

Energy Audits 101

This following power point presentation is intended to provide information for the residents of the Town of Belmont. The goal towards achieving energy reduction may require the involvement of one or all three of the above organizations to help the reduce energy usage through offered incentives. All comments and statements made during this presentation are solely the opinion of Inspection Services Inc.

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WHAT IS AN ENERGY AUDIT?

An energy audit is a package of services that delivers the following benefits to customers:

1. Educates and creates awareness regarding energy usage and conservation opportunities.
2. Provides customers with recommendations which will increase the comfort, health, safety and prolong the durability of the property.
3. Helps protect the environment by reducing waste, pollution and carbon footprint.

WHAT IS THE PURPOSE OF AN ENERGY AUDIT?

Help evaluate:

- Building shell and envelope issues.
- Building mechanical and electrical systems.
- Evaluate current energy usage and consumption patterns.
- Diagnose areas of energy waste.

An energy audit will (cont.):

- Health and safety issues before & after.
- Recommend energy conservation measures.
- Educate building occupants.
- Offer energy savings projections based on improvements.
- Document existing conditions.

WHAT TYPES OF ENERGY AUDITS ARE THERE?

Commercial

- Typical profile is a high energy user where energy efficiency incentive programs offered by the Utilities tend to be more comprehensive with both prescriptive and custom options .

Residential

- Typical profile is 1200 – 5000 square foot home which have prescriptive incentives and /or unit allowances for increasing overall energy efficiency.

TYPICAL ENERGY INCENTIVISED IMPROVEMENT MEASURES

Commercial

- Lighting
- HVAC
- PUMPS / VFD's
- Motors
- Building Controls
- Boiler Improvements
- Domestic Hot Water
- Waste Heat Recovery
- Cogeneration, Solar,
Wind, Geothermal

Residential

- Lighting
- Air Sealing
- Insulation
- Boiler Improvements
- Fuel Switching
- Domestic Hot Water
- Windows?
- Controls
- Appliances

ENERGY TERMS, DEFINITIONS & FUN-FACTS

- **BTU**- British thermal unit, amount of heat necessary to raise one pound of water one degree F (Why is this important?)
- **kWh** – kilowatt hour, 1000 watts of electricity used per hour (Why is this important?)
- **Therm** – How natural gas is metered = 100,000 BTUs'
- **Cubic Foot** – How water / sewer is metered
- **EER or SEER** – Energy Efficiency Ratio - BTU's divided by watts (Why is this important?)

ENERGY TERMS, DEFINITIONS & FUN-FACTS

- **Heating Degree Days** – HDD, number of degrees below 65 F in 24 hours (Belmont = 6333/yr)
- **Cooling Degree Days** – CDD, number of degrees above 78 F in 24 hours (Belmont = 659)
- **Convection, Conduction, Radiation**
- **Thermal barrier, Air barrier, Vapor barrier**

ENERGY TERMS, DEFINITIONS & FUN-FACTS

- **Insulation**, R-value vs. U-value (calculations use U-value)
 - Window single *pain*=R-1, Double=R-2, Triple=R-3
- **Hot goes to cold**
- **Wet goes to dry**
- **High pressure goes to low pressure**
- **Incandescent Bulb** = 90% heat 10% light
- **Fluorescent Bulb** = 90 % light 10% heat (1/4 less watts)
- **Electric Demand** – One of the ways the Utility charges for high usage
- **Ventilation** – Controlled vs. Uncontrolled

ARE ALL AUDITS THE SAME?

