MGC Energy Audits
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2.4.36

Home Owner
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Energy Audit Report

I. Potential first year energy savings: $2,508.95 67%

The primary areas of opportunity for energy improvement are: Sealing air leaks up to the ventilation limit; Install interior storms (double in windows, triple in skylights); Insulate the basement ceiling; Add storm doors; Add insulation and weatherstripping to attic and knee wall hatches; Install a heat retaining ventilation system, and complete air sealing; Increase insulation in attic spaces.

II. Your Building

A. Heated living space

1. Floor Area: 3,163 Square feet
2. Volume: 16,078 Cubic Feet

B. Number of Occupants: 3

C. Number of Smokers: 0

D. Date of audit: February 29, 2013 11:59 AM

E. Conditions at time of audit:

1. Indoor temperature:	68 ºF	2. Outdoor temperature:	32 ºF
3. Relative humidity	24% %	4. Dew Point	30 ºF
5. Wind speed	10 MPH	6. Barometric pressure	30.00 inches of Hg.

F. Solar orientation of southern wall of building: 179 degrees. 1.0 degrees off true.

G. Surface area of building 7717.7 sq feet. G. Surface area of windows: 460 sq. feet

H. Ratio of window area to floor area (heated): 7.8%

I. Ratio of South facing window area to floor area (heated): 2.2%

J. Building Shape Efficiency 50% **Building Volume Efficiency** 35%

Shape efficiency refers to the fact that heat loss is related to surface area, and that different shapes have different wall surface areas, for a given floor area (i.e. usable square footage). Volume efficiency is similar but considers the usable volume rather than the usable square footage of the building, and thus adjusts for multiple floors. Both are taken as a percentage of a perfect cube.

K. Occupant comments and complaints:

1. Barn is cold.

2. Main house is drafty.

III. Energy Use (per year)

All energy (including heat) is given in terms of kiloWatt-hours (kWh). This is a convenient unit, and does not imply that it is all electricity. 1 kiloWatt-hour is equal to 3413 British Thermal Units (BTU).

A.	Primary heating:	Boiler (hot water)		Fuel:	Oil	Price:	$3.80	
	Used: 973	Gallons	Efficiency: 85.0%	kWh:	36,903.5	Cost:	$3,696	
B.	Secondary heating:	Stove: air tight		Fuel:	Hardwood	Price:	$235.00	
	Used: 1.7	Cords	Efficiency: 75.0%	kWh:	12,424.7	Cost:	$388	
D.	Domestic Hot Water (estimated)			Fuel:	Oil	Price:	$3.80	
	Used: 149	Gallons	Efficiency: 85.0%	kWh:	5,643.1	Cost:	$565	
E.	Electricity use:	price: $0.158		kWh:	6,250.0	Cost:	$988	
	Total purchased energy:			kWh:	**61,219.6**	**Cost:**	**$5,636**	

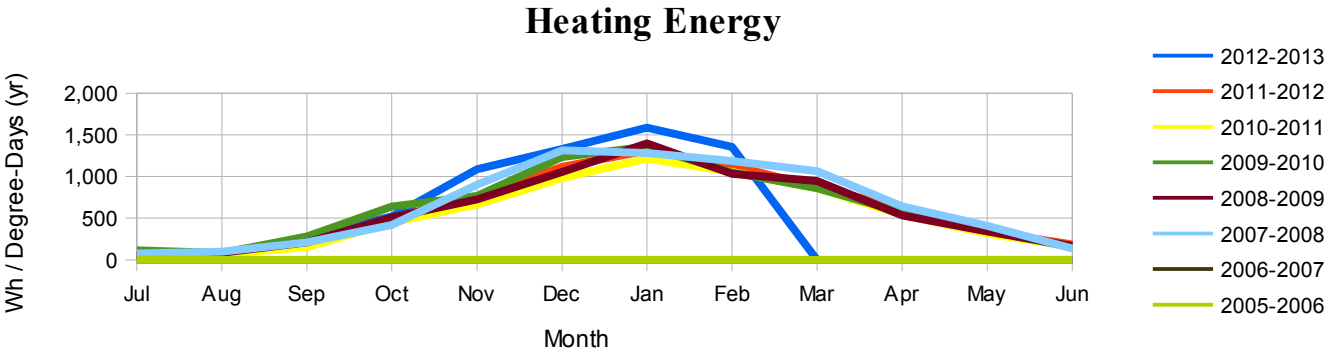
F. **Total Carbon Dioxide** (CO_2) produced: **39,031** pounds per year.

