

THE 12 EQUILIBRIUM HOUSES WILL BE “NET ZERO” ENERGY: PRODUCING AS MUCH ENERGY AS THEY USE OVER THE COURSE OF A YEAR, AND COULD WELL SET THE COURSE FOR THE DESIGN AND CONSTRUCTION OF FUTURE HOUSING IN CANADA. [Photo: Will Bruder Architects, Ltd.]



# Canadian Green Housing

CMHC's EQUILIBRIUM initiative sets new course

AL DUECK

The Canadian housing industry has seen several green design initiatives in the past number of years, ranging from R2000 to Super E. To a greater or lesser degree, each of these programs has had the effect of leveraging our newer housing stock to higher levels of performance.

The EQUILIBRIUM Housing Initiative is CMHC's challenge to design and build 12 net zero energy housing projects across the country. "Net zero" energy housing produces as much energy as it uses over the course of a year. It represents an unprecedented collaboration between industry, government and consumer interests and expertise which aims to accelerate Canada's transformation into an environmentally responsible society - at least with respect to housing standards.

The EQUILIBRIUM Housing program is built around homebuilding teams selected by CMHC to build pilot demonstration homes in various parts of Canada. They will feature a combination of resource and energy-efficient technologies to reduce environmental impacts, as well as "providing healthier and more comfortable living spaces."

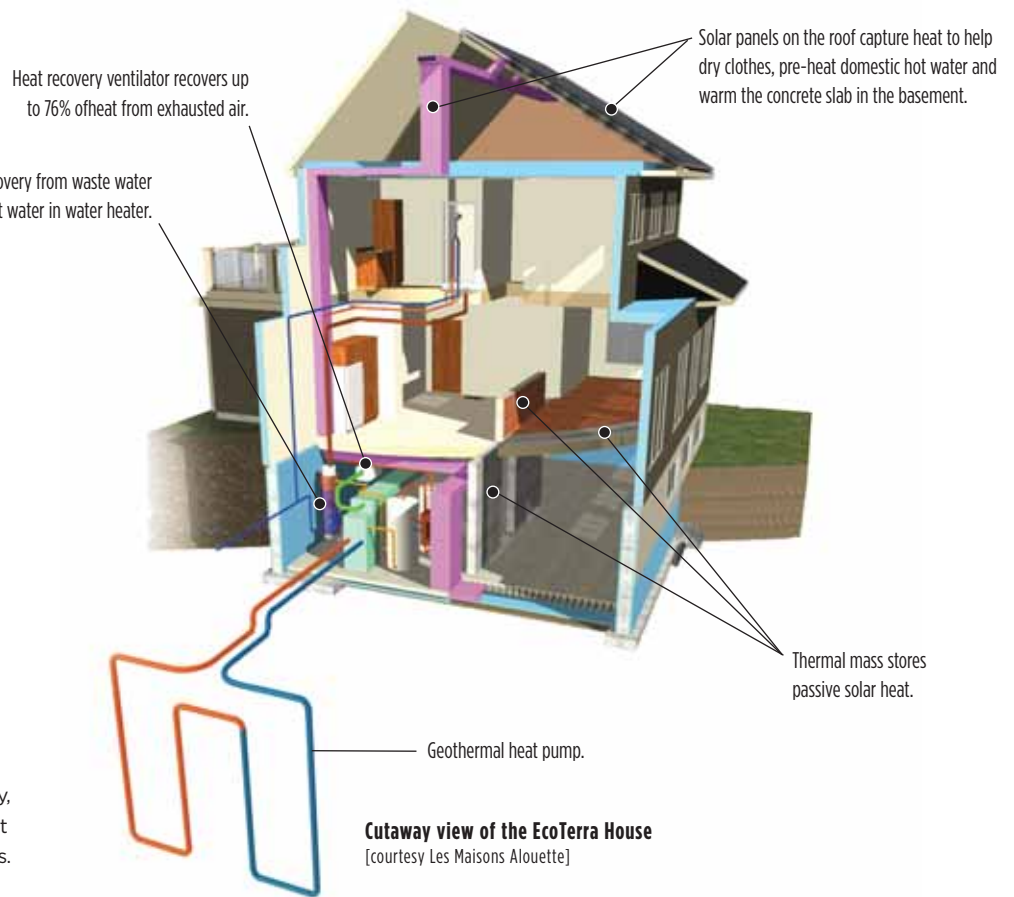
Launched in early 2007, the objectives of the program are ambitious:

1. Reduce the energy intensity of our housing sector,
2. Mitigate household energy cost increases,
3. Foster a growing renewable energy and sustainable housing industry in Canada,
4. Contribute to meeting Canada's international commitment of reducing green house gas [GHG] emissions in the Kyoto Accord and beyond, and
5. Support Canada's inclusion in competitive international markets with our next generation of value-added exports.

