NHSAVES Fall 2020 Button Up

NHsaves
Your Source for Energy Efficiency

EVERSOURCE Liberty Utilities your New Hampshire Electric Co-op Unitil

How to Improve the Energy Efficiency of Your Home

200922

NHSAVES Button Up Overview

- Energy Use and Savings Tips
- Insulation and Air Sealing A-B-Cs
- What to Do?
- NHSAVES Programs

What is the "greenest" energy?

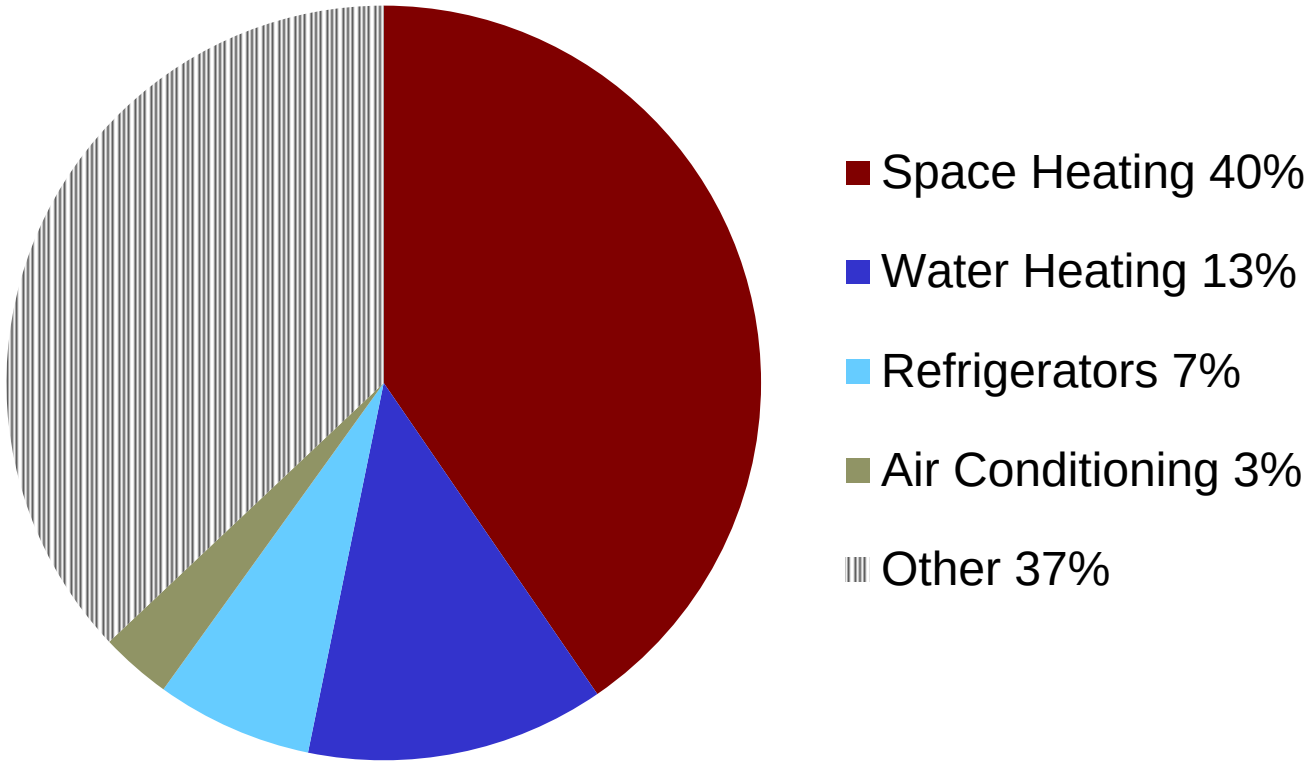
Energy that you don't use!

BUTTON UP NH

We Spend a Lot on Energy!

NH spends over $5 billion per year on energy

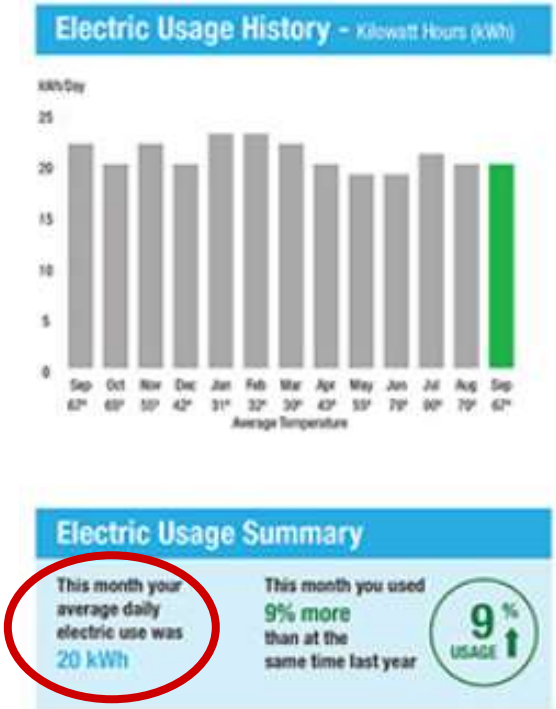
New Hampshire Residential Energy Costs per Household, ~$3,100, 2017

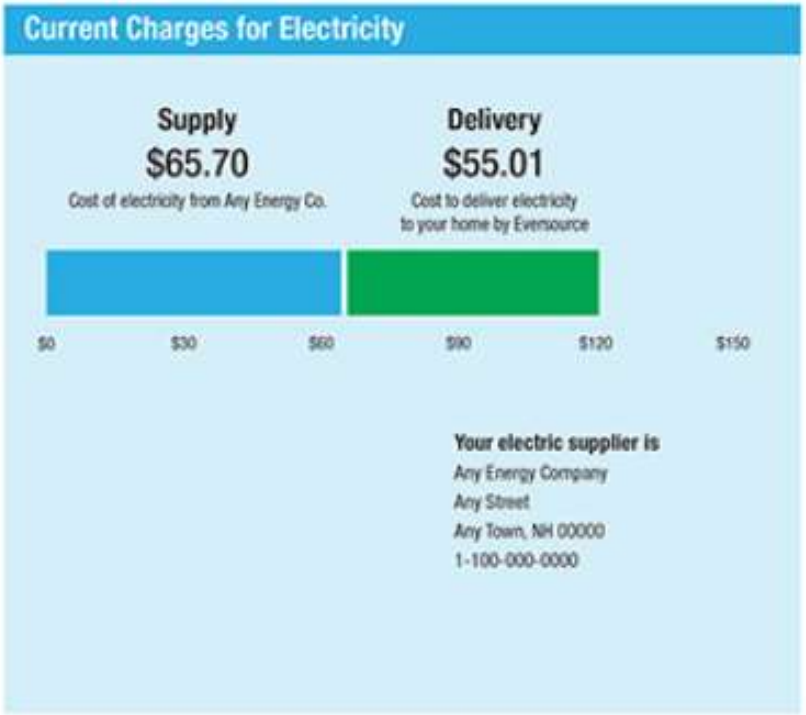


Current NH energy fuel prices: www.nh.gov/osi/energy/

Get to Know Your Energy Bills

Know how much electricity you are using
And what is using it





Bill source: Eversource

Average NH Usage:
(residential bill -- varies widely)

Daily:	~20 kilowatt-hours (kWh)
Monthly:	600 kWh
Annually:	7,200 kWh

Measuring Electricity Use

How much electricity do individual appliances use?