G. **Improvement trends** (change from previous year):

Figures are adjusted for weather (degree-days).

	Heating Energy:	**Total Energy**
2012-2013	12.2%	7.3%
2011-2012	-9.8%	-10.3%
2010-2011	12.8%	12.4%
2009-2010	-5.7%	-6.2%
2008-2009	8.9%	8.8%

H. The chart below shows the heating fuel usage after adjusting for varying weather conditions. While periodic fuel deliveries will produce spikes in the chart, you should be able to see if efforts you have been taking are having an effect on you fuel usage.



I. The building used 1% less fuel than the calculations predict. All numbers in the sections below reflect the calculated values.

J. **Solar Energy:**

1.	Active Thermal (solar heat panels)	0.0	kWh per year		
2.	Passive Thermal (windows)	2,997.0	kWh per year		
3.	Solar Electric (photovoltaic (PV))	0.0	kWh per year		
4.	Total Solar	2,997.0	kWh per year	6.2%	of all energy

K. **Solar Availability: (percentage of sunshine not blocked by trees etc.)**

a. **Windows (South facing windows)**

1.	January	73%	2.	February	79%	3.	March	69%	4.	April	73%
5.	May	59%	6.	June	78%	7.	July	59%	8.	August	55%
9.	September	60%	10.	October	50%	11.	November	68%	12.	December	72%

d. Photovoltaic (rooftop reading adjusted for PV panel characteristics)

1.	January	9%	2.	February	29%	3.	March	24%	4.	April	54%
5.	May	51%	6.	June	76%	7.	July	57%	8.	August	51%
9.	September	56%	10.	October	50%	11.	November	9%	12.	December	8%

L. Comparisons based on energy use per degree-day.

7345 Degree days per year here (for Wiscasset, Maine).

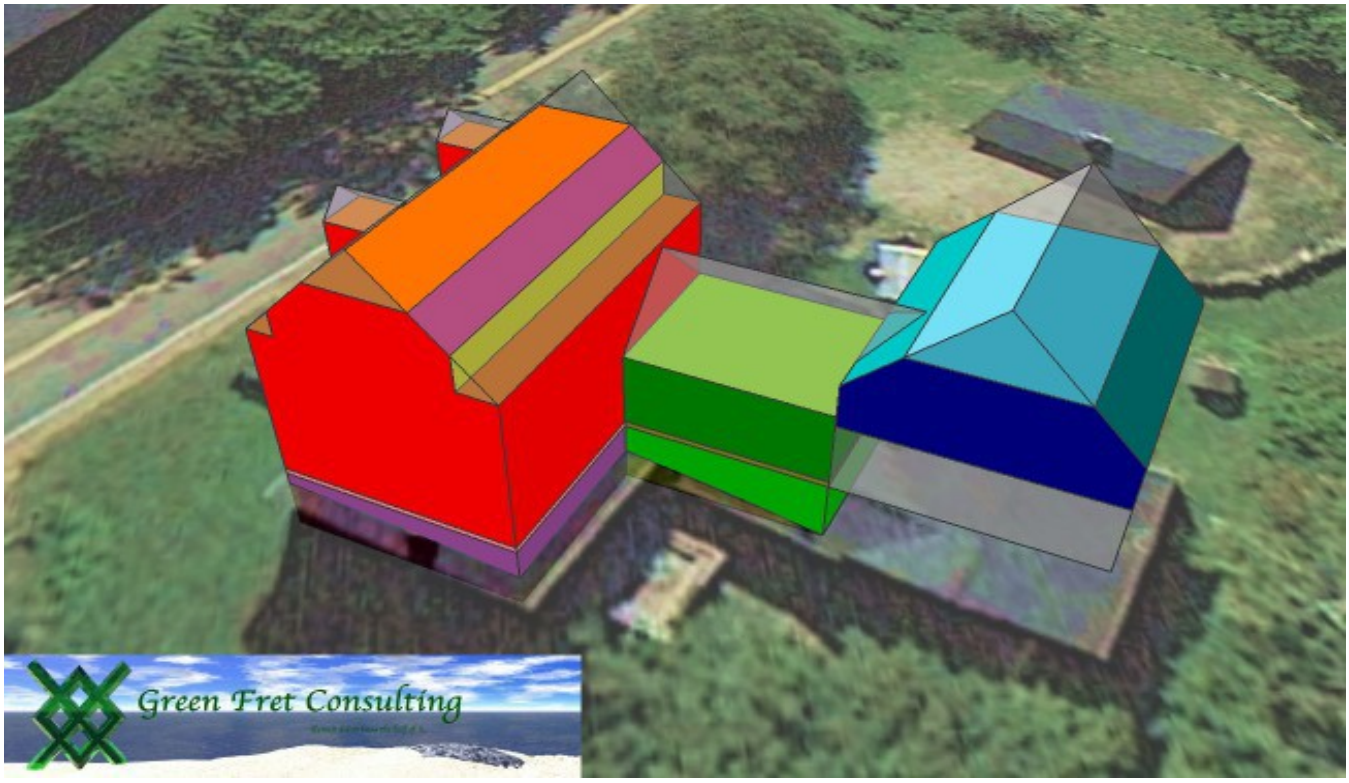
1.	Your building currently uses:	8.33	kWh / Degree Day	100%
2.	With the improvements suggested:	3.51	kWh / Degree Day	42%
3.	Average of our audited houses	8.37	kWh / Degree Day	100%
4.	Energy efficient house	2.05	kWh / Degree Day	25%
5.	Passivhaus Standard	0.60	kWh / Degree Day	7%
6.	Prototype extremely efficient houses:	0.64	kWh / Degree Day	8%