Encouragingly, the winning participants have already formed a cooperative community, with information flows between and amongst the teams and supporting advisors and suppliers.

**EQUILIBRIUM PROJECT HIGHLIGHTS**

The special expertise of EcoTerra by Alouette Homes is factory-built modular construction, with numerous completed projects in the US and overseas. Their single family home in the small town of Eastman, QC is the most



**Cutaway view of the EcoTerra House**  
[courtesy Les Maisons Alouette]

advanced. "In order to get to zero energy consumption all design strategies must be implemented in terms of thermal envelope, air permeability and renewable energy systems," says Bradley Berneche, president of Alouette Homes. "According to the rules of the initiative, our score is EGH 98 and our house will have a total energy consumption of 9.45 kWh/square meter, per year."

EcoTerra achieves this in part by up-grading the building envelope insulation to R35 in the walls and R54 in the ceiling, and windows with high performance triple pane glass. The ambitious performance goals require much more than an enhanced building envelope, and include optimization of thermal mass with maximum south exposure, waste water and solar panel heat recovery, photovoltaic solar panels, plus heating provided from geothermal sources.

As in the other projects, some interesting strategies have emerged, such as the heat recovery from the solar panels which helps

to dry clothes, pre-heat domestic hot water and warm the concrete slab in the basement.

In Manotick near Ottawa, Minto Homes has launched the construction of Inspiration EcoHome, a first step in a mixed use development with a focus on sustainability. Again, design and construction has focused on reducing heat loss, 55% more efficient than a typical home, through double-wall construction, triple-pane windows and a high level of insulation.

There is also an innovative "all-off" switch that allows homeowners to turn off all sources of unnecessary power whenever they leave the home. Window locations optimize the sun exposure to heat the home in the winter while roof lines provide shade in the summer to keep the house cool.

In Edmonton, Peter Amerongen, president of Habitat Studios, was up to the challenge. "When we saw CMHC's call for proposals, we thought that if anyone could achieve net zero energy housing in a cold prairie climate Habitat could," he says.

**AMONG THE FEATURES OF THE ECO TERRA HOUSE BY ALOUETTE HOMES ARE SOLAR PANELS ON THE ROOF THAT CAPTURE HEAT TO HELP DRY CLOTHES, PRE-HEAT DOMESTIC HOT WATER AND WARM THE CONCRETE SLAB IN THE BASEMENT. [2] [Photo Les Maisons Alouette]**



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## The Passive House – The European Experience

Dr. Guido Wimmers

In designing the Riverdale project, a two unit condominium, he found that achieving net zero, “turned out to be considerably more difficult than we expected, but in the process we’ve learned a huge amount.” Amerongen further notes that, “Solar energy is the most scarce when we need it the most and is quite expensive to harvest. It is necessary to reduce energy consumption- to conserve energy- until the cost of further conservation, on the basis of cost per unit of energy saved, exceeds the cost of collecting solar energy.

Conservation always has the edge over solar energy collection because conservation measures like insulation and better windows are permanent, have no moving parts and need no maintenance, and they’re good for the life of the building.” The Riverdale double wall system exemplifies some of the thinking and effort that has gone into this program.

As Peter comments, “The wall system has very low incremental cost, very little embodied energy and low environmental impact. It uses only regionally produced lumber and recycled newspaper and has cut the wall component of heat loss by approximately 70% compared to a standard 2x6 wall. Similarly, costs and overall environmental impact has guided all of the selections of material, strategies and equipment.”

Gayle Wood, coordinator of the Laebon CHES home project in Red Deer, notes that,

“The ‘house as a system’ approach has given us the opportunity to analyze the way we do things now and look for better, more efficient materials and construction methods, and then look at how to integrate them all to optimize performance.”

