Case Study #5 Carpiquet Road

SUMMARY: This profile features a house built by a builder for his son (Figure 1). He framed the house with a 38x89 mm (2x4 in.) wall, then filled the wall cavity with expanded polystyrene (EPS) foam billets. He then installed another 5 cm (2 in.) layer of EPS, then a 38x89 mm (2x4 in.) inner wall insulated with mineral wool insulation. The simple design of his house made air-sealing easy. The house is heated with electric baseboards.

Figure 1: SuperGreen House, Whitehorse, Yukon

Why SuperGreen[1]? Builder, Occupant Comments: This builder explains his reasons for going SuperGreen simply. "It's a lot of work to build a house, so I might as well just do it right and save as much money and energy in the heating as we can." He focussed on increased insulation and good windows.

He used Yukon Housing Corporation's technical support to see what was new and then spent a bit of time on the internet to come up with his own design. He did the plumbing himself and hired an electrician and a tile setter, both of whom he would recommend. He prepared all the drawings and told them what he wanted, then they had discussions as needed about how each part would work.

He didn't run the design through the EnerGuide Rating system, though he did rely somewhat upon advice from an energy specialist. He's happy with how the process worked and would use this design again.

He feels that it's less costly to build SuperGreen when you account for the long term fuel savings compared to the extra cost of additional insulation, but he points out that he's referring to the way he approached SuperGreen, not necessarily the way others approach it.

Location: This SuperGreen house is on an infill lot located in the Takhini North subdivision, Whitehorse, Yukon.

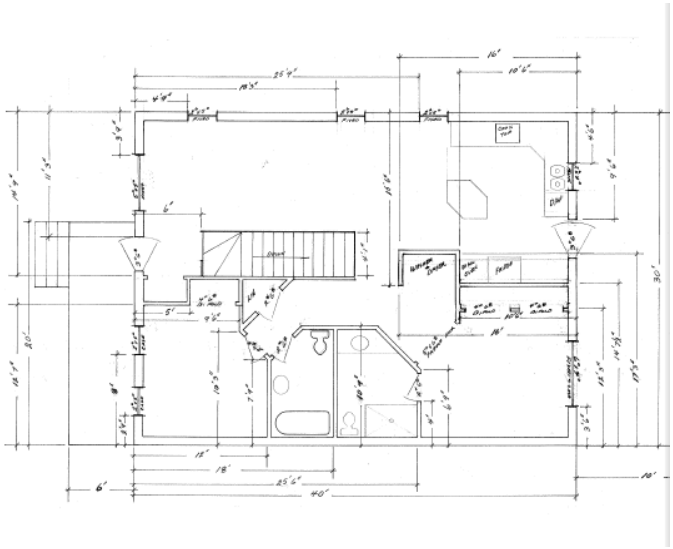


Figure 2: Main floor plan

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

Designer-Builder Team: He did some upfront work with the construction team to effectively incorporate SuperGreen building processes.

Type of House: This house is a modest-sized detached bungalow of 223 m^2 (2400 ft^2) which includes the finished basement. It has no attached garage and no rental suite (Figure 2).

Technical Details

Building Envelope:

- Walls (Figure 3): Framed with 38 x 89 mm (2x4 in.) filled with type IV EPS foam plus a continuous layer of type IV EPS foam and air-vapour barrier followed by an additional 38 x 89 mm (2x4 in.) wall with mineral wool insulation. Effective RSI 6.3 (R36).
- Ceilings: High heel trusses, vented attic, fibreglass insulation. Total RSI 12.3 (R70).

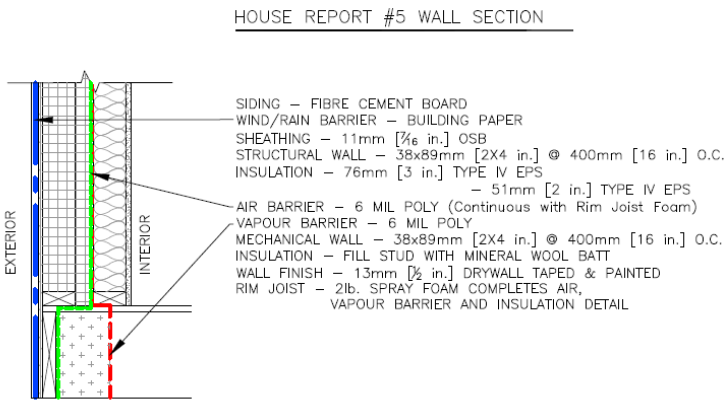


Figure 3: Wall section

- Foundation: Walk-out basement (half), walls are the same as the main floor except the outer framing is 38x140 (2x6 in.).
- Foundation floor: Treated wood floor joists with type IV EPS between.
- Windows: Fixed and casement style, triple-glazed, argon-filled low-e throughout (shipped from Alberta).
- Doors: Metal. polyurethane foam-filled.

