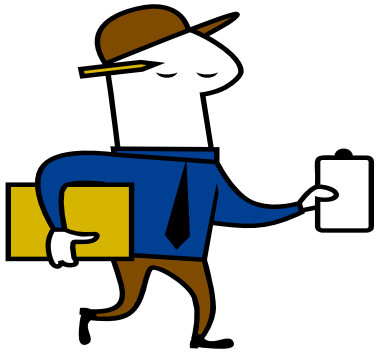

My Home Energy Audit

Andrew Siliski

Location
Newton

Utility Companies
NStar (electricity); KeySpan (gas)

Using the suggestions from MIP&L's *Everyday Environmental Stewardship* guide for a *Home Energy Audit*, I called MassSave and scheduled an audit for my family's early 20th century house. Here is what happened.

How I Got Ready

First I called KeySpan, NStar, and Newton Public Works and had them mail me my natural gas, electricity, and water histories. Then, I looked around the house for any specific areas for the audit to concentrate on. My heating costs are relatively high, so I had the auditor primarily look at insulation and the heating system. When the audit was done I wished I had asked about the refrigerator. It is 15 years old and probably uses a whole lot more electricity than a new, high-efficiency model.

What Happened During the Audit

We began in the basement looking at the boiler, DHW system, and insulation. I asked him to look at a corner of the house that is much colder in the winter compared to the rest of the house. After five minutes of inspecting the basement, the auditor found the problem: no insulation. This permits cold air to circulate throughout the inner wall; he recommended installation of foam board insulation to stop the air flow.

Then we walked through each floor room by room.

The Results

The recommendations for my house ranged from simple to complex. For example

- ***Behavior Changes* —** Close AC ducts in winter.
- ***Simple DIY* —** Install foam board insulation, which requires a single trip to Home Depot and then an easy installation
- ***Expensive by Professionals* —** Replace the home boiler and controls.

Because I was especially interested in the heating and insulation system, I asked the auditor to look at these rather than electrical appliances like the refrigerator. However, the auditor observed that the primary lighting on the 1st floor uses dimmable floodlighting on the first floor. The auditor gave me 12 CFL dimmable flood lights valued at $18 each for free. By scheduling the audit, I got bulbs worth $216 and I'll save 75% on electricity compared to the old bulbs.

Specific Auditor Recommendation

New boiler. Replace the 17± year-old gas-fired hydronic boiler with a high-efficiency (Minimum efficiency = 90%) boiler rated at 135,000 btu. A new 92% efficient condensing-mode direct vent gas hydronic boiler will result in a 15% improvement in efficiency. This will lower monthly heating costs.[1] To buy and install the new efficient gas boiler would cost approximately $7,450. Regaining this money entirely through savings on gas bills would take about 20 years at this year's price. ($7,450/$363 saved at 15% efficiency improvement) Since fuel prices are virtually guaranteed to rise, the payoff is likely to be considerably shorter.

Equations Used to Calculate Savings

See Appendix A for base data

(New Eff – Old Eff)/Old Eff = Savings
SO
(92% - 80%)/80% = 15% savings!

Savings % x Annual Therms = Therms Saved
Savings % x Annual $s = $s Saved

[Remember use *Heating* Therms and $s only]

A better way to understand the benefit is to figure the cost of a "typical" boiler installation vs. a "high-efficiency" boiler. The typical boiler will cost about $5,850 to install. It will have an efficiency about what the current boiler has — 80±%. The *Net* cost for the "high-efficiency" boiler is $1,600. Saving the same $363 means the "net" cost is paid-back a bit more than 4 years. **AND** if the gas company provides the maximum $800 rebate, the *Net* cost is only $800, which means the pay-back happens just over 2 years. With that kind of return replacing the boiler before the end of its "useful life" will make sense financially and in terms of good environment stewardship.

The auditor didn't make any recommendations about our DHW heater. We heat twice the DHW we need to because when the old DHW tank failed, the only equipment the plumber had on short-notice was a commercial-grade over-sized tank. DHW can be generated "on-demand" (only when you actually need it) and by efficient equipment. Some boilers come with an on-demand component. Or we could buy a standalone "on-demand" DHW heater. And get more rebates.

[1] The boiler is for heat only. We have a gas-fired DHW tank. So I figured that a no-heat summer month (July, for example) is the typical DHW use. So I subtracted that use and cost from each "heating" month and excluded all DHW-only months, to get the final Heating-Only use and cost.

Insulation just inside the bulkhead door. Install foam board insulation over the fiber glass insulation. There is an open air cavity from this at ground level all the way up to the second floor. This corner of the house on the 1st and 2nd floors is very cold during the winter (10°). Installing this foam board will cut off outside air from reaching the air cavity inside the wall. This will significantly lower heating bills as well as make that corner on the first and second floor much more comfortable. So improved quality-of-life at a reduced cost!

