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BOUT YOUR HOUSE

North Series 5

EAGLE LAKE HEALTHY HOUSE

Canada Mortgage and Housing Corporation's (CMHC) Healthy Housing™ has five key guiding principles for designing and building housing:

- Occupant health
- Energy efficiency
- Resource efficiency
- Environmental responsibility
- Affordability.

CMHC's First Nations Healthy Housing™ initiative

First Nations face challenges supplying infrastructure and affordable, quality housing in their communities. CMHC held an Aboriginal home show in Sioux Lookout, Ont. in May 1997. The Eagle Lake Healthy House and others projects evolved from this show. Workshops, at which CMHC contributed what it has learned from other Healthy Housing demonstrations, such as CMHC's Healthy House in Toronto, enabled First Nations to explore their vision of northern housing and to further develop solutions to northern

housing problems. It seems that Healthy Housing is complementary with First Nations teachings to think seven generations ahead about environmental consequences.

The project

Workshops with First Nations Tribal Councils and CMHC steered development of the concept of a Northern Healthy House. All approaches to design, materials and construction methods were discussed and agreed to by consensus.

In 1997, Eagle Lake First Nation, near Dryden, Ont., decided to go ahead with the project. The Eagle Lake Healthy House is an innovative solution to housing durability, costs, water quality and safety. At the same time, the Eagle Lake First Nation has improved its technical and management skills in housing.

Through working with Eagle Lake First Nation, CMHC wanted to deal with the problem of providing infrastructure in northern and remote locations.

The goal of a self-contained portable utility system was met by Architectural & Community Planning Inc. of Kenora, Ont. The company developed the EcoNomad™, which meets CMHC's objectives for a "Combined Heating and Utilities Module" (CHUM).

The EcoNomad™ provides the house with a portable, integrated system for heat, power, drinkable water and waste water adequate for a family of five. The Healthy House at Eagle Lake First Nation is a 107 m² (1,152 sq. ft.) bungalow on an insulated concrete slab foundation. It's design goes hand-in-hand with the EcoNomad™ while minimizing costs and the environmental impact of both construction and day-to-day running of the household. The Eagle Lake Healthy House is also healthy and comfortable throughout the year for the occupants.



HOME TO CANADIANS
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The partners

The collective effort focused on water quality, safety, affordability and durability. A highly creative team came together and developed the concept of integrating existing technology into a self-contained, utility system.

Eagle Lake First Nation committed the community to the project and contributed funds, construction management and labour.

Tribal Councils providing support were:

- Bimose Tribal Council
- Keewatinook Okimakanak (Northern Chiefs Council)
- Matawa First Nation Management Inc.
- Pwi Di Goo Zhing Nee Yaa Zing Tribal Council
- Shibogama First Nation Council
- Windigo First Nations Council.

First Nations organizations supporting the project were:

- Ontario First Nations Technical Services Corporation (OFNTSC)

Partners providing project funding were:

- Bank of Montreal
- CMHC
- Indian and Northern Affairs Canada
- Northern Ontario Heritage Fund

Others contributing to the project included:

- In December 1997, Architectural & Community Planning Inc. made an important contribution to solving remote housing infrastructure needs with the development of the EcoNomad™. The EcoNomad™ is a self-contained, off-grid utility system which Architectural

& Community Planning plans to manufacture in Northern Ontario and market for use in housing, commercial and industrial facilities in remote and Northern areas.

- Dow Chemical, which provided the insulation materials for the house.
- FedNor and the National Research Council Industrial Research Assistance Program, which provided funds for the EcoNomad.

The EcoNomad™

The EcoNomad™ is a self-contained, off-grid utility system containing all the utilities for the Eagle Lake Healthy House—power, heat, water supply, hot water, waste water management and water reclamation. The metal-clad unit is 2.4 x 2.4 x 6.1 m (8 x 8 x 20 ft.), separate from the home.

Power system

The core of the EcoNomad™ is efficient use and system integration of a small (garden tractor size) diesel generator. The generator co-generates electricity and heat for space heating and domestic hot water. The computer-controlled unit produces 6 kW of power and 12 kW of heat. The EcoNomad™'s generator provides power to the batteries first. This is backed up by photovoltaic panels (PV) and a wind generator.