- **Use a watt meter**
  - Available from NH public libraries
  - Measures watts, time, and kilowatt-hours with appliance on or off

Electricity Usage Calculations

Watts x Hours = Watt-Hours
1,000 Watt-Hours = 1 Kilowatt-Hour (kWh)

Example-

TV set: 300 watts when on
Average use per day: 3 hours
Per day: 300 * 3 hours = 900 watt-hours
Per year: 900 * 365 days = 328,500 watt-hours

Convert watt-hours to kilowatt-hours;
328,500 / 1,000 = 328.5 kWh per year

~$55 in electricity (@ ~17¢ per Kilowatt-Hour)

Major Household Electricity Uses

Residential Electricity Use	Approximate Annual Kilowatt-hours	Potential for saving energy
Lighting	1,200	***
Electric Water Heater	*2,100*	***
Refrigerators & Freezers	1,050	***
Dehumidifiers	900	***
Electric Clothes Dryer	*800*	**
Entertainment Centers	650	*
Furnace Fans & Boiler Pumps	400	*
Dishwasher & Clothes Washer	350	**
Cooking	300	*

Electricity consumption varies widely from household to household. Energy savings come from efficiency and/or conservation.

Whole House Electricity Monitors

- **Provides:**
  - Current electrical use
  - Total consumption by day, week, etc.
- **May also provide**
  - Usage by circuit
  - Individual device use
- **Brands:**
  - Sense, Smappee, Engage, TED, Vue Smart, etc.
  - $100 - $300

Energy Saving Tip: Conservation!

Shut things off
when not in use

Find and Control Energy Drips

Energy "drips" use power when the device is off

- **These phantom loads include:**
  - Plug in chargers
  - Anything with a clock
  - Anything with a remote
  - Anything with a light
  - DVRs and set-top boxes

Phantom Loads- Some Examples

POWER DRAINS

LG washing machine
7W ■ On but not running
4W ■ Off

Apple TV, first generation
21W ■ On
17W ■ Off

Samsung cable box
28W ■ On and recording
26W ■ Off and not recording

Apple MacBook, plugged in
48W ■ Open, charging
48W ■ Closed, charging
27W ■ Open, fully charged

By The New York Times

A good solution – **smart** power strip:

Available from the NHSaves Catalog

Other Energy Conservation Tips

- Turn down hot water heater temperature to 120° at tap
- Set dehumidifiers appropriately
  - Target +/-60% max humidity
- Wash clothes in cold water
- Line dry clothes *outside,* if possible

Solar clothes dryer

Lighting Efficiency

The LED Lighting Revolution!

- Any existing 60+ watt light bulbs?
  - *Easy $$ savings per year with LED bulbs*
- Lots of opportunities
  - Screw-in light bulbs
  - Outdoor lighting
  - Holidays lights
  - Can lights and linear lighting

- Look for:
  - Light color (2700° K = “warm white” is what most people like)
  - Dimming and dimmer capability
  - “Suitable for enclosed fixtures”
  - “Suitable for damp locations”

Other Energy Efficiency Tips

Saving electricity and other fuels

- Low-flow showerheads and faucet aerators

- Hot water and heating pipe insulation: R-3 – R-5 best
- Smart plugs, hubs and switches
- Use ENERGY STAR labeled appliances and electronics

NHSAVES Rebates on ENERGY STAR Appliances

Rebates include:

Electric Clothes Dryers	$40 - $200
Clothes Washers	$25 - $50
LED light bulbs	instant rebates
Refrigerators	$40 - $75
Room Air Conditioners	$20

Also pool pumps, room air purifiers & dehumidifiers

And free haul-away + $30 for recycling an **OLD refrigerator or freezer**

www.energystar.gov lists appliance efficiency

NHSAVES.com/nh-rebates for appliance rebate forms & updates

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NHsaves Your Source for Energy Efficiency

Staying Warm in Your Home

Fact: We have to heat our homes to live in New Hampshire and stay warm

Goal: Use less energy to heat our homes **and still stay warm and comfortable**
(not just turn down thermostat!)

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Heating Energy Saving Tips

No or low cost options to use less heat:

- Turn down heat when you're not in a room or in the house

- Use programmable or smart thermostats
- Remove window A/C units in winter
- Latch closed windows

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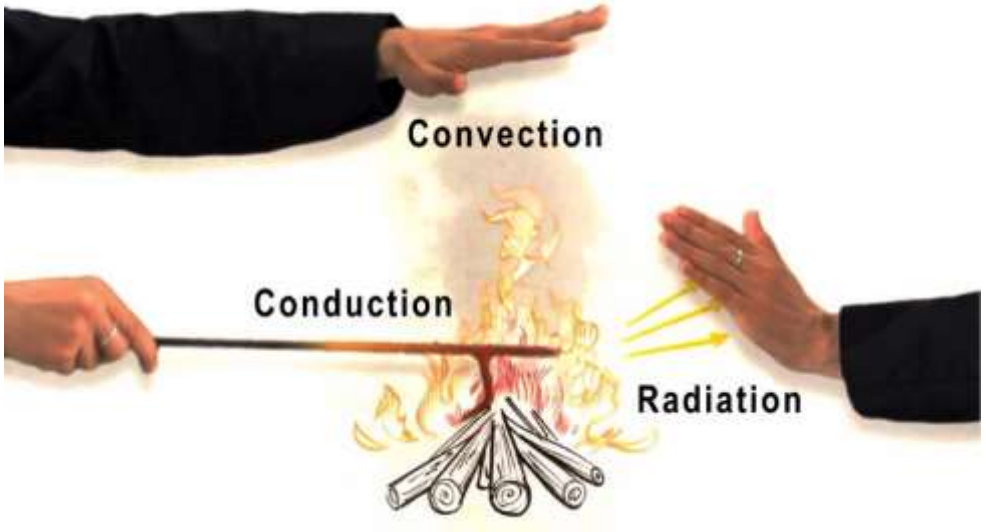
Staying Warm in Your Home: Building Science and Energy Efficiency

1. **Heat always moves from Hot to Cold.**
   - ***Fact:*** The heat inside our homes is always making it's way through the building shell and heating the outdoors.
   - ***Goal:*** Slow this process down

1. **Heat moves via three methods:**
   - Conduction
   - Convection
   - Radiation

