What is Net Zero?

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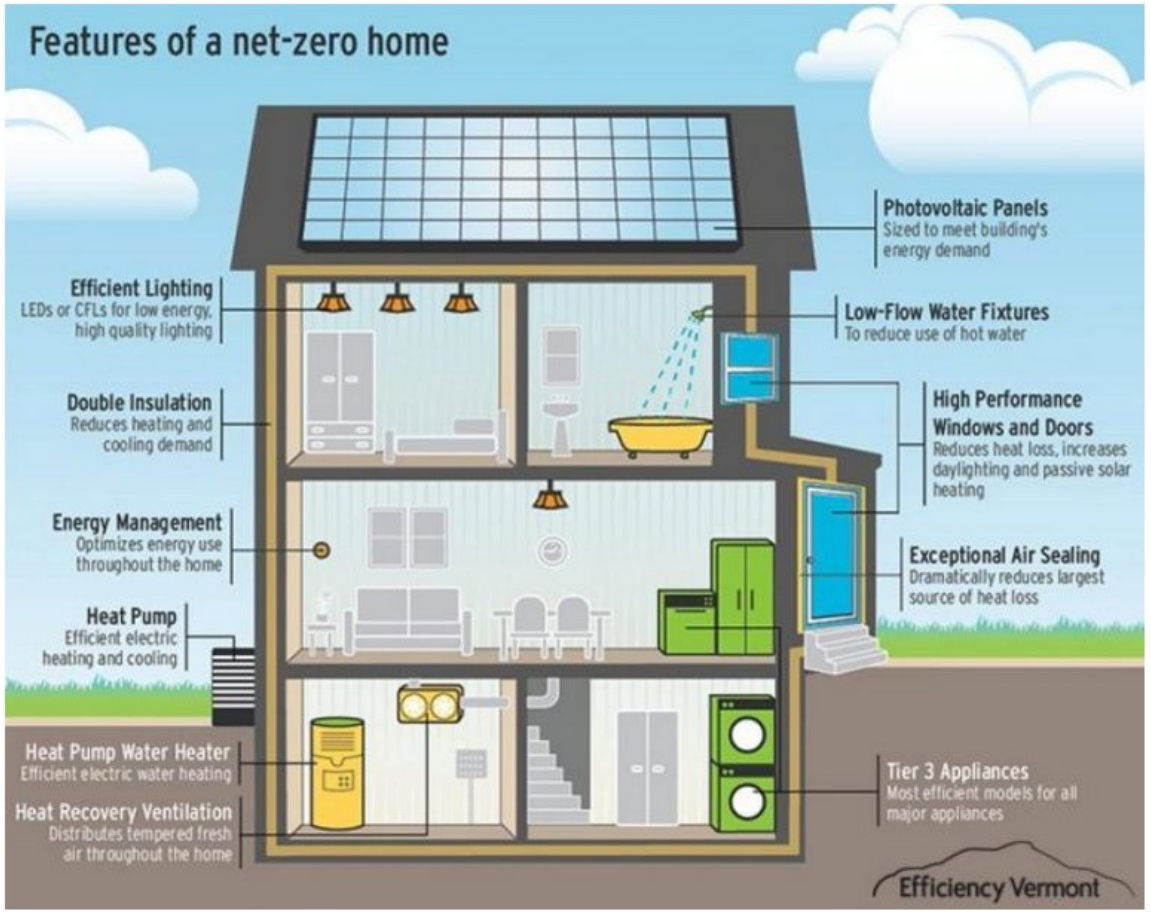