IV. Heat Losses

		kWh / year	% of total	Cost / year	Saving year 1
1.	**Walls**				
AA	Walls (Main)	7,039.9	15.6%	$582.79	$324.64
AB	Walls (Ell)	1,568.9	3.5%	$129.88	$72.35
AC	Walls (Barn)	2,535.6	5.6%	$209.91	$116.93
AD	Knee Walls	1,165.3	2.6%	$96.46	$77.56
	Subtotal	**12,309.6**	**27.2%**	**$1,019.04**	**$591.48**
2.	**Attic & Roof**				
AF	Attic (Main)	1,957.7	4.3%	$162.07	$117.52
AG	Attic (Ell)	1,191.3	2.6%	$98.62	$74.16
AH	Attic (Barn)	912.9	2.0%	$75.57	$46.80
AI	Roof (Main)	1,312.5	2.9%	$108.65	$0.00
AK	Roof (Barn)	1,119.2	2.5%	$92.65	$0.00
	Subtotal	**6,493.6**	**14.3%**	**$537.57**	**$238.47**
3.	**Basement**				
AL	Basement Ceiling (Main)	5,204.3	11.5%	$430.83	$351.35
AM	Basement Ceiling (Ell)	1,998.1	4.4%	$165.41	$134.89
AN	Cantilevered Floor (Barn)	935.7	2.1%	$77.46	$0.00
	Subtotal	**8,138.0**	**18.0%**	**$673.70**	**$486.24**
4.	**Utilities**				
BE	Pipes, Heating	587.3	1.3%	$48.62	$42.67
	Subtotal	**587.3**	**1.3%**	**$48.62**	**$42.67**

5.	**Windows & Doors**				
BJ	Windows (South facing)	448.7	1.0%	$37.15	$79.12
BK	Windows (other directions)	2,612.8	5.8%	$216.29	$161.55
BL	Skylights	63.2	0.1%	$5.23	$11.05
BM	Doors	1,640.3	3.6%	$135.79	$47.37
	Subtotal	**4,765.0**	**10.5%**	**$394.47**	**$299.09**
6.	**Air Leakage and Ventilation**				
BO	Infiltration (Whole House)	12,959.9	28.6%	$1,072.87	$636.70
BP	Ventilation (Whole House)	0.0	0.0%	$0.00	$418.43
	Subtotal	**12,959.9**	**28.6%**	**$1,072.87**	**$1,055.13**
7.	**Total**	**45,253.5**	**100.0%**	**$3,746.26**	**$2,713.08**

Note: Negative numbers above indicate that heat gains through windows exceeds heat losses or changes due to improvements made elsewhere.



V. Infiltration Analysis:

A. Introduction

While houses do not need to breathe, humans and pets do; and any combustion appliances also need a supply of fresh air. ASHRAE has established national safety guidelines for ventilation. In a leaky house there may be a sufficient fresh air supply, but because it is dependent on external factors such as weather, it may not be reliable, and a lot of heating energy is wasted. A tight house may require controlled mechanical ventilation which recovers the heat contained in the exhausted air and transfers it to the incoming stream of fresh air. Such a system both conserves energy and provides the requisite amount of fresh air.