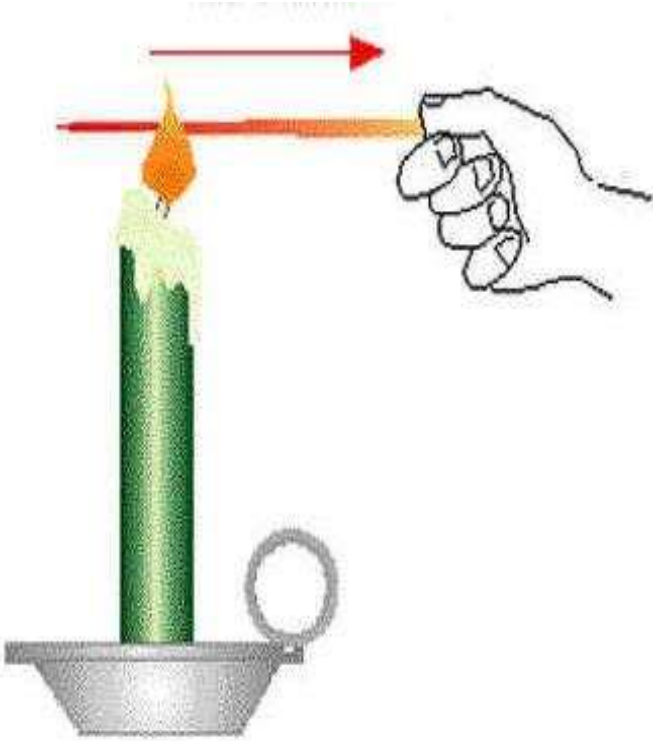


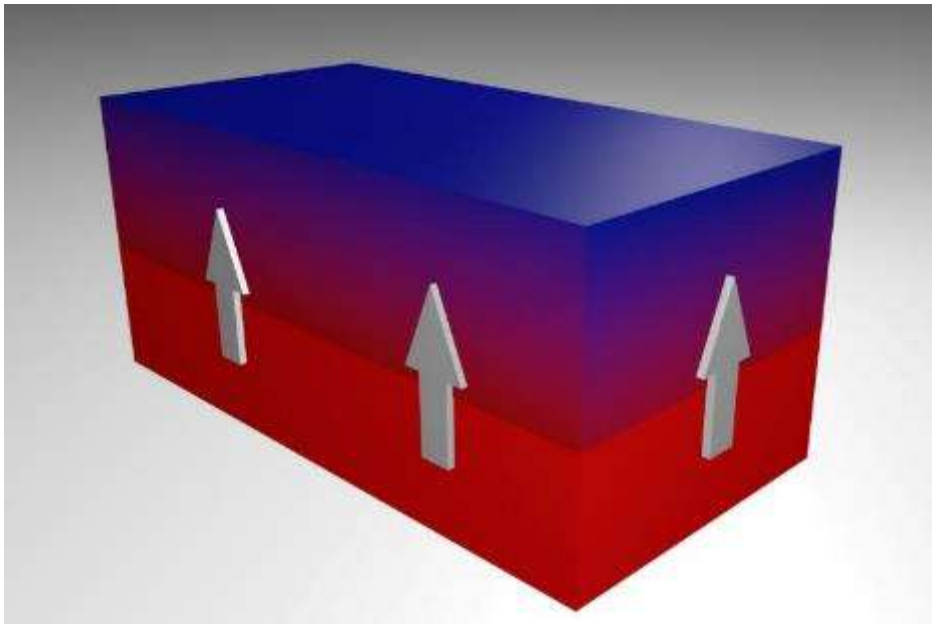
Building Science- Conduction & Insulation

Conduction

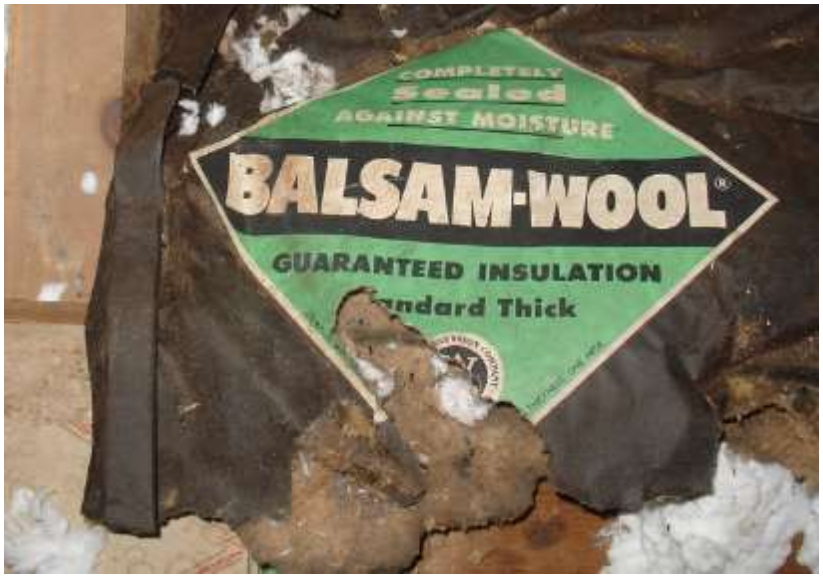
The movement of heat through materials

Insulation is a poor thermal conductor: GOOD!





Lots of materials can be insulating…



Insulation & Building Materials R-Values

R-Values The higher the R-value the better the insulation

Approximate R-values: *(per inch, if installed properly)*

• Fiberglass	R-3.7
• Cellulose	R-3.6
• Rigid foam board	R-4 - R-7
• Spray foam	R-6 - R-7
• Double pane window	R-3 (new windows)
• Softwood	R-1.3
• 8” concrete wall	R-1 (for 8”!)

Functional R-values may be affected more by install quality than the material used.

Installed Insulation R-Values

A **new house** built to the new 2015 **NH Energy Code**:

Attic	R-38 to R-49
Walls	R-20
Basement walls	R-15 to R-19
Doors and windows	R-3.1 (U ≤ 0.32)

www.puc.nh.gov

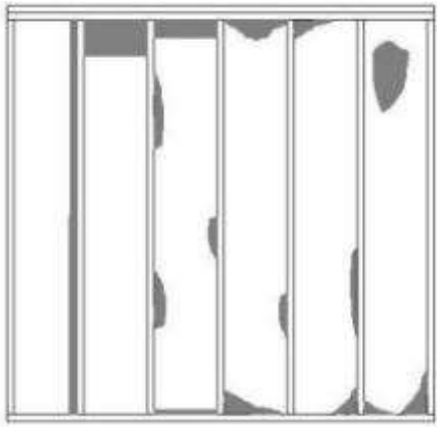
Average NH House functional R-Values:

Attic	R-10 to R-30 (some are R1!)
Walls	R-3 to R-16
Basement walls	R-1 to R-5

Quiz:

What is the average R-value of an attic with R-38 insulation covering 95% of the area?

Hint: It's less than R-30…



Insulating Thermal Barriers May Be…

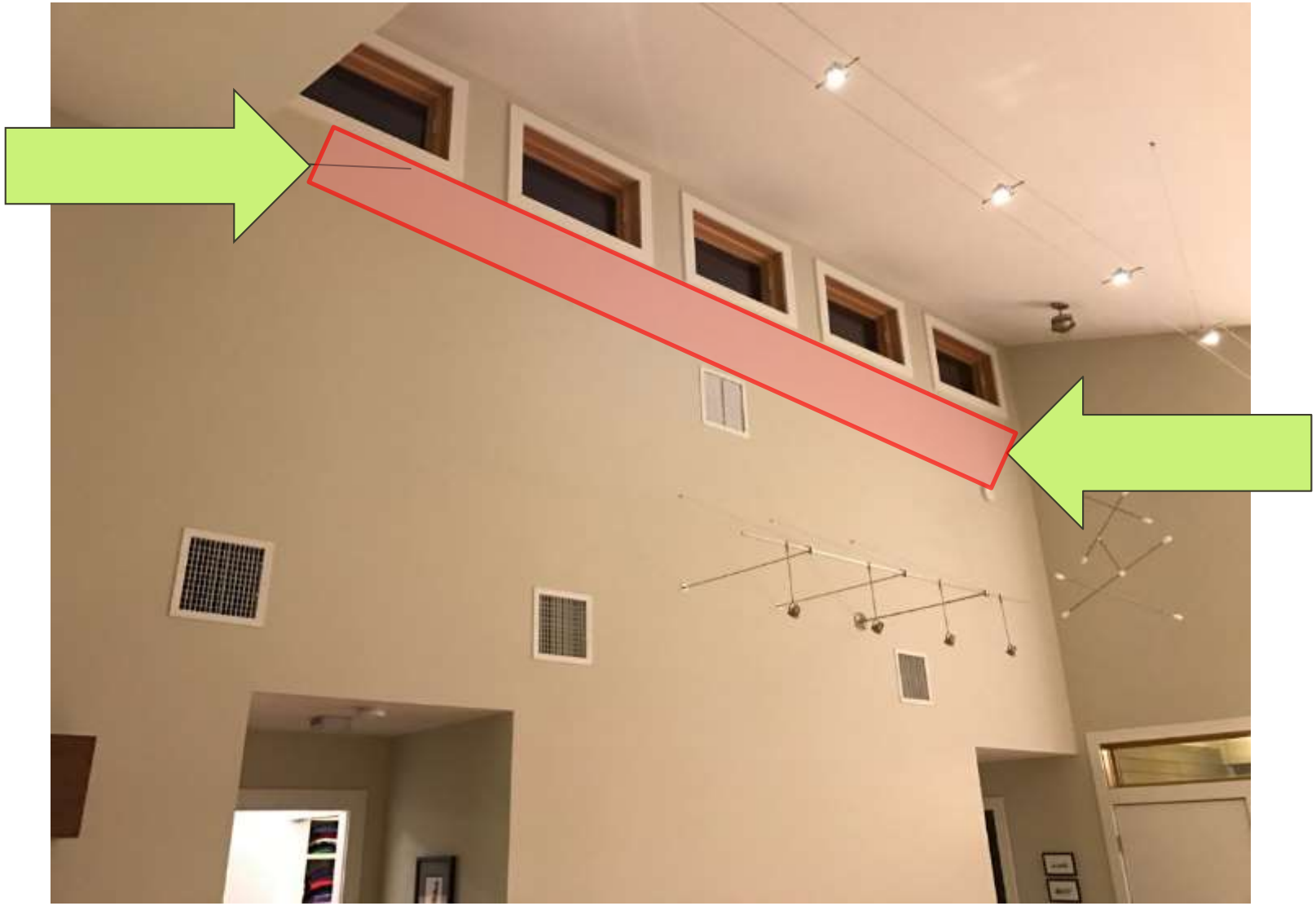
Insufficient (not enough R value)

