SAVE $$: DIY Home Energy Audit

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Energy Action Month Workshop

October 13, 2015

Outline

- **Jeopardy**
- **Home Utility Analysis**
- **DIY Home Energy Audit**
- **Resources, Rebates, and Incentives**
- **Case Studies**

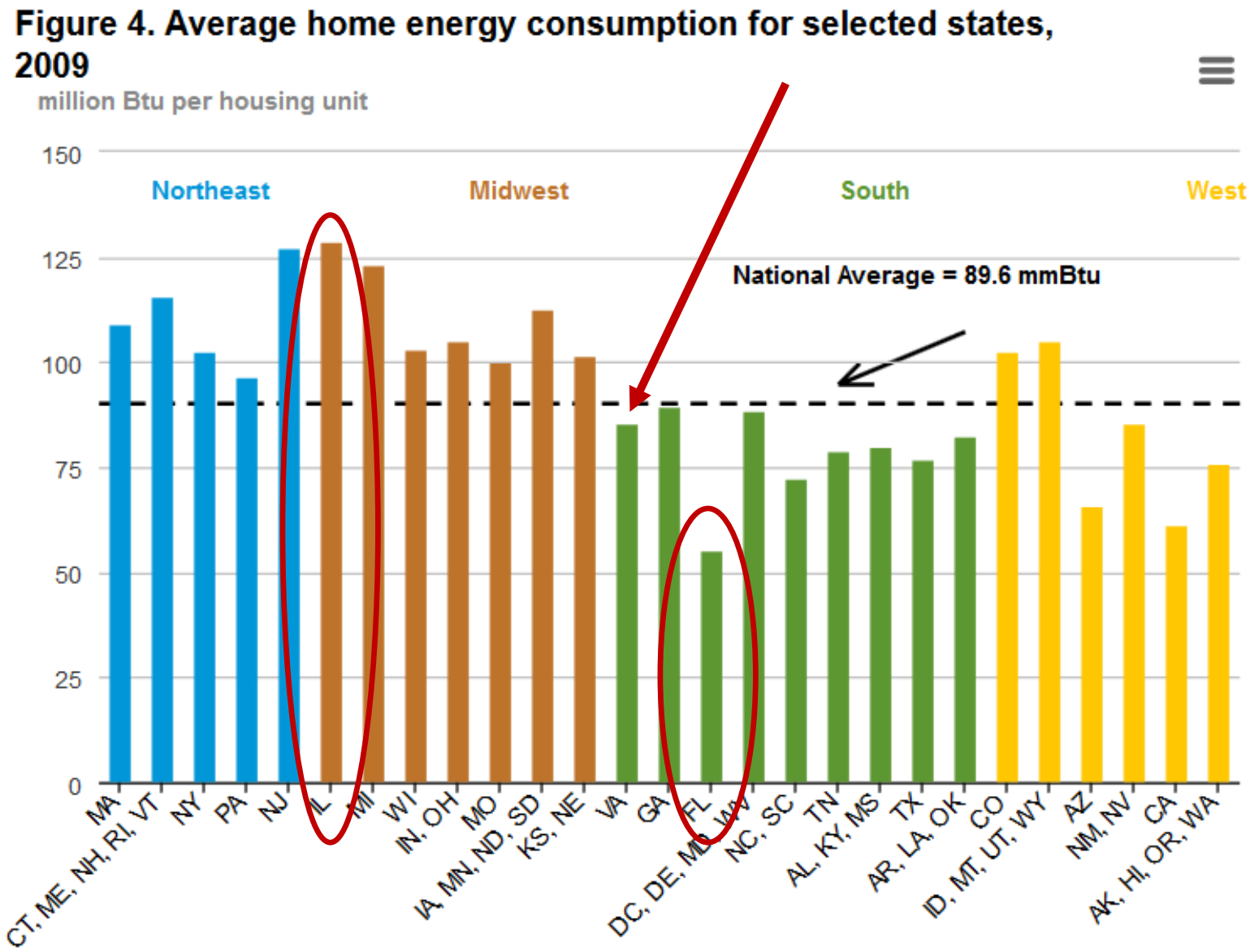
Jeopardy!

- **During this season, homes across the United States use more energy than at any other time of year.**
- **This state uses the least amount of energy in the US, compared to other states.**
- **This state uses the most amount of energy in the US, compared to other states.**