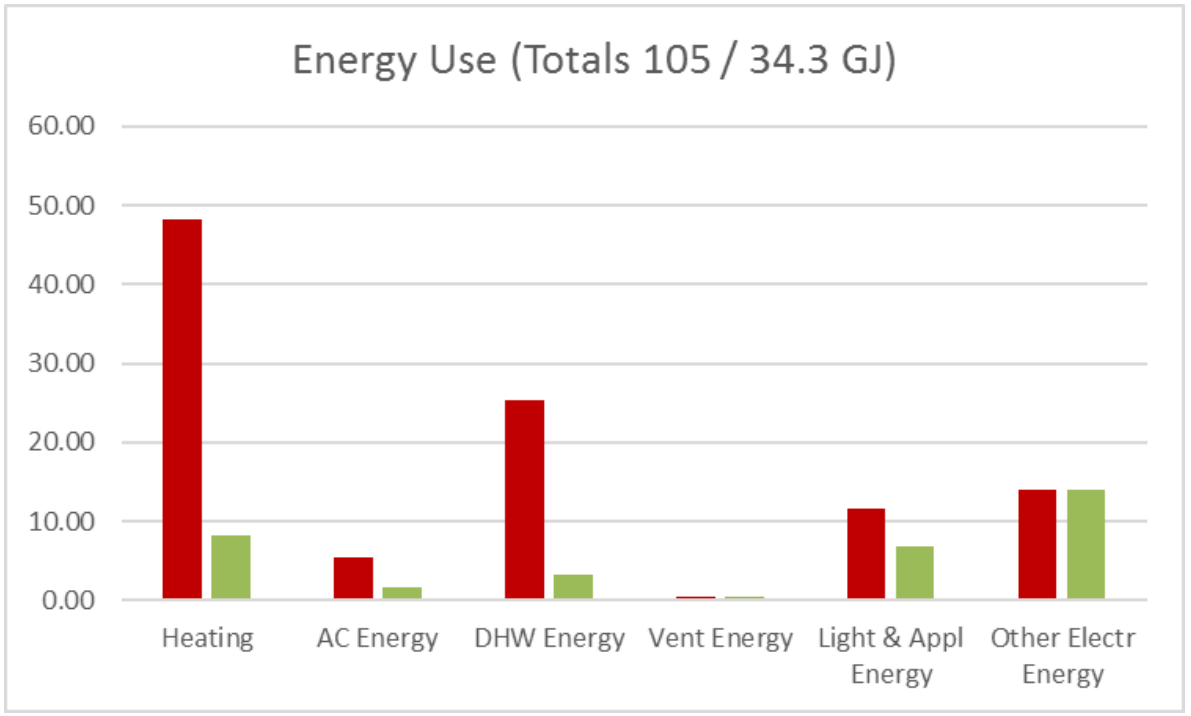
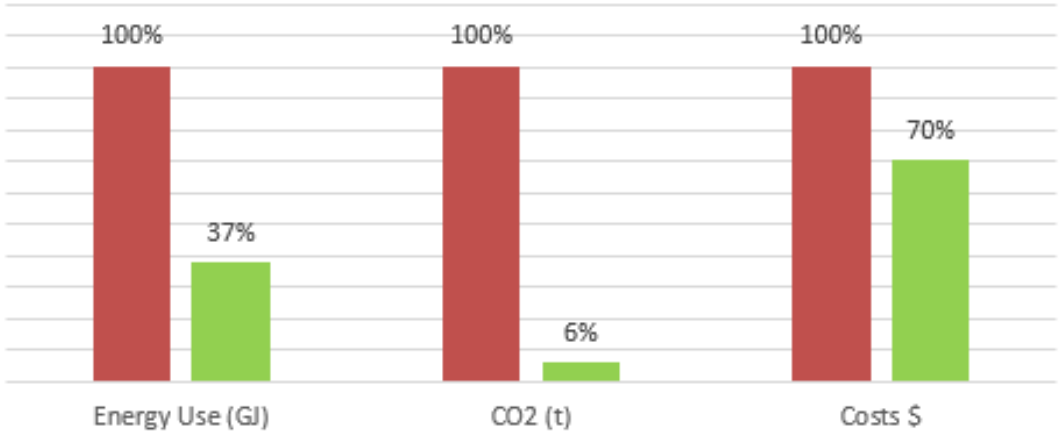
Yearly household energy = Yearly energy generated onsite