Incomplete (no R value in spots)

Misaligned (R value there, but not working)

Insufficient (not enough R value)

Incomplete (missing R value in spots)



Any Problems?

Misaligned Insulation
(R value not doing anything)

“Heat Rises:” True or False?

Answer: FALSE!
Heat conduction can move an any direction

But… Warm AIR will rise (making it look like heat is rising)

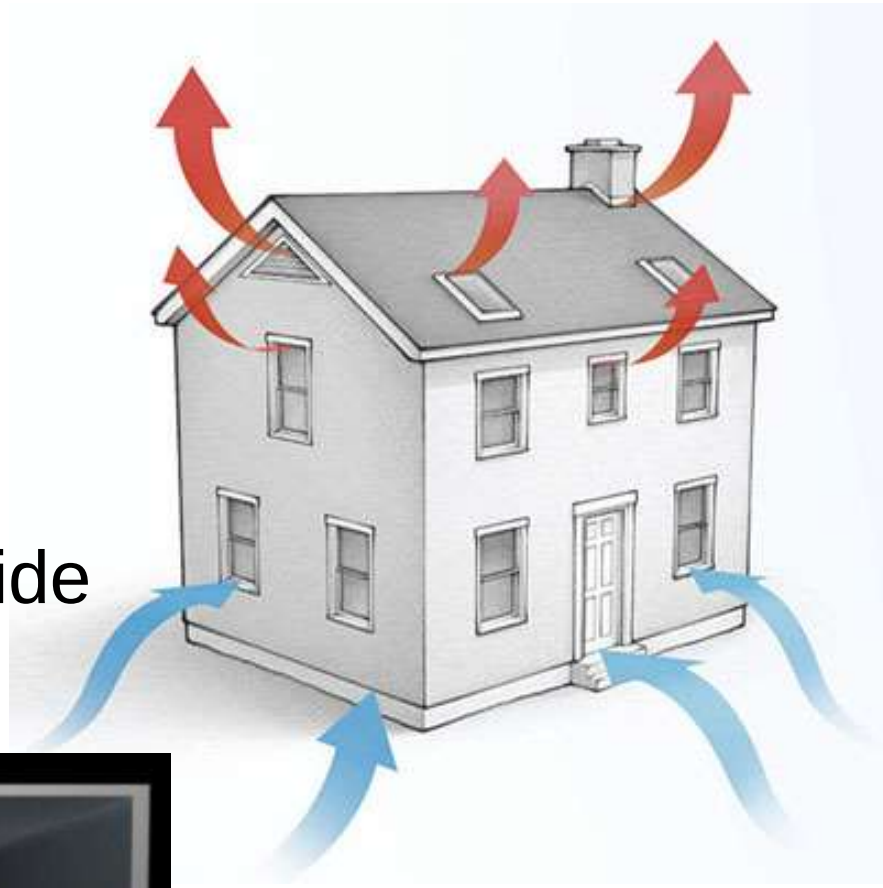
Heat actually moves from hot to cold

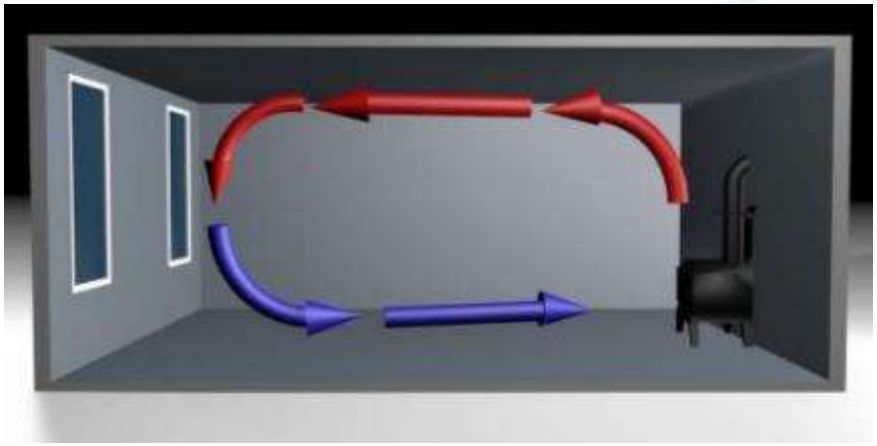
Convection Causes Air Leakage

Warm air is more buoyant – rises and leaks out the top of a building

Cold air leaks in down low

Convective air currents
= “Stack Effect”
  Stronger when colder outside





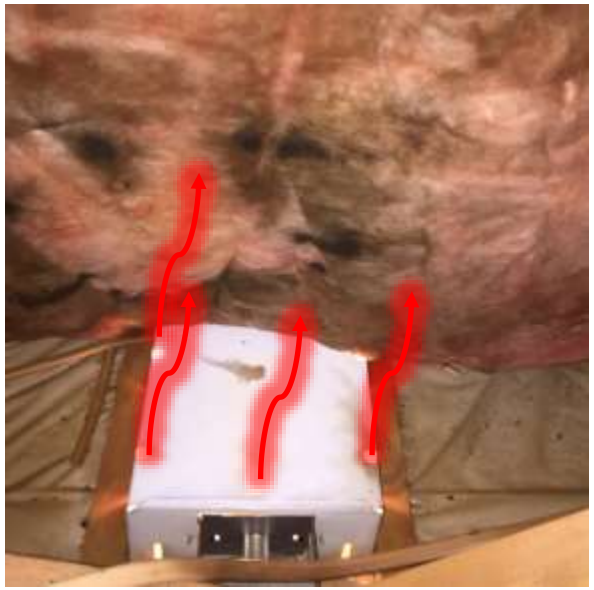
Biggest Air Leakage Areas: “A - B – C”

- **A – Attic** (top of the building)
- **B – Basement** (bottom of the building)
- **C – Center** of the building

A – Lots of Air Leaks in the Attic

Common air leaks at the top of a building:

- Attic hatches and pull-down stairs
- Chimney chases
- Pipe and electrical penetrations
- Recessed ceiling lights
- Bath fans
- Electrical boxes in the ceiling



This Attic Hatch w- 16” Fiberglass: Good?

