

The upcoming explosion in careers  
addressing  
energy consumption  
in buildings and homes

... and a deep energy home reno

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# Professionals *Already* in High Demand

- Energy Managers & Auditors
- Energy Modellers (new construction)
- Skilled & Experienced Building Managers
- Highly Skilled & Knowledgeable Trades People
  - Multidisciplinary & collaborative
  - Problem solving

# People who design, build/renovate, and operate buildings

- Upgrade Building Science / Building Physics  
[BuildingScience.com](http://BuildingScience.com)
- Look into PassivHaus / Passive House training  
[www.PassiveBuildings.ca](http://www.PassiveBuildings.ca)

Awareness of energy flows and orders of  
magnitude of energy consumption

# Reno2050

Home of

**Russell Richman**, P.Eng

Assistant Professor (Building Science)  
Faculty of Architecture, Ryerson University

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Energy Audit by

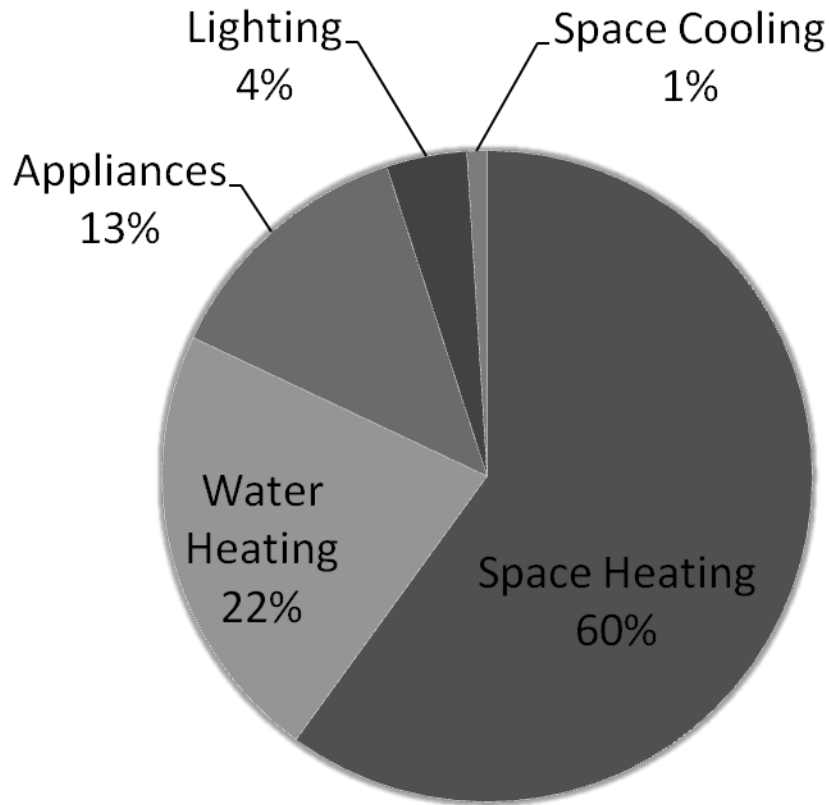
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# Household Energy Consumption

Canadian Households, 2002  
Energy Consumption 1399 Petajoules



# EnerGuide Ratings

House Characteristics	Typical Rating
Older house not upgraded	0 to 50
Upgraded older house	51 to 65
Energy-efficient upgraded older house or typical new house	66 to 74
Energy-efficient new house	75 to 79
Highly energy-efficient new house	80 to 90
House requiring little or no purchased energy	91 to 100

$$EGH = 100 - 20 * (\text{ThisHome} / \text{BenchmarkHome})$$

Benchmark Home is R2000, EGH 80

OR,  $\text{RelativeConsumption} = (100 - EGH) / 20$

So, EGH 0 home is 5x annual energy

EGH 60 home is 2x annual energy

EGH 90 home is *HALF* annual energy

# Before & After

## 1908

- EnerGuide 0 (actually -14, rounds up)
- 14.5 ACH@50Pa
- Equivalent Hole: 3.8 sqft
- Required 157,000 BTU/h furnace minimum
- Annual heating consumption 400 Million BTUs (422 GJ)

## 2011

- EnerGuide 83, soon EnerGuide 84
- 2.3 ACH@50Pa
- Equivalent Hole: 0.4 sqft
- Required 22,400 BTU/h furnace minimum
- Annual heating consumption 22 Million BTUs (23 GJ)

# Results

- Air changes (leakiness) reduced by **84%**
- Equivalent hole reduced by **89%**
- Furnace heating power ('size') reduced by **86%**
- Annual total energy consumption

**reduced by 95%**

# Costs

- \$300,000 total gut renovation
- 10 to 15% premium on energy upgrades over standard renovation:
  - Spray foam +\$15,000 better than code
  - Windows double cost (+\$10,000) better than code
  - HRV & Boiler: \$7000 premium together
  - Radiant piping \$7000 premium over ductwork
  - Other \$3000 premium
- Total \$39,000 premium, 13% extra cost

# Payback

400 GJ saved annually

\$0.50/m<sup>3</sup> gas

\$13/GJ gas

\$0.10/kWh electricity

\$28/GJ electricity

If 400 GJ is 82% gas 18% electricity, \$4260 + \$2015

**\$6,275 annual savings**

Incremental cost simple payback \$39,000/\$6,275

**6 years**

# Before & After



# Before & After



# Before



# Today



Most effective ventilator  
94% at 0 C, 80% at -25 C  
UltimateAir RecoupAerator

95% efficient boiler



# Today



## R-14 Windows

Inline Fibreglass frames  
ECO heat mirror



**R-20** Basement floor

**R-25** Basement walls

**R-40** Main Walls

**R-50** Ceiling

**Reno2050**

Home of **Russell Richman**

**richman@ryerson.ca**

Energy Audit by **David Elfstrom**

**david@elfstrom.com**