Single Detached, Now House™, Toronto, Canada.

PROJECT SUMMARY
Retrofit to house; single contract
CMHC EQuilibrium Housing Initiative
Funded by CMHC / RBC Bank
Reduction of primary energy: 80%

SPECIAL FEATURES
External foam insulation
17.1 m² solar PV (17.3 kWh/ m²/yr)
4.8 m² solar thermal (13.1 kWh/ m²/yr)

PROJECT TEAM
Lorraine Gauthier, President,
The Now House Project Inc.
David Fujiwara, Architect

OWNER
Private

IEA – SHC Task 37
Advanced Housing Renovation with Solar & Conservation
BACKGROUND

Now House™ is a retrofit project for an existing 1 1/2 storey (2 bedroom) standard house from 1946; known as the War Vet Homes. There are approximately 200,000 of these units dispersed throughout Canadian cities (1940-1950’s). If deep emission reductions can be obtained from upgrades to this housing type, these retrofits would provide a strong measurable gain for a CO₂ management strategy.

The renovations met the Net Zero Energy Healthy House (NZEHH) standards set out in a home design competition conducted by Canada Mortgage and Housing Corporation (CMHC). Now House™ is one of twelve winning teams from that competition and the only retrofit project. These demonstration homes are located across Canada (2007-2008) as part of CMHC’s EQuilibrium Sustainable Housing Demonstration Initiative.

SUMMARY OF THE RENOVATION

• External insulation to all elevations (RSI 5.8; R-33)
• Roof insulation: flat (RSI 8.8; R-50); sloped (RSI 5.6; R-32)
• New insulation to basement walls (RSI 4.4; R-25) + floor
• Solar thermal system provides hot water for heating and domestic hot water, PV solar panels;
• Heat Recovery Ventilator (55 L/s)
• Grey water heat recovery
• Upgraded windows; (RSI 1; R-5.7)
CONSTRUCTION

Roof sloped  
U-value: 0.178 W/(m²·K)  
(from exterior to interior)
Existing metal roof 02 mm
Air gap 25 mm
Existing wood plank deck 25 mm
Icynene between roof rafters (RSI 2.11) 75 mm
Blue SM Polystyrene (RSI 3.52) 100 mm
Gypsum Board 13 mm
Total 250 mm

Main wall  
U-value: 0.172 W/(m²·K)  
(interior to exterior)
Plastered gypsum board 13 mm
Existing 100x50 wood studs 100 mm
Blown cellulose insulation 100 mm
Plywood sheathing 19 mm
SM Polystyrene insulation 50 mm
Rigid polyisocyanate insulation 50 mm
Tyvec + vinyl siding + air space 25 mm
Total 357 mm

Basement walls  
U-value: 0.436 W/(m²·K)  
(from interior to exterior)
Plastered gypsum board 13 mm
Rigid polyisocyanate 50 mm
Cast-in-situ concrete foundation 200 mm
Total 263 mm
THE CHANGING CHARACTER OF NOW HOUSE

The photographs on the left illustrate the changing character of the house during the project from the original presentation to a mid-construction signage for promoting the transition as a flagship for local community action and then as a finished project. An important consideration was the retention of the existing character, so that it remained a component of the existing post-war housing stock.

The pictures on the right show the evolution of the rear garden facade. The top photograph illustrates the removal of the existing roof for the application of the close-celled spray foam onto the sloped ceilings of the upstairs rooms.

The central photograph shows the plastic sheet installed as a vapour retardant before the siding is replaced (and protecting roof insulation before the metal roof finish is installed). The bottom view is of the solar panels, both PV (on the right) and evacuated solar tube thermal collectors.

Photograph
1 Existing house (before) 4 Insulating rear roof
2 During construction 5 Vapour membrane to exterior
3 Finished project 6 Solar equipment at rear of home
SPRAY FOAM DETAILING

The approach to insulating the house was to keep all insulation processes on the exterior walls of the home. This meant that the owner could occupy the house during the retrofit. Insulation to the main floor was applied following the construction of wing panels that were fixed to the original internal wd. sheathing. They are constructed of 40 x 40mm wood slats so as to reduce cold bridging and are placed vertically to provide a framework for applying the spray foam.