VA avg: 85.6 MBTU/year

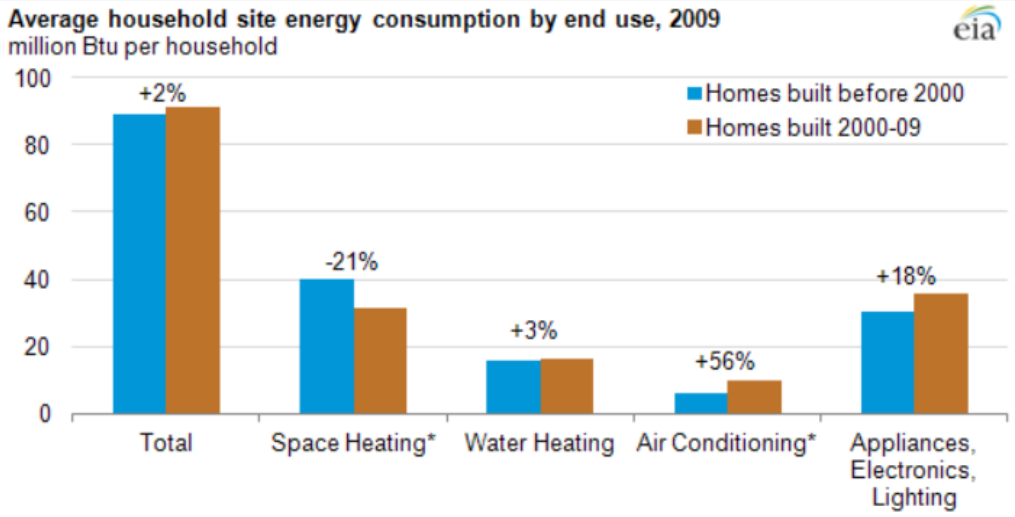
Joan's home: 88.4 Mbtu/yr

Accounting for area, my home uses 28% more energy per square foot



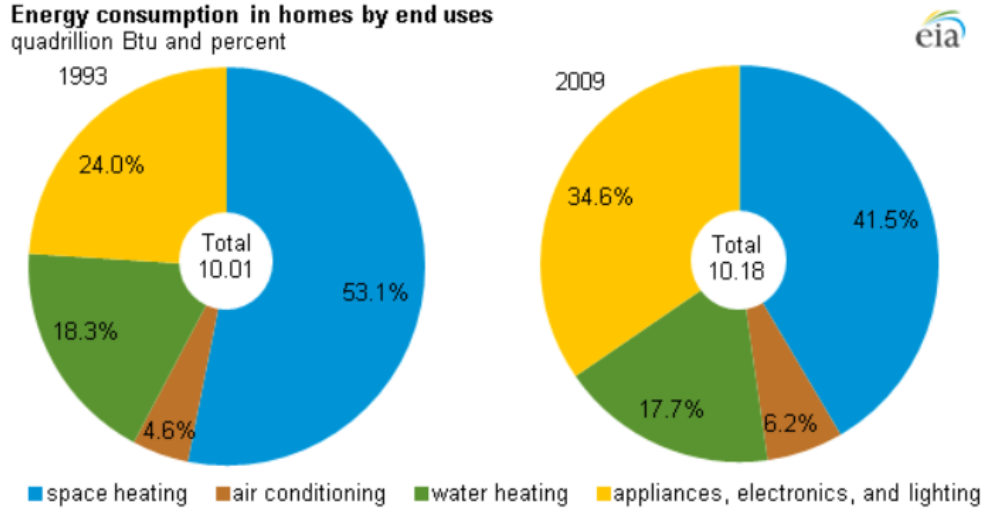
eia Source: Residential Energy Consumption Survey. Includes occupied primary housing units only.

Newer U.S. homes are 30% larger but consume about as much energy as old

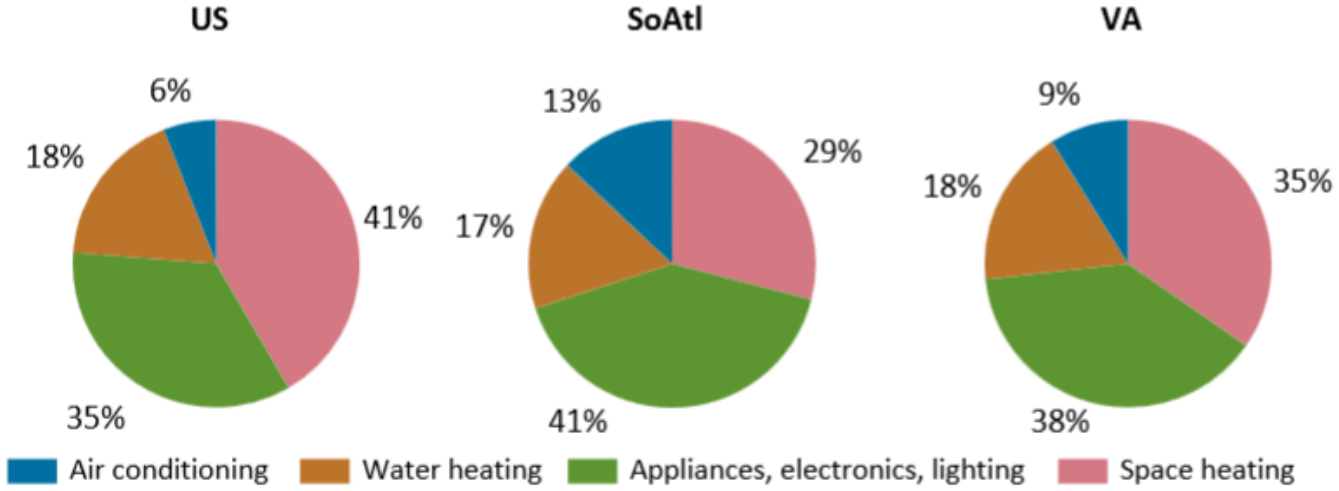


Source: U.S. Energy Information Administration, 2009 Residential Energy Consumption Survey

Heating and cooling no longer majority of U.S. home energy use



Source: U.S. Energy Information Administration, Residential Energy Consumption Survey.
Note: Amounts represent the energy consumption in occupied primary housing units.



