designer-Builder Team: Through their experience building several SuperGreen houses, HFHY has established a building committee, with includes SuperGreen building specialists and experts in various fields of high-efficiency products and technologies. Their goal is to achieve a minimum EnerGuide Rating of 86 on each project.

The actual construction of this triplex was a highly collaborative and volunteer-based undertaking. Over the course of construction, volunteers on the site included CAFN citizens, staff and leadership, chiefs from other Yukon First Nations, HFHY's Executive Director, President and Board members, several representatives of HFH's national Global Village Director and Aboriginal Housing Program National Manager, Yukon Government MLA's, members of the RCMP, Yukon College, Yukon Housing Corporation and Canada Mortgage and Housing Corporation.

[1] SuperGreen is a Yukon Housing Corporation standard of energy efficient house construction.

During one especially productive week of construction, National Assembly of First Nations Chief and other First Nation Dignitaries along with the HFH National Leadership Team came to Whitehorse to swing hammers at *Kų Kàtthe Ä'ą*. Canada's Governor General also contributed volunteer labour to the building.

Tradespeople on the site were provided with a full set of plans to guide their work. They were also charged with the responsibility of coordinating the work and managing the volunteers on a continuous basis.

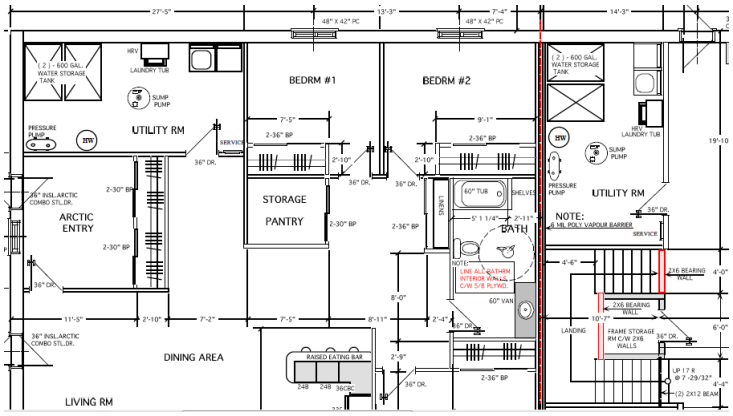


Figure 2: Main floor plan

Type of House: *Kų Kàtthe Ä'ą* is a triplex consisting of two 3-bedroom single storey units on either side of a 4-bedroom, 2-story unit. Unlike a typical town-house or condo, the entryways for the end units are located on the sides of the building to offer maximum privacy.

The house incorporates many accommodating features that allow the home to be easily adapted for life's changing needs. This includes wider halls and doorways and wheel-chair turning areas in the bathroom and kitchen. In the middle unit, extra large closets allow room to install a lift if needed in the future. There is ample "flex" space on the main floor to build an additional bedroom. The homes are built as a slab on grade.

Technical details

Building Envelope:

- Walls (Figure 3): Structural 38x140 mm (2x6 in.) walls with mineral wool insulation, spaced 100 mm (4 in.) away from a second internal 38x89 mm (2x4 in.) wall, also insulated with mineral wool. The space between the walls is filled with 2lb spray foam insulation.

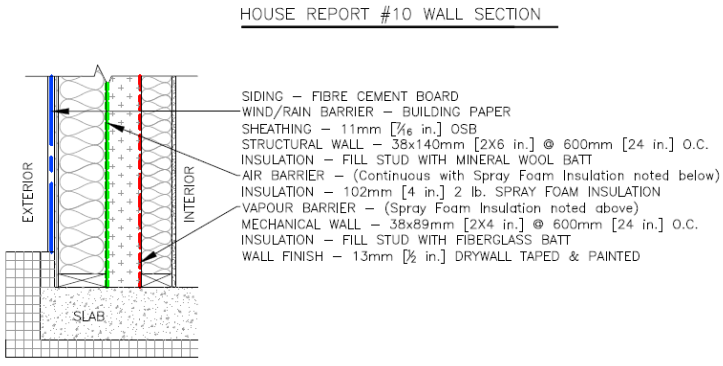


Figure 3: Wall section

- Ceilings: High heel trusses with RSI 17.6 (R100) cellulose.
- Foundation: Slab on grade with RSI 3.5 (R20) foam insulation underneath.
- Windows: Fixed and casement style vinyl, quad glazing, argon-filled, low-e (no low-e on south side to maximize solar gain), locally manufactured.
- Doors: Metal polyurethane insulated double (inner and outer) door system, locally manufactured.

Mechanical Systems:

- Space heating: Electric baseboard.
- Ventilation: Fully ducted Venmar EKO 1.5 heat-recovery ventilator (HRV) 64% SRE at -25°C (13°F) balanced at 57 L/s (120 cfm) high speed and 28 L/s (60 cfm) low speed.
- Hot water: Electric conserver tanks.
- Renewable energy system: 14 kW grid-connected solar photovoltaic (PV) system distributed over the 3 units.