Hint: filter…

Moisture in Attics and Air Leakage

Attic air leaks can lead to condensation, mold and rot

Warm, moist air leaks into the attic where it hits cold surfaces and condenses.

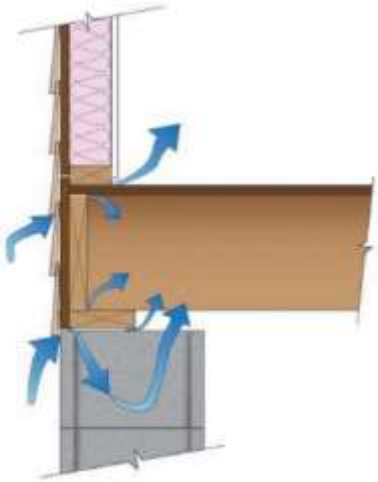
NOT a leaky roof.

An (air) leaky ceiling!

B - Basement Air Leakage & Air Sealing

Air Sealing Opportunities in Basements and Crawl Spaces

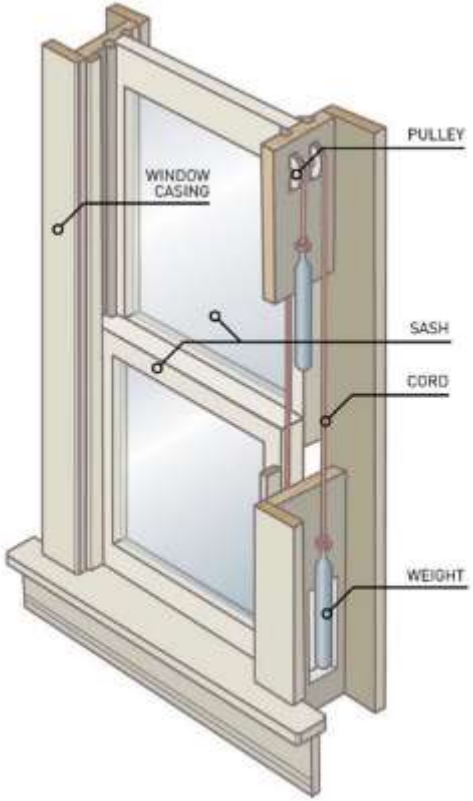
- Exterior doors
- Electrical, plumbing and other penetrations
- Box sill (rim joist) area
- Around old basement windows



C – Center of the House Air Leakage

More visible, but <u>fewer</u> air sealing opportunities

- Cracks around exterior doors
  - "Q-lon" door kit weatherstripping
  - Bottom of door sweeps
- Fireplace flues can be huge leakers
- Old pulley-hung windows
- Most windows *<u>don't</u>* leak much air

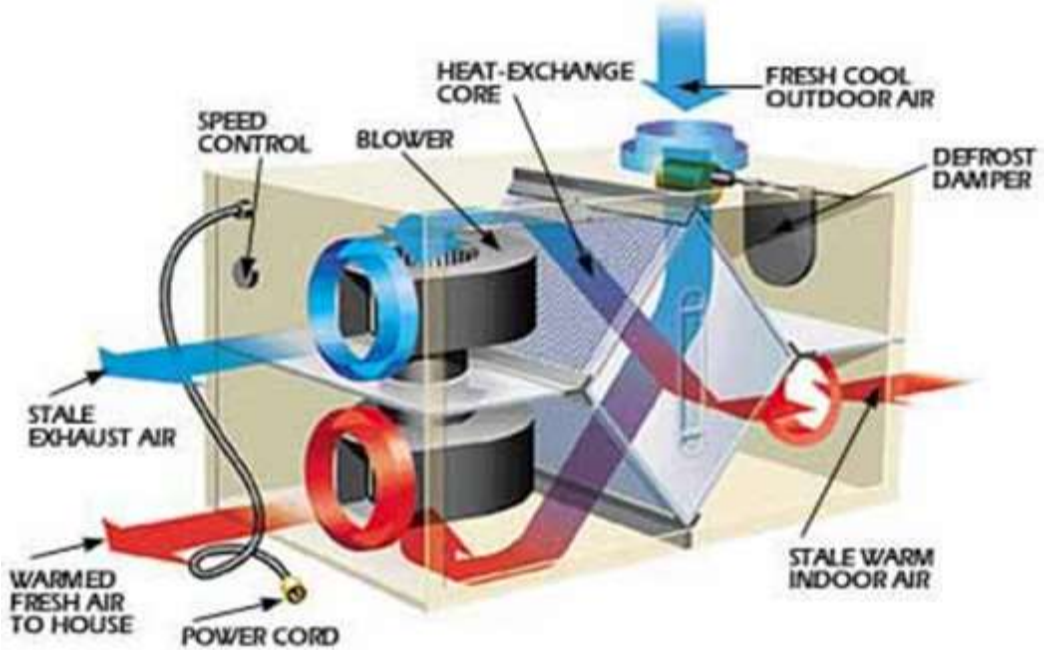


Air Sealing and Fresh Air

Fresh Air is needed for a healthy home

- For a typical home, about 1/3 of the home's air should be exchanged every hour
- Many NH homes are 2 – 4 times too leaky!
  - Leaky homes are "nosebleed dry" in winter

“Seal Tight and Ventilate Right”



Control air leakage, and…

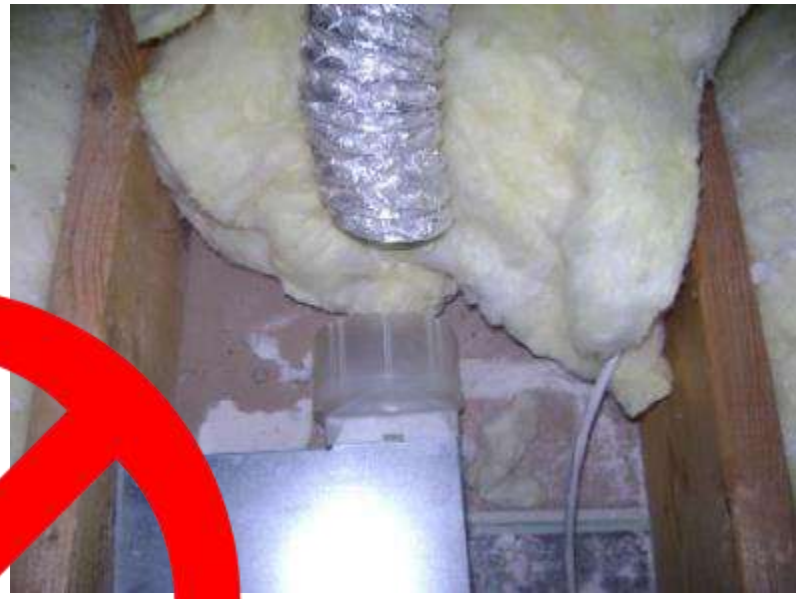
Provide measured fresh air flow

- As simple as a high quality bathroom fan
- Or a heat recovery ventilator (HRV)

With controllability

- High and low air flow settings
- Timers, occupancy sensors, CO_2 sensors, etc.

Bath Fan Venting



Vent fans to <u>Outside</u> with insulated rigid vent pipe

NOT into attic!

ADVANCED

Guess What This Is?