B. Whole House

LBL Infiltration Factor 17.1

		50 Pascals (test)		Normal Pressure	
1.	Air changes per hour	14.8	ACH_{50}	0.9	$ACH_{(natural)}$
2.	Cubic feet per minute air flow	3,953.1	CFM_{50}	230.7	$CFM_{(natural)}$
3.	Equivalent leakage area: (CGBS)	314.8	square inches	2.2	square feet

4. Every square inch of this that you can plug for less than $23.86 is worth doing.

5. Air sealing opportunities of 59% are possible before supplemental ventilation is required to stay within ASHRAE Standard guidelines.

Building tightness limit: 1607 CFM50.

O. Seal air leaks. Air leaks were marked with removable painter's tape during the audit (Representative leaks are marked where many examples exist). In addition to the locations marked, the following should be addressed:

1 The area surrounding the chimney should be sealed whenever it passes through a surface (floor or ceiling). High temperature and fire resistant materials are required.

2 All penetrations of the attic ceiling, best done with expanding foam insulation.

3 The gaps between floorboards, above basement, should be sealed. This can be done from below, and possibly as part of insulating the basement ceiling.

4 The attic hatch should be made such that it closes firmly against the jamb, and then that gap should be weatherstripped.

5 The access panels to the areas behind the knees walls should be made such that the close firmly and securely against weatherstripping. The panels should also be insulated.

6 Plug up any unused (either temporarily or permanently) chimneys or fireplaces. Interior storm windows can be used to do this, and maintain the appearance.

7 Seal any gaps above the inside of the closet doors.

8 Replace recessed lights with lights that can be sealed (either IC rated recessed lights or fixtures within the living space). Alternatively the lights can be insulated by making a box at least 3" inches away from the lights, and insulating and sealing that.

9 All intersections between dissimilar materials (for example, brick and wood) should be sealed with flexible caulk.

10 All outlets and switches should have foam gaskets installed behind the wall plate. Childproof caps should be used in all outlets not currently in use; the leftover 'holes' from the gaskets can be inserted onto the childproof caps to make them more airtight.

11 Heating pipes from the basement should be sealed around with foam insulation.

12 There are chases which allow air and heat communication between floors which should be closed off, at the top and bottom.

P. Before supplemental ventilation is required: Safe reduction percentage: 59%

Savings: $637 For 7 years: $4,457 Per square inch: $23.86

Q. With supplemental ventilation:

Savings: $418 For 7 years: $2,929 Per square inch: $23.86

R. Total:

Savings: $1,055 For 7 years: $7,386 Per square inch: $23.86

S. Recommended Ventilation:

We recommend a Heat Retaining Ventilator (HRV) or Energy Retaining Ventilator (ERV).

Mechanical ventilation should be considered in light of the anticipated level of infiltration, after fixes have been made. Minimum recommended ventilation for the purposes of fresh air is 93.8 CFM continuously.

VI. Moisture Analysis:

A. Estimated equilibrium humidity:

Current	Jul	Aug	Sep	Oct	Nov	Dec	**Jan**	Feb	Mar	Apr	May	Jun	Winter	
RH	77%	77%	47%	33%	23%	20%	20%	21%	26%	35%	49%	65%	26%	%
Dew	61	61	56	47	38	29	25	26	32	39	48	56	32	°F
Fixed	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Winter**	
RH	93%	93%	81%	63%	49%	39%	35%	37%	42%	51%	65%	81%	42%	%
Dew	66	66	62	55	48	42	40	41	44	49	56	62	44	°F

B. Wall sheathing below dew point; condensation in walls:

Air leakage through the walls of the building has the potential to deposit water in the wall cavity, which leads to mold, rot, and other problems. In the current state of the building, this can happen in the winter when the dew point of the interior air is above 32ºF, which equates to 26% Relative Humidity (RH) at the thermostat setting of 68ºF. With the tested air leakage and the amount of water added into the house by daily activities, this can amount to 11.2 gallons per day.

After air sealing and other recommended fixes are made to the house. the situation will be altered, as additional insulation changes the dew point at which water condenses in the walls. In general, insulation on the exterior of surfaces increases the allowable dew point, while insulation inside the walls decreases it. Reducing the air leakage will reduce the potential amount of water. With the recommended fixes, the allowable dew point is 51.0ºF which translates to a Relative Humidity (RH) of 54% at the thermostat setting of 68ºF. Reducing the air leakage to what we think is an achievable level, the amount of water which might potentially condense in the walls would be reduced to 0.3 gallons per day.

