



R-2000 NET-ZERO ENERGY Pilot Case Study

ARCADIA COMMUNITY II MINTO COMMUNITIES



Kanata, 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.

Minto Communities was the first to build net-zero energy townhomes in Kanata-Ottawa, Ontario.

The **BUILDER: MINTO COMMUNITIES**

-  Built the Innova Home in Emerald Meadows, Kanata – was the largest builder to offer R-2000 homes
-  Built the Inspiration – The Minto ecohome as part of the CMHC EQUilibrium Initiative in 2009 to 2010
-  Won Ontario Home Builder of the Year in 2012 and 2014; Ontario Green Builder of the Year in 2011, 2012, 2014 and 2015
-  One of the first builders to offer net-zero energy ready as an upgrade for homebuyers

Affordability

In comparison to houses in the same location built to code, the Minto net-zero energy homes cost about \$45,000 more to build. For the buyer, the townhouses range from \$352,900 for the smallest unit (1,655 sq. ft.) to \$412,900 for the largest corner unit (2,091 sq. ft.).

Key **FEATURES**

EnerGuide Rating

0
GJ/Yr



Roof:

R-60 blown cellulose



Main walls:

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



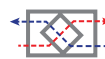
Basement:

walls: R-20 batt + R-15 XPS (3")
under slab: R-10 XPS (2")



Windows:

low-E, argon-filled, triple pane



HRV:

75% efficient at 0°C and 64% at -25°C



Airtightness:

1.44 to 1.5 ACH at 50 Pa



Space heating and cooling:

air source heat pump, 8.26–8.43 HSPF/
15–17 SEER + electric furnace



Water heating:

2.78 EF hybrid heat pump water heater,
46.0% efficient drain water heat recovery



Rated annual energy consumption:

31.03 to 34.84 GJ

These townhouses consume ~50% less energy than their reference houses.



Electricity generation:

≤10 kW solar PV system unit, 30 to 34 panels 250 W each, rated annual energy production: 36 to 41 GJ



Estimated net annual energy use:

-4.87 to -6.25 GJ

The HOME



Unit A

Unit B

Unit C

Unit D



Top: front elevation

Bottom: basement floor plan

Note: Elevations may differ from the actual construction.



Top: ground floor plan

Bottom: second-floor plan

Technical SUMMARY

Minto Communities, Kanata, Ontario				
Townhouse unit (4 total)	Unit A (end)	Unit B (middle)	Unit C (middle)	Unit D (end)
Site characteristics				
Location	Kanata-Ottawa West, Ontario			
Site type	Suburban, new development			
Design conditions				
Number of occupants	2 adults, 1 child ¹			
Heating degree days ²	4,500			
Building description				
Floor area (including basement)	210.94 m ²	187.61 m ²	178.3 m ²	225.84 m ²
Heated volume	533.80 m ³	481.40 m ³	458.9 m ³	533.80 m ³
Exposed floor area	15.06 m ²	11.80 m ²	11.47 m ²	18.87 m ²
Ceiling area	78.36 m ²	68.66 m ²	66.51 m ²	85.90 m ²
Main wall area	132.39 m ²	62.39 m ²	57.99 m ²	131.48 m ²
Total window area	20.53 m ²	16.31 m ²	16.31 m ²	27.13 m ²
Thermal characteristics	Effective		Nominal	
Roof	10.57 RSI		R-60 blown cellulose	
Main walls	4.78 to 5.03 RSI		R-24 batt + R-10 XPS (2")	
Basement walls	5.42 RSI		R-20 batt + R-15 XPS (3")	
Windows (average value)	0.94 to 0.99 RSI		low-E, argon, triple pane	
Basement floor	1.76 RSI		R-10 XPS (2")	
Measured airtightness level	1.47 ACH @ 50 Pa	1.44 ACH @ 50 Pa	1.50 ACH @ 50 Pa	1.47 ACH @ 50 Pa
Building performance (annual energy consumption)³				
Space heating	8.11 GJ	4.17 GJ	3.89 GJ	8.50 GJ
Domestic water heating	3.67 GJ	3.66 GJ	3.66 GJ	3.67 GJ
Lighting, appliances and other plug loads	21.10 GJ	21.01 GJ	21.40 GJ	20.40 GJ
Mechanical ventilation	0.22 GJ	0.31 GJ	0.31 GJ	0.28 GJ
Space cooling	1.73 GJ	1.89 GJ	1.88 GJ	1.88 GJ
Rated annual energy consumption	34.84 GJ	31.03 GJ	31.14 GJ	34.72 GJ
Rated annual energy production⁴	39.71 GJ	37.28 GJ	36.10 GJ	40.97 GJ
Net annual energy use (consumption minus production)	-4.87 GJ	-6.25 GJ	-4.96 GJ	-6.25 GJ
EnerGuide rating (ERS)	0* GJ	0* GJ	0* GJ	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. These houses use only solar photovoltaics as their 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 004 Insulation

Rigid insulation materials and cellulose loose fill insulations shall have low-VOC content as determined through ECOLOGO or GREENGUARD certification. Rigid insulation materials include extruded polystyrene insulation, polyisocyanurate insulations with or without reflective facers, expanded polystyrene rigid insulations and spray foam insulations. Fibrous insulations (e.g. batt and blanket type, loose fill or semi-rigid boards [fiberglass and mineral wool]) shall be formaldehyde-free, as determined through 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.