The PV panels and wind generator reduce generator run time, which reduces fuel consumption especially during the summer.

Heat and hot water

As the generator runs it produces heat. The heat is stored in the hot water tanks to provide domestic hot water and space heating. Solar water heating panels also provide heat when there is sunshine.

A radiant, in-floor heating system warms the home's interior with this evenly distributed heat source. The unit has two upright hot water tanks with a total capacity of 875 L (193 gal.) of hot water.

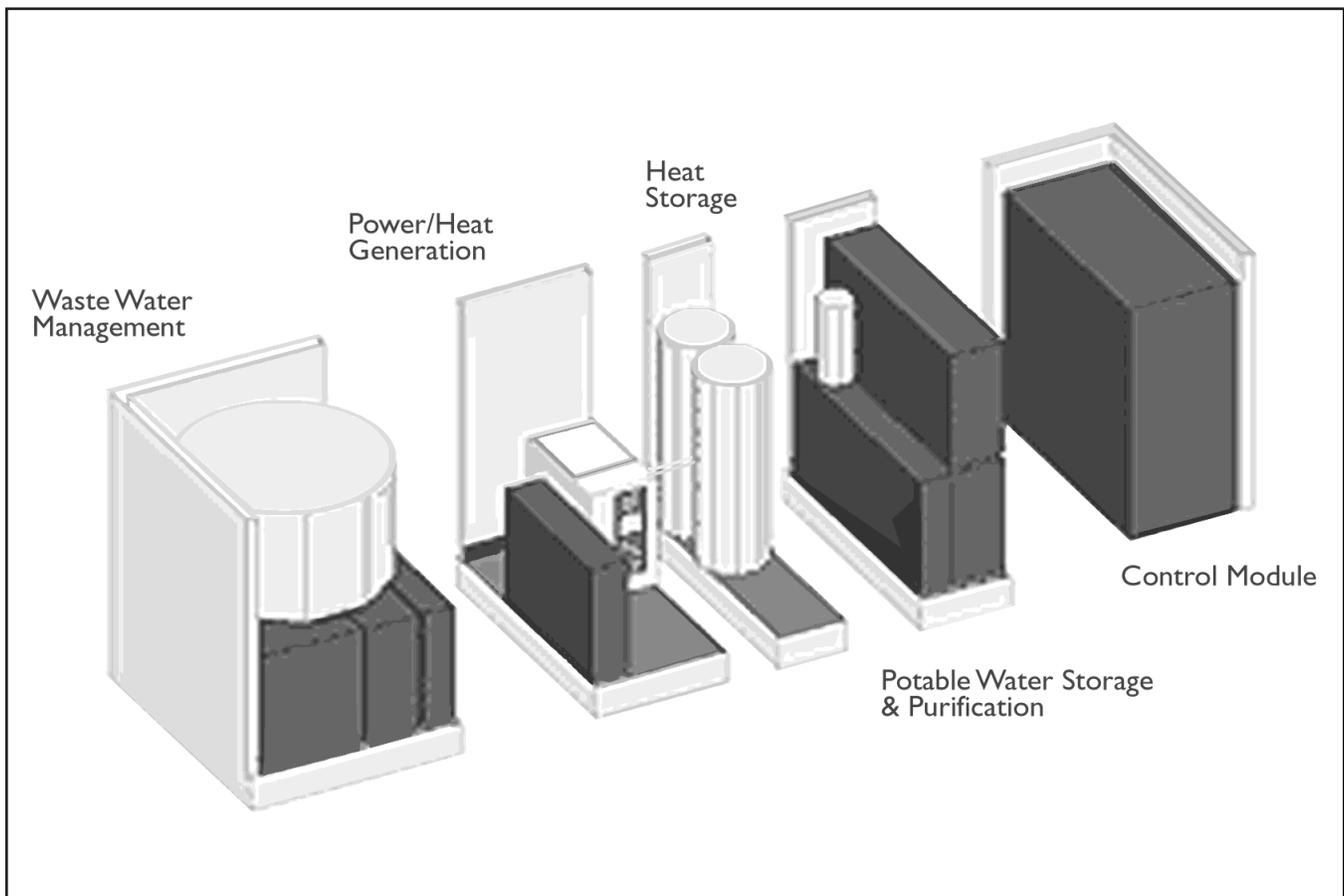
Water supply

Water for drinking and bathing comes from nearby Eagle Lake. The EcoNomad™ has a ten day, 2,250 litre (495 gal.) storage tank. For most household applications this meets the Health Canada recommendation of 100 L (22 gal.) a day per person.

The water is treated using a slow sand filter followed by a one micron filter along with ultraviolet (UV) light treatment. The filtered water flows into two holding tanks with a total capacity of 1,080 L (234 gal.) The technology is proven effective in removing Giardia, Cryptosporidia and other water-borne parasites, organic and inorganic compounds, sediment, foul odours and discoloration.

Waste water

The waste water module can treat up to 1,250 litres (275 gal.) of waste water a day. A custom designed, two-chamber septic system in conjunction with a Waterloo Biofilter® provides primary and secondary waste water treatment. Reclaimed, clear, non-potable water is held in a reclaimed-water holding tank and then re-circulated for use in the toilet. Using the reclaimed water reduces net water consumption by up to 30 per cent and reduces waste water treatment quantities accordingly. The balance of the water is flushed into a septic field that is one-third the size of a normal septic field, since much less has to be discharged.



Occupant health

- The heat recovery system (HRV) is balanced to continually supply fresh air while removing stale, moisture-laden air.
- The radiant floor heating system does not stir up dust as forced air systems tend to.
- The house has no basement where mold, which thrives in cold, damp conditions, might grow.
- Low VOC (volatile organic compounds) paint was used on all walls.