Humidity levels in the building should be kept below the dew point indicated. Note that the relative humidity is the most common measure of humidity, however it varies with temperature, while the dew point does not. If the temperature of the house is different from the thermostat setting given above, the relevant relative humidity will also be different. If the humidity is excessive, it can be lowered by reducing the amount of water being put into the house, say, by reducing use of humidifiers; increasing ventilation of areas such as kitchens and bathrooms when humidity is being created in those and so on.

If humidity remains high, this indicates that it is time to install a heat retaining ventilator (HRV) or Energy Retaining Ventilator (ERV), to vent the humidity while retaining about 85% of the heat in outgoing air.

C. Other surfaces which may condense water:

Interior surfaces can also become so cold that they also condense water from the air. This leads to a similar set of problems as above, and can additionally cause the glass seals in multiple pane windows to fail prematurely. In its current state, the building requires the dew point to not exceed 36.5ºF to prevent condensation on any surface. Possible problem areas are: Skylights,

Possible problem areas are: Skylights,

In its fixed state, the building requires the dew point to not exceed 54.8ºF to prevent condensation on any surface.

D. Ventilation:

One method of controlling humidity levels is to increase the ventilation in the building. Since, ventilation is nearly the same thing as air leakage, and causes a similar loss of heat energy, we recommend a heat retaining ventilator, which will prevent 85% of that heat loss. These ventilation levels are not required to be additive, the maximum level, for current conditions, will satisfy all requirements.

Since there is currently no ventilation system in the building, humidity will need to be controlled by other means.

After fixes have been made, we recommend a minimum of 65 CFM of continuous ventilation, for the purpose of keeping the humidity below the levels specified above.

To maintain the humidity below the maximum desired level (50% Relative Humidity), the ventilation level should be kept at 0 CFM, for current building conditions, and after fixes have been accomplished, at 37 CFM.

In order to satisfy ASHRAE recommendations for fresh air, ventilation of 93.8 CFM is required.

VII. Recommendations:

A. Recommendations with 7 Year Simple Payback

Our recommendations below are presented in order of logical progression and in what we predict will be a decreasing order of return on investment. We try to give as many recommendations as possible, with an eye toward achieving a maximally efficient buil7 times the projected first year savings, but might in the future if fuel prices rise (or if the work is combined with other maintenance or renovations). All savings numbers are given in terms of a single year at fuel prices at the time of the audit (see 7 year savings by the largest amount. Some alternatives may also be given, obviously savings assume only one alternative is chosen.

0 Fix Vital Issues. The first priority for any house is to stop any deterioration of the structure, and any dangers to the safety of occupants. The following items fall into that category:

• Cover Dirt in Subterranean Spaces. The crawl space should have a plastic sheet, covering any exposed dirt. It should be sealed against the walls and and any obstructions.

• Fix gutters. The gutter system should move water from the roof to someplace away from the building. Gutters should be checked and cleaned at least once a year.

0 Fix Systemic Issues.

• Lower Water Temperature. Lower the the temperature of the hot water heater to 120.0ºF.

Savings $126

1 Remove window screens for the winter.

Allow more solar heat in; also a good time to clean the windows. Also ensure that any exterior storm windows are closed tightly, and the windows are fully closeed and locked.

Savings,1st Year: $34

2 Seal Whole House air leaks.

Air leaks should be addressed before most other issues because they require access to areas which will be covered once the other fixes are made. See the Air Infiltration Section, for locations of places for improvement.

Savings,1st Year: $600 Break Even Price: $10,457 Per Square Inch: $22.48

3 Install triple interior storm panels (Skylights).

The skylights will benefit from having interior storm panels installed. These are available finished, in kit form, or can be made at home from instructions on our website: http://www.midcoastgreencollaborative.org/storms.html

Savings,1st Year: $9 Break Even Price: $55 Per Square Foot: $27.41

4 #N/A **#N/A**

#N/A

Savings,1st Year: #N/A Break Even Price: #N/A #N/A #N/A

5 Insulate the Main basement ceiling.

After sealing air leaks, add a vapor barrier against the warm side, and install insulation between the joists to fill the area.

