

How to Improve the Energy Efficiency of Your Home

For energy cost savings, improved comfort, and lower carbon footprint



NHSaves ButtonUP Overview

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

NHSaves Button Up presentation PDF available from PAREI at: plymouthenergy.org/nh-saves-button-up/



Presented by:



Plymouth Area
Renewable Energy
Initiative

Plymouthenergy.org

The Greenest Energy

What is the
“GREENEST”
Energy?

The Greenest Energy

What is the
“**GREENEST**”
Energy?

Negawatts
Energy that you
don't use!

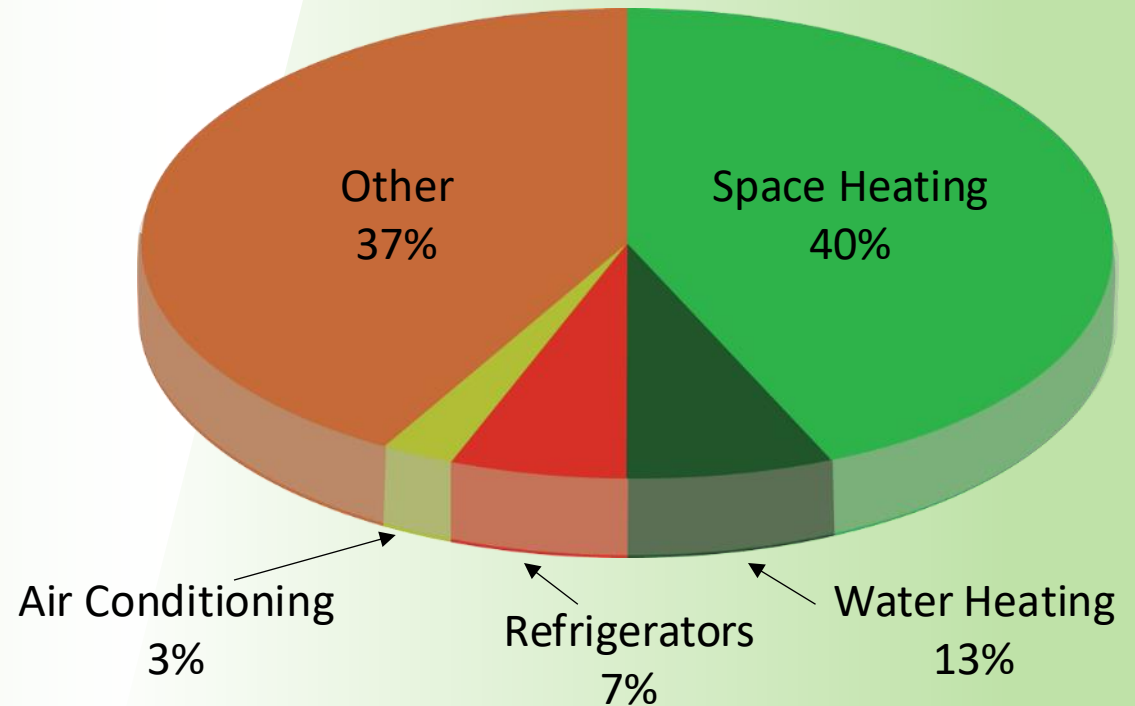


Rising Cost of Energy

New Hampshire Residential
Energy Costs per Household:
~\$3,000 in 2020

**NH: 9th most energy-
expensive state in the U.S.**

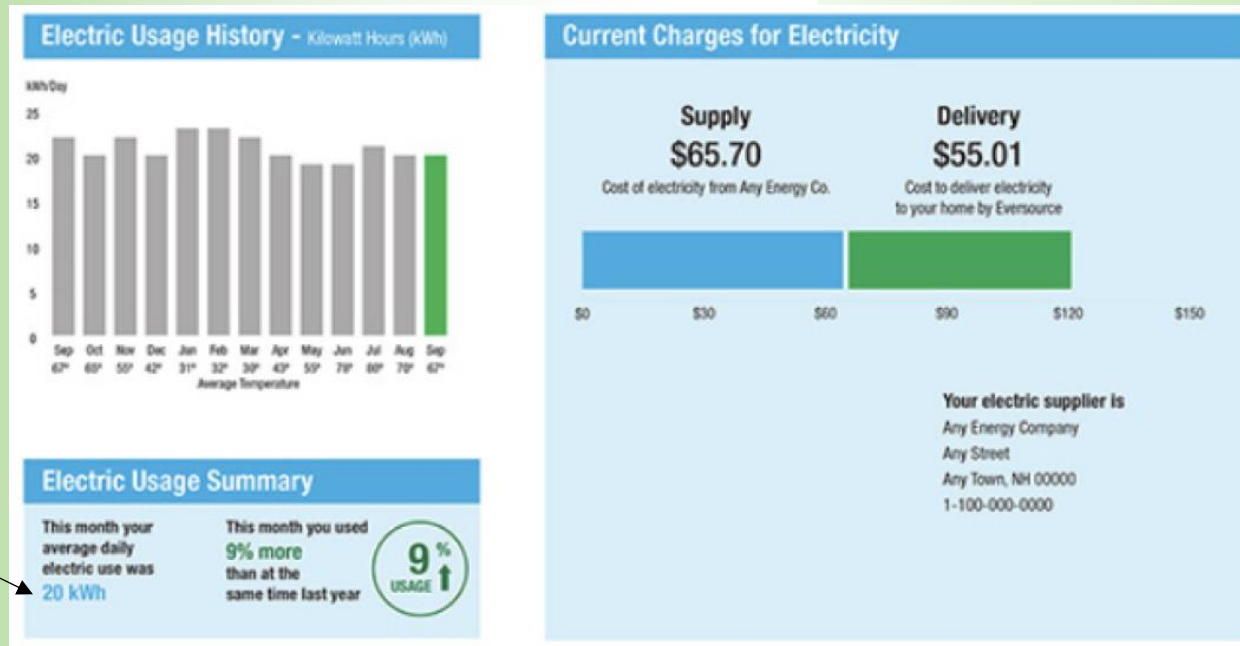
-WalletHub 7/23



Current NH energy fuel prices: www.energy.nh.gov/energy-information/nh-fuel-prices

Get to Know Your Energy Bills

Know how much electricity you are using



Daily Average
~20 kilowatt-hours
(kWh)

Monthly: 600 kWh

Annually: 7,200 kWh



Major Household Electrical Uses

Where are
you
using
electricity?