- Fibre cement siding, a composite material of cement and wood fibres, is fire-resistant. This provides greater occupant security in communities that face the threat of forest fires and that have limited firefighting resources.
- The closets do not have conventional doors, so there is continuous air movement which helps prevent condensation and the possibility of mold.
- Cabinets are made of a manufactured board combining straw fibres and non-toxic resins.

Energy efficiency

- R50 insulation in the walls is achieved using I-beam trusses on the exterior walls to hold additional fibreglass insulation.
- The attic has R60 blown-in-place fibreglass insulation.
- Three layers of two-inch Styrofoam insulation have been placed below and around the concrete slab to retain heat. The slab is used as a heat sink, since its own mass retains heat and can slowly disperse it.
- The triple-glazed, Low-E casement windows can be opened for cross-ventilation in the summer.
- Fixed, sealed window units in the living room area reduce heat loss while providing heat through solar gain.
- The HRV provides efficient ventilation of moisture-laden air to the exterior while raising the temperature of fresh, incoming air.
- The concrete slab is heated by hot water recirculating in plastic piping embedded in the slab which makes a lower temperature setting possible.

- Double drywall increases the mass of the house to store heat and gradually disperses it to the rest of the house. The concrete slab and the double drywall work together, as a “house-as-a-system”, to provide a comfortable environment.
- Energy efficient appliances and fixtures.

Resource efficiency

- The EcoNomad™ reclaims water and reduces water consumption and treatment of waste water by as much as 30 per cent.
- Renewable energy sources, the sun and the wind, reduce consumption of non-renewable energy.
- Large windows on the south of the house take advantage of the potential for solar gain.
- Sunlight entering the south windows warms the concrete slab and adds a natural-heat source to the home.
- The fibre-cement siding is more durable than typical wood fibre or vinyl siding.
- The faucets, toilet, shower head and washing machine use less water than conventional units.

- The 12 x 12-in. ceramic tile flooring was selected for durability, low cost and low maintenance.