Savings,1st Year: $351 Break Even Price: $6,125 Per Square Foot: $6.96

6 Install interior storm panels (South).

The Southern windows will benefit from having interior storm panels installed. These are available finished, in kit form, or can be made at home from instructions on our website: http://www.midcoastgreencollaborative.org/storms.html

Savings,1st Year: $66 Break Even Price: $386 Per Square Foot: $12.17

7 Insulate Heating hot water pipes.

We recommend at least 5/8" thick ozone friendly foam pipe insulation, sized to snugly fit the pipes on all pipes in unheated spaces.

Savings,1st Year: $40 Break Even Price: $701 Per Linear Foot: $3.31

8 Install interior storm panels (Not South).

The non-southern windows will benefit from having interior storm panels installed. These are available finished, in kit form, or can be made at home from instructions on our website: http://www.midcoastgreencollaborative.org/storms.html

Savings,1st Year: $139 Break Even Price: $806 Per Square Foot: $10.75

9 Add insulation to exterior doors.

The exterior doors should have storm doors added. The hatches to the attic and knee wall spaces should have foam board insulation added to the back.

Savings,1st Year: $45 Break Even Price: $130 Per Square Foot: $5.83

10 Insulate the Knee Walls.

Blow cellulose insulation into the cavity behind the knee wall (the steep section of the roof), being sure to maintain any needed roof ventilation.

Savings,1st Year: $78 Break Even Price: $1,352 Per Square Foot: $5.54

11 Add heat retaining ventilator (HRV), and continue air sealing.

Add supplemental ventilation, preferably a Heat Retaining Ventilator (HRV). This will allow further air sealing (see Air Sealing section) while both maintaining adequate fresh air for occupants and at the same time saving around 85% of the heat in the outgoing air.

Savings,1st Year: $351 Break Even Price: $6,111 Per Square Inch: $22.48

12 Further insulate the Ell attic.

After the air sealing has been accomplished in the attic, a vapor barrier should be added, and then insulation added (starting with the empty cavity below the flooring) to bring the total up to at least R-60 (roughly 20" total). Insulating the attic without properly air and vapor sealing it first, can exacerbate moisture issues, and actually make matter worse, so seal first then insulate.

Savings,1st Year: $74 Break Even Price: $1,293 Per Square Foot: $3.83

B. Additional Recommendations for Consideration

13 Further insulate the Main attic.

After the air sealing has been accomplished in the attic, a vapor barrier should be added, and then insulation added (starting with the empty cavity below the flooring) to bring the total up to at least R-60 (roughly 20" total). Insulating the attic without properly air and vapor sealing it first, can exacerbate moisture issues, and actually make matter worse, so seal first then insulate.

Savings,1st Year: $118 Break Even Price: $2,049 Per Square Foot: $3.21

14 Insulate the Barn walls.

The exterior walls should have the insulation increased to at least R-40. This can be accomplished in a number of ways, such as adding structural insulated panels or a larsen truss, and re-siding.

Savings,1st Year: $117 Break Even Price: $2,039 Per Square Foot: $2.89

15 Insulate the Ell walls.

The exterior walls should have the insulation increased to at least R-40. This can be accomplished in a number of ways, such as adding structural insulated panels or a larsen truss, and re-siding.

Savings,1st Year: $72 Break Even Price: $1,261 Per Square Foot: $2.89

16 Insulate the Main walls.

The exterior walls should have the insulation increased to at least R-40. This can be accomplished in a number of ways, such as adding structural insulated panels or a larsen truss, and re-siding.

Savings,1st Year: $325 Break Even Price: $5,660 Per Square Foot: $2.89

C. Break Even Price

This is the price for which the savings in fuel costs per month is the same as the additional cost of a mortgage (or home improvement loan) monthly payment. This assumes NO fuel inflation. Improvements which cost less than the break even point will provide positive cash flow immediately.

If consideration of fuel inflation is desired, then that rate ,as well as the time frame needs to be considered. For example, if inflation of heating fuel is predicted to be 7 percent, and the heating system will be replaced when the price of fuel doubles, which will be in 10 years, then the Break Even Price should be multiplied by the 1.48 factor from the table below to find the actual break even point.

