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 m^2 solar PV (17.3 kWh/ m^2 /yr)
4.8 m^2 solar thermal (13.1 kWh/ m^2 /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

Before

Now House project

Heated volume:	382 m^3
Heated floor area:	139 m^2
Ceiling area:	63 m^3
Footprint area:	58 m^3
External wall area:	127 m^2
Window area total:	14.8 m^2
South glazing to floor ratio:	8%
Air tightness target:	1.5ACH @ 50 Pa

General statistics for Now House

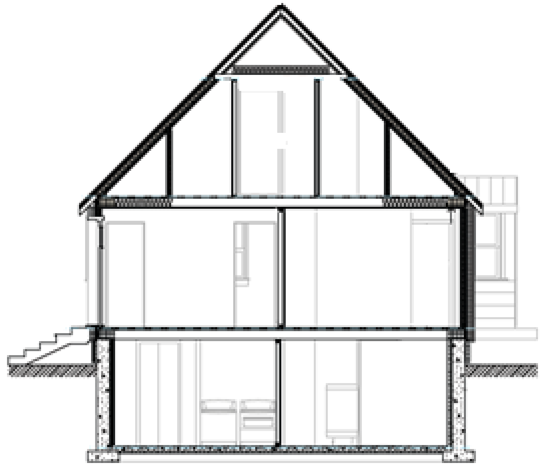
BACKGROUND

Now House^{TM} 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 CO_2 management strategy .

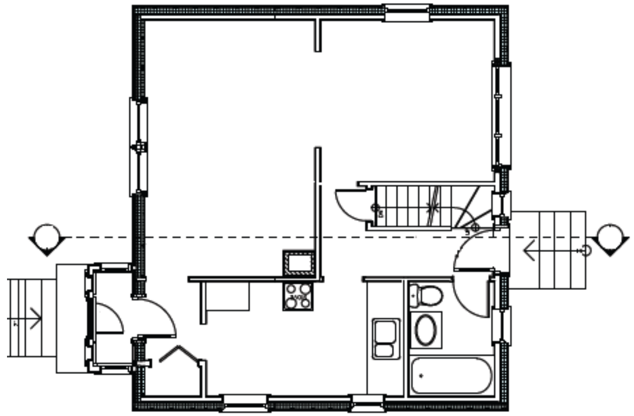
The renovations met the Net Zero Energy Healthy House (NZEHH) standards set out in a home design competition conducted by Canada Mortgage and Housing Corporation (CMHC). Now House^{TM} is one of twelve winning teams from that competition and the only retrofit project. These demonstration homes are located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

SUMMARY OF THE RENOVATION

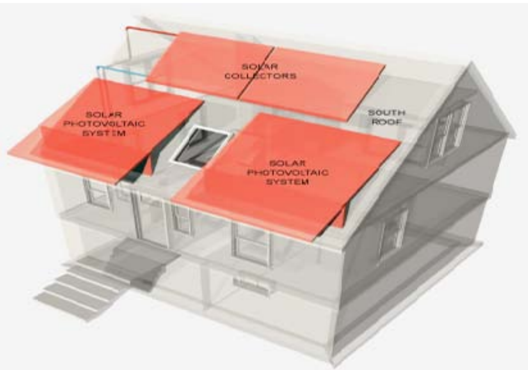
•External insulation to all elevations (RSI 5.8; R-33)
•Roof insulation: flat (RSI 8.8; R-50); sloped (RSI 5.6; R-32)
• New insulation to basement walls (RSI 4.4; R-25) + floor
• Solar thermal system provides hot water for heating and domestic hot water, PV solar panels;
•Heat Recovery Ventilator (55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



SECTION



GROUND FLOOR



Graphic layout of Solar Systems

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	25mm
Icynene between roof rafters (RSI 2.11)	75mm
Blue SM Polystyrene (RSI 3.52)	100 mm
Gypsum Board	13 mm
Total	250 mm