Environmental responsibility

- Clean energy from the sun and the wind reduce fossil fuel consumption.
- The EcoNomad™ reduces fuel consumption by using a small diesel engine generator which produces heat and electricity simultaneously and achieves fuel efficiencies of 90 per cent or better. EcoNomad™ functions are designed to optimize the efficiency of all mechanical components.
- Reduced fuel consumption reduces greenhouse gases (CO₂) since more than 80 per cent of CO₂ emissions are from the burning of fossil fuels.
- The Waterloo Biofilter® process treats waste water to such an extent that the treated water is referred to as non-potable reclaimed water. This water is safely treated for reuse in the toilet, which reduces water consumption by up to 30 per cent. The Waterloo Biofilter technology also helps reduce land and water pollution.

- In 1999, the Ontario Building Code reduced the size of the septic field used with the Waterloo Biofilter by two-thirds as a result of the high quality of the treated water. The reduced area bed size minimizes the cost of construction and related environmental impacts of large septic area beds.
- The EcoNomad™ is completely portable and can be installed or removed without significant construction, excavation or land clearing, which reduces the impact of conventional utility infrastructure.

Affordability

- The ability to unplug the house from conventional infrastructure can reduce the upfront cost of providing conventional utilities to an individual house.
- In more remote communities than Eagle Lake sewer and water infrastructure costs can be as high as \$150,000 to \$200,000 a house. Hydro infrastructure can range from \$15,000 to \$35,000 a house. The Eagle Lake Healthy House clearly demonstrates that the house and infrastructure can be built for the same price as conventional infrastructure alone.

- Overall energy savings resulting from this integrated approach can be as high as 40 per cent because the house uses heat energy as well as electricity from the generator.
- Total utility bills are expected to be \$50 to \$60 a month, depending on the occupants' lifestyle.
- The EcoNomad™ is designed for extreme winter weather operation suitable for northern and circumpolar countries.
- Metal roofing has been used because it has increased life expectancy and durability compared to conventional roofing.
- The EcoNomad™ technology can be adapted for connection to several homes.
- The EcoNomad™ container has a computerized, remote monitoring system. The EcoNomad™ systems can be monitored from the house, the First Nation office or any other location. Along with operating instructions for the container, there are prompts for maintenance. The computer detects and warns about possible problems, such as low fuel or pump difficulties.

Table I EcoNomad™ utility components and capabilities

| Utility component | Eagle Lake Healthy House - five-person capacity |
|--|---|
| Structural container shell | |
| | Insulated aluminum body with structural steel floor |
| Drinking (potable) water | |
| Water source Treatment process System capacity Storage | Eagle Lake Combination of slow sand filter; one micron filter, ultraviolet (UV) light treatment 500 L a day based on 100 L per person per day for the five-person family 1 - 2,250 L source water tank 2 - 540 L filtered water tanks |
| Hot water | |
| Source of energy Storage tanks Total capacity | Primary: micro co-gen Secondary: roof-mounted, flat plate solar collector Two upright tanks 875 L |
| Non-potable reclaimed water | |
| Components in container External components Reuse application Savings | Septic tank, Waterloo Biofilter®, re-circulation and non-potable water storage tank Sand absorption bed Toilet Up to 30 per cent |
| Space heating | |
| | Radiant infloor circulation using hot water |
| Ventilation | |
| | Heat recovery ventilator (HRV) |
| Power | |
| Power generation Batteries Photovoltaic panels Wind generator | Primary: 6 kW diesel micro co-generator Secondary: solar, wind (20% of electrical requirements) 20-105 ampere hour sealed batteries configured in 48 volt system Four photovoltaic panels 75 watts peak output each Produces up to 300 watts of electricity (1/3 kWh) Mounted on roof of container; produces 550 to 600 watts of power |
| Central monitoring system | |
| | In-unit computer and remote monitoring |

Other useful information from Canada Mortgage and Housing Corporation

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| CMHC's Healthy House in Toronto | Free | NHA 6749 |
| Clean-up Procedures for Mold in Houses | \$3.95 | NHA 6753 |
| The Clean Air Guide | \$5.95 | NHA 6695 |
| Building Materials for the Environmentally Hypersensitive | \$29.95 | NHA 6742 |
| Healthy Housing Renovation Planner | \$34.95 | NHA 2172 |

To order these publications and to find out about other CMHC publications, contact:

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