CONSUMPTION BY END USE

While Virginia's weather is similar to the national average, residents use more energy for air conditioning (9%) and less energy for heating (35%) than is typical in other parts of the country.

Home Utility Analysis

Assessing Energy Use in the Home

Why start with utility bills?

Tells you how you compare, where you could be.

"I think you'll agree that this comparison, though unpopular, has some real merit."

ENERGY STAR®
Home Energy Yardstick

Assess the energy efficiency of your home and see how it measures up:

EPA's Home Energy Yardstick provides a simple assessment of your home's annual energy use compared to similar homes. By answering a few basic questions about your home, you can get:

- Your home's Home Energy Yardstick score (on a scale of 0 to 10);
- Insights into how much of your home's energy use is related to heating and cooling versus other everyday uses like appliances, lighting, and hot water;
- Links to guidance from ENERGY STAR on how to increase your home's score, improve comfort, and lower utility bills; and
- An estimate of your home's annual carbon emissions.

Learn more about how the Home Energy Yardstick works.

See a sample results page.

Getting Started:

To calculate your Yardstick score, all you need is some basic information about your home:

- Your ZIP code;
- Your home's square footage;
- Number of full time home occupants;
- A list of all the different fuels used in your home (e.g., electricity, natural gas, fuel oil); and
- Your home's last 12 months of utility bills (usually found in the 12 month summary provided on your bill or through a Green Button file).

https://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted

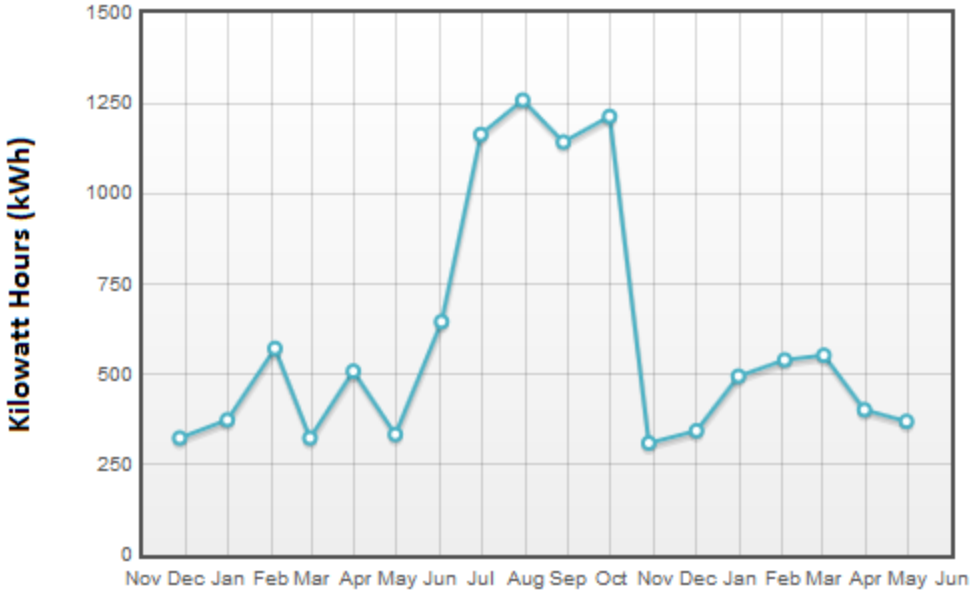
Export To Excel

Date	Meter Reading	Reading Details	CCFs	Therms	Days Used
04/15/2015	9083	Final	17	17	21
03/25/2015	9066	Actual	111	111	30
02/23/2015	8955	Actual	192	192	31
01/23/2015	8763	Actual	130	130	31
12/23/2014	8633	Actual	78	78	29
11/24/2014	8555	Actual	39	39	31
10/24/2014	8516	Actual	0	0	29
09/25/2014	8516	Actual	0	0	30
08/26/2014	8516	Actual	0	0	32
07/25/2014	8516	Actual	0	0	30
06/25/2014	8516	Actual	0	0	29
05/27/2014	8516	Actual	1	1	32
04/25/2014	8515	Actual	30	30	30
03/26/2014	8485	Actual	121	121	29
02/25/2014	8364	Actual	159	159	32
01/24/2014	8205	Actual	126	126	32
12/23/2013	8079	Actual	80	80	31
11/22/2013	7999	Actual	34	34	29
10/24/2013	7965	Actual	0	0	30
09/24/2013	7965	Actual	0	0	32
08/23/2013	7965	Actual	0	0	31
07/23/2013	7965	Actual	0	0	29
06/24/2013	7965	Actual	0	0	32
05/23/2013	7965	Actual	5	5	30