Residential Electricity Use	Approximate Annual Kilowatt-hours	Potential for saving energy
Electric Water Heater	2,100	***
Refrigerators & Freezers	1,050	***
Lighting	1,000	**
Dehumidifiers	900	***
Electric Clothes Dryers	800	**
Entertainment Centers	650	*
Furnace or Boiler	400	**
Dish and Clothes Washers	350	**
Cooking	300	*

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

Measuring Electricity Use

How much electricity do plug-in devices use?

Use a watt meter

- Available from many NH public libraries
- Measures watts, time, and kilowatt-hours



Whole House Electricity Monitors

Provides:

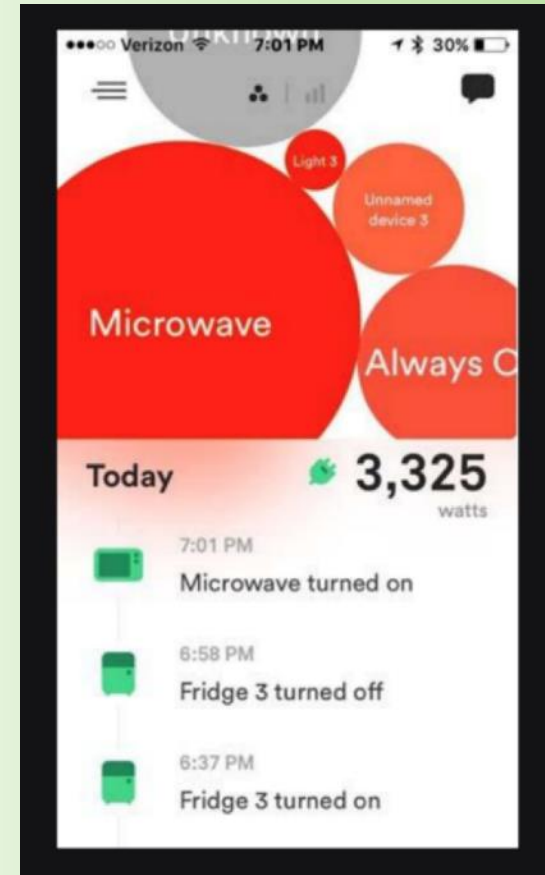
- Current electrical use
- Total consumption by day, week, etc.

May also provide:

- Usage by circuit
- Individual device use

Brands:

- Sense, Smapppee, Engage, TED, Vue Smart, etc.
- \$100 - \$300
- Electrician install



Energy Saving Tip: Conservation

Shut things off
when not in use



And eliminate phantom
loads when possible



Lighting Efficiency

The LED Lighting Revolution

Any existing 60+ watt
light bulbs?

- Low LED prices
- Easy \$\$ savings

Lighting Efficiency

The LED Lighting Revolution

Any existing 60+ watt light bulbs?

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- Easy \$\$ savings

Lots of opportunities

- Screw-in light bulbs
- Outdoor lighting
- Holidays lights
- Can lights and linear lighting



Lighting Efficiency

The LED Lighting Revolution

Any existing 60+ watt light bulbs?

- Low LED prices
- Easy \$\$ savings

Lots of opportunities

- Decorative light bulbs
- Outdoor lighting
- Holidays lights
- Can lights and linear lighting



Look for:

- Light color (2700° K = “warm white”)
- Dimming and dimmer capability
- “Suitable for enclosed fixtures”
- “Suitable for damp locations”



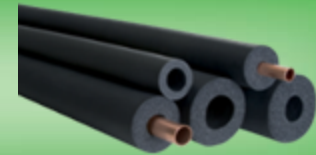
Domestic Hot Water Energy Savings

Actions to save on hot water heating costs

Install low-flow showerheads & faucet aerators



Install hot water & heating pipe insulation: R-3+



Turn down hot water aquastat to 120° at tap



Wash clothes in cold water



Other Energy Conservation Tips

Actions you can
do around the
house

Set dehumidifiers at
60-70% humidity



Line dry clothes *outside*, if
possible



Purchase ENERGY STAR
appliances



NHSAVES Rebates on ENERGY STAR Appliances

Rebates include:

energystar.gov

lists appliance efficiency

nhsaves.com/nh-rebates

appliance rebate forms & updates

2nd refrigerator: Free haul-away + \$75 for an OLD refrigerator or freezer

Electric Clothes Dryers

\$40 - \$200

Clothes Washers

\$25 - \$50

Dehumidifiers

\$25

Refrigerators

\$40 - \$50

Room Air Conditioners

\$20

Also pool pumps, room air purifiers & other efficient appliances

Staying Warm in Your Home

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

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!)



Heating Energy Savings Tips

No or low-cost options to use less heat:

Turn down heat when not in a room or in the house



Use programmable or smart thermostats



Remove window A/Cs in winter



Close storm windows



Latch closed windows



Staying Warm in Your Home

Heat always moves from Hot to Cold

Fact: Winter warmth inside our homes seeks to “escape” through the building shell to outdoors.