Mechanical Systems:

- Space heating: Electric baseboard.
- Ventilation: Fully ducted Eneready Diamond E heat-recovery ventilator (HRV) 70% SRE at -25°C (13°F) balanced at 54 L/s (114 cfm) high speed and 24 L/s (50 cfm) low speed.
- Hot water: Electric conserver tank.

Lessons Learned:

The design was very straightforward and there were no particular hurdles or challenges because he had the plans in place and knew what needed to be done.

He planned the walls so they would be quick to put up, well insulated and not allow any moisture to get into the wall and cause mold. This system was easy to build and made for a very tight sealed house without a lot of fussing about it. He had seen other super-insulated wall systems go up and he wanted to try to make his process simpler.

First, he built a 38x140 mm (2x6 in.) structural wall in the wood basement. The wall stud spaces were filled with EPS foam billets. On the inside of that, he placed 5 cm (2 in.) of EPS foam and put the air-vapour barrier on the inside of that. He then built a 38x89 mm (2x4 in.) wall inside the air-vapour barrier for the plumbing and wiring. He filled that cavity with RSI 2.5 (R14) mineral wool batts. The main floor walls were constructed the same way only he reduced the structural wall to use 38x89 mm (2x4 in.) studs.

Figure 4: Window and exterior door

He purchased windows from Alberta because of the 25 year guarantee. The doors were locally purchased. (Figure 4)

For the ceiling, once the poly was in place on the inside of the trusses, he added 38x64 mm (2x3 in.) strapping which he filled with RSI 1.4 (R 8) fibreglass batt insulation. He then hauled fibreglass batts into the attic space and placed them himself. He didn't enjoy this part but he doesn't trust blown-in insulation.

Insulating the foundation floor was simple also and he would do that system again.

He chose electric heat because it's 100% efficient (one kW of electricity equals 1 kW of heat), it was inexpensive to install and it requires little or no maintenance.

Other Energy Efficiency and Sustainability Features:

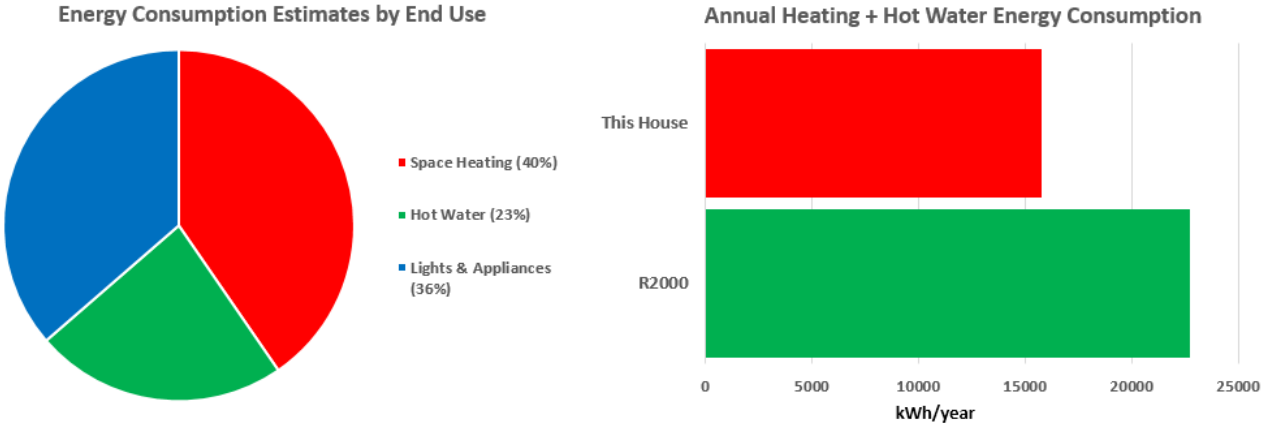
- Control systems: Setback thermostat.
- Lighting: All light-emitting diodes (LED) lamps, with motion sensors outside under eaves, in the back, front and side of house.
- Appliances: All appliances are Energy Star® rated.

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: 85



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	8.5 kW (29,003 BTU/h)
Main floor(s) heated area	99 m^2 (1,064 ft^2)
Finished basement heated area	99 m^2 (1,064 ft^2)
Total liveable area	198 m^2 (2,128 ft^2)
Building footprint	112 m^2 (1,200 ft^2)
Window area	17 m^2 (183 ft^2)
% of windows facing south	7 %
Air leakage rate @ -50 Pa (*as operated*)	0.56 ach
Equivalent leakage area (hole size) @ -10 Pa (*as operated*)	125 cm^2 (19.4 in^2)
Annual energy use per m^2	124 kWh/m^2
Projected total annual energy usage	24,460 kWh/yr
Actual performance as it compares to occupant utility bills	Data not available - House occupied less than 1 year at time of publication

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