Years	1%	2%	3%	4%	5%	6%	**7%**	8%	9%	10%
5	1.03	1.05	1.08	1.11	1.14	1.17	**1.20**	1.23	1.27	1.31

10	1.05	1.11	1.17	1.24	1.31	1.40	**1.48**	1.58	1.68	1.80
15	1.08	1.17	1.28	1.40	1.54	1.70	**1.88**	2.09	2.32	2.59
20	1.11	1.24	1.40	1.60	1.83	2.10	**2.43**	2.83	3.30	3.86
25	1.14	1.32	1.55	1.83	2.19	2.65	**3.21**	3.92	4.81	5.92
30	1.17	1.41	1.71	2.12	2.66	3.37	**4.31**	5.53	7.13	9.22

VIII. Heating and Cooling Profiles

These charts show when, as opposed to how much, energy is used to make the building comfortable. The numbers represent the predicted temperature inside the building on an average day in the month given (with heating, cooling, and open windows included in the calculation). The window option uses a simplistic rule, it doesn't look ahead to what the weather might be in a few hours (and so should not be used as a guide). This is a general, not specific, guide. The 'setback' at the front of a row indicates that thermostat energy savings are in effect.

A. Existing conditions

	TIME	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
setback	01:00	73.6	73.0	68.4	62.8	60.9	60.0	60.0	60.0	60.0	62.1	64.6	70.9	°F
setback	02:00	72.0	72.0	67.1	61.0	60.0	60.0	60.0	60.0	60.0	60.2	63.3	69.8	°F
setback	03:00	71.2	71.1	65.9	60.0	60.0	60.0	60.0	60.0	60.0	60.0	62.0	68.7	°F
setback	04:00	70.5	70.2	64.8	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.7	67.6	°F
setback	05:00	69.9	69.4	63.7	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	66.9	°F
setback	06:00	69.3	69.0	62.9	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	66.7	°F
	07:00	69.7	69.2	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	°F
	08:00	70.3	69.7	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.3	°F
	09:00	71.2	70.5	68.3	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.7	°F
	10:00	72.0	71.5	68.9	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	69.4	°F
	11:00	73.1	72.4	69.5	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.1	70.1	°F
	12:00	74.2	73.4	70.2	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.2	70.9	°F
	13:00	75.5	74.7	71.3	68.3	68.0	68.0	68.0	68.0	68.0	68.0	68.7	71.9	°F
	14:00	77.0	76.3	72.5	68.9	68.0	68.0	68.0	68.0	68.0	68.1	69.5	73.2	°F
	15:00	78.6	77.8	73.5	69.4	68.0	68.0	68.0	68.0	68.0	68.3	70.3	74.5	°F
	16:00	80.0	79.1	74.3	69.7	68.0	68.0	68.0	68.0	68.0	68.5	71.1	75.7	°F
	17:00	81.1	80.0	74.5	69.1	68.0	68.0	68.0	68.0	68.0	68.4	71.7	76.6	°F
	18:00	81.6	80.1	74.2	68.3	68.0	68.0	68.0	68.0	68.0	68.0	71.9	77.0	°F
	19:00	81.2	79.5	73.8	68.0	68.0	68.0	68.0	68.0	68.0	68.0	71.3	76.5	°F
	20:00	80.5	78.7	73.3	68.0	68.0	68.0	68.0	68.0	68.0	68.0	70.5	76.1	°F
	21:00	79.5	77.7	72.6	68.0	68.0	68.0	68.0	68.0	68.0	68.0	69.5	75.5	°F
	22:00	78.3	77.1	71.7	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.4	74.7	°F
setback	23:00	76.8	75.5	70.7	66.3	65.6	64.7	64.1	64.4	65.2	66.1	67.3	72.9	°F
setback	00:00	75.3	73.9	69.6	64.6	63.2	61.4	60.4	61.0	62.4	64.1	66.0	72.0	°F
Average		**75.1**	**74.2**	**69.9**	**66.2**	**65.7**	**65.6**	**65.5**	**65.6**	**66**	**65.9**	**67.3**	**71.8**	

Legend: Red = Heating, Blue= Cooling, Green = Windows Open, Black = Normal.

Heating Set Point: 68 °F Setback: 60 °F Cooling Set Point 99 °F Setback: 99 °F

Given the expected humidity levels, (see VI. A.) we recommend a setback temperature no lower than: 63.3°F to avoid condensation issues. Current setback levels allow some building components to cool to the point where condensation occurs, which can lead to mold and rot problems.

The predicted energy saving for the described thermostat setbacks are: Heating 5.4% Cooling 0.0%.