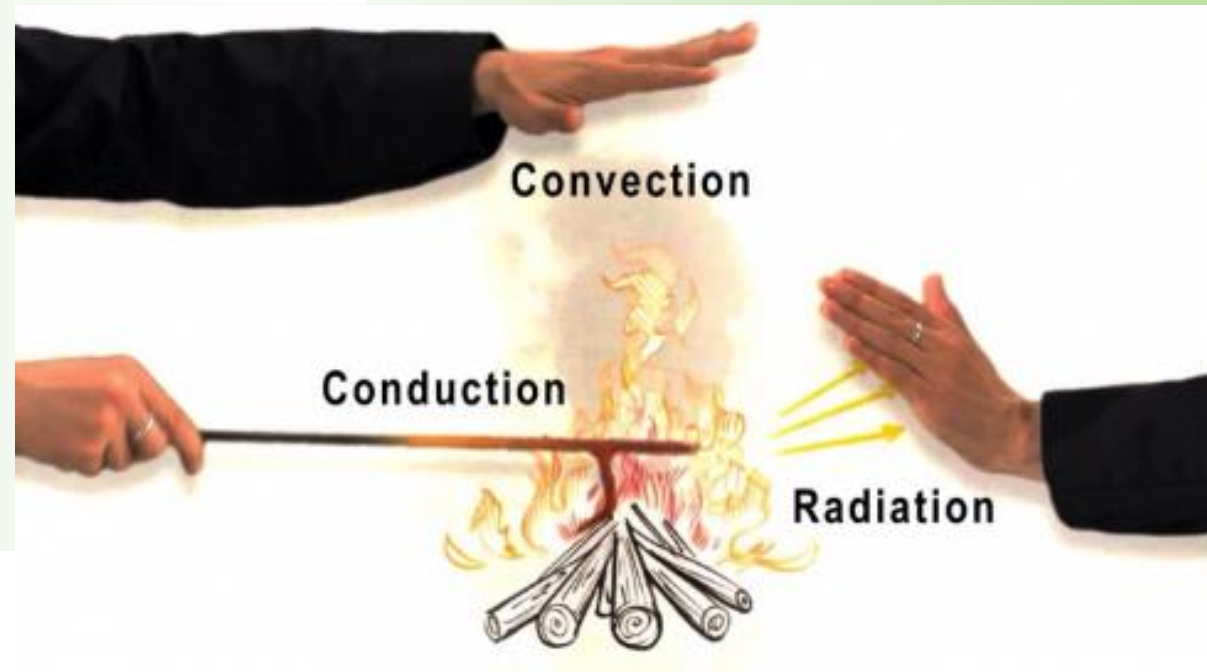
Goal: Slow this process down



Building Science and Heat Transfer

Heat moves via three methods:

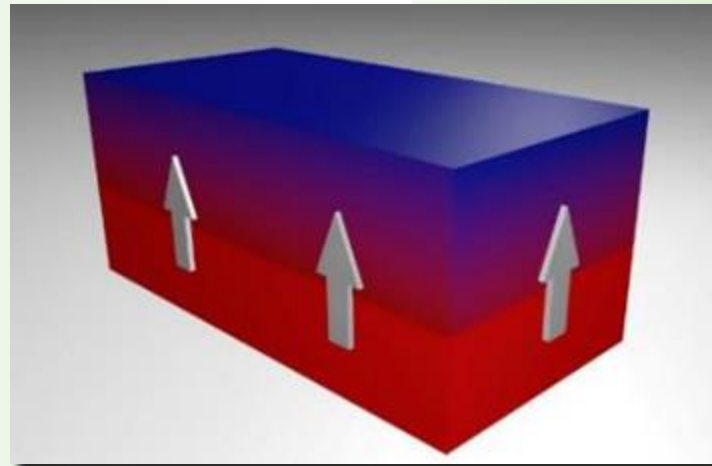
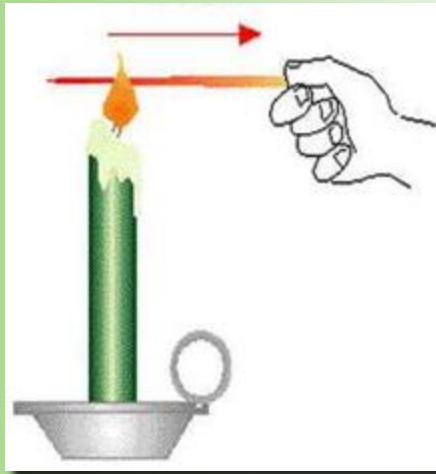
- Conduction
- Convection
- Radiation



Building Science – Conduction & Insulation

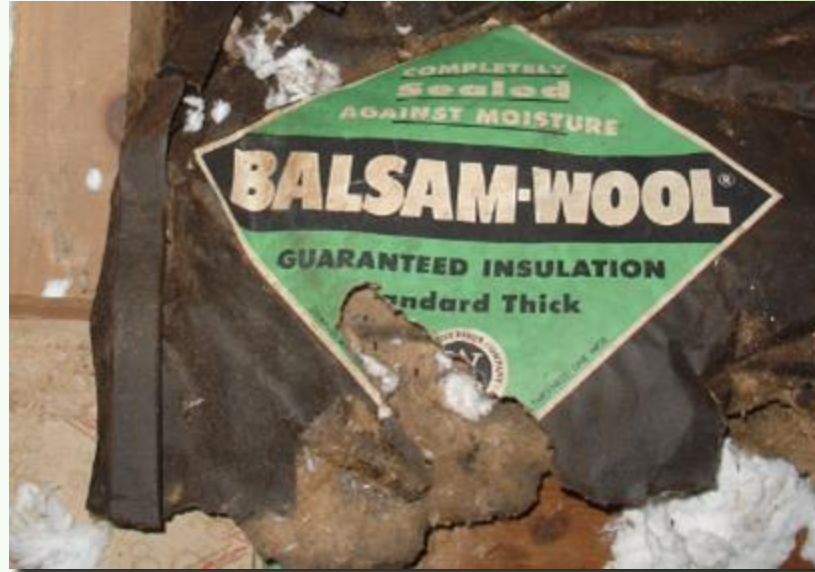
Thermal Conduction:

The movement of heat through materials



Insulation is a poor thermal conductor: GOOD!

Lots of Materials Can Be Insulation...



Insulation & Building Materials R-Values

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

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

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

Fiberglass	R-3.7
Cellulose	R-3.6
Rigid foam board	R-4 to R-7
Spray foam	R-6 to R-7
New double pane window	R-3.5 Whole Window
Softwood	R-1.3
Concrete, stone, or brick	R-0.14 !

Installed Insulation R-Values

NEW house built to the NH Energy Code:

Attic	R-38-49
Walls	R-20
Basement walls	R-15 to R-19
Doors and windows	R-3.1 (U \leq .32)

puc.nh.gov

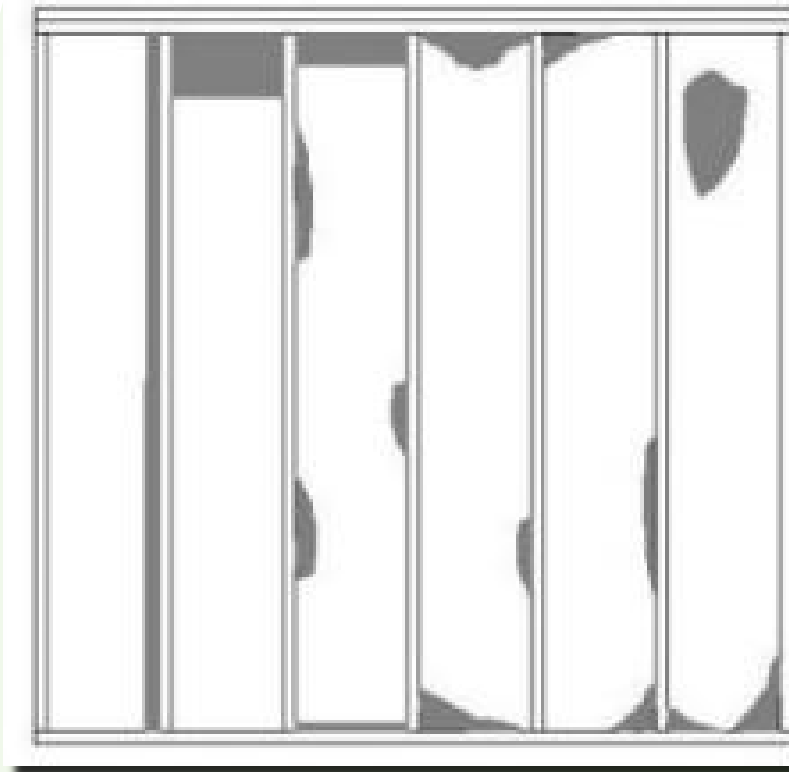
Average NH House functional R-Values:

Attic	R-10 to R-30
Walls	R-3 to R-16
Basement walls	R-1 to R-5

Installed Insulation R-Values

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
(low R value in spots)



Missing
(where?)



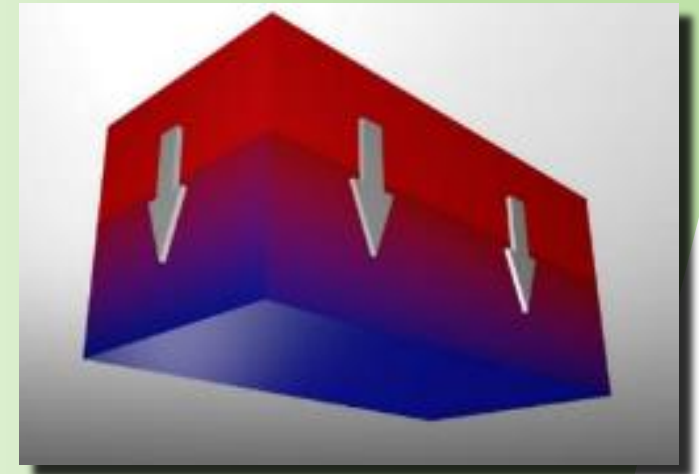
Quiz:

Heat rises:
true, or false?

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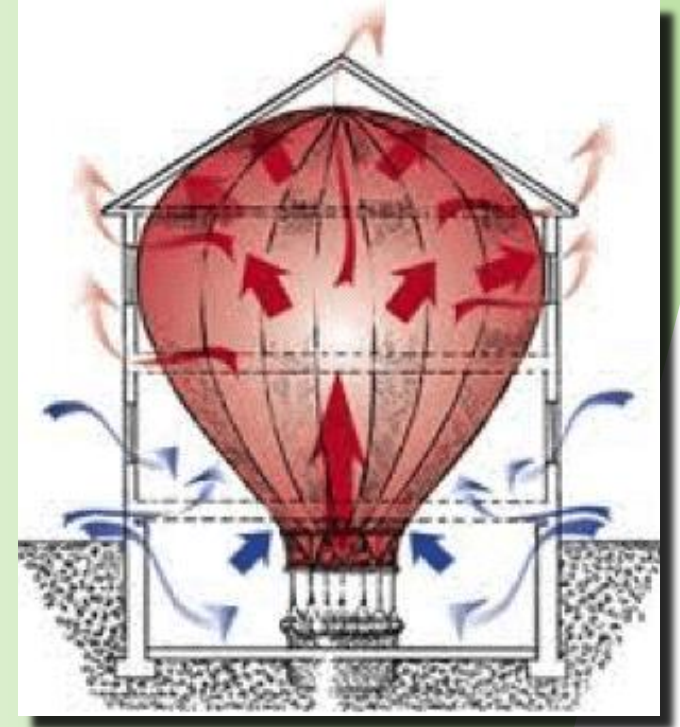
Answer: FALSE!
Heat conduction
can move in any
direction from
hot to cold!



Quiz:

Heat rises:
true, or false?

But... Warm AIR
rises (making it
look like heat is
rising)



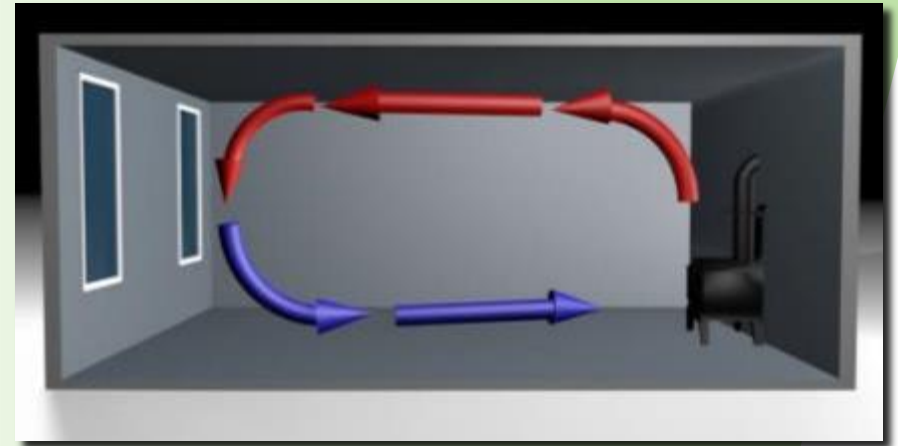
Convection Causes Winter Air Leakage

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

Cold outside air leaks in down low



Convective air currents
= “Stack Effect”
*Stronger with big temperature
differences*



Ranking of Air Leakage Areas: “A – B – C”

1st priority: A - Attic

2nd: B - Basement

3rd: C - Center



A - Lots of Air Leaks in the Attic (and insulation opportunities)

Common air leaks at the top of a building:



Ceiling lights & bath fans



Pipe & electrical penetrations



Chimney chases



Tops of interior walls



Ducts & registers

Is this Good?

This pegboard attic hatch with 16" fiberglass insulation?



A - 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.