- Audits are just like ice cream, many different flavors and the price depends on the number of scoops.
- There are three (3) basic types
 1. **Screening / Walkthrough** - In the front door and out the back don't stop, visual observations
 2. **Diagnostic** – All the above plus, building measurements, analytical tools (Blower door, Combustion analyzer, Infrared, etc..), recommendations
 3. **Investment Grade** – All the above plus, numerical analysis and software modeling

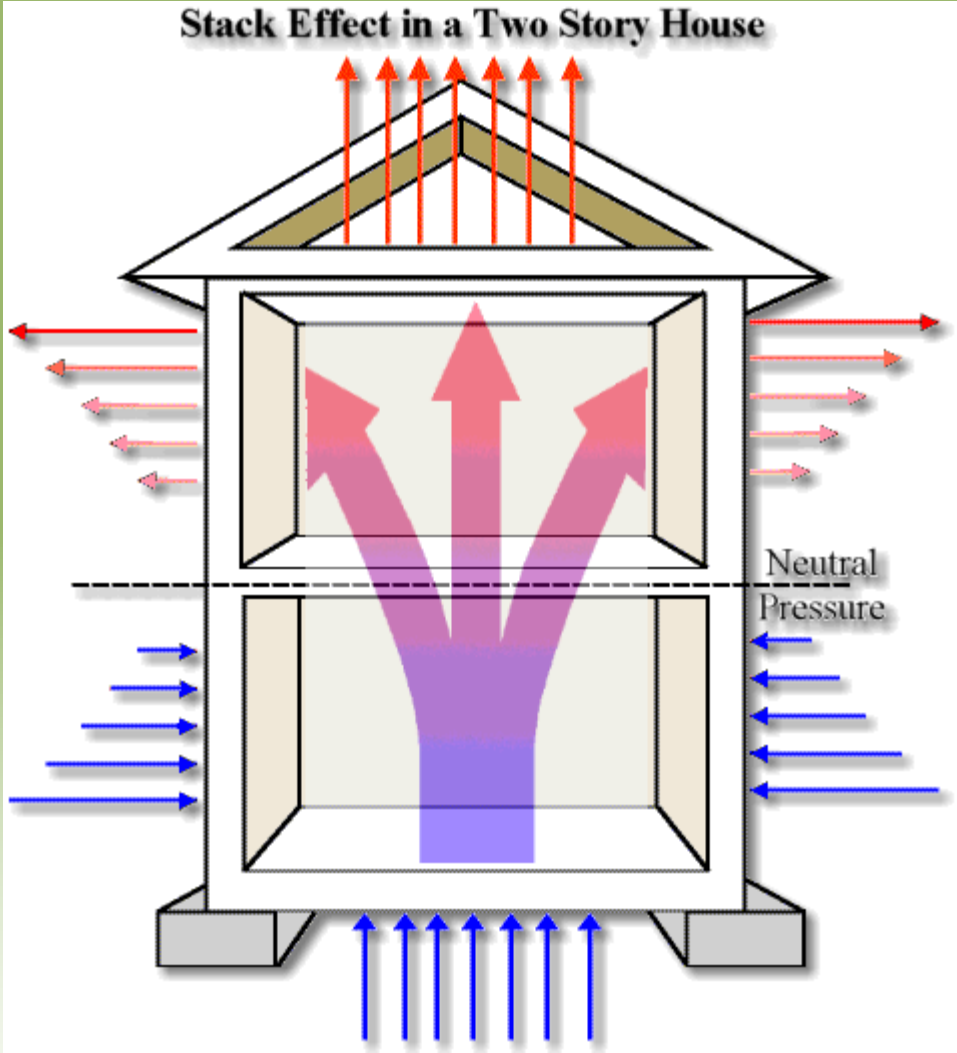
AUDIT PROCESS?

1. Customer Interview
2. Inspection Survey & Data Collection
3. Building Envelope
4. Attic Inspection
5. Basement Inspection
6. Thermal Boundary
7. Heating System
8. Electrical System
9. Windows and Doors
10. Air Leakage
11. Duct Testing
12. Ventilation
13. Report