Bathroom Vent House in Attic

Health & Safety - Indoor Moisture

Sources of Indoor Moisture

- **Eliminate, Isolate or Control:**
  - Wet basements and crawl spaces
  - Dirt basements and crawl spaces
  - Bath fans venting into attics
  - Bathrooms without bath fans
  - Disconnected clothes dryer vents

Other indoor moisture sources: Plants, humans, pets, open sump pits, cooking, leaky pipes, new construction materials, open basement windows in summer

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Indoor Air Pollution

Eliminate, Isolate or Control:

- ✓ Tobacco smoke
- ✓ Cooking odors
- ✓ Paints
- ✓ Solvents
- ✓ Fuel & engines
- ✓ Cleaning products
- ✓ New carpet / pads
- ✓ New furniture
- ✓ Dust
- ✓ Asbestos insulation

Quiz

Image courtesy of Efficiency Vermont

What is the biggest factor causing ice dams on this house?

The Solution?

Priorities-1: The $100 DIY Package

~50% return on investment

- LED light bulbs
- Low-flow showerheads and faucet aerators
- Simple DIY air sealing in Attic and Basement
- Smart power strips

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Priorities-2: The $1,000 Package

~20% ROI

All the items in the $100 package, plus:

- Strategic **air sealing**
  - A-B-C Attic and basement priorities
- Smart **thermostat(s)**
- **Pipe insulation** where needed
- **Duct sealing** with mastic, and added duct insulation
- **Window treatments** – cellular insulating shades, etc.

- Home Performance with ENERGY STAR $100 energy assessment, if qualified

Priorities-3: The $10,000 Package

~10% ROI

All of the items on the $1,000 package, plus:

- Full energy **assessment** with prioritized recommendations
  - TREAT, REM-Rate or Home Energy Score energy modeling if considering options
- Blower-door guided **air sealing** throughout the house
- Upgrades to attic, basement and wall **insulation**
- New **bath vent fan** and improved exhaust vent ducting
- Strategic **appliance**, **heating**, **cooling** and domestic **hot water** improvements

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Are you feeling overwhelmed?

Home Performance Professionals (Energy Auditors and Contractors)

Comprehensive, whole-house energy assessment

- Building envelope inspection & tests
- Combustion equipment efficiency & safety tests
- Written report with prioritized list of cost-effective improvements

Finding Qualified Energy Professionals

- Look for -
  - Certifications: BPI Building Analyst or RESNET Energy Rater
  - Tools of the trade: blower door, infrared camera, combustion analyzer, etc.
  - Experience, references, written energy assessment / proposal

- Qualified contractor lists
  - REPA - NH Residential Energy Performance Association vetted full member profiles www.repa-nh.org
  - NHSaves qualified residential contractors

Tools of the Trade: Blower Door

Blower door tests now Energy Code-required

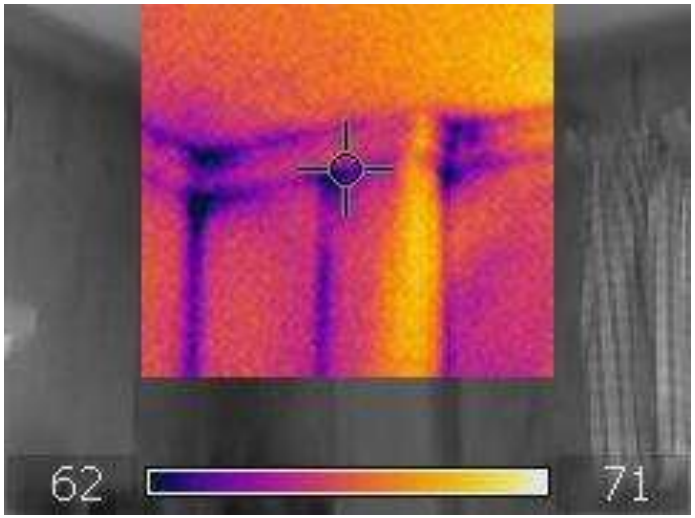
Blower Door

- Measures *amount* of air leakage: CFM_{50}
- Identifies *sources* of air leakage
- Determines air ventilation rates
- Prioritizes air sealing opportunities
- Confirms amount of air sealing accomplished

Tools of the Trade: Thermal Camera

Infrared Thermal Camera

- Visual images of hot and cold areas
- Helps sleuth insulation issues
- Used with a blower door to show air leakage pathways

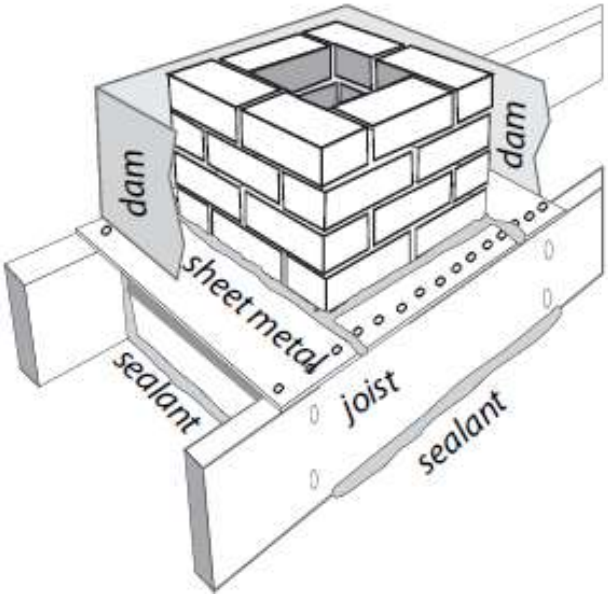


Remember "ABC"-- Attic, Basement, Center -- for Insulation and Air Sealing

If using blown insulation, cover attic with 12" – 16"
AFTER *air sealing!*

Photo: blown-in cellulose attic insulation

A: Attic Air Sealing



Attic insulation and hatches

Hybrid Approach: Spray Foam & Cellulose

- Two inches of spray foam (primarily for air sealing)
- Covered by 14” cellulose (for insulation)
  - R-60 total

Cape / Kneewalls Air Sealing & Insulation

B: Basement air sealing- before...and after

Basements- Thermax or Spray Foam

Uncovered foam needs a fire barrier. Professional installation advised.

Fix basement water issues first

C: Air Sealing in Center of House

"Chimney Balloon"

Framed Wall Insulation- best after attic and basement are improved

Densepack cellulose air seals & insulates empty cavities

Image courtesy of Vermont Dept. of Children & Families

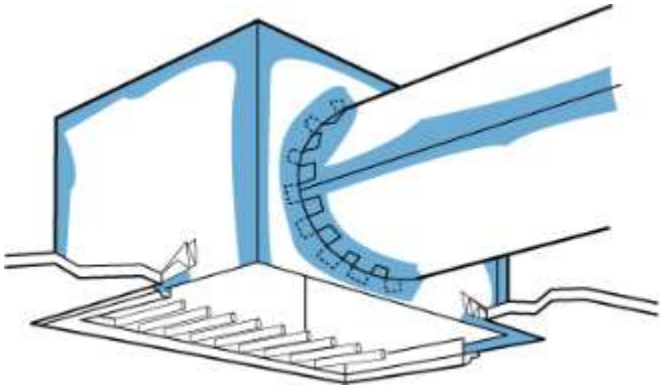
During installation, densepack tube is inserted into *each cavity.*

Professional installation recommended.

Seal Leaky Attic and Basement Ducts

Mastic!

- Goop on to seal ducts
- Reinforce with drywall joint tape
- NOT duct tape!
- Then insulate ducts completely



Window Options

What about windows?