Meter Read Date	Days	Meter Reading Method	Meter Read	Usage (kWh)	Demand	Avg. Daily Usage
04/30/2015	30	AMR - MOBILE READ BY VAN	52415	370	0	12
03/31/2015	29	AMR - MOBILE READ BY VAN	52045	402	0	14
03/02/2015	28	AMR - MOBILE READ BY VAN	51643	553	0	20
02/02/2015	33	AMR - MOBILE READ BY VAN	51090	540	0	16
12/31/2014	30	AMR - MOBILE READ BY VAN	50550	495	0	17
12/01/2014	34	AMR - MOBILE READ BY VAN	50055	344	0	10
10/28/2014	28	AMR - MOBILE READ BY VAN	49711	310	0	11
09/30/2014	33	AMR - MOBILE READ BY VAN	49401	1214	0	37
08/28/2014	29	AMR - MOBILE READ BY VAN	48187	1143	0	39
07/30/2014	30	AMR - MOBILE READ BY VAN	47044	1259	0	42
06/30/2014	28	AMR - MOBILE READ BY VAN	45785	1164	0	42
06/02/2014	33	AMR - MOBILE READ BY VAN	44621	646	0	20
04/30/2014	30	AMR - MOBILE READ BY VAN	43975	334	0	11
Totals				8774.0		

Joan's home

My Energy Usage



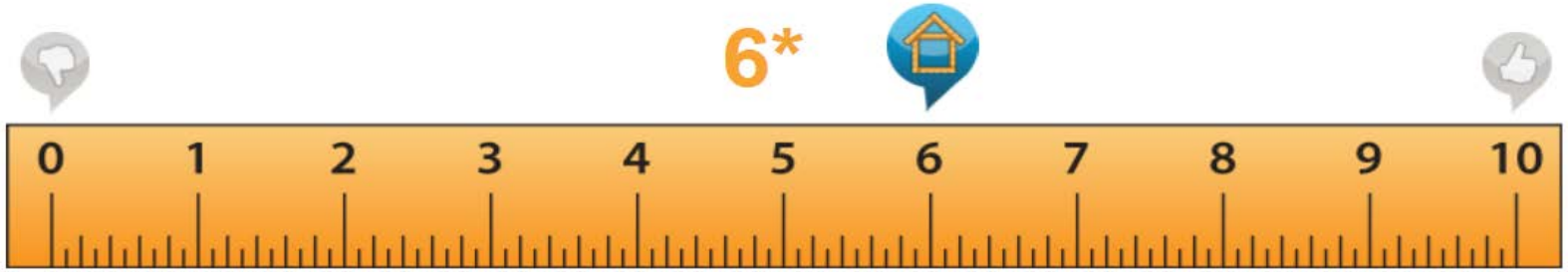
Ccf—equals the volume of 100 cubic feet (cf) of natural gas
MMBtu—equals 1,000,000 British thermal units (Btu) (One Btu is the heat required to raise the temperature of one pound of water by one degree Fahrenheit.)
Therm—One therm equals 100,000 Btu, or 0.10 MMBtu
Kilowatt hour (**kWh**) is a unit of energy equal to 1,000 watt-hours. Ex: A heater rated at 1000 watts (1 kilowatt), operating for one hour uses one kilowatt-hour (equivalent to 3.6 megajoules) of energy. A 40-watt light bulb operating for 25 hours uses one kilowatt-hour.

Joan's home

Your Score

April 2014 - March 2015

Share:

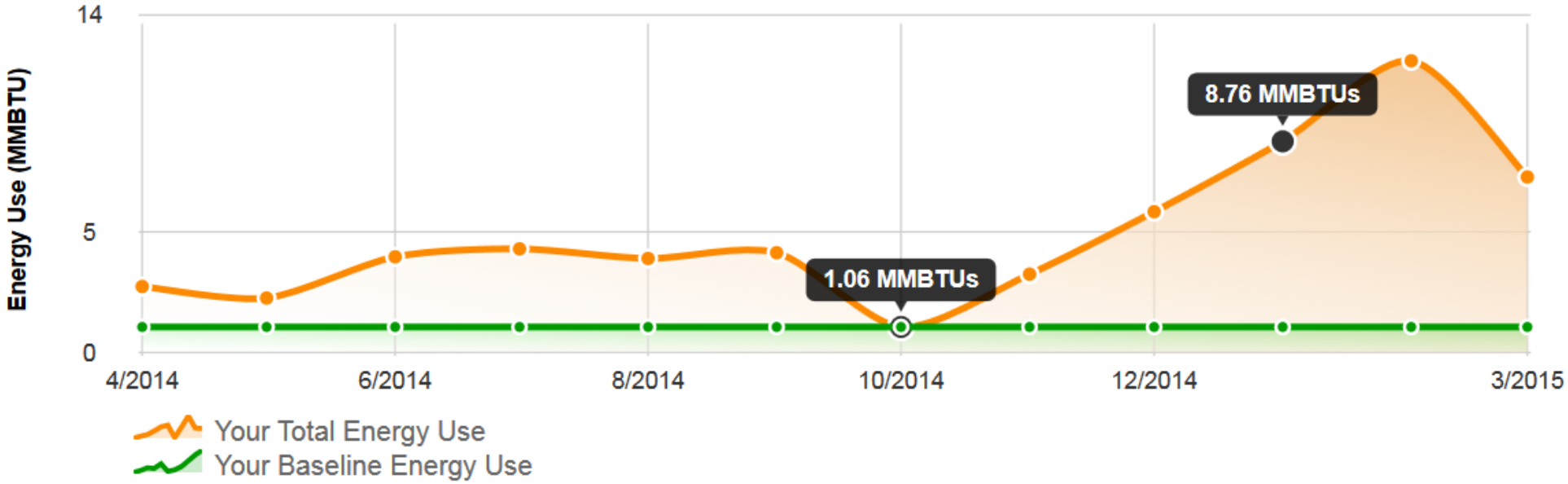


How do I Improve My Score?