TYPICAL HOME



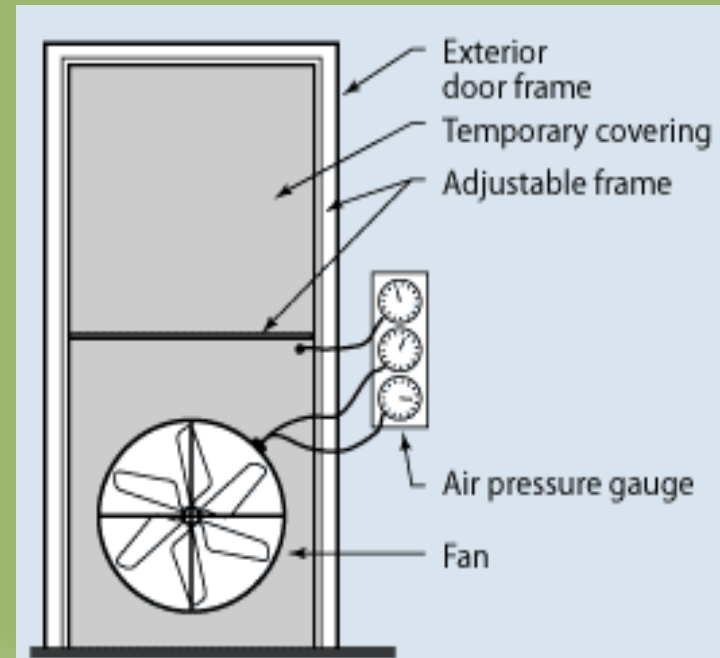
Air Movement in a Home



Blower Door Tests

Beginning January 1, BMLD's energy auditors now use blower door tests to help determine a home's air-tightness. These are some reasons for establishing the proper building tightness:

- Reducing energy consumption due to air leakage
- Increase personal comfort
- Ensure the minimum ventilation requirements are met



WHY SEAL AND INSULATE?

Sealing and insulating the "envelope" or "shell" of your home—its outer walls, ceiling, windows, doors, and floors—is often the most cost effective way to improve energy efficiency and comfort. A knowledgeable homeowner or skilled contractor can save up to 20% on heating and cooling costs (or up to 10% on total annual energy bills) by sealing and insulating.

To Seal and Insulate with ENERGY STAR:

- **Seal air leaks** throughout the home to stop drafts,
- **Add insulation** to block heat loss in winter and heat gain in summer, and
- **Choose ENERGY STAR** qualified windows when replacing.

BENEFITS

- **Lower utility bills**
- **Improved comfort, especially during summer and winter**
- **Reduced noise from outside**
- **Less pollen, dust, and insects entering your home**
- **Better humidity control**



BMLD

**Your Community-
Owned Utility**

www.belmont-ma.gov/electric



**ENERGY STAR
PARTNER**

HOW MUCH DOES ENERGY COST & CAN YOU READ THE BILL?

- BMLD current electrical charges are approximately \$0.20/ kWh
- BMLD has held electrical rates fairly steady, the cost for electricity was also \$0.20/ kWh back in 1898 when there were only 34 customers!
- Natural gas costs are in the ball park of \$1.38/ therm which if converted to equivalent electrical costs = \$0.047/ kWh
- Look at the BMLD PDF's

CURRENT BILL CALCULATION

DELIVERY SERVICES

CUSTOMER CHARGE 237.07

DEMAND CHARGES:

DISTRIBUTION CHARGE

$14.30 \times 2489.9 \text{ KVA} = 35,605.57$

TRANSITION CHARGE*

$2.73 \times 2489.9 \text{ KVA} = 6,797.43$

TRANSMISSION CHARGE

$5.03 \times 2489.9 \text{ KVA} = 12,524.20$

TOTAL DEMAND 2489.9 KVA TOTAL DEMAND CHARGE 54,927.20

PEAK CHARGES:

DISTRIBUTION $0.000610 \times 380208 \text{ KWH} = 231.93$

TRANSITION* $0.006300 \times 380208 \text{ KWH} = 2,395.31$

RENEWABLE ENERGY $0.000500 \times 380208 \text{ KWH} = 190.10$

ENERGY CONSERVATION $0.002500 \times 380208 \text{ KWH} = 950.52$

OFF PEAK CHARGES:

DISTRIBUTION $0.000610 \times 529152 \text{ KWH} = 322.78$

TRANSITION* $0.006300 \times 529152 \text{ KWH} = 3,333.66$

RENEWABLE ENERGY $0.000500 \times 529152 \text{ KWH} = 264.58$

ENERGY CONSERVATION $0.002500 \times 529152 \text{ KWH} = 1,322.88$

TOTAL KWH 909360 TOTAL KWH CHARGE 9,011.76

CURRENT DELIVERY CHARGES 64,176.03

LOAD ANALYSIS: KVA DATE TIME POWER FACTOR

PEAK: 2,766.6 08/18 12:25 89.500%

OFF PEAK: 2,455.0 08/18 09:00 89.100%

Electric Bill is
not easy to
understand

WHAT QUALIFICATIONS SHOULD AN ENERGY AUDITOR HAVE?

- **Commercial** – Have them show you a typical report . What are you getting for your money?
 - Experience! – Usually, the more the better.
 - Engineering degree
 - Professional certifications
 - Licensed Engineer
 - Certified Energy Manager
 - LEED-AP
 - Certified Energy Auditor
 - Licensed Tradesman

WHAT QUALIFICATIONS SHOULD AN ENERGY AUDITOR HAVE?

- **Residential** – Have them show you a typical report. What are you getting for your money?
- Industry recognized certifications
 - Building Performance Institute (BPI)
 - Building Analyst Professional
 - Building Shell and Envelope Professional
 - Heating Professional
 - A/C & Heat Pump Professional
 - Manufactured Housing Professional
 - Multi-Family Building Analyst

WHAT QUALIFICATIONS SHOULD AN ENERGY AUDITOR HAVE?

- **Residential – cont.**
 - Residential Energy Services Network (RESNET) Auditor
 - Can perform HERS rating
 - What is a HERS rating? Numerical score on a scale from 1-100 which categorizes the home's energy efficiency
- What's the difference between BPI and RESNET?
 - BPI has additional safety guidelines for ventilation and combustion appliance testing
- Note: MassSave energy audits require BPI certification

ENERGY INDEXES

kWh/sq ft		HERS Index	Energy Star		kBTU/sq ft
29		240			100
26	Very Inefficient Home				90
23		190			80
20				Inefficient Home	70
17	Average Existing Home				60
15		120		Average New Home	50
10	Energy Star Home		75		40
8		70		Very Efficient Home	30
5	Passive Homes				20
2		20			10
				Zero Energy Homes	

WHAT DO I DO AFTER THE AUDIT?

- Read the report and make sure you understand the contents
- Prioritize improvements according to (your choice):
 - Energy reduction
 - Cost (simple payback, LCC, Savings to investment ratio)
 - Comfort
 - SAFETY
 - Incentive Funding
 - Need (equipment failure)

DON'T FORGET HEALTH & SAFETY

- Do not create a hazard. Ensure the minimum ventilation ratio is maintained. Remember Indoor pollutants come from a variety of sources:
 - Carbon Monoxide – combustion appliances
 - Carbon Dioxide – not enough outside air
 - Radon- have it tested
 - VOC's – paints, solvents, carpets, etc...
 - Moisture – mold
 - Dust – allergens
- Remember, you can make the problem worse

WHAT DO I DO NEXT?

- Today:
 - Conduct your own visual walkthrough and make a list so when you bring in an auditor you are prepared and informed. Become more aware!
 - Look at your energy bills, cost and usage
- Next 60 days
 - Have an audit completed and prioritize measures
- Next 120 days
 - Begin implementation measures and monitor energy usage

Resources

- Saturn Energy Auditor Field Guide - Saturn resource Management, Inc.
- Residential Energy – John Krigger & Chris Dorsi
- BMLD – Belmont Municipal Light Dept. website
- Energy New England - website
- National Grid - website
- Building Performance Institute - website
- Residential Energy Network – website
- Energy Star - website

QUESTIONS?

Thank you!

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