There are many reasons to replace windows…

…*Cost-effective* energy savings is rarely one of them

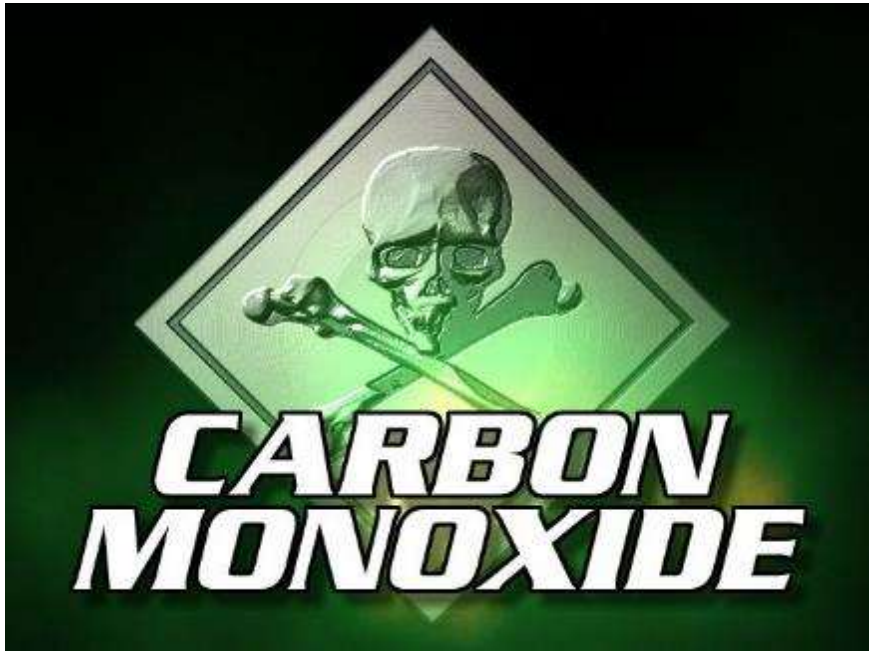
New windows ~R-3 – R-4

Old windows, with leaky sashes, can be replaced, *or…*

Other options include adding storm windows, indoor storms, cellular shades, or window quilts

Combustion Safety and Carbon Monoxide

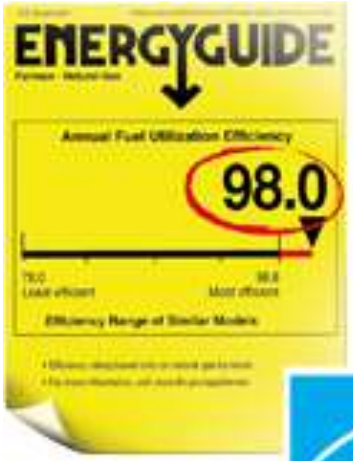
Back-drafting flue gases into a home can poison occupants



Seek combustion safety assistance from a home performance professional.

Make sure CO detectors are installed and functional.

Heating System Recommendations



- Test & clean regularly
- Seal and insulate ducts
- Replace furnace filters regularly
- Consider a more energy efficient replacement

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ENERGY STAR

Energy Audit Examples

Beautiful, large, expensive… but a *huge energy hog,* with a *massive ice dam problem!*

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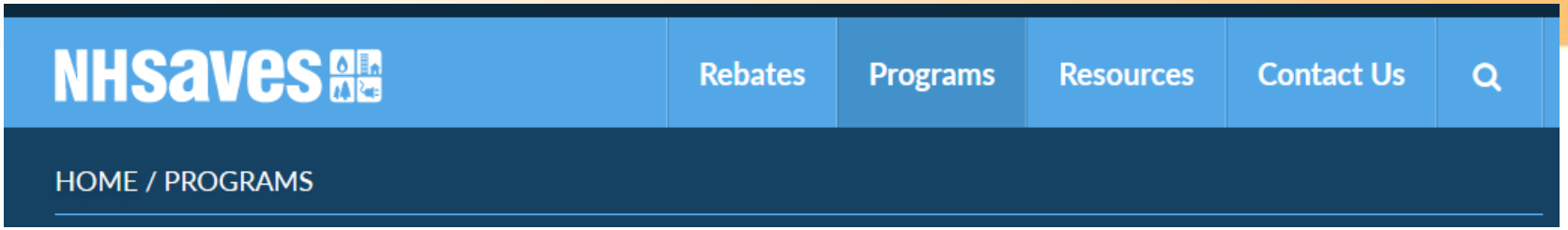
Recessed can lights in attic

What is different about this house?

Shelf lighting was the culprit!

More attic ventilation?

NHSaves Programs and Incentives



- Lighting and ENERGY STAR appliance rebates
- Heating, cooling and water heating systems
- ENERGY STAR new homes
- Net Zero home competition
- Home Energy Assistance
- Financing

- **Energy audits and weatherization**
  - Home Performance with ENERGY STAR

nhsaves.com

Heating, Cooling & Hot Water Incentives

NHSaves rebates for *efficient* systems

- Mini-split cold climate heat pumps as well as a/c only
- Natural gas boilers, furnaces & hot water
- WiFi smart thermostats (w-heat pumps & natural gas)
- Heat pump electric hot water heaters

Go to NHSAVES.com for specific incentives

- Utility-specific
- Financing
- Funding availability

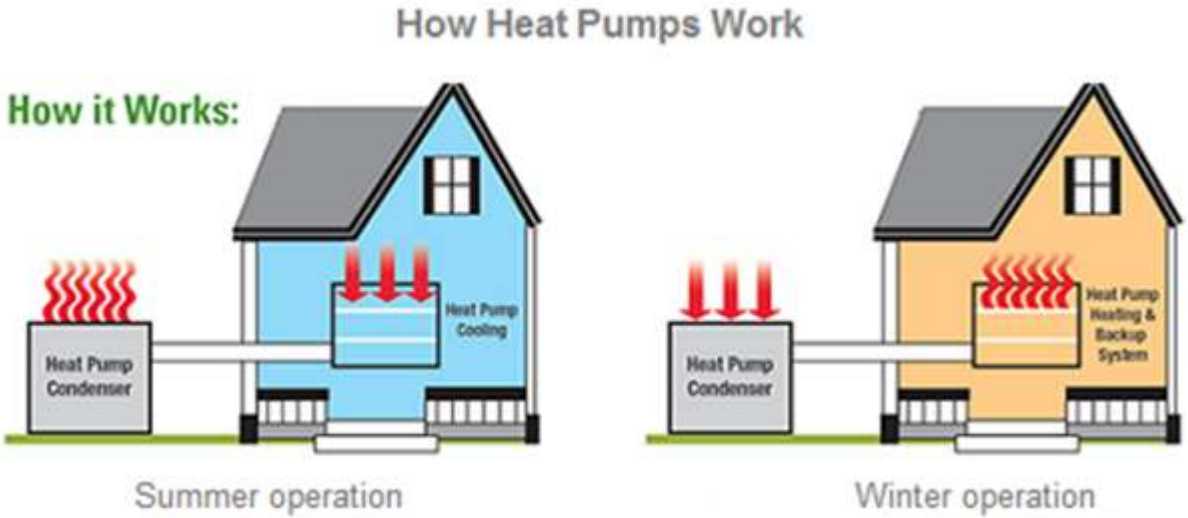
High Efficiency Heat Pumps

Ductless Cold Climate Heat Pumps for A/C & Heat

- “Mini splits” heat and cool air
- “Cold climate” models
  - Can extract heat from -20° air!