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NOT a leaky roof.
An (air) leaky ceiling!

B - Basement Air Leakage & Air Sealing Opportunities



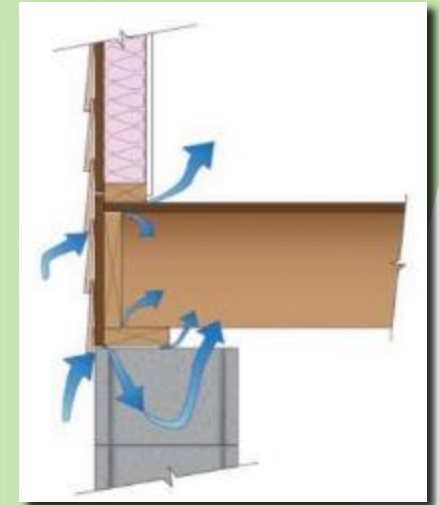
Exterior doors



Around old
basement windows



Electrical, plumbing
and other
penetrations



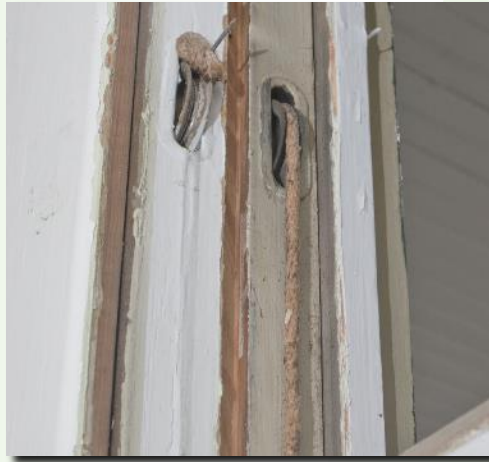
Box sill
(rim joist)
area

C - Center of the House Air Leakage

More visible, but fewer air sealing opportunities



Cracks around exterior doors



Old pulley-hung windows



Fireplace & woodstove flues

Most windows don't 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)

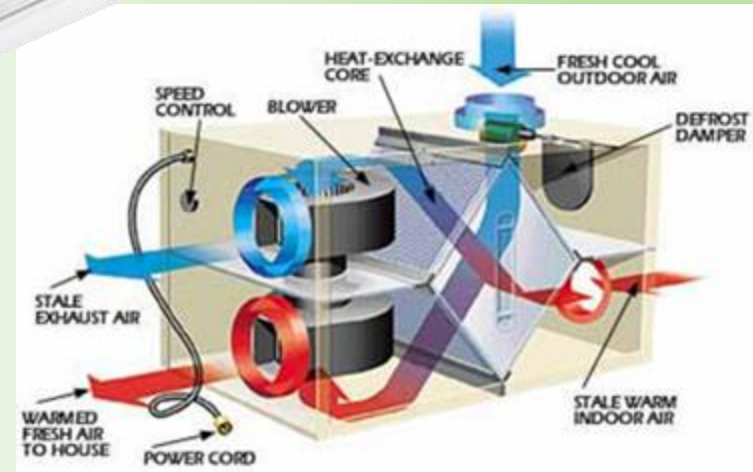
“Seal Tight and Ventilate Right” Mechanical Ventilation

Control air leakage, and...
Provide measured fresh air & stale air exhaust

- 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, CO2 sensors, etc.



Bath Fan Venting

Vent fans to Outside with insulated rigid vent pipe

NOT into attic!



ADVANCED

Health & Safety - Indoor Moisture

Eliminate, Isolate, or Control sources of indoor moisture:

- Wet or dirt floor basements/crawlspaces
- 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



Quiz

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



The Solution?



Remember “ABC”-- Attic, Basement, Center

Air Sealing and
Insulation -
Cover attic with 12” –
16” of blown
insulation

***AFTER* air sealing!**



Attic **before** and **after** air sealing & insulation

A - Attic Air Sealing -- Prior to Insulation



Air sealed chimney chase w- fire-rated materials



Spray foam "skim coat" attic air seal, prior to insulation

A - Attic Insulation, Floors, and Hatches



A - Cape / Kneewalls Air Sealing & Insulation



Spray foam prior to drywall fire barrier



Metal-faced “Thermax” brand foam board is fire-rated for kneewalls

B - Basement Air Sealing and Insulation



BEFORE

AFTER

Insulated and air-sealed custom door

B - Basement Wall Insulation



Thermax

Fix basement water issues first



Spray Foam

Uncovered foam needs a fire barrier.
Professional installation advised.



C - Air Sealing in Center of House



Chimney flue blocker



Exterior door "Q-lon"
style weatherstripping



Fire-rated air sealing
around an exposed
chimney chase

C – Denspack Insulation in Framed Walls

**Denspack insulation air seals
& insulates empty cavities**

During installation, tube is inserted
into each cavity.



ADVANCED

Professional installation
recommended.

