



R-2000 NET-ZERO ENERGY Pilot Case Study

FALCONRIDGE SLOOT CONSTRUCTION LTD.



Guelph, Ontario



Project DESCRIPTION

Natural Resources Canada (NRCan) spearheaded a national demonstration project to engage the residential industry in designing and building net-zero energy houses. The goal was to showcase industry leadership in realizing such an ambitious goal while delivering homes attractive to the marketplace.

NRCan established the energy performance framework that ensured consistent and transparent rating of the homes. The Pilot requirements were based on NRCan's R-2000 high performance home program, a well-established and premium housing program in Canada.

This project saw the construction of 26 net-zero energy or net-zero energy ready homes. A net-zero energy home is a house that produces as much energy as it consumes on an annual basis.

Construction of the Falconridge net-zero energy home was completed in 2016. The home was designed with a focus on the building envelope for minimal air leakage and maximum insulation performance.

The **BUILDER: SLOOT CONSTRUCTION LTD.**

 Rotary Dream Home - Most Outstanding Single-Detached Design over 2,500 square feet 2012 – Guelph & District Home Builders' Association

 Officially labelled the first Next Generation ENERGY STAR® Certified Home in Canada, 2013

 Received the Building Innovation Award, EnerQuality Awards of Excellence 2013

Key **FEATURES**

EnerGuide Rating

0
GJ/Yr



Roof:

R-60 blown cellulose



Main walls:

R-24 batt + R-10 XPS (2")



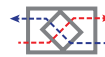
Basement:

walls: R-20 batt + R-5 XPS (1")
under slab: R-10 XPS (2")



Windows:

low-E, argon-filled, triple pane



HRV:

67% efficient at 0°C and 60% at -25°C



Airtightness:

0.93 ACH at 50 Pa



Space heating and cooling:

air source heat pump, 8.7 HSPF/24 SEER + 97.5% AFUE natural gas furnace



Water heating:

0.98 EF natural gas tankless, 58.9% efficient drain water heat recovery



Rated annual energy consumption:

40.56 GJ

This home consumes ~60% less energy than its reference house.



Electricity generation:

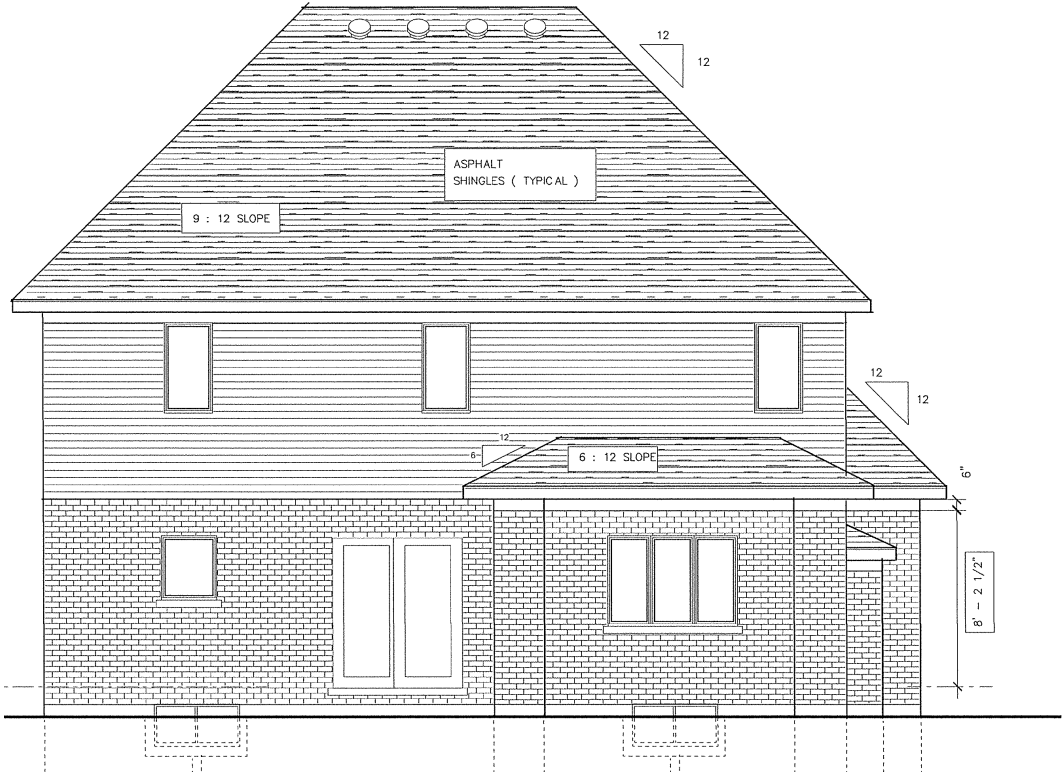
≤10 kW solar PV system, 41 panels 235 W each, rated annual energy production: 43.82 GJ



Estimated net annual energy use:

-3.26 GJ

The HOME



Top: front elevation

Bottom: back elevation

Note: Elevations may differ from the actual construction.