The photograph on upper left illustrates the depth of the close-celled foam while the bottom photograph shows the base of the cantilevered wing wall, which is not connected to the Celfort 200 rigid foam system used on the exterior basement walls.

The upper right photograph shows the process of applying the foam between the wing panels while the bottom photograph shows the front facade as set up before the foam is applied.
EXTERNAL BASEMENT INSULATION

Provision of full height external insulation around basement walls allowed a tanking membrane to be applied to reduce dampness penetration and facilitated the laying of proper drains at the base of footings. Extruded polystyrene was selected as a moisture resistant, rigid foam insulation installed as 2 layers (62mm @ U = 0.46; RSI 2.17; R-12.5) (see pink panels) and protected by a vertical drainage layer (black) and stucco finish above ground (bottom right photo). Photographs show the installation process starting with bitumen membrane on the concrete walls, the metal strip fixing system and drainage membrane.
NOW HOUSE COMMUNITY ENGAGEMENT

The Now House was the only retrofit project of 12 EQuilibrium demonstration homes selected by CMHC to be built across Canada (2007) to promote five key principles that guide the design and construction of sustainable housing and communities: Health, Energy, Resources, Environment, and Affordability. Each project had to communicate and educate the public and seek to achieve market acceptance of EQuilibrium™ houses and sustainable communities. The Now House engaged the local neighbourhood and general public through a series of public events during the design, planning and construction phases of the project.
Regular natural gas domestic hot water tanks (DHW) have an efficiency range of 55-60%. The Now House employs a compact wall-hung high efficiency boiler which improves efficiency to above 90%. This gas boiler provides heat only when necessary (to the solar storage tank) as a back up to the solar thermal system.

Two sets of solar evacuated tubes produce 1,823 kWh annually (13.1 kWh/m² of heated floor area) and are supported by a greywater heat recovery system. The solar thermal system provides hot water for domestic use and home heating. It is connected to a 454-litre storage tank.

### BUILDING SERVICES

Purchased energy was reduced by enlarging the south-facing window (for winter solar gain); upgrading the existing EnergyStar® (92% effic./4.5kW) forced-air gas furnace with a new high-efficiency fan motor and supplementary solar radiant heating in the basement floor.

The 2.6 kWp grid-connected solar PV system generates 2,400 kWh/yr. It was sized to reduce the net energy cost to zero through the Ontario “Standard Offer” contract ($0.42/kWh is received for solar electricity supplied to the grid, while grid electricity is purchased at $0.11/kWh).

### Summary of U-values W/(m²·K)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>Attic ceiling</td>
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<tr>
<td>Walls</td>
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<td>Basement walls</td>
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<tr>
<td>Windows</td>
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<td>0.95</td>
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### ANNUAL RENEWABLE ENERGY PRODUCTION

- Solar electricity: 17.3 kWh/m²
- Solar heating (space and water): 13.1 kWh/m²
- Shower drain water heat recovery: 8.9 kWh/m²
- **Total on-site production**: 39.3 kWh/m²
- Space heating: 23.1 kWh/m²
- Domestic water heating: 35.6 kWh/m²
- Appliances/lighting: 36.8 kWh/m²
- Mechanical ventilation: 1.5 kWh/m²
- **Total energy consumption**: 96.9 kWh/m²

### ENERGY PERFORMANCE

- Space + water heating + ventilation
  - Before: 191.9 kWh/m²
  - After: 38.2 kWh/m²
  - Reduction: 80%
  - Canadian Rating: ecoENERGY for Houses: 94

### INFORMATION SOURCES

- Lorraine Gauthier, lorraigne@workworthdoing.com
- EQuilibrium Housing CMHC Web Site
- Brochure authors
  - Lorraine Gauthier (The Now House Project Inc.)
  - Paul Parker and Shane O'Neill (U of Waterloo)