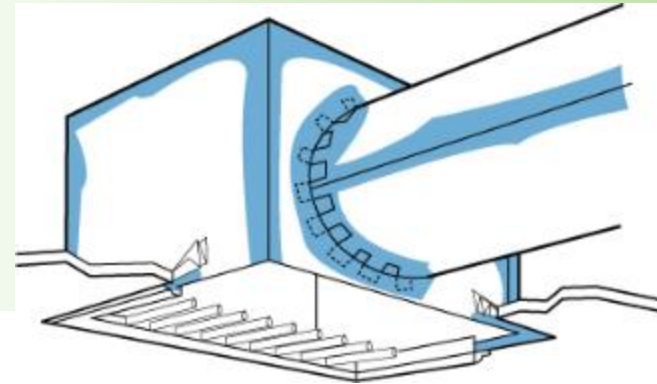


Image courtesy of Vermont Dept. of Children & Families

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

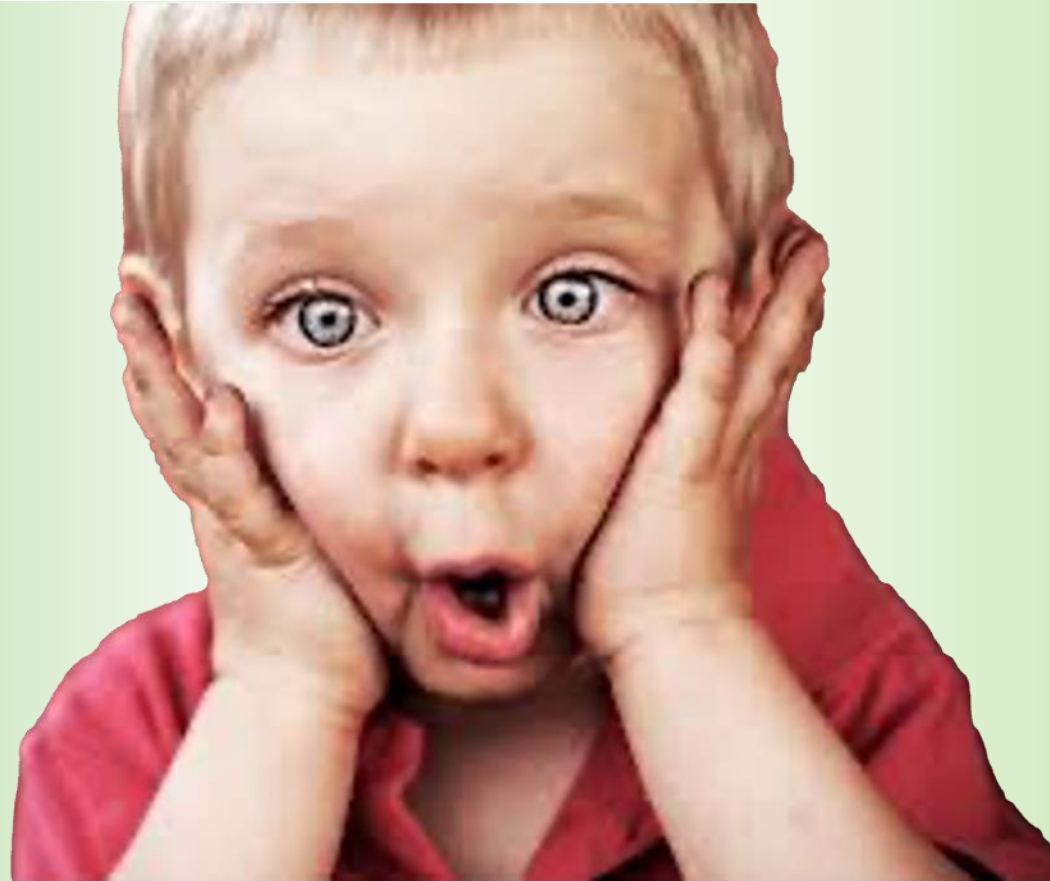
What about windows?

- *There are many reasons to replace windows...
...Cost-effective energy savings is rarely one of them*
- New windows ~R-3.5 – R-4
- Old, leaky windows can be replaced, or...
- Other options include: adding storm windows, indoor inserts, cellular shades, window quilts, or window repair



Photo:
WindowDressers.org

Feeling Overwhelmed?



Home Performance Pros (Energy Auditors and Contractors)

Comprehensive, whole-house energy assessment

- Building envelope inspection & tests
 - Including a blower door air leakage test
- Combustion efficiency & safety tests
- Written report with prioritized list of cost-effective improvements



Finding Qualified Energy Professionals



Look for

- *Certifications:* BPI Building Analyst, BPI HEP Energy Auditor, 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 members
- NHSaves qualified residential contractors

Tools of the Trade

Blower Door

- Measures amount of air leakage: CFM50
- Identifies sources of air leakage
- Determines air ventilation rates
- Prioritizes air sealing opportunities
- Confirms amount of air sealing accomplished



Blower door tests now
Energy Code-required

Tools of the Trade

Infrared Thermal Camera

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



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 properly installed and functional.



ADVANCED

Heating System Recommendations

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



Test & Clean



Replace filters



Efficiency Priorities

Focus on the **building envelope first**, then heating and cooling systems

- An efficient heating or cooling system in a leaky envelope still wastes a lot of energy!
- Also seal & insulate ducts and heating / hot water pipes



Energy Audit Example

Massive air leak to the attic -- hiding behind a mirror



NHSaves Rebates and Services- nhsaves.com

- Appliance rebates
- Heating, cooling and water heating incentives
- ENERGY STAR New Homes
- Home Energy Assistance
- Financing
- **Energy Audits and Weatherization:**
 - **Home Energy Performance program**

EVERSOURCE



Efficient Heating, Cooling & Hot Water

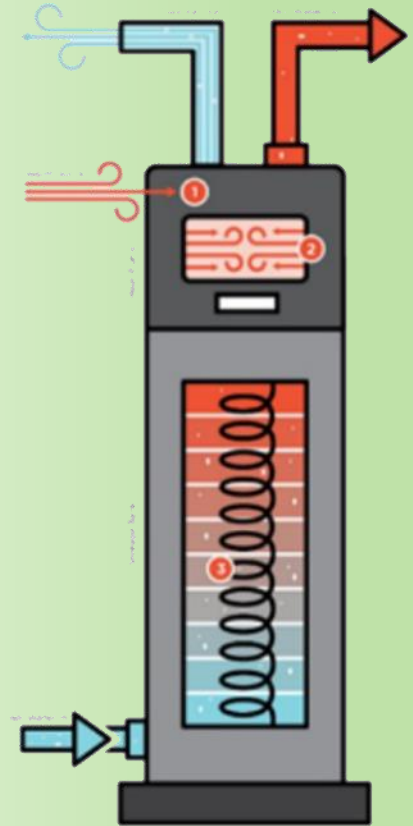
Plenty of high efficiency options & incentives

- Efficient natural gas boilers and furnaces (NHSaves)
- Mini-split cold climate heat pumps (NHSaves & IRA)
- Heat pump electric hot water heaters (NHSaves & IRA)
- EPA certified wood and pellet stoves (IRA)
- Wi-Fi smart thermostats (NHSaves)

