### Homeowners’ Annual Heating Related Costs

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<tbody>
<tr>
<td>Oil Forced Air</td>
<td>$26,680</td>
<td>$28,310</td>
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<tr>
<td>Propane Forced Air</td>
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<tr>
<td>Electric Baseboards</td>
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<tr>
<td>Pellet Stove</td>
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<tr>
<td>SuperGreen with Air-Source Heat Pump</td>
<td>$5,660</td>
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### Annual Greenhouse Gas Emissions

- **GHG Emissions if all electricity for heating is from diesel electric generation**
- **Biomass GHG Emissions**
- **Fossil Fuel GHG Emissions (incl. electricity generation related emissions)**

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<td>Electric Baseboards</td>
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<td>SuperGreen with Electric Baseboards</td>
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<td>SuperGreen with Air-Source Heat Pump</td>
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### Financial

- Low insulation levels no longer permitted in City
- Annual maintenance
- High energy cost fluctuation = lack of financial certainty (i.e. fixed income homes)
- Risk of fuel spills
- Risk of house fires & burns

### Environmental

- Low maintenance
- Low & predictable heating costs (regulated)
- Locally produced energy
- Does not work during power outages

### Social

- Low & predictable heating costs (regulated)
- Locally produced energy
- Does not work during power outages
- Replacement after 20 years

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*Based on costs and opportunities as of September 2011. See reverse side for data sources and analysis basis.*
1. Pre-Energy Efficiency Bylaw Home (before 2009) with Oil-Forced Air Heating:

   Insulation: 2x4 construction, double pane glass, high air leakage (3.2 ACH), no HRV, no foundation insulation (EnerGuide Rating ~61)
   Heating System Efficiency: 80%
   Total Annual Heating Requirement: 29,200 kWh/yr
   Incremental Construction Costs:
     • Reduced construction cost: $-12,200
     • Oil Furnace, Fuel Tank: $10,500
     • Ductwork: $6,500
     • Total: $4,800
   Total Operating Costs:
     • Oil costs (3,960 L/yr): $5,116
     • Annual furnace maintenance: $184
     • Insurance premium (+5%): $44
     • Electricity (13,500 kWh/yr): $1,623
     • Total: $6,967
   Fossil Fuel Emission Factor: 2.7 tonnes CO₂ e / 1000 L (GHG Protocol) + electricity emissions (see below)

2. Conventional New Construction with Oil-Forced Air Heating:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~80)
   Heating System Efficiency: 83%
   Total Annual Heating Requirement: 14,300 kWh/yr
   Incremental Construction Costs:
     • Oil Furnace, Fuel Tank: $10,500
     • Ductwork: $6,500
     • Makeup air device: $1,250
     • Total: $18,250
   Total Operating Costs:
     • Oil costs (1,670 L/yr): $2,150
     • Annual furnace maintenance: $184
     • Insurance premium (+5%): $44
     • Electricity (13,600 kWh/yr): $1,628
     • Total: $4,006
   Fossil Fuel Emission Factor: 2.7 tonnes CO₂ e / 1000 L (GHG Protocol) + electricity emissions (see below)

3. Conventional New Construction with Propane-Forced Air Heating:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~80)
   Heating System Efficiency: 87%
   Total Annual Heating Requirement: 14,200 kWh/yr
   Incremental Construction Costs:
     • Propane Furnace, Installed: $7,000
     • Ductwork: $6,500
     • Makeup air device: $1,250
     • Total: $14,750
   Total Operating Costs:
     • Propane costs (2,260 L/yr): $2,333
     • Propane tank rental: $100
     • Insurance premium (+5%): $44
     • Electricity (13,600 kWh/yr): $1,628
     • Total: $4,165
   Fossil Fuel Emission Factor: 1.5 tonnes CO₂ e / 1000 L (Environment Canada National GHG Inventory) + electricity emissions (see below)

4. Conventional New Construction with Electric Baseboards:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~80)
   Heating System Efficiency: 100%
   Total Annual Heating Requirement: 14,200 kWh/yr
   Incremental Construction Costs:
     • Electric baseboards: $4,000
     • Ductwork: $6,500
     • Makeup air device: $1,250
     • Total: $4,000
   Total Operating Costs:
     • Electricity (27,500 kWh/yr): $3,599
     • Total: $3,599
   Electricity Emission Factor: 0.017 tonnes CO₂ e / 1000 kWh (based on 2011 Yukon electrical grid generation, Yukon Energy Corp. 2011 Business Plan), see details below.