Your Energy Use

Annual Electricity Use: 8404 kWh

Annual Natural Gas Use: 581 Therms



Todd's home

ENERGY STAR®
Home Energy Yardstick

Tell us about your home... | Enter your utility bill data... | Review your information... | That's it! Get your score!

Review Your Information

Print

Calculate My Score

Address:
Address Not Provided
Edit

Date Range: May 2014 - April 2015
Edit

My Monthly Data:
Edit

Billing Period	Electricity kWh	Natural Gas CCF
May 2014	523	6
June 2014	575	6
July 2014	921	5
August 2014	720	5
September 2014	797	5

ENERGY STAR®
Home Energy Yardstick

Print

EPA's Home Energy Yardstick compares your household's actual energy use to similar homes and assigns it a score from 0 to 10 (10 being the most energy efficient). An average household scores a 5.

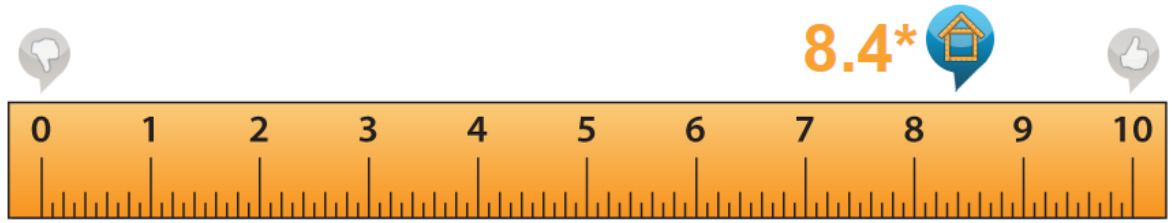
Your Home

Occupants: 4
Square Footage: 1,200
Fuel Types: Electricity, Natural Gas

Your Score

Share:

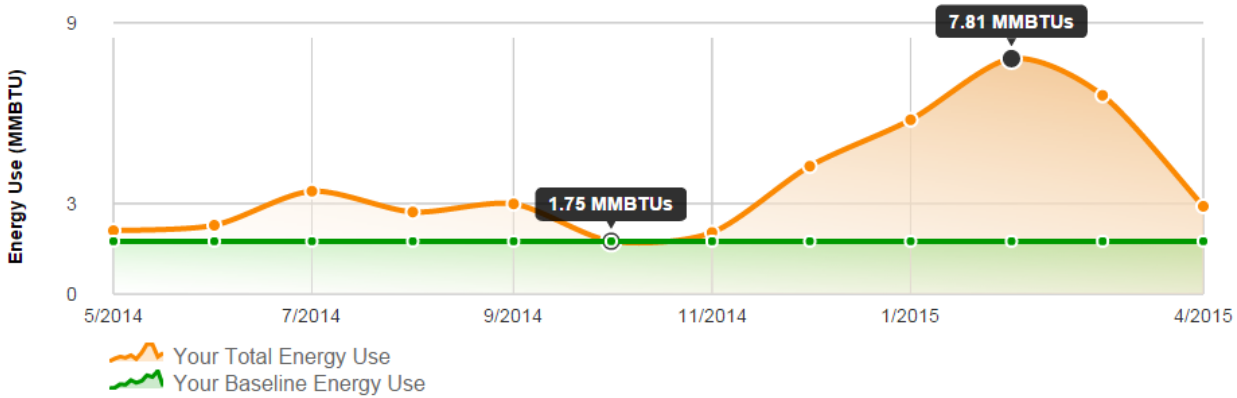
May 2014 - April 2015



How do I Improve My Score?

Monthly Energy Use

What does this graph tell me? (408KB)



ENERGY STAR **HOME** ADVISOR

Are you ready to increase your home's energy efficiency and all-around comfort? With the ENERGY STAR® Home Advisor, you can create a profile of your home's energy efficiency features and get a prioritized list of energy-saving recommendations customized to your home.

My ENERGY STAR highlights

RECENT ACTIVITY
0 items on your to do list
0 completed items

READY FOR YOU
N/A available

RETURNING? SIGN IN HERE

SAVE YOUR PROGRESS

MY ENERGY STAR **CREATE** ACCOUNT

Thank you for your interest in creating your own My ENERGY STAR account where you can track all your actions and impact and get access to special deals.

My ENERGY STAR highlights

RECENT ACTIVITY
0 items on your to do list
0 completed items

READY FOR YOU
N/A available

Email (Username): Confirm Email:

Password: Confirm Password:

Create a password that is at least 8 characters long and includes at least three of the following: lowercase letters, uppercase letters, numbers and/or special characters (such as *, #, %, etc.).