B. After all recommended fixes are made.

	TIME	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
setback	01:00	77.4	77.8	76.5	69.2	65.1	63.8	63.1	63.5	64.5	67.7	73.6	77.3	°F
setback	02:00	76.0	77.4	75.8	68.3	64.0	62.4	61.5	62.0	63.3	66.8	72.8	76.7	°F
setback	03:00	75.7	76.9	75.1	67.4	63.0	61.0	60.0	60.5	62.1	65.8	72.0	76.1	°F
setback	04:00	75.3	76.4	74.4	66.5	62.0	60.0	60.0	60.0	61.0	64.9	71.2	75.5	°F
setback	05:00	75.1	76.0	73.7	65.6	61.1	60.0	60.0	60.0	60.0	64.1	70.5	75.2	°F
setback	06:00	74.5	75.9	73.1	64.9	60.2	60.0	60.0	60.0	60.0	63.7	70.5	75.3	°F
	07:00	75.2	76.3	73.1	68.0	68.0	68.0	68.0	68.0	68.0	68.0	70.7	75.7	°F
	08:00	76.0	77.1	73.7	68.2	68.0	68.0	68.0	68.0	68.0	68.2	71.1	76.3	°F
	09:00	76.9	78.0	74.6	68.8	68.1	68.0	68.0	68.0	68.2	68.6	71.6	77.0	°F
	10:00	77.5	79.0	75.5	69.5	68.5	68.0	68.0	68.2	68.6	69.1	72.3	77.7	°F
	11:00	78.1	79.4	76.4	70.3	69.0	68.0	68.0	68.4	68.9	69.6	72.8	78.4	°F
	12:00	78.8	79.9	77.2	71.0	69.4	68.1	68.0	68.6	69.1	70.0	73.4	79.1	°F
	13:00	79.7	80.6	78.3	71.9	70.0	68.3	68.2	69.0	69.6	70.6	74.1	79.4	°F
	14:00	80.9	81.6	79.4	72.9	70.7	68.6	68.4	69.5	70.2	71.4	75.0	79.9	°F
	15:00	82.0	82.6	79.9	73.8	71.1	68.6	68.4	69.8	70.8	72.1	75.9	80.5	°F
	16:00	83.0	83.3	80.2	74.4	71.0	68.0	68.0	69.8	71.1	72.7	76.7	81.1	°F
	17:00	83.8	83.8	80.0	74.2	70.3	68.0	68.0	68.8	71.0	73.1	77.3	81.5	°F
	18:00	84.1	83.6	79.8	73.8	69.7	68.0	68.0	68.0	70.1	72.9	77.7	81.5	°F
	19:00	83.7	83.0	79.6	73.4	69.0	68.0	68.0	68.0	69.2	72.4	77.4	80.9	°F
	20:00	83.0	82.2	79.3	72.8	68.2	68.0	68.0	68.0	68.3	71.7	76.9	80.7	°F
	21:00	82.2	81.3	78.9	72.3	68.0	68.0	68.0	68.0	68.0	71.0	76.4	80.4	°F
	22:00	81.2	81.0	78.4	71.6	68.0	68.0	68.0	68.0	68.0	70.3	75.8	80.0	°F
setback	23:00	80.1	79.7	77.9	70.9	67.1	66.6	66.4	66.5	66.9	69.5	75.1	78.4	°F
setback	00:00	78.8	78.2	77.2	70.0	66.1	65.2	64.8	65.0	65.7	68.6	74.4	77.9	°F
	Average	**79.1**	**79.6**	**77.0**	**70.4**	**67.3**	**66.2**	**66.0**	**66.4**	**67.1**	**69.3**	**74.0**	**78.4**	

Legend: Red = Heating, Blue= Cooling, Green = Windows Open, Black = Normal.

Heating Set Point: 68 °F Setback: 60 °F Cooling Set Point 99 °F Setback: 99 °F

Given the expected humidity levels, (see VI. A.) we recommend a setback temperature no lower than: 57.1°F to avoid condensation issues, once the recommended changes have been made. Or alternatively, an increase in ventilation during those setback times when the temperature is below our recommended level.

The predicted energy saving for the described thermostat setbacks are: Heating 2.9% Cooling 0.0%.

IX. Closing remarks

The focus of this energy audit is the thermal performance of the building envelope and some basic measures such as eliminating the wasteful use of electricity. It is possible to expand the scope of energy audits (as many do) to include other features and a much more time consuming (and costly) investigation. It is our conviction, based on experience, that simple improvements to the building envelope yield the best return on investment and that the potential benefits of the numerous "whistles and bells" with which the scope of an energy audit could be embellished would, at best, be marginal.

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