My Home Retrofit / Heat Pump Journey – Part 1

Background: In the mid-2000's I doubled the insulation in our home's attic, sealed around ceiling fixtures, wire penetrations into the attic and had new low-E thermal pane windows installed except for the front bay window.

Motivation: I have had an interest in the environment for a long time having joined Pollution Probe in the early 1970's. After retirement, seeing the deepening climate crisis, I started to read and follow more about the issues and available solutions. I also got involved in the local climate movement. I had been reading about ground source heat pumps for some time when cold climate air source heat pumps started to be deployed with great success.

Two factors took me from considering options to taking action:

1. Kingston announced the **Better Homes Kingston** program.
2. A close friend had a cold climate air source heat pump installed and raved about it.

My Home Retrofit / Heat Pump Journey – cont'd

The first action was to sign up for **Better Homes Kingston** and schedule an **energy audit**. The energy audit took around two hours. The auditor made measurements of the dimensions of the house, the number and size of windows, tested the windows to see if they were "low-e", evaluated the doors, looked at the installed insulation, etc. The most interesting part was the blower door test where a portable blower is temporarily installed in the front door opening. The blower sucks air out of the house so that you can go around the house and feel for incoming air leaks. For my house one leak source was the joint between the ceiling and wall in the sunroom. The pressure difference measured lets the auditor calculate the total air leakage value for the house.

Blower door in place (cover still on fan)

Here are some extracts from the energy audit:

HOMEOWNER INFORMATION SHEET

Your EnerGuide* rating and this report are based on data collected and, where necessary, presumed from your evaluation. Rating calculations are made using standard operating conditions.

ENERGUIDE

Rating: 131 gigajoules per year (GJ/year)

Heated floor area: 278.1 m² (2993.4 ft²)

Rated energy intensity: 0.47 GJ/m²/year

Evaluated by: Jaymi Armitage

Quality assured by: GCC-Sustainable Kingston

File number:

Data collected: April 27, 2022

Year built: 1974

NRCan.gc.ca/myenerguide

My Home Retrofit / Heat Pump Journey – cont'd

HOW YOUR RATING IS CALCULATED:

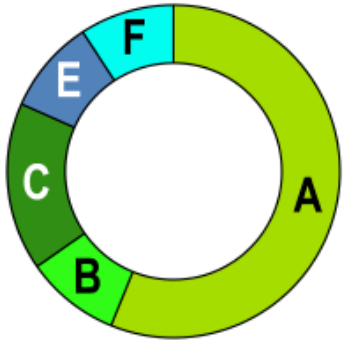
I.	Rated annual energy consumption	131 GJ/year
II.	Minus renewable energy contribution	- 0 GJ/year
	Equals your **EnerGuide rating**	**= 131 GJ/year**

I. Your rated annual energy consumption is the total amount of energy your house would use in a year based on the EnerGuide Rating System standard operating conditions. For your house, this includes 37.6 GJ of passive solar gain.

Energy Sources	Rated Consumption (GJ/year)	Equivalent Units (per year)	Greenhouse Gas Emissions (tonnes/year)
Natural gas	92	2477 m3	4.7
Electricity	39	10717 kWh	0.4
Total	131		5.1

HOW YOUR RATED ENERGY IS USED:

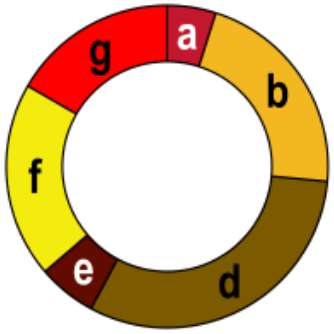
The chart below represents the breakdown of rated annual energy consumption in your home under standard operating conditions. You can use these figures as a guide to help identify where you can lower home energy costs through proper home maintenance, efficient home operation, energy efficiency renovations or equipment replacement.



A.	Space heating	55%
B.	Space cooling	9%
C.	Water heating	16%
D.	Ventilation	0%
E.	Lights & appliances	9%
F.	Other electrical	11%

WHERE YOUR HOME LOSES HEAT:

Houses lose heat through their exterior shell, or building envelope. The chart below shows where and how your home loses heat. The quality and upkeep of your home can have a major impact on the amount of energy your heating and cooling systems use annually.



a.	Attic/Ceiling	5%
b.	Main Walls	22%
c.	Exposed floors	0%
d.	Windows	32%
e.	Exterior doors	4%
f.	Basement/Foundation	20%
g.	Air leakage/ventilation	17%

My doubling of attic insulation 20 years ago really helped!!

My Home Retrofit / Heat Pump Journey – cont'd

RECOMMENDED ENERGY EFFICIENCY UPGRADES

A customized plan to improve the energy efficiency of your home is found below:

1. Insulate foundation

This was the start of my roadmap for upgrades

2. Insulate main walls

- ❑ Increase the insulation value of your main walls (Second level) by RSI 1.45 (R-8.3).

3. Upgrade doors

4. Upgrade windows

- ❑ Replace one window with an ENERGY STAR certified model.

5. Upgrade ventilation system

- ❑ Install a heat recovery ventilator or energy recovery ventilator certified by the Home Ventilating Institute (HVI) or that is ENERGY STAR certified.

6. Upgrade hot water system

7. Perform air sealing

A heat pump would also improve space cooling efficiency (A/C)

Adding attic insulation was listed but had a very small benefit.

8. Upgrade heating system

My Home Retrofit / Heat Pump Journey – cont'd

As part of the Better Homes Kingston process, I next had a consultation with an energy advisor, and this is what he and I decided made sense from a **cost** ($, effort / disruption) / **benefit** (environmental, comfort and $) perspective:

1. Upgrade the insulation in the Basement Walls and Joist Header "pockets"
2. Upgrade the main wall insulation for the only wall easily accessible without removing siding or brick: the garage / living room wall
3. Upgrade doors: Replace the wood panel front door / dual pane sidelights with a solid metal door with triple glazed sidelight windows; replace the dual pane sliding glass doors that had lost their seal with a triple glazed unit; add insulation manually to the wood door into the garage from the basement
4. Replace the front bay window with a triple glazed unit
5. Install a Heat Recovery Ventilator (HRV). My hope was I would reduce the air leaks into the house so much that the HRV would be needed to maintain air quality by bringing in outside air while recovering the heat in the outgoing air
6. Install a heat pump electric water heater*
   - These two items would allow me to get off natural gas which has environmental benefits, means fewer bills to pay and avoided the on-going delivery charges that would remain if I still had any active natural gas hookup.
7. Perform air sealing for the leak sources identified by the energy audit.
8. Install a cold climate air source heat pump

To be continued in Part 2

* per Natural Resources Canada: An ENERGY STAR certified heat pump water heater is up to four times more efficient and uses up to 70% less energy, on average, than a standard electrical water