First Name: Last Initial: Zip Code:

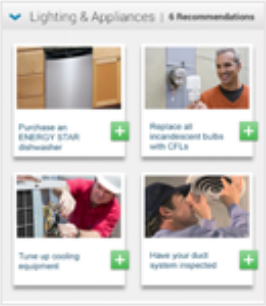
https://www.energystar.gov/campaign/assessYourHome

Home Advisor in three simple steps

Create your home's energy profile.

Let the Home Advisor walk you through creating your comprehensive home profile. Don't have all the information right now? That's ok; you can always come back.

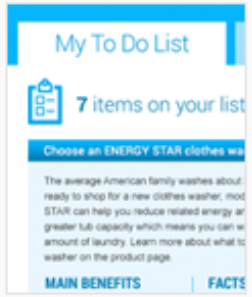
- GUIDED SETUP
- ALL YOUR ENERGY INFO IN ONE PLACE
- ADD YOUR OWN NOTES



Get custom recommendations.

Using your home's unique profile, the Home Advisor gives you prioritized recommendations for improving energy efficiency.

- THE LATEST ENERGY STAR INFORMATION
- PRIORITIZED FOR YOU
- DRIVEN BY YOUR DATA



Improve your home's efficiency.

Build your list of improvements and track your progress. Update your home's profile and view the latest recommendations.

- INTEGRATED WITH MY ENERGY STAR TO-DO LIST
- EASILY UPDATE YOUR PROFILE

Profile | Recommendations

Review and Edit Your Home Profile

The ENERGY STAR Home Advisor is designed to help you complete a basic review of the energy efficient features of your home, build an ENERGY STAR Home Profile, and get customized and prioritized recommendations for improvements to increase efficiency and comfort. If you want help, consider hiring a home energy auditor. See how the Home Advisor works.

Norfolk, VA
23509

My Home Basics

Not Started

Basic information about your home, including house size and type, year built, and fuels used for heating and cooling.

Minimize

GENERAL BUILDING: EDIT

Building Type:
Year Built:
Year Occupied:
Conditioned Square Footage:
Foundation Type:
Fuels Used:
Renewables in Use:
Occupants:
Additional Features:
Programmable Thermostat:

CERTIFICATIONS OR RATINGS:

NOTES:

Add some notes!

Todd's home

Profile | Recommendations

Review and Edit Your Home Profile

The ENERGY STAR Home Advisor is designed to help you complete a basic review of the energy efficient features of your home, build an ENERGY STAR Home Profile, and get customized and prioritized recommendations for improvements to increase efficiency and comfort. If you want help, consider hiring a home energy auditor. See how the Home Advisor works.

My Home Basics

Fully Complete

Basic information about your home, including house size and type, year built, and fuels used for heating and cooling.

View/Edit Profile

Utility Bills (Home Energy Yardstick)

Partially Complete

Assess the energy efficiency of your home based on your utility bills and see how it measures up.

View/Edit Profile

Lighting & Appliances

Fully Complete

Age and efficiency of products in your home.

View/Edit Profile

Building Envelope

Partially Complete

Air tightness and insulation levels as well as the efficiency of windows and doors.

View/Edit Profile

Heating & Cooling

Fully Complete

Type and efficiency of your home's HVAC system and hot water heater.

View/Edit Profile

Other Home Features

View/Edit Profile

Information on any renewable systems in your home and other features of your home you want to highlight.

Profile | Recommendations

Recommendations Based on Your Home Profile

We've used the information you provided through the ENERGY STAR Home Advisor to generate these customized and prioritized recommendations. You can improve these recommendations by completing your Home Profile and updating it when you finish improvement projects. You may also want to consider hiring a professional home energy auditor to perform a thorough assessment of your home.

Your Home Profile is 91% Complete.

91%

12 total recommendations

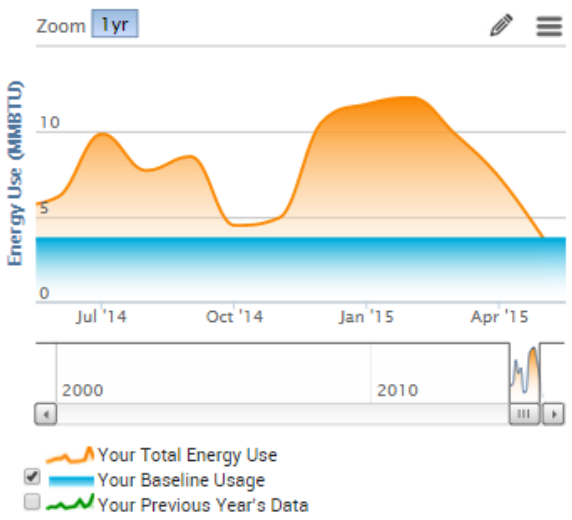
Want to improve your recommendations?

