

SAB Homes

The Canadian Green Homebuilding Magazine

ISSUE NUMBER 01 | JUNE/JULY 2009 | PM40024961 | \$4.95

1st
Issue

INSULATION

The best-value way to start building green: types and installation

SPANIER HOUSE

Architect designs own sustainable home on common sense ideas

RIVERDALE NET-ZERO DUPLEX

Bells and whistles... standard looking home anything but

LEED FOR HOMES

It's new, it's here, it's WOW!

PLUS... news and products to build the more livable home

Opposite bottom
Overhangs on south-facing windows prevent over-heating in the summer.

Right The photovoltaic system of 28 modules is 108 sq.ft. in area.

The front [south] elevation of the duplex.

The second floor deck off the master bedroom has framing support for the solar panels.



Riverdale net Zero Project

energy in,
equals energy out,
in Edmonton duplex

PETER AMERONGENAND,
GORDON HOWELL

The goal of the Riverdale-Net Zero Project was to prove that it is possible to build housing that offers an exceptional quality of life for the homeowners while also dramatically reducing greenhouse gas emissions, energy consumption and the overall impact on the environment.

The project is one of 15 similar houses across the country that forms part of Canada Mortgage and Housing Corporation's [CMHC] EQUILIBRIUM™ Sustainable Housing Initiative.

Located in central Edmonton, the 768 sq.-ft. [234 sq.m] per unit duplex uses an electricity-producing solar photovoltaic array, a solar hot water heating system, and passive solar gains to produce as much energy as it needs to heat, light and operate each of the homes.

The units are very well insulated with R-values at least double the building code minimums. The building envelope is also very tightly sealed, allowing the project to achieve very low air leakages of about 0.5 air changes per hour. Indoor air quality is maintained at a high level through the use of low VOC [volatile organic compound] materials and high-efficiency heat recovery ventilation.

To conserve resources and reduce waste, the duplex was built using, to the fullest extent possible, materials that are regionally produced.

CONSTRUCTION

The building is framed using a double-stud wall system, which was determined to be the least expensive and most environmentally acceptable type of wall construction that could accommodate the high levels of insulation required.



The walls consist of two 2x4 studs separated by 9in. [230 mm] of space, all filled with cellulose [recycled newspaper] insulation. Given the prognosis for much of Canada's northern pine forests due to pine beetle infestation, it is hard to think of a better place to store this wood carbon than in a house with a 100-year life expectancy.

Within the building, about 7500 kg of additional massive materials - mostly in the form of a decorative concrete feature wall- are used to provide thermal storage for the heat generated by incident solar radiation.

SOLAR ENERGY SYSTEMS

Large 55sq.ft. [17 sq.m] south-facing windows [incorporating overhangs to prevent overheating in summer] allow the low-angle winter sun to strike concrete, tile and other interior sur-



Building close-up

CMHC predicts that 40% of the heating will be provided by passive solar, 28% by internal sources, 21% by solar panels, and 11% by photovoltaic panels. The superior envelope delivers R-100 in the roof, and R-56 in the walls.



Details - Solar heating system

Details - Wall assembly



1 The north windows are quadruple glazed with three soft low-e coatings and argon filled.

2 South-facing windows maximize passive solar gain.

3 Installing a section of exterior wall.

4 The double wall system reduces heat loss by 70% as compared to a standard 2x6 insulated wall, yet uses only 6.5% more wood.

5 Copper pipe wrapped around the vertical drain pipe collects heat from waste hot water.

6 The concrete water storage tank in the basement. Walls still to be insulated and finished.

7 Installing the photovoltaic modules.

An electricity-producing solar photovoltaic array, a solar hot water heating system, and passive solar heating produce as much energy as is needed to heat, light and operate each of the duplex units.

faces and warm them up. As exterior temperatures drop at night, the heavy surfaces release the stored heat, warming the interior spaces and minimizing the need for additional heat from other sources.

This passive solar space heating is one of three solar technologies employed in the house. The others are active solar water heating and solar electricity.

The active solar heating system is rated at 7,000 W of heat production. It consists of seven solar heating collectors, with a total 62 sq.ft. [19 sq.m] of absorber surface mounted vertically above the second floor windows plus two pumps, controls, five heat exchangers, piping, and a 300 litre and a 17,000 litre water storage tank in the basement. It heats water for both household domestic uses and space heating.