Non-insulated walls and door in the attic. Install foam fiberglass/board insulation. The insulation was ripped out prior to duct work and was never replaced. There is no insulation in between the house and the outside from this point. Installing fiberglass or board insulation will reduce heating costs.

Central cooling intake vent. Buy and install an intake cover for the winter to prevent the useless heating of the cooling vents. These are available at www.batticdoor.com and magnetically seal right on to vents.

Air Conditioning output vent. Close this vent during the winter to prevent the useless heating of the cooling vents. Closing the AC intake vents will only work if the out-take vents are shut.

The auditor did not recommend the following:

1. Insulation or Air sealing Upgrades. Except as stated above where insulation is not present, the house is up to code for insulation. Replacing or adding extra layers of insulation is not needed. Guess we've done some things right.

2. Replacing or Upgrading Windows. There are two types of windows in the house: relatively new, single paned windows, and old (date unknown, but probably original) single pane windows with the original frames. Many are "over sized" and non-standard windows. These windows are costly to replace, as much as $1,000 per window, which is 2-3 times a standard window. New energy-efficient windows are eligible for the replacement loan of $15,000. For now, this money would better be spent elsewhere. However, if we were planning to live in the house a long time more, making this change sooner rather than later would make sense. And of course, upgraded windows will always add to the sale price of the house when we do move! So like lots of other things, the *cost-benefit* analysis has many elements, not just simple energy pay-back.

Other ideas I found at www.MIPandL.org and at the www.MassSave.com link to our gas company.

1. Interior "storm" windows. We could make ourselves (or buy from one of several manufacturers) interior "storm" windows. These add a thermal barrier, like a thermopane window. These would work well in winter. They would cost a lot less than new windows. And they are eligible for rebates. I also learned that *exterior* storm windows are for weather, not thermal performance. They have "weep holes" at the bottom to permit rain to drain off in the summer, when screens are down. Of course in the winter these same holes let cold air in!

2. Programmable thermostat. These thermostats never forget, unlike human beings who forget to change their manual thermostats. They have the temperature go up and down as many as 4 times a day, whenever you want. Some "remember" what temperature you want at a certain time of day (say early morning warmth in the winter) and how long it takes to get that warm, then start your heating early enough to it is warm when you want it. Most can be installed by the homeowner, and get a $50 rebate! Experts estimate a 5% improvement in efficiency just by this means.

Appendix A

Gas Use at our House – Keeping Track Makes Sense (and $s!)

I figured out the savings on the boiler by using MIP&L's *Utility Use and Cost* form. The details on gas use are shown on the next page. I got it at www.MIPandL.org. There is lots of information and useful stuff there.

I learned that creating tables of our home utility use and cost shows patterns. They also show how our use of gas and electricity match in relation to degree days. These long term tables helped us think about our utility use, and how to change for the better.

Year	Bill Date	$s	% increase $s	Therms	$/thrm	% increase therms	Heating Degree Days	% increase Degree Days
2005	January	$578.51		358	$1.62		868	81.96%
	Februrary	$493.97		319	$1.55		661	104.26%
	March	$464.76		305	$1.52		604	126.89%
	April	$194.50		141	$1.38		173	88.27%
	May	$107.36		101	$1.06		110	423.08%
	June	$55.79		32	$1.74		5	166.67%
	July	$42.72		25	$1.71		0	
	August	$39.10		21	$1.86		0	
	September	$32.20		18	$1.79		0	
	October	$84.13		63	$1.34		96	104.35%
	November	$289.09		187	$1.55		269	84.59%
	December	$419.05		259	$1.62		692	112.34%
		$2,801.20		1,829	$1.53		3,478	101.70%
2006	January	$510.30	88.21%	300	$1.70	83.80%	568	65.44%
	Februrary	$405.87	82.16%	249	$1.63	78.06%	667	100.91%
	March	$401.00	86.28%	250	$1.60	81.97%	502	83.11%
	April	$168.44	86.60%	116	$1.45	82.27%	178	102.89%
	May	$106.30	99.01%	95	$1.12	94.06%	66	60.00%
	June	$62.40	111.84%	34	$1.84	106.25%	0	
	July	$64.76	151.58%	36	$1.80	144.00%	0	
	August	$49.00	125.31%	25	$1.96	119.05%	0	
	September	$43.31	134.50%	23	$1.88	127.78%	2	
	October	$66.07	78.53%	47	$1.41	74.60%	88	91.67%
	November	$224.57	77.68%	138	$1.63	73.80%	199	73.98%
	December	$330.40	78.85%	194	$1.70	74.90%	433	62.57%
		$2,432.42	86.83%	1,507	$1.61	82.39%	2,703	77.72%
	DHW only	$613.35	DHW >	380	$1.61	*DHW therms average of June<>August x 12*		
	Hearting Only	$1,819.07		1,127	**75%**	**<is % of total therms heating only**		