Complete your home profile

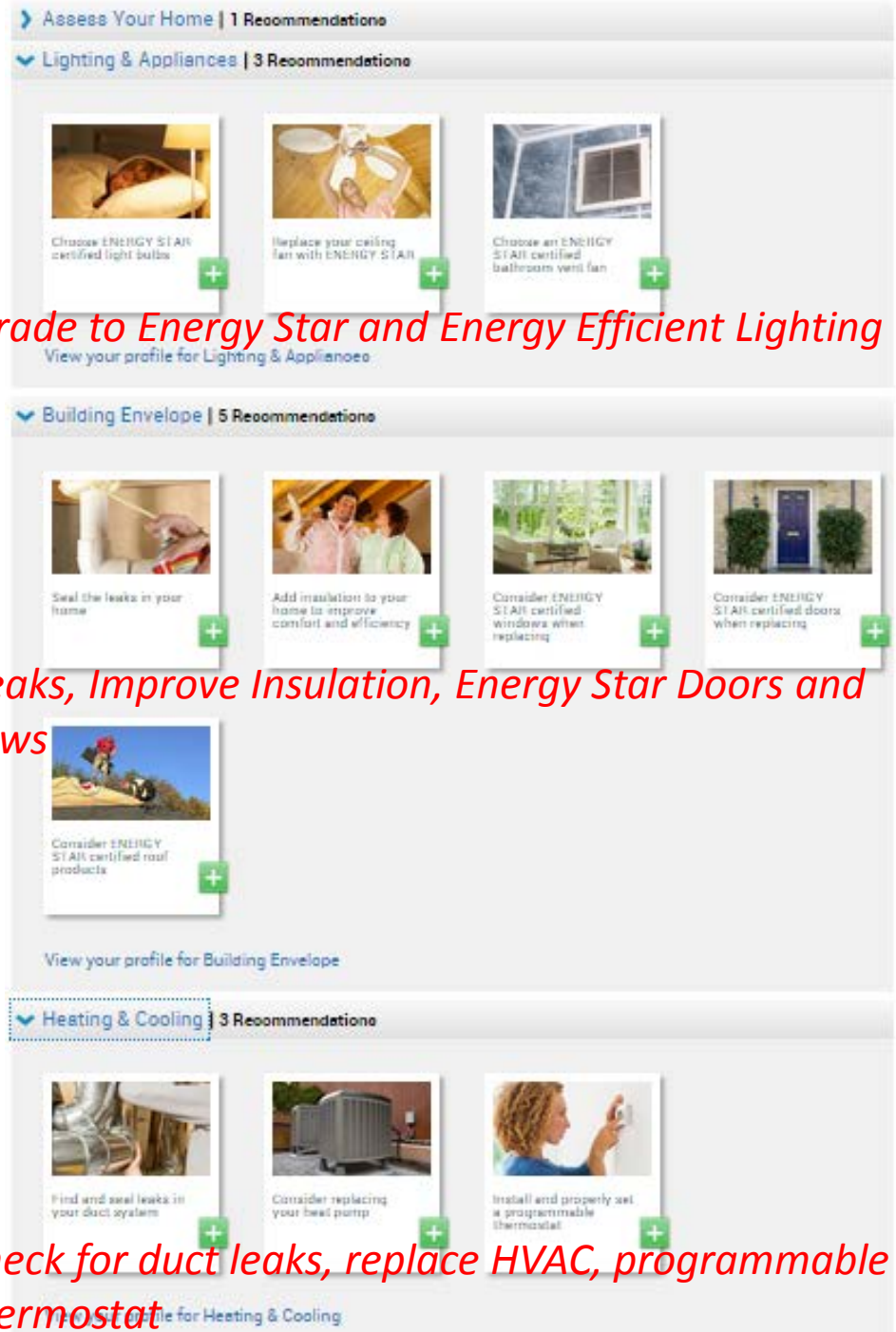
- Assess Your Home | 1 Recommendations
- Lighting & Appliances | 3 Recommendations
- Building Envelope | 5 Recommendations
- Heating & Cooling | 3 Recommendations

Your Annual Energy Use

Electricity: 9,033 kWh



Todd's home



Upgrade to Energy Star and Energy Efficient Lighting

Seal Leaks, Improve Insulation, Energy Star Doors and Windows

Check for duct leaks, replace HVAC, programmable thermostat

Good and Bad of Todd's Home Score

GOOD

- Smaller home (1,200 ft^2)
- Natural Gas Appliances
- Natural Gas Tankless Water Heater
- HE, Energy Star Washer/Dryer
- Energy Star Refrigerator
- Energy Star Dishwasher
- 12 SEER Trane 1200 XL (older model, efficient for its time)
- Manually adjust HVAC when we leave for the day
- LEDs in all lamp fixtures

BAD

- No insulation in crawlspace under living space floor
- Attic Hatch in hallway with thermostat, not well insulated
- No Programmable Thermostat
- No shade or curtains in den(sun room)
- No shade or curtains in half bath
- Poor/no insulation in exterior walls (1953 construction)
- Inadequate attic insulation
- Back Door not well sealed
- 12 SEER Trane 1200 XL (older model, efficient for its time)

DIY Home Energy Audit

Tips and Tools

DIY Home Energy Audit – What to Look For

- Check for Air Leaks
- Check Insulation
- Inspect Heating & Cooling Equipment
- Lighting
- Appliances and Electronics
- Professional Home Energy Audit

IT'S A PROGRAM ON CONSERVING ENERGY.

Check for Air Leaks

Locate Air Leaks

First, make a list of obvious air leaks (drafts). The potential energy savings from reducing drafts in a home may range from 5% to 30% per year, and the home is generally much more comfortable afterward.