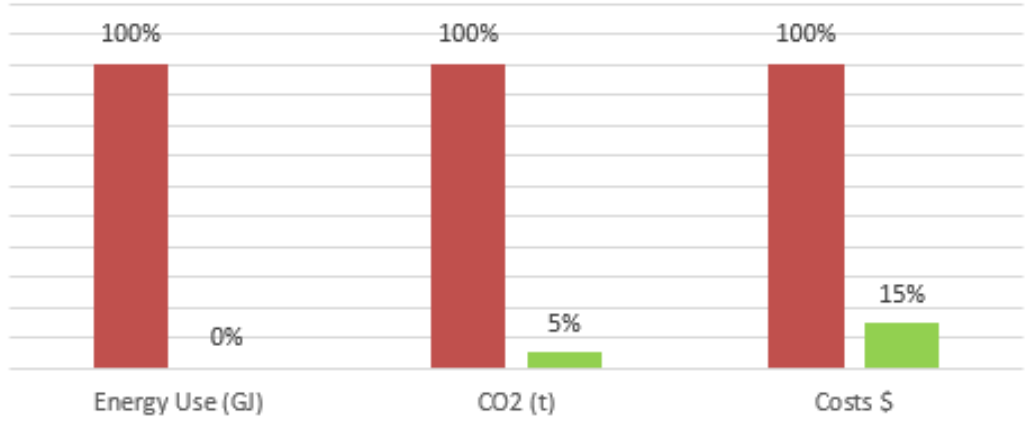


Net Zero retrofit savings

- Lower energy consumption (65-100%)
- Electricity generation offsetting consumption
- Carbon reductions of up to 95%



Net-Zero Ready: Conservation Upgrades Only



Net-Zero: Including Solar Panel Production

Net Zero example

Net Zero Energy Retrofit on 1980s row house, as follows:

1. Mid-efficiency gas furnace to ASHP & electric furnace
2. Standard gas DHW to HP water heater & DWHR
3. Air leakage reduced from 4.6 to 1.5 ACH50
4. Lighting and appliance upgrades
5. All windows replaced with triple-pane fiberglass
6. 500 sq.ft. of solar panels installed to match reduced usage

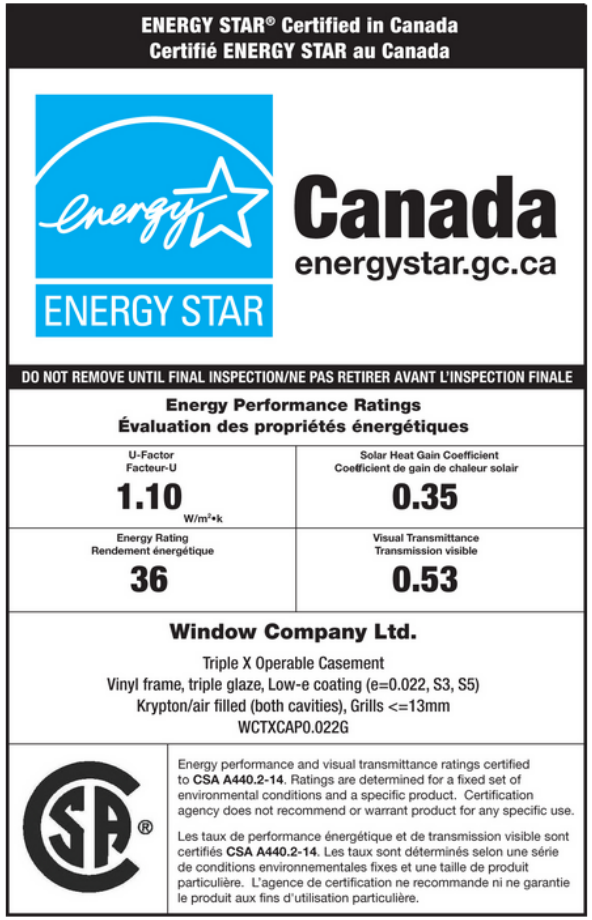
Moving toward Net Zero

How?

1. **Lower heating/cooling demand**
2. **Ultra-efficient heating**
3. **Electricity generation on site**

Toward Net Zero:
lower heating/cooling demand

- Plenty of insulation
- Low air leakage target (1.5 ACH50)
- Advanced windows



Providing ventilation

- 1.5 ACH50 translates to very low natural ventilation rates
- The answer is **Fresh Air Machines**: HRV or ERV equipment