The building envelope for the CHES home features R-54 walls for both the main floor and the basement. Conventional wood frame homes with concrete basements are generally R-20 on the main floor and R-12 in the basement. The ceiling of this home will have R-80 insulation, double the norm for Alberta housing.

The Passive house is a very energy efficient building standard which has captured the European market in the last 10 years. It provides an excellent level of thermal comfort that can be maintained without active heating and cooling systems.

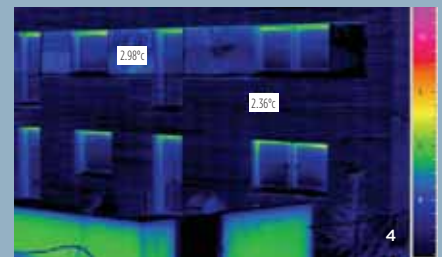
Living in a passive house can be described as a year round stay in a climatic spa. Fresh air flows in constantly, but traffic noise, dust, soot and pollen remain outside. No heat is lost, and there are no cold building surfaces to generate asymmetrical radiation temperatures, all surface areas are equally warm, even the windows. The result is simply a healthy and comfortable indoor environment.

Passive houses typically employ superinsulation, 3-pane glazing with insulated window frames, and rigorous energy design focused on eliminating thermal bridges and air infiltration. A wide range of insulation materials are used to create high R-values at all parts of the envelope.

Passive houses can be constructed from dense or lightweight materials but some internal thermal mass is desirable to reduce summer peak temperatures and increase winter temperatures, as well as guarding against possible over-heating in spring or autumn before normal solar shading becomes effective.

Typically passive houses use the excess internal heat that comes from even the most efficient household appliances, lighting and entertainment electronics as well as their occupants. They also utilize passive solar gain.

The ventilation system with heat recovery in a passive house is a fresh air supply system,



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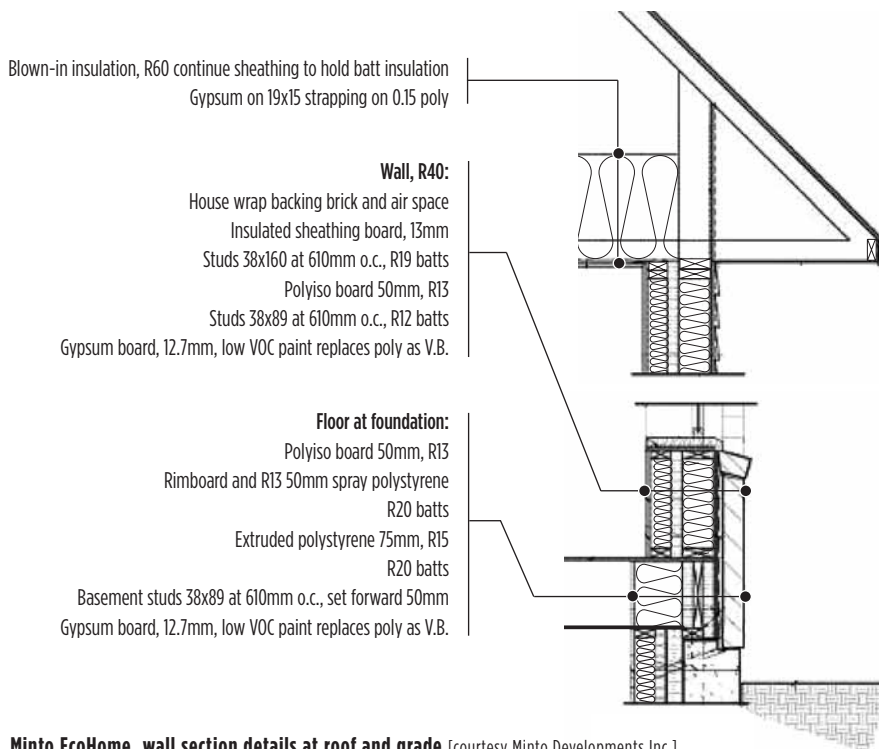
not an air conditioning system that recirculates inside air. They routinely recapture heat from air being exhausted using whole-house heat recovery ventilation [HRV], depending on climatic conditions.

Passive houses typically have an 800 to 1500 Watt heating element integrated into the supply air duct of the ventilation /HRV system. The element can be heated by a small heat pump, by thermal solar energy or simply by natural gas. Because the heating capacity and the heating energy required by a passive house are both very low, it does not much matter what source is selected for the energy supply.

