How to Improve the Energy Efficiency of Your Home
NHSAVES Button Up Overview

- Energy Use and Savings Tips
- Staying Warm and Reducing Heating Costs
- Air Sealing A-B-C’s
- Insulation Options
- Addressing Health and Safety Concerns
- Working with Professionals
- NHSAVES Programs
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

- Space Heating 40%
- Water Heating 13%
- Refrigerators 7%
- Air Conditioning 3%
- Other 37%

Current NH energy fuel prices: [www.nh.gov/osi/energy/](http://www.nh.gov/osi/energy/)
Get to Know Your Energy Bills

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

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

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

Bill source: Eversource
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

- Read the appliance name plate and determine how many hours it is on: \( \text{Amps} \times \text{Volts} = \text{Watts} \)
# Major Household Electricity Uses

<table>
<thead>
<tr>
<th>Residential Electricity Use</th>
<th>Approximate Annual Kilowatt-hours</th>
<th>Potential for saving energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>1,200</td>
<td>***</td>
</tr>
<tr>
<td><em>Electric Water Heater</em></td>
<td>2,100</td>
<td>***</td>
</tr>
<tr>
<td>Refrigerators &amp; Freezers</td>
<td>1,050</td>
<td>***</td>
</tr>
<tr>
<td>Dehumidifiers</td>
<td>900</td>
<td>***</td>
</tr>
<tr>
<td><em>Electric Clothes Dryer</em></td>
<td>800</td>
<td>**</td>
</tr>
<tr>
<td>Entertainment Centers</td>
<td>650</td>
<td>*</td>
</tr>
<tr>
<td>Furnace Fans &amp; Boiler Pumps</td>
<td>400</td>
<td>*</td>
</tr>
<tr>
<td>Dishwasher &amp; Clothes Washer</td>
<td>350</td>
<td>**</td>
</tr>
<tr>
<td>Cooking</td>
<td>300</td>
<td>*</td>
</tr>
</tbody>
</table>

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

- Control with a smart power strip:

Available from the NHSaves Catalog
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”)
  - 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/rebates for appliance rebate forms
1. Heat always moves from Hot to Cold.
   - **Fact:** The heat inside our homes is always making its way through the building shell and heating the outdoors.
   - **Goal:** Slow this process down

2. Heat moves via three methods:
   - Conduction
   - Convection
   - Radiation
Building Science: 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

Quiz: Does “heat rise?”
   NO, but warm air does!
Air Sealing Priorities: A - B - C

- A – Attic (top of the building)
- B – Basement (bottom of the building)
- C – Center of the building
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
Air Sealing Opportunities in Basements and Crawl Spaces

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

Why not this?
More visible, but fewer air sealing opportunities

- Install or improve exterior door weatherstripping
  - “Q-lon” style door kits on exterior
  - Bottom of door sweeps
- Securely seal unused fireplaces
- Seal wall outlets with gaskets ~
- Seal around old pulley-hung windows
**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

![Diagram of a house with air flow paths and vents labeled.](image-url)
“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, CO₂ sensors, etc.
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
Conduction

The movement of heat through materials
Conductive Heat Loss and Insulation R-Values

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

Approximate R-values:  (if installed properly)
- Fiberglass  R-3.7 per inch
- Cellulose  R-3.6 per inch
- Rigid foam board  R-4 - R-7 per inch
- Spray foam  R-6 - R-7 per inch
- Double pane window  R-3 (new windows)
- Softwood  R-1.3 per inch
- 8” concrete wall  R-1 (for 8”!)

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

A new house built to the current 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

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

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

Photo: blown-in cellulose insulation
Framed Wall Insulation

Densepack cellulose air seals & insulates empty cavities

During installation, densepack tube is inserted into each cavity.

Professional installation recommended.

Image courtesy of Vermont Dept. of Children & Families
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
Heating System Recommendations

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

How Heat Pumps Work

How it Works:

1. **Summer operation**
   - Heat from the environment is used to cool the house.

2. **Winter operation**
   - Heat from the environment is used to heat the house.

(Graphics of heat pump condenser and heat pump cooling diagram are shown.)
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 hot water heaters

Go to NHSAVES.com for specific incentives

- Utility-specific
- Financing
- Funding availability
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
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

*Blower door tests now Energy Code-required*
Infrared Thermal Camera

- Visual images of hot and cold areas
- Helps sleuth insulation issues
- Used with a blower door to show air leakage pathways
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](http://www.repa-nh.org)
- NHSaves qualified residential contractors
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
- Low or no interest financing may be available
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
**Home Heating Index Results:** 8+  

### Your Results

<table>
<thead>
<tr>
<th>Basic Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Utility</td>
</tr>
<tr>
<td>Zip Code</td>
</tr>
<tr>
<td>Conditioned Square Footage</td>
</tr>
</tbody>
</table>

### Heating Index

- Your home may be a good candidate for weatherization services.

<table>
<thead>
<tr>
<th>Index</th>
<th>Energy Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>Low Energy</td>
</tr>
<tr>
<td>4 - 8</td>
<td>Moderate Energy</td>
</tr>
<tr>
<td>7 - 8</td>
<td>High Energy</td>
</tr>
<tr>
<td>8+</td>
<td>Very High Energy</td>
</tr>
</tbody>
</table>

**Annual Heating Fuel Usage** 75,400.00 BTUs/SF

<table>
<thead>
<tr>
<th>Fuel Types</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Oil, Wood</td>
<td>800 Gallons</td>
</tr>
<tr>
<td>Heating Oil</td>
<td>2 Full Cords</td>
</tr>
</tbody>
</table>

**Enroll For Home Efficiency Audit**

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

Button Up NH

[Proceed to Enrollment Form]
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
Summary

- Know about your energy use and savings opps.
- Air seal first: A-B-C
- Add insulation where you can
- Keep your home safe
- Utilize NHSAVES energy efficiency resources
Thank You

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

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