NHSaves = NHSaves incentives

Go to [NHSaves.com](https://www.nhsaves.com) for specifics

IRA = Separate “Inflation Reduction Act” federal tax credits



High Efficiency Heat Pumps

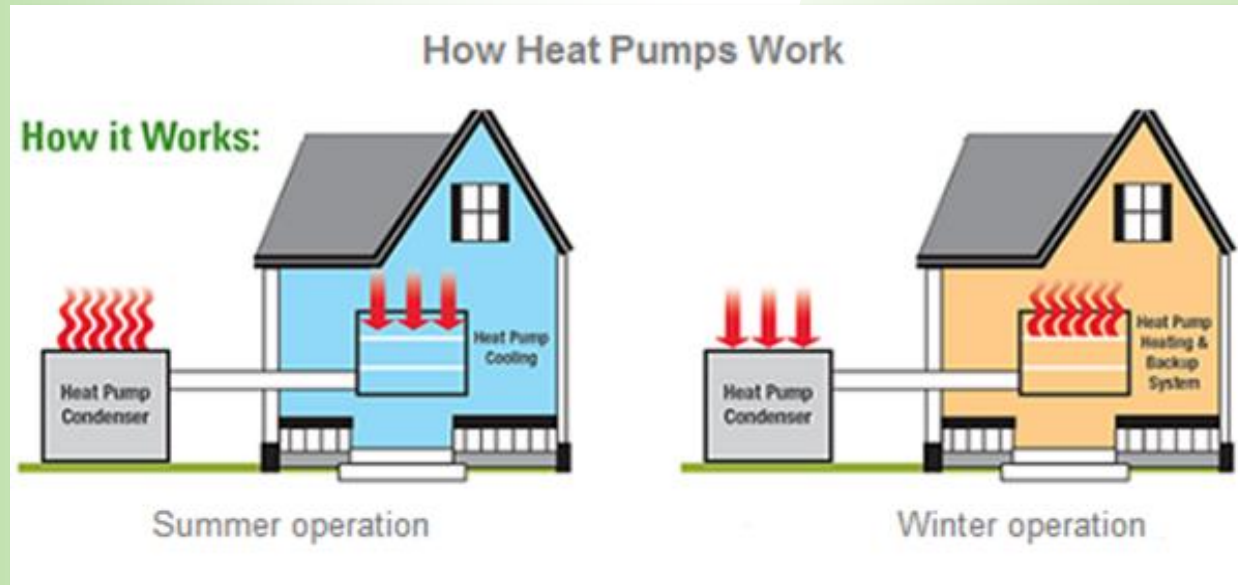
Cold Climate Heat Pumps for A/C & Heat

- Ductless “mini splits” heat and cool air
- Also ducted heat pumps
- “Air-to-water” heat pump boilers...
- Cold climate models can extract heat from -20° air!



High Efficiency Heat Pumps for Water and Air

Heat Pumps move heat from one place to another...



...using the refrigeration cycle

NHSaves Heating, Cooling & Hot Water Incentives

A sampling of NHSaves rebates for efficient systems:

Mini-split cold climate heat pumps	\$250*/ton
Natural gas boilers and furnaces	up to \$1,500
Heat pump hot water heaters	\$750
Wi-Fi smart thermostats	\$85**

Go to [NHSAVES.com](https://www.nhsaves.com) and contact your utility for specific incentives

- Utility-specific
- Low-interest financing options
- Funding availability



Energy Efficient NEW Construction

NHSaves ENERGY STAR Certified NEW Homes

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



“Drive to Net Zero Competition” for home builders

- Net zero homes = no net usage of energy
- “Reduce then produce”
- with solar PV
- Cash prizes for builders



NHSaves for Existing Homes

NHSaves “Home Energy Performance” program for existing homes

- Qualify with online “Home Heating Index” calculator
- Comprehensive home energy audit for \$100
 - Credited towards improvement work -- net cost: \$0
- Pays for **75%** of eligible energy improvements up to \$6,000*
- Low or no interest financing may be available

nhsaves.com/residential/weatherization/



NHSaves.com “Test Your Home” – Home Heating Index



Test Your Home

Here's what you will need to get started:

- ✓ Your heating usage for the past twelve months
- ✓ The conditioned square footage of your home
- ✓ Your heating fuel source and your utility provider
- ✓ Your zip code

TEST YOUR HOME

NHSaves- Home Heating Index Calculator

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

Natural Gas (Therms)

Enter Usage Value

Select Natural Gas Provider

Select Utility

Do you use electric heat or heatpumps?

Yes No

Heating Oil (Gallons)

800

Propane (Gallons)

Enter Usage Value

Wood (Full Cords)

2

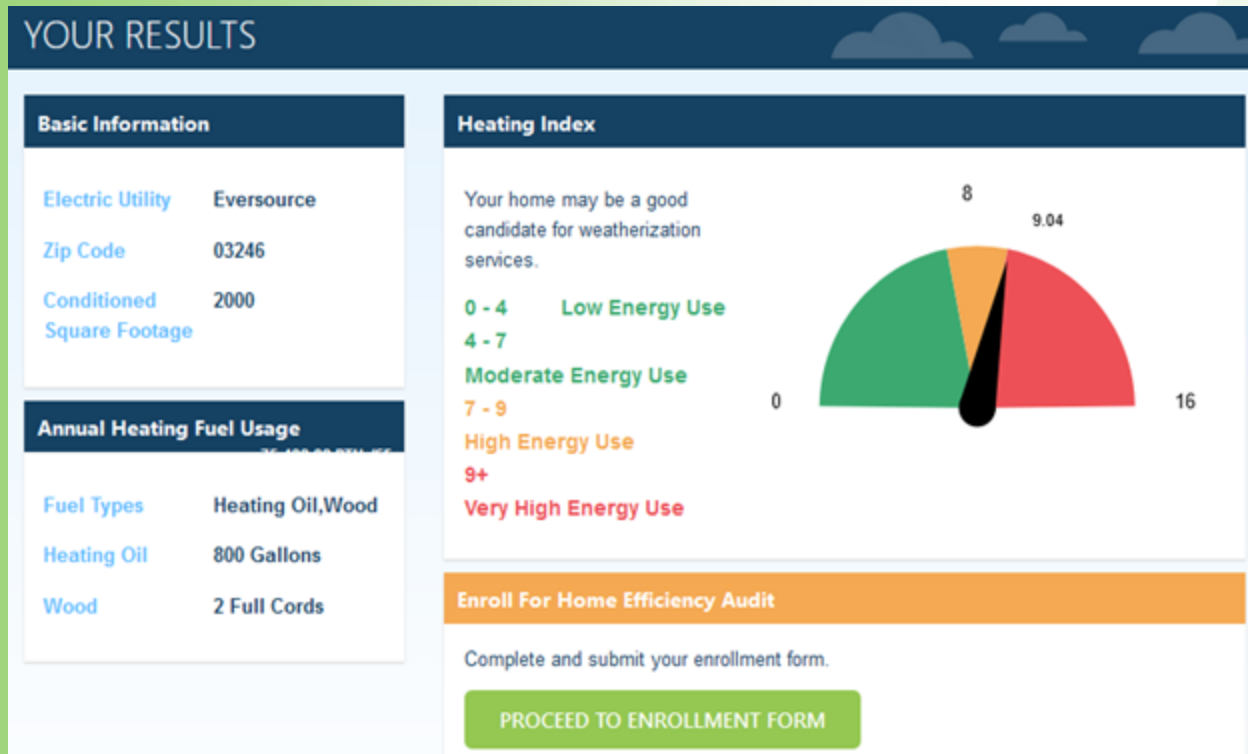
Wood Pellets (Tons)

Enter Usage Value

*If your home has electric heat, also enter monthly kilowatt-hours electricity usage.