Technical SUMMARY

Sloot Construction Ltd., Guelph, Ontario		
Site characteristics		
Location	Guelph, Ontario	
Site type	Suburban, new development	
Design conditions		
Number of occupants	2 adults, 1 child ¹	
Heating degree days ²	3,890	
Building description		
Type: Two-storey, 4 bedroom, 4 bathroom, single detached residence		
Floor area (including basement)	327.20 m ²	
Heated volume	897.59 m ³	
Exposed floor area	27.59 m ²	
Ceiling area	125.60 m ²	
Main wall area	236.35 m ²	
Total window area	24.71 m ²	
Thermal characteristics	Effective	Nominal
Roof	10.04 RSI	R-60 blown cellulose
Walls: Main floor	5.54 RSI	R-24 batt + R-10 XPS (2")
Basement	4.23 RSI	R-20 + R-5 XPS (1")
Windows (average value)	0.95 RSI	low-E, argon-filled, triple pane
Basement floor	1.76 RSI	R-10 XPS (2")
Measured airtightness level	0.93 air changes per hour at 50 Pa	
Building performance (annual energy consumption)³		
Space heating	9.70 GJ	
Domestic water heating	6.87 GJ	
Lighting, appliances and other plug loads	22.24 GJ	
Mechanical ventilation	0.25 GJ	
Space cooling	1.50 GJ	
Rated annual energy consumption	40.56 GJ	
Rated annual energy production⁴	43.82 GJ	
Net annual energy use (consumption minus production)	-3.26 GJ	
EnerGuide rating (ERS)	0* GJ	

1. Occupant assumptions based on EnerGuide Rating System Version 15.

2. Heating degree days data from the National Building Code.

3. Building Performance is modelled using HOT2000 version 11.3.

4. The rated annual energy production accounts for the contribution of eligible energy-producing systems.
This house uses only solar photovoltaics as its energy-producing system for electricity generation.

* This house has been designed to produce more energy than it consumes on an annual basis.

R-2000 standard pick list

Indoor Air Quality

IAQ 003 Flooring

Carpeting and carpet cushion

Except as noted, carpeting and carpet cushion used together in the house shall meet either of the following criteria:

- ◆ The carpet shall be labeled under the Canadian Carpet Institute's Green Label Plus Program, and the carpet cushion shall be labeled under the Carpet and Rug Institute's Green Label Plus Program.
- ◆ A non-Green Label carpet and/or non-Green Label Plus carpet cushion shall cover no more than 10 percent of the interior floor area including the basement floor area. Where carpeting is used in the basement, the basement slab shall be insulated with a minimum R-10, be heated, or have no direct contact between the carpet and concrete floor.

Solid surfaces

All solid flooring, such as bamboo, cork, laminate, resilient (sheet) stone, tile and wood, shall all have low-VOC content as determined through ECOLOGO or GREENGUARD certification. Wood flooring shall be from a sustainable source, as determined through a third-party under the Programme for the Endorsement of Forest Certification (PEFC) International or the Forest Stewardship Council (FSC).

Note: Vinyl flooring shall not be used.

Underlayment

All particleboard-flooring underlayment shall meet either of the following criteria:

- ◆ E-1 European standard or the ANSI A208.1-1993 Table B standard
- ◆ have all surfaces sealed with a sealer with a low-VOC content as determined through ECOLOGO or GREENGUARD certification or be pre-finished

Flooring adhesives

All flooring adhesives shall all have low-VOC content as determined through Green Seal, ECOLOGO or GREENGUARD certification.

IAQ 005 Air filtration

Install a medium-efficiency air filter with a minimum MERV rating of 13 where air-circulating, heating, or cooling systems are used.

NOTE: The HVAC designer will need to take the pressure drop of the MERV 13 filter into account when sizing the ducts.

Energy Efficiency

EE001 Energy-efficient appliances

An ENERGY STAR® certified clothes washer, dishwasher and refrigerator shall be included with the sale of the house.

EE004 Reduced energy consumption of the house

Predicted energy consumption is at least 15% less than the R-2000 whole house energy target, as provided in Clause 5.1.2 of the R-2000 standard.

Environmental Stewardship

ES002 Damp proofing and waterproofing

All damp proofing shall be water-based or all waterproofing shall be mechanically fastened.

Water Conservation

WC003 Hot water runs

Comply with the following two criteria: The water heater shall be installed within a 10-m pipe run from the furthest bathroom or kitchen fixture and the hot water pipes shall be insulated.

Resource Management

RM001 Use of wood-conserving technologies

The measures below shall be used substantially (80% or more) for the given application:

a) use of at least four advanced framing techniques (Optimum Value Engineering) throughout the framing of the house from existing best practices, such as:

- ◆ 2x6 framing at 600 mm (24") on centre
- ◆ spacing roof trusses up to 600 mm (24") on centre
- ◆ two-stud corners
- ◆ single top plates
- ◆ elimination of jack studs and cripples
- ◆ engineered lintels and single headers, where possible

b) use of finger-jointed framing lumber or engineered lumber

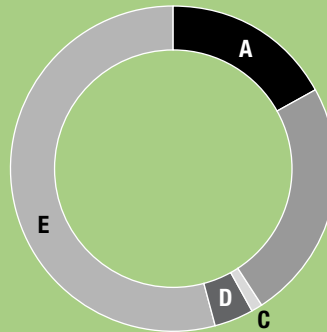
RM007 Roofing

Use roof cladding for pitched roofs that have a minimum durability of 35 years and are recyclable.

The PERFORMANCE



Energy consumption by usage



A Water heating	17%
B Space heating	24%
C Ventilation	1%
D Space cooling	4%
E Base loads (appliances, lighting, etc.)	54%



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