Windows - triple and quadruple glazing by **Duxton Windows**, Winnipeg

Sidings - western red cedar shingle siding, and stucco

Paint - interior and exterior by Cloverdale Paints, Edmonton

Heat Recovery Ventilator - Venmar, Drummondville, Quebec

Fan coil - Enerzone, London ON

Solar heating system - Taylor Munro Energy Systems, Delta BC

Solar photovoltaic system - Sanyo modules with SMA inverter, SunTop PV array rack supplied through Conergy, Edmonton

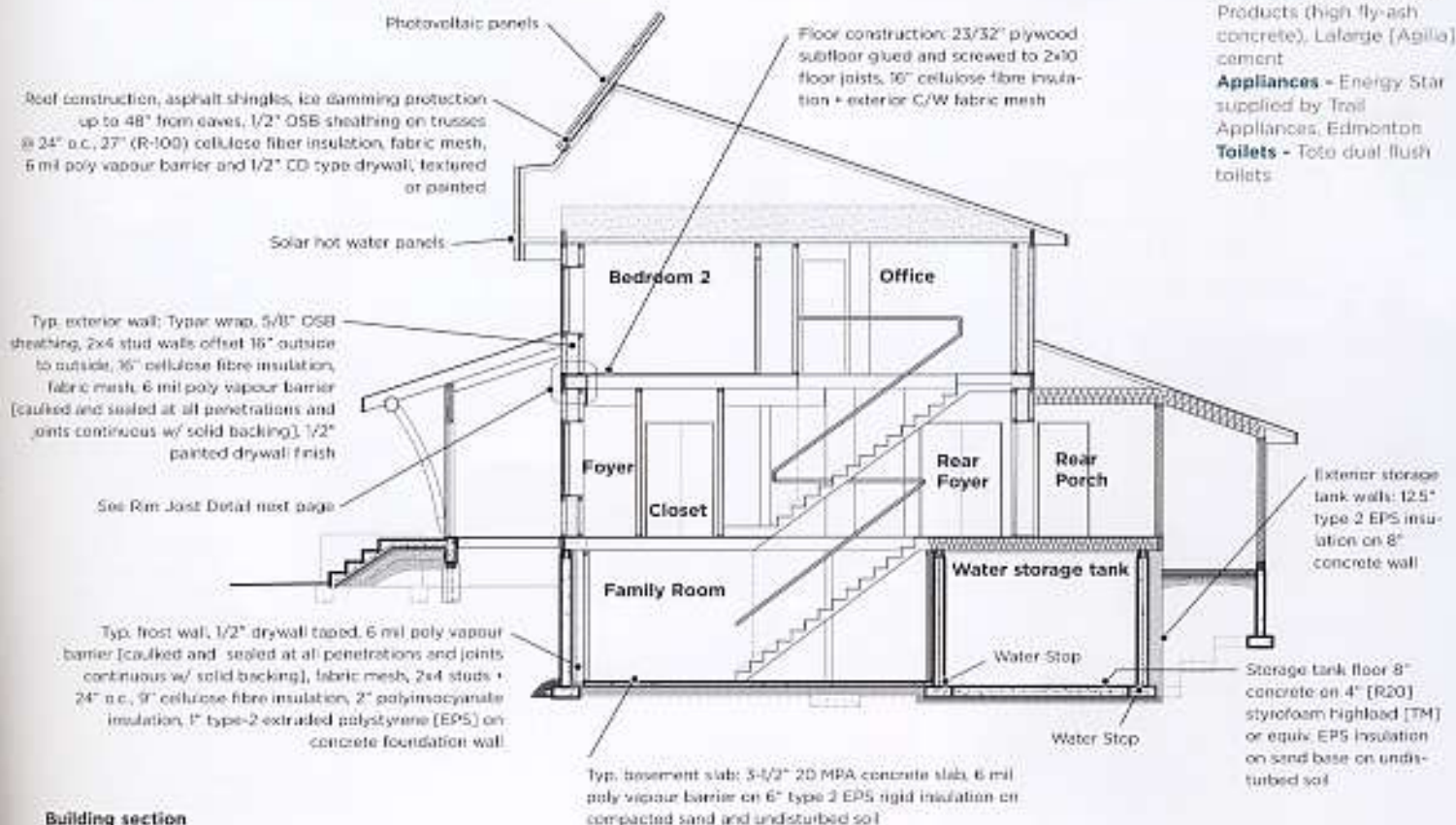
Insulation - Cellulose fibre [recycled newspaper] by Cancell Industries, Edmonton

Flooring - Cork, travertine, Forbo marmoleum [linoleum] supplied through Action Floor, Edmonton

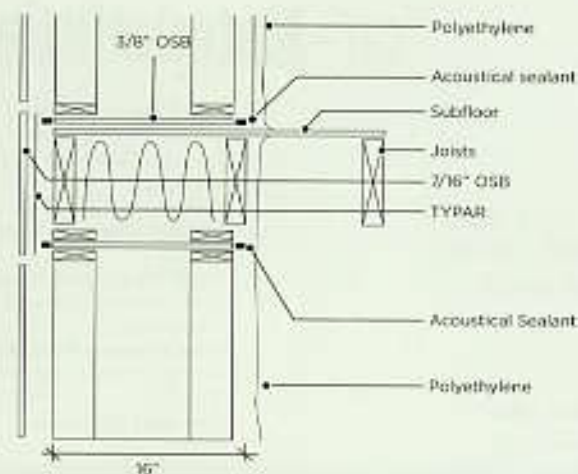
Building controls - UPM controls, Newmarket, ON supplied through Triline Design Centre, Edmonton