NHSaves- Home Heating Index Calculator

If Home Heating Index Results Are High Enough* – Your Home Qualifies!



***Minimum HHI** values for full *NH Home Energy Performance* eligibility:

Eversource:	4
Liberty Electric:	10
Liberty Gas:	8
NHEC:	9
Unitil Electric:	8
Unitil Gas:	9

(As of January 2025. Qualification criteria may change)

**Even with lower HHI scores, you may still qualify for NHSaves programs, such as “HEP-lite.”

NHSaves Home Energy Performance Report

Sample NHSaves Home Energy Performance report with 75% utility cost-share up to \$6k; 100% for air sealing

Proposed Improvement	Total Cost	Utility Rebate	Customer Co-Pay	**		Customer Accepts
				Pay Back Period (years)	Customer Cost Savings (\$/year)	
Ancillary Savings - Boiler (1.0)	\$0.00	\$0.00	\$0.00	0.0	\$1.72	
Improve 660 sq ft of attic floor insulation from 3 inches to 18 inches.	\$2,844.01	\$2,133.01	\$711.00	4.9	\$144.32	
Non-energy saving measure (1.0)	\$425.74	\$0.00	\$425.74		\$0.00	
Reduce the house air leakage from 2287 CFM50 to 1500 CFM50.	\$580.80	\$580.80	\$0.00	0.0	\$343.62	
Improve 480 sq ft of floors from 0 inches insulation to 9 inches insulation	\$3,000.00	\$2,250.00	\$750.00	2.5	\$300.22	
Ancillary Savings - Central A/C (1.0)	\$0.00	\$0.00	\$0.00	0.0	\$9.93	
Improve 90 sq ft of rim joist from No insulation to High insulation	\$656.10	\$172.56	\$483.54	29.9	\$16.19	
Program Delivery/Audit Fee	\$863.64	\$863.64	\$0.00			
Customer Co-Pay Pre-Payment			-\$100.00			
Totals	\$8,370.29	\$6,000.00	\$2,270.29	2.8	\$816.00	

Total Eversource Rebate: \$6,000.00

Customer Co-Pay Balance: \$2,270.29

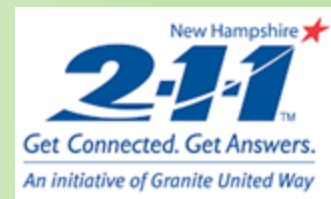
Weatherization & Fuel Assistance Programs (Income-Qualified)

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



Federal Inflation Reduction Act Tax Credits

In addition to NHSaves, 3 big energy efficiency programs for existing homes in the IRA:

(1) 25C Energy Efficient Home Improvement Tax Credit

- 30% tax credit for 2024+, with limits
- Equipment, installations, and services must meet US DOE criteria
- For homeowners' principal residence or renters
- Available NOW -- claim in 2025 on 2024 federal taxes

Examples of maximum tax credits:

Heat pumps, incl. hot water: \$2,000	Weatherization: \$1,200
Biomass stoves & boilers: \$2,000	Energy audits: \$150
Fossil fuel heaters: \$600	Windows: \$600

IRA's Electrification Rebates (HEAR)

(2) Home Electrification and Appliance Rebates (HEAR)

- [~June 2025 start date](#)- to be administered by NH Dept. of Energy
- Income-qualified occupants- using “Area Median Income” (AMI)
- Under 80% AMI: 100% rebates
- 80% - 150% AMI: 50% rebates
- Point-of-sale rebates up to \$14,000 for qualified installations, with limits
- For owned or rented residential units- using AMI of occupants*

*Example
max
rebates:*

Heat pumps: \$8,000	Weatherization: \$1,600
Heat pump hot water: \$1,750	Electric wiring: \$2,500
Electric range or HP dryer: \$840	Electric load center: \$4,000

*50+% occupants under 80% AMI: building qualifies

IRA's Home Efficiency Rebates

(3) Home Efficiency Rebates (HOMES)

- [Late 2025 start date](#)- to be administered by NH Dept. of Energy
- Whole home retrofit program- weatherization, potentially HVAC, etc.
- Emphasis on households under 80% AMI & disadvantaged communities
- For owned or rented residential units- using AMI of occupants
- *IRA rebate programs can be combined with IRA tax credits and NHSaves incentives!*

<i>(assuming modeled energy savings -- rebate specifics not finalized)</i>	<i>Rebate %</i>	<i>Max rebate w- 20-35% savings</i>	<i>Over 35% savings</i>
Under 80% AMI	100%	\$15,000	\$20,000
All higher incomes	100%	\$15,000	\$20,000

Summary

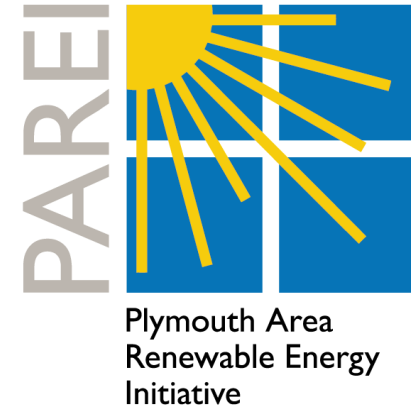
- Know about your energy use and savings opportunities
- Air seal first: A-B-C
- Add insulation where you can
- For expert work, work with a home performance professional
- Utilize NHSaves energy efficiency programs

NHsaves[®]
ButtonUP
your home | your comfort | your savings



Thank You

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



For a copy of the presentation please visit:
plymouthenergy.org/button-up
Support future workshops ...let your utility know.



EVERSOURCE