EE005 Solar ready

The house shall be constructed in accordance with NRCan's *Solar Ready Guidelines for Solar Domestic Hot Water and Photovoltaic Systems*.

Environmental Stewardship

ES003 On-site construction waste management

Provide dedicated on-site bins for salvaging wood, cardboard, metal and scrap as part of a written, corporate, on-site construction waste management plan.

NOTE: This requirement can also be met by a third-party off-site waste diversion.

Water Conservation

WC004 Irrigation systems

Landscaping systems shall be designed to not require irrigation, be irrigated with rainwater or domestic reclaimed water (in accordance to CSA B128.1-06 Design and Installation of Non-Potable Water Systems) only, or be irrigated by the following type of system. Should potable water be required for irrigation, irrigation systems shall include a low-volume, non-spray irrigation system (drip irrigation, bubblers, drip emitters, soaker hose), and a zoned irrigation system that separates turf and bedding areas.

Resource Management

RS008 Insulation

As a minimum, the product or combination of products chosen shall be used in the entire building envelope.

Glass fibre (batt, blanket, loose fill or semi-rigid type): be third-party certified to meet or exceed a minimum of 70% recycled content

Cellulose: be third-party certified to meet or exceed a minimum of 80% recycled content

Rock wool (batt, blanket or semi-rigid type): be third-party certified to meet or exceed a minimum of 40% recycled content

Foam board insulation: Extruded polystyrene insulation shall be third-party certified to meet or exceed a minimum of 20% recycled content. Expanded polystyrene insulation and the EPS component in an insulated concrete form (ICF) shall be certified to meet or exceed a minimum of 10% recycled content.

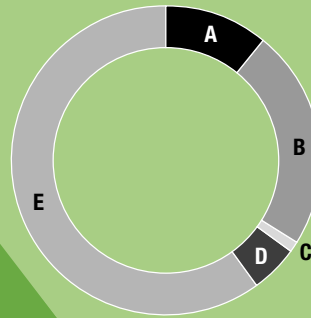
Spray-on foam insulation: be third-party certified to meet or exceed a minimum of 5% recycled content

The PERFORMANCE



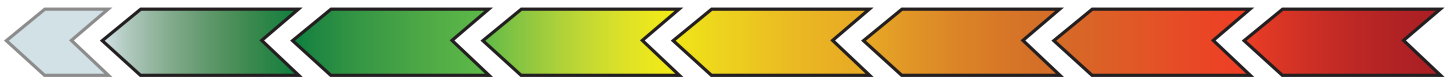
Townhouse unit A

Energy consumption by usage



A Water heating	11%
B Space heating	23%
C Ventilation	1%
D Space cooling	5%
E Base loads <small>(appliances, lighting, etc.)</small>	60%

▼ 0 GJ net annual energy use



▲ 0 GJ/Year
this house

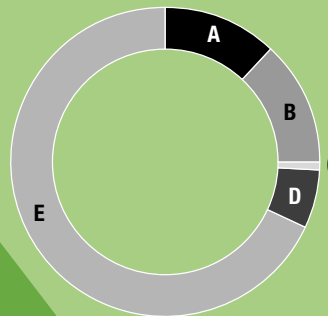
▲ 35 GJ/Year
net-zero
energy ready

▲ 87 GJ/Year
reference house



Townhouse unit B

Energy consumption by usage



A Water heating	12%
B Space heating	13%
C Ventilation	1%
D Space cooling	6%
E Base loads <small>(appliances, lighting, etc.)</small>	68%

▼ 0 GJ net annual energy use



▲ 0 GJ/Year
this house

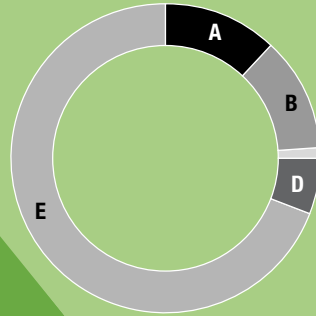
▲ 31 GJ/Year
net-zero
energy ready

▲ 69 GJ/Year
reference house



Townhouse unit C

Energy consumption by usage

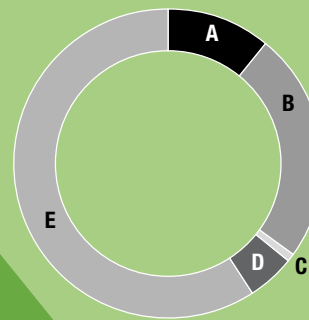


A Water heating	12%
B Space heating	12%
C Ventilation	1%
D Space cooling	6%
E Base loads (appliances, lighting, etc.)	69%



Townhouse unit D

Energy consumption by usage



A Water heating	11%
B Space heating	24%
C Ventilation	1%
D Space cooling	5%
E Base loads (appliances, lighting, etc.)	59%



This case study was developed by buildABILITY Corporation for Natural Resources Canada's Office of Energy Efficiency, 2016.

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