Concrete - Burnco Rock Products (high fly-ash concrete), Lalarje (Agilia) cement

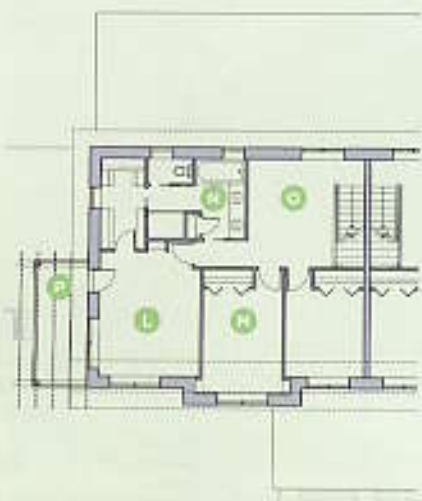
Appliances - Energy Star supplied by Trail Appliances, Edmonton
Toilets - Toto dual flush toilets



Building section



Rim joist detail, second floor



Second floor plan, west unit



Main floor plan, west unit

- | | |
|---------------|------------------|
| A Front porch | I Patio |
| B Dining room | J Garage |
| C Living room | K Rear porch |
| D Foyer | L Master bedroom |
| E Kitchen | M Bedroom |
| F Pantry | N Bathroom |
| G Powder | O Office |
| H Rear foyer | P Deck |

The solar electric system is rated at 5,600 W of electricity generation. It consists of 28 solar electric modules [108 sq.ft., 33 sq.m in area] at 53° on the roof, a DC switch, a DC to AC inverter, and an AC switch. The system generates an average of 6600 kWh of electrical energy per year between 320 VDC and 420 VDC, and feeds the house breaker panel at 240 VAC. There is no battery bank.

The house is heated using a forced-air fan-coil. Fan coils are similar to conventional furnaces that heat a combination of fresh and re-circulated air. Instead of gas burners or electric elements, however, the fan coil uses heat from hot water circulated from the solar storage tanks.

ACHIEVING NET ZERO ENERGY

The house achieves net zero energy through a number of complementary strategies: by having an ultra-energy efficient building envelope and

The EnerGuide Rating System for Houses [EGH]

EnerGuide for Houses [EGH] is a rating system developed by Natural Resources Canada [NRCan] to help people measure the energy efficiency of their housing envelope. In a further refinement, CMHC and NRCan developed a special rating system to account for the electrical energy efficiency of the Net Zero Houses. It is referred to as EGH*. The EnerGuide number is a ratio of the heat and electrical energy consumption of any house relative to a net zero energy house.

The following list shows how the technologies in the Riverdale NetZero house provide for its EGH* rating of 100.

Energy efficiency alone	86
Plus electrical efficiency and passive solar heating	93
Plus active solar space and water heating	96
Plus solar electricity	100

In comparison, typical houses built in the 90s have EGH ratings of 62 to 65, typical houses built in the 70s have EGH ratings of 55 to 58. Under the Built Green program in Alberta and BC, a Built Green Bronze home has an EGH of 74 to 75, Built Green Silver is 76-77, Built Green Gold is 78-79, and R-2000 is 80 to 82.

Detail - Basement Insulation



Space for cellulose insulation [R33]

Isocyanurate insulation [R13]

Expanded polystyrene insulation [R8]

50% fly-ash concrete

very efficient electrical appliances, lights and motors, which together minimize the energy consumption. This reduced consumption is then met entirely using on-site solar systems.

All solar heat produced is either used by the house directly at the time of its production or stored for later use in the solar water tank. All solar electricity generated is either used by the house directly at the time of its generation, or supplied to the city electrical grid to offset the electricity that was purchased at other times of the day or year.

The final result is a net zero annual energy purchase, meaning that the only electricity costs are the connection fees related to billing and maintaining the electrical supply system. ♦

More info: www.riverdale.netzero.ca, www.cmhc-schl.gc.ca

PETER AMERONGEN IS A PRINCIPAL OF HABITAT STUDIOS AND WORKSHOP LTD.
GORDON HOWELL IS A PRINCIPAL OF HOWELL MAYHEW ENGINEERING LTD.

Above Walls are insulated with blown-in cellulose insulation made of recycled newspaper.

Below Other than the thicker walls visible at the windows, the Riverdale duplex looks like any modern home.

Below right The landscaping uses incigenous plants that require little watering, and the permeable driveway controls surface run-off.



CREDITS

Building Design

Habitat Studio and Workshop Ltd., and Menasc Isaac Architects Ltd., Edmonton

Building Envelope

Habitat Studio and Workshop Ltd., Dumont and Associates

Passive Solar and Structural

Solnorth engineering Ltd., Edmonton

Solar Thermal Design

Hydraft Development Services Inc., Threshold Energies Corporation, Taylor Munro Energy Systems Inc., Philip Mees, and Dumont and Associates, Edmonton

Solar Photovoltaic Design

Howell Mayhew Engineering Inc., Edmonton

Energy Modelling

Howell Mayhew Engineering Inc., Edmonton

Solar Thermal Controls

Trimline Design Centre Inc., Edmonton

Sustainable materials

Green Alberta Inc., Edmonton

Lighting Design

Relumen Engineering Inc., Edmonton