5. Conventional New Construction with Firewood Heating:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~70)
   Heating System Efficiency: 40%
   Total Annual Heating Requirement: 16,000 kWh/yr
   Incremental Construction Costs:
     • Wood stove, chimney & labour: $6,000
     • Electric baseboard backup: $4,000
     • Makeup air device: $1,250
     • Total: $11,250
   Total Operating Costs:
     • Firewood costs (3.3 cords/yr): $797
     • Insurance Premium (+10%): $88
     • Electricity (16,000 kWh/yr): $1,366
     • Total: $2,851
   GHG Emission Factors: 1.86 tonnes CO₂ e / tonne (GHG Protocol) + electricity emissions (see below)

6. Conventional New Construction with Pellet Stove Heating:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~70)
   Heating System Efficiency: 78%
   Total Annual Heating Requirement: 15,200 kWh/yr
   Incremental Construction Costs:
     • Pellet stove, chimney & labour: $4,750
     • Electric baseboard backup: $4,000
     • Makeup air device: $1,250
     • Total: $10,000
   Total Operating Costs:
     • Pellet costs (3.4 tonnes/yr): $1,103
     • Insurance Premium (+10%): $88
     • Electricity (15,700 kWh/yr): $1,520
     • Total: $3,311
   GHG Emission Factors: 1.86 tonnes CO₂ e / tonne (GHG Protocol) + electricity emissions (see below)

7. Conventional New Construction with Air-Source Heat Pump – Forced Air:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~80)
   Heating System Efficiency: 180% with rated COP of 2.75
   Total Annual Heating Requirement: 14,200 kWh/yr
   Incremental Construction Costs:
     • Mini-split Heat Pump, installed: $14,300
     • Ductwork: $6,500
     • Makeup air device: $1,250
     • Total: $20,800
   Total Operating Costs:
     • Electricity (21,200 kWh/yr): $2,690
     • Total: $2,690
   Electricity Emission Factor: 0.017 tonnes CO₂ e / 1000 kWh (estimated 2011 Yukon electrical grid generation, Yukon Energy Corp. 2011 Business Plan)

8. Conventional New Construction with Ground-Source Heat Pump – Forced Air:

   Insulation: Energy Conservation Bylaw prescriptive approach (Enhanced 2x6 construction, EnerGuide Rating ~80)
   Heating System Efficiency: 250% with rated COP of 4.2
   Total Annual Heating Requirement: 14,200 kWh/yr
   Incremental Construction Costs:
     • Heat Pump, installed, inc. 4 boreholes: $35,000
     • Ductwork: $6,500
     • Makeup air device: $1,250
     • Total: $41,500
   Total Operating Costs:
     • Electricity (18,800 kWh/yr): $2,343
     • Total: $2,343
   Electricity Emission Factor: 0.017 tonnes CO₂ e / 1000 kWh (estimated 2011 Yukon electrical grid generation, Yukon Energy Corp. 2011 Business Plan)

9. SuperGreen Construction with Electric Baseboards:

   Insulation: Super Insulated R60 walls, R100 ceiling, R30 under-slab, air-tight (0.8 ACH), double doors (EnerGuide Rating ~88)
   Heating System Efficiency: 100%
   Total Annual Heating Requirement: 6,300 kWh/yr
   Incremental Construction Costs:
     • Extra materials, insulation & labour: $16,600
     • Electric baseboards: $2,456
     • Total: $19,056
   Total Operating Costs:
     • Electricity (19,600 kWh/yr): $2,456
     • Electric baseboards: $2,456
     • Total: $2,456
   Electricity Emission Factor: 0.017 tonnes CO₂ e / 1000 kWh (estimated 2011 Yukon electrical grid generation, Yukon Energy Corp. 2011 Business Plan)


   Insulation: Super Insulated R60 walls, R100 ceiling, R30 under-slab, air-tight (0.8 ACH), double doors (EnerGuide Rating ~90)
   Heating System Efficiency: 170% with rated COP of 2.78 (Fujitsu RMXK)
   Total Annual Heating Requirement: 6,300 kWh/yr
   Incremental Construction Costs:
     • Extra materials, insulation & labour: $16,600
     • Mini-split Heat Pump, installed: $15,750
     • Electric baseboards: $2,450
     • Total: $39,800
   Total Operating Costs:
     • Electricity (17,700 kWh/yr): $2,499
     • Total: $2,499
   Electricity Emission Factor: 0.017 tonnes CO₂ e / 1000 kWh (estimated 2011 Yukon electrical grid generation, Yukon Energy Corp. 2011 Business Plan)

Common Elements:

- House Size: 1,800 sq. ft. (average Yukon home size) + full ICF basement, no garage
- Mortgage Term: 25 year amortization, 5yr @ 4.08%, 10yr @ 4.69%
- Down Payment: OHC mortgage insurance (Ecoh Rating 80 or higher)
- Energy Costs:
  - Arctic Stove Oil - $1.29 / L, Propane - $1.03 / L (source: Yukon Retail Fuel Prices)
  - Pellets - $365 / ton ($7.30 / bag based on average Whitehorse retail price in November 2011), Wood: $240 / cord.
  - Electricity: $0.152 + $0.102 for 0-1000kWh +$0.137/kWh for 1000-2500kWh + $0.149 for >2500kWh / month.
  - Heat Pump, installed, inc. 4 boreholes: $35,000
  - Ductwork: $6,500
  - Makeup air device: $1,250
  - Total: $41,500
  - Electricity (18,800 kWh/yr): $2,343
  - Total: $2,343
- Electricity Emission Factor: 0.017 tonnes CO₂ e / 1000 kWh (estimated 2011 Yukon electrical grid generation, Yukon Energy Corp. 2011 Business Plan)

All costing contractor supplied as of Sept 1, 2011 or actual construction costs from 2010 building season

24/01/2013