Lessons Learned:

The wall system used in this building is simple enough to allow a high amount of volunteer involvement in the construction and it has a high insulation value. For these reasons, HFHY has adopted it as their new wall system of choice. To reduce the number of different dimensions and types of materials on site they ordered only mineral wool insulation, and only as thick batts. When thinner insulation was needed for the inner wall they were able to split them with a bread knife. This process worked quite well and simplified the ordering of materials.

The double door system works well in this wall system with very few frost issues.

Figure 4: Interior view

The decision to install simple electric baseboard heaters eliminates regular maintenance and servicing costs associated with furnaces and boilers.

The lot allowed for sitting the wall of building with the most glazing directly south to maximize passive solar gains. To encourage solar heat gains, the windows on the south side do not have a low-e coating.

Figure 5: Exterior view

The solar array is located on the rooftops of the triplex. The roofs are intentionally asymmetric and face north and south to optimize the slope of the array for solar collection without unintentionally adding wind or snow loading to the structures.

ATCO Electric Yukon contributed financially to the installation of the 14 kW solar PV system. The executive director of HFHY arranged the donation of the solar modules from a company in Ontario. Another Ontario manufacturer provided a discount on the string inverters.

Other Energy Efficiency and Sustainability Features:

- Lighting: Lighting is compact fluorescent lamps (CFL).
- Appliances: All appliances are Energy Star® rated.
- Other features include: Grid-connected solar array with string inverters that can provide some electricity in the event of regional power outages.

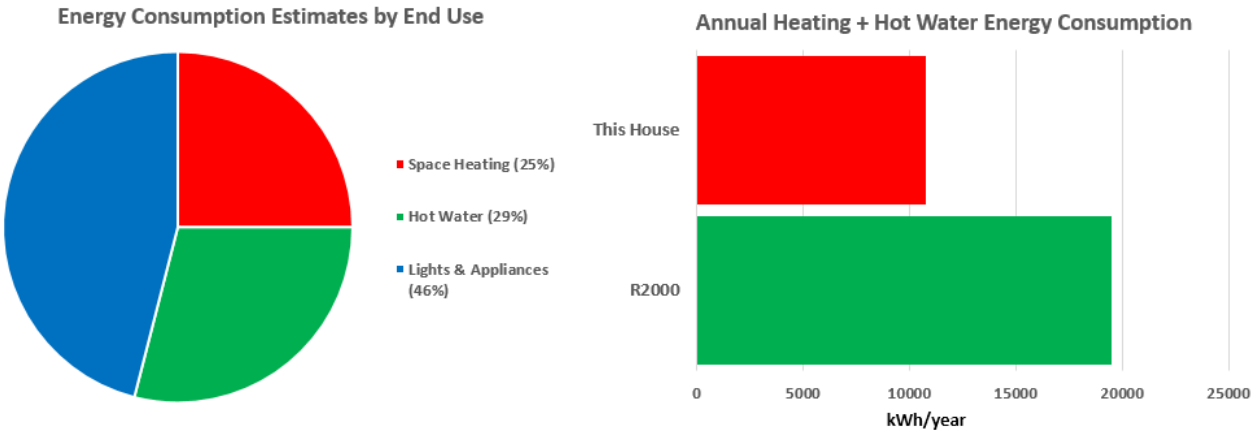
House Energy Consumption Performance:

An EnerGuide rating is a measure of a home's energy performance. EnerGuide has been in place since the mid 1990's. It makes use of actual house parameters like insulation values, mechanical equipment efficiencies and air tightness in a computer energy simulation (Hot 2000) using standardised occupant conditions for plug in loads, hot water use and thermostat settings. The figure below shows the energy breakdown of this house.

The R2000 program has been in place since the 1980's and has been the benchmark for energy efficient new housing in Canada. That benchmark has been upgraded recently, but for reference this house has been compared to the old familiar standard where a house deemed to be efficient gets an 80 or better on the EnerGuide scale.

EnerGuide Rating: 86 without solar PV array (90 including the solar PV array)

(All data below shows without array)



Project latitude	60.5°N
Annual heating degree day zone	>6000HDD°C
Mean January temperature	-16.2°C (2.8°F)
January heating design temperature	-41°C (-43°F)
Heating system design heat load	6.5 kW (22,179 BTU/h)
Main floor(s) heated area (Unit A)	183 m^2 (1,974 ft^2)
Total liveable area	183 m^2 (1,974 ft^2)
Building footprint (Unit A)	196 m^2 (2,112 ft^2)
Window area	12.9 m^2 (139 ft^2)
% of windows facing south	55 %
Air leakage rate @ -50 Pa (*as operated*)	0.8 ach
Equivalent leakage area (hole size) @ -10 Pa (*as operated*)	141 cm^2 (21.9 in^2)

Annual energy use per m^2	107 kWh/m^2
Projected total annual energy usage	19,604 kWh/yr
Actual performance as it compares to occupant bills	Data not available - House occupied less than 1 year at time of publication

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