Heat Pump Hot Water Heaters

- More efficient than regular electric water heaters



Energy Efficient NEW Construction

NHSaves ENERGY STAR Certified NEW Homes

- Incentives for builders
- Verified by a HERS Rater
- Energy savings, more comfortable and higher resale value

- "Drive to Net Zero Competition" for home builders
  - Net zero homes = no net usage of energy
  - "Reduce then produce"
    - typically with solar PV
  - Cash prizes for builders

Net Zero Homes: The Future

Solar PV on the roof, heat pump heating, cooling and hot water, super insulated and excellent air quality

Picture: Vermod

NHSaves Existing Homes- Home Performance with ENERGY STAR

NHSaves.com/programs/energy-audits-weatherization

- Qualify with online "Home Heating Index" calculator
- Provides home energy audit for $100
  - Credited towards improvement work -- **net cost: $0**
- Pays for *50%* of eligible energy improvements up to *$4,000* (percent and cap may change next year)
- Low or no interest financing may be available

HOME PERFORMANCE WITH ENERGY STAR

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EVERSOURCE

Liberty Utilities

New Hampshire Electric Co-op

Unitil

NHSaves.com "Test Your Home"

HOME / PROGRAMS / ENERGY AUDITS & WEATHERIZATION

ENERGY AUDITS & WEATHERIZATION

Save money and energy with Home Performance with ENERGY STAR®!

Home Performance with ENERGY STAR® is a comprehensive, whole house approach to improving energy efficiency and comfort at home, while reducing your energy costs and helping the environment. Installing energy efficient upgrades can save you up to 20% or more on your annual energy costs.

TEST YOUR HOME

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EVERSOURCE | Liberty Utilities | New Hampshire Electric Co-op | Unitil

NHSaves- Home Heating Index Calculator

NHSaves

Back to NHSaves.com

CHECK YOUR ELIGIBILITY

STEP 1 | Basic Information

Electric Utility: Eversource

Zip Code: 03246

Conditioned Square Footage: 2000

How do I calculate Conditioned Square Footage?

STEP 2 | Annual Heating Fuel Usage

Only the amount of fuel used to heat your home for the last 12 months

Electricity (kWh): Enter Usage Value	**Natural Gas (Therms)**: Enter Usage Value
Heating Oil (Gallons): 800	**Propane (Gallons)**: Enter Usage Value
Wood (Full Cords): 2	**Wood Pellets (Tons)**: Enter Usage Value
Kerosene (Gallons): Enter Usage Value	

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Home Heating Index Results: 8+ √

YOUR RESULTS

Basic Information

Electric Utility	Eversource
Zip Code	03246
Conditioned Square Footage	2000

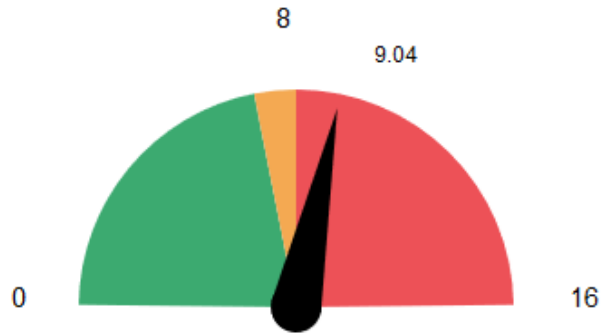
Annual Heating Fuel Usage 75,400.00 BTUs/SF

Fuel Types	Heating Oil,Wood
Heating Oil	800 Gallons
Wood	2 Full Cords

Heating Index

Your home may be a good candidate for weatherization services.

0 - 4	Low Energy
4 - 8	Moderate Energy
7 - 8	High Energy
8+	Very High Energy



Enroll For Home Efficiency Audit

Complete and submit your enrollment form. For more information about our energy audits and weatherization program, click here.

PROCEED TO ENROLLMENT FORM

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Sample NHSaves Report (@ 50% cost-share)

Proposed Improvement	Total Cost	Utility Rebate	Customer Co-Pay	ESTIMATED VALUES **	
				Pay Back Period (years)	Customer Cost Savings ($/year)
AC Ancillary Savings	$0.00	$0.00	$0.00	0.0	$13.42
Boiler Ancillary Savings	$0.00	$0.00	$0.00	0.0	$4.70
LED Bulbs	$138.60	$138.60	$0.00	0.0	$110.04
Attic	$4,194.30	$3,774.87	$419.43	0.3	$1,347.56
Basement	$646.00	$581.40	$64.60	0.3	$196.80
Air Sealing	$1,700.00	$1,700.00	$0.00	0.0	$227.04
Health And Safety	$252.00	$226.80	$25.20		
Program Delivery/Audit Fee	$992.17	$992.17	$0.00		
Customer Co-Pay Pre-Payment			- $100.00		
Totals	$7,923.07	$7,413.84	$409.23		

Annual energy savings: $719
Total customer payment: $2,047
35% return on investment!
Utility max rebate increasing in 2021, and will be other ways to qualify

Income-Qualified Weatherization and Fuel Assistance Programs

- Weatherization Assistance Program & Home Energy Assistance
  - Financial assistance that pays for energy reduction measures in a home
  - Contact:
    - County-based Community Action Agencies (CAAs)
    - Your utility, or dial 211
- NH Electric and Fuel Assistance programs
  - Financial assistance with electricity and fuel bills
  - Same CAA, utility and 211 contacts

Weatherization Works

New Hampshire 2-1-1
Get Connected. Get Answers.
An initiative of Granite United Way

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Contacts for Income-Qualified Programs

Contact a Community Action Agency (CAA) to learn more about income-qualified Weatherization and Fuel Assistance programs:

Office Location	County	CAA	Phone Nunber
Laconia	Belknap	CAPBMCI	524-5512
Meredith	Belknap	CAPBMCI	279-4096
Tamworth	Carroll	TCCAP	323-7400
Keene	Cheshire	SCS	352-7512 or 800-529-0005
Berlin	Coos	TCCAP	752-3248
Ashland	Grafton	TCCAP	968-3560
Hillsborough (M, W, Th & F)	Hillsborough	SNHS	924-2243 or 877-757-7048
Manchester	Hillsborough	SNHS	647-4470 or 800-322-1073
Milford	Hillsborough	SNHS	924-2243 or 877-757-7048
Nashua	Hillsborough	SNHS	889-3440 or 877-211-0723
Peterborough	Hillsborough	SNHS	924-2243 or 877-757-7048
Concord	Merrimack	CAPBMCI	225-6880
Franklin	Merrimack	CAPBMCI	934-3444
Suncook	Merrimack	CAPBMCI	485-7824
Warner	Merrimack	CAPBMCI	456-2207
Derry	Rockingham	SNHS	965-3029 or 855-295-4105
Portsmouth	Rockingham	SNHS	436-3896 or 800-639-3896
Raymond	Rockingham	SNHS	895-2303 or 800-974-2303
Salem	Rockingham	SNHS	893-9172 or 800-939-9172
Seabrook	Rockingham	SNHS	474-3507 or 800-979-3507
Dover	Strafford	CAPSC	435-2500
Farmington	Strafford	CAPSC	435-2500
Claremont	Sullivan	SCS	542-9528 or 800-529-0005

More information at:
www.nh.gov/osi/energy/programs/weatherization/index.htm

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Summary

- Know about your energy use and savings opportunities
- Air seal first: A-B-C
- Add insulation where you can
- For expert work, work with a home performance professional
- Utilize NHSAVES energy efficiency programs

Thank You

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Button Up NH is coordinated by the Plymouth Area Renewable Energy Initiative with support from the NHSaves' utilities.

Visit **www.plymouthenergy.org** for a copy of the presentation

Support future workshops …let your utility know**.**

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