By definition, Passive Houses are limited to an annual heating demand of 15 kWh/m<sup>2</sup> of floor area. Even in harsh alpine climates, Passive houses need less than a tenth of the heating energy, cooling and hot water than normal houses in Canada. With these new standards, heating energy consumption in Canadian households could be reduced by at least 90%, with a commensurate increase in thermal comfort and indoor environmental quality.

DR. GUIDO WIMMERS AUTHORED THE INSULATION ARTICLE ON PAGE 26.

A PASSIVE HOUSE IN AUSTRIA. [3] THE HEAT LOSS IMAGE OF THE PASSIVE HOUSE, WHERE DARK BLUE INDICATES LOW LOSS AND RED INDICATE HIGH HEAT LOSS, SHOWS THE HIGH INSULATION PERFORMANCE OF THE ENVELOPE - INCLUDING THE WINDOWS [GREEN COLOUR] THAT SHOW ONLY MODERATE HEAT LOSS. [4]



**Minto EcoHome, wall section details at roof and grade** [courtesy Minto Developments Inc.]



**AS WITH ALL EQUILIBRIUM HOUSES, THE RIVERDALE PROJECT IN EDMONTON HAS A HIGHLY INSULATED ENVELOPE, IN THIS CASE ACHIEVED WITH A DOUBLE WALL CONSTRUCTION THAT, ACCORDING TO THE BUILDER, HAS LOW INCREMENTAL COST. [5] [Photo Habitat Studios]**

Wood adds,” We have also added R-20 insulation under the basement slab. In addition to the superior wall systems we have also upgraded our windows, aiming for some passive solar gain on the south and minimum U values on the other sides of the home where we are using quad pane windows.” The quad glass windows were developed specifically for projects in the EQUilibrium Initiative.

Typical Laebon Homes achieve around 3.0-3.5 air changes per hour on a blower door test, whereas this home is expected to achieve 0.5 air changes per hour. A Venmar Heat Recovery Ventilation system is being installed in order to ensure proper ventilation, draw out stale moist air and ensure all rooms have adequate fresh air.

Another unique member of this innovative group, Yipi! Net Zero Footprint Housing, will be situated half way between Prince Albert and the Prince Albert National Park, Saskatchewan. YIPI! team members include project developer Nexus Solar Corporation, builder South Beach Homes Ltd. a division of Montreal Lake Cree Nation, CMHC, the Saskatchewan Research Council, as well as numerous technical and agency partners. Jeannine Paul of Nexus Solar says, “We

believe we are the only ones using amorphous photovoltaic panels on steel roofing. Design software suggests we will be achieving 100% of our annual power and heating needs from this source, based on our building envelope design.”

There are a number of patterns that are emerging from the EQUilibrium project. First, energy conservation through higher performing building envelopes, whether achieved by newer wall systems, common sense double walls, or factory-built walls.

Second, more thorough and thoughtful design as it relates to orientation and window layout and selection is seeking greater benefits from daylighting and effective solar gain while avoiding summer over heating. The more careful consideration of the basic issues of orientation and layout can make a significant difference to overall performance.

Third, there seems to be considerably greater interest and effectiveness in the use of additional sources of “free power” such as photovoltaics. This would appear to be the result of technological progress as well as the considered need in the EQUilibrium project to balance the reduction of demand for conventional

power and heat with ‘free’ renewable sources in order to achieve “net zero”.

Lastly, a fascinating mix of projects and project teams is likely to provide lots of material for evaluation, consideration and even stimulation for years. As the program notes, the demonstration homes will offer the opportunity to measure the performance of EQUilibrium housing under real-world conditions. These projects will also help set a new standard for healthy, sustainable and energy-efficient housing in Canada for generations to come. ◀

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Web sites with additional information:  
[www.cmhc.ca](http://www.cmhc.ca) - type in the search keyword “EQUilibrium”, [www.riverdalenetzero.ca](http://www.riverdalenetzero.ca), [www.chess.laebonhomes.com](http://www.chess.laebonhomes.com), [www.maisonlouette.com](http://www.maisonlouette.com), [www.yipi.ca](http://www.yipi.ca), [www.minto.com](http://www.minto.com).