Net Zero:
low heating/cooling needs

- Heating: only 36000 btu/hr heating for a 2000 sf home

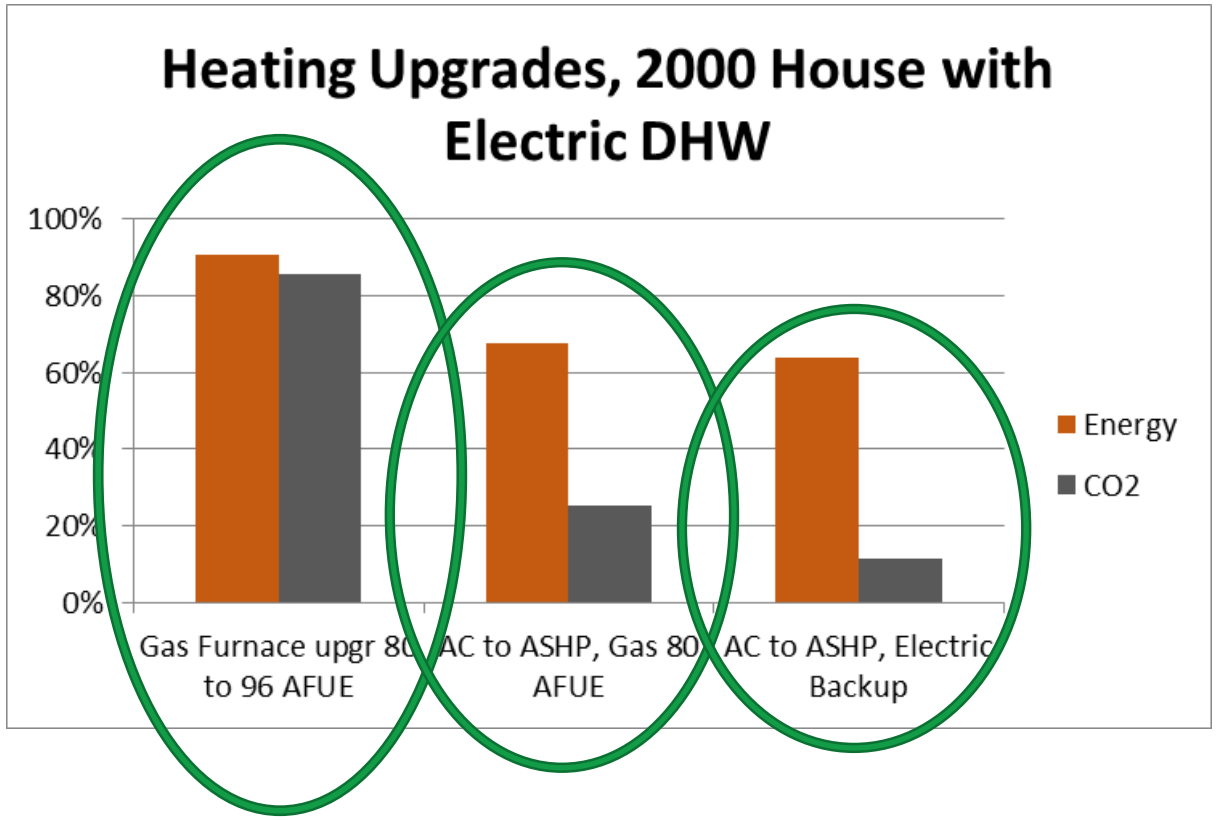
- Cooling is also necessary for:
  - ambient temperature above 26°C for extended periods
  - high interior energy use
  - high occupancy load (100 W per person)
  - excessive solar gain

- ASHPs are a good choice for this application

Toward Net Zero:
Heating upgrades

If you have an electric water heater,

- Upgrading gas heating efficiency gets only 10% energy reduction, 15% drop in CO_2
- Upgrading AC to operational ASHP can get 33% energy, 75% drop in CO_2 (orig. furnace)
- Removing gas entirely and replacing with heat pump gets 35% energy, 90% CO_2



Toward Net Zero:
Electricity Generation

- Rooftop available for PV tells you the maximum energy use you can offset
- 500 sq.ft. of South-facing: ~35 GJ yearly
- 10 kW net metering limit (Ottawa) means **45 GJ** is max production
- Wind not generally available in Eastern Ontario

Toward Net Zero:
The balance

- **45 GJ** max electricity production means:
- **45 GJ** max house rating on the ERS scale
- House details need to be modeled in HOT2000 to match this level

Certified Energy Advisor

- Creates models based on plans
- Figures out the energy balance
- Recommends cost-effective solutions
- Performs blower testing and site inspections
- Provides the Net Zero label

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Process vetted by CHBA

Each **Net Zero** and **Net Zero Ready** Home is verified by government-licensed third-party **Service Organizations** and recognized by **CHBA** for its achievement.

Results

- Outstanding comfort
- Tiny carbon footprint
- Very low operating costs