Main wall — *U-value: 0.172 W/(m²·K)*

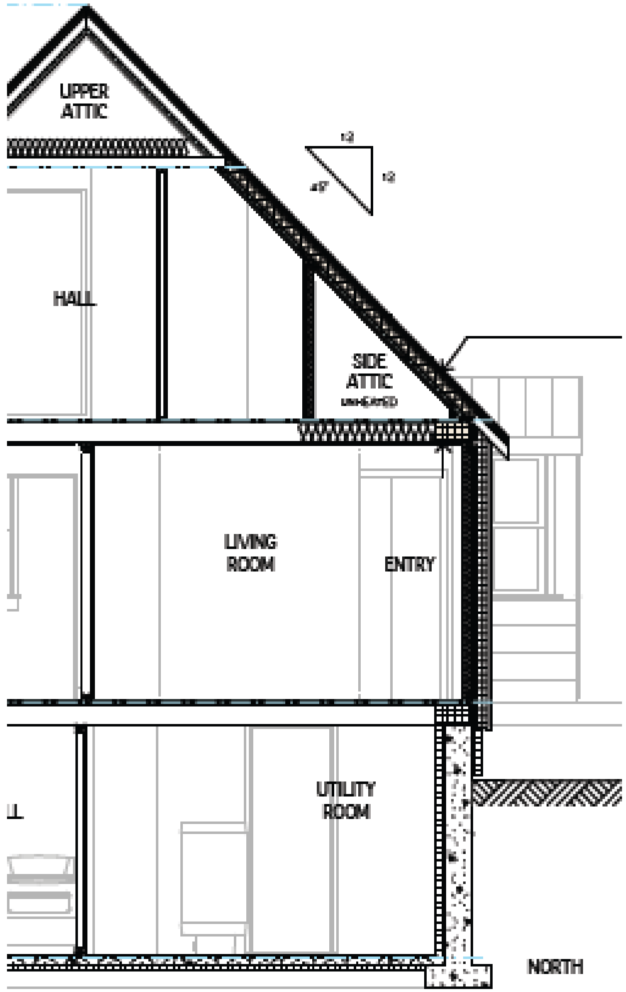
(interior to exterior)

Plastered gypsum board	13 mm
Existing 100x50 wood studs	100 mm
Blown celulose insulation	100mm
Plywood sheathing	19 mm
SM Polystyrene insulation	50mm
Rigid polylsocyanate insulation	50 mm
Tyvec +vynil sidding + air space	25mm
Total	357 mm

Basement walls — *U-value: 0.436 W/(m²·K)*

(from interior to extrior)

Plastered gypsum board	13 mm
Rigid polylsocyanate	50 mm
Cast-in-situ concrete foundation	200 mm
Total	263 mm



Cross section through portion of house

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)
2 During construction
3 Finished project
4 Insulating rear roof
5 Vapour membrane to exterior
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.

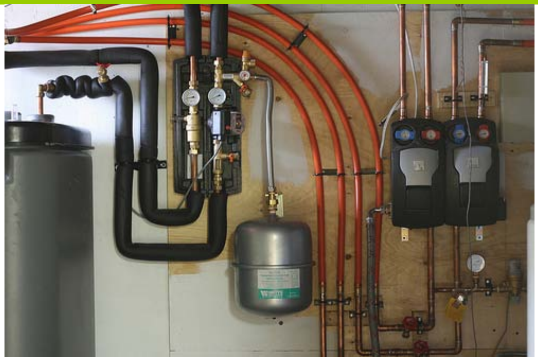
The upper right photograph shows the process of applying the foam between the wing panels while the bottom photograph shows the front facade as set up before the foam is applied.

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/m^2 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.

Summary of U-values W/(m^2·K)

	Before	After
Attic ceiling	0.43	0.18
Walls	0.43	0.17
Basement walls	1.0	0.44
Windows	2.5	0.95

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).

ANNUAL RENEWABLE ENERGY PRODUCTION

Solar electricity	17.3 kWh/m^2
Solar heating (space and water)	13.1 kWh/m^2
Shower drain water heat recovery	8.9 kWh/m^2
Total on-site production	**39.3 kWh/m^2**

Space heating	23.1 kWh/m^2
Domestic water heating	35.6 kWh/m^2
Appliances/lighting	36.8 kWh/m^2
Mechanical ventilation	1.5 kWh/m^2
Total energy consumption	**96.9 kWh/m^2**

ENERGY PERFORMANCE

Space + water heating+ ventilation
Before: 191.9 kWh/m^2
After: 38.2 kWh/m^2
Reduction: 80%
Canadian Rating: ecoENERGY for Houses: 94

INFORMATION SOURCES

Lorraine Gauthier,
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http://www.nowhouseproject.com/workDemoMain.php

EQuilibrium Housing CMHC Web Site

http://www.cmhc-schl.gc.ca/en/inpr/su/eqho/index.cfm
http://www.cmhc-schl.gc.ca/en/inpr/su/eqho/noho/index.cfm

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