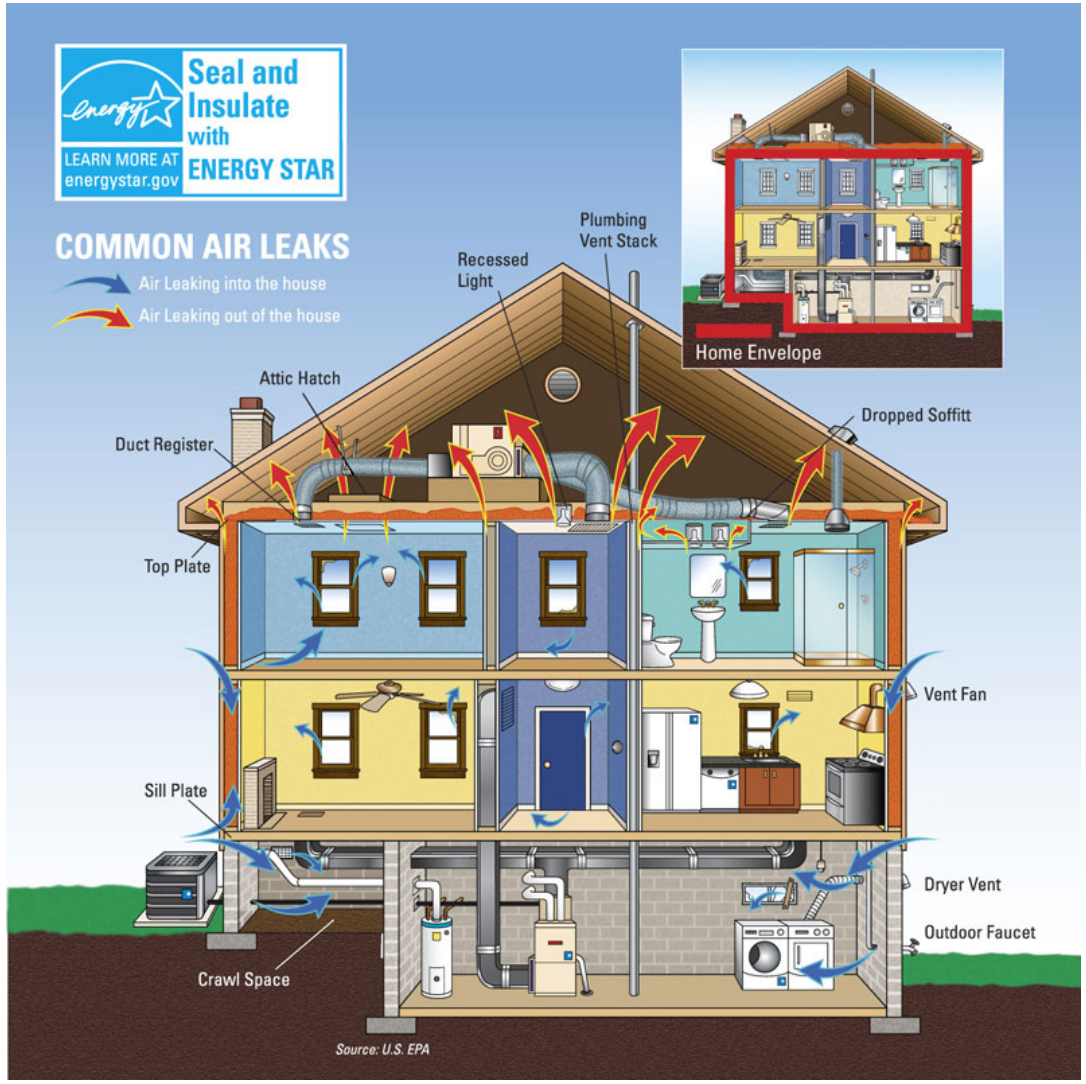
Check for indoor air leaks, such as gaps along the baseboard or edge of the flooring and at junctures of the walls and ceiling. Also check for leaks on the outside of your home, especially in areas where two different building materials meet.

Seal Air Leaks

Plug and caulk holes or penetrations for faucets, pipes, electric outlets, and wiring

Look for cracks and holes in the mortar, foundation, and siding, and look for leaks around windows and doors.

Seal them with the appropriate material.



http://energy.gov/energysaver/articles/do-it-yourself-home-energy-audits

Check Wall Insulation

- Select an exterior wall and turn off the circuit breaker. Once you are sure your outlets are not getting any electricity, remove the cover plate from one of the outlets and gently probe into the wall with a thin, long stick or screwdriver. A plastic crochet hook is particularly suited, as it will retrieve small bits of any insulation material for easy identification.
- You could also make a small hole in a closet, or in some other unobtrusive place to see what, if anything, the wall cavity is filled with. Ideally, the wall cavity should be totally filled with some form of insulation material.

TYPE	WHAT IS IT?	WHERE DOES IT GO?	WHY DO YOU NEED IT?	DIY TIPS
BATTING	Glass fibers in puffy strips with or without a paper face.	Attics, walls, and between crawl space joists.	Stop heat loss into your attic. Wall insulation keeps out cold.	Don't compress or flatten the batting. It reduces the R-value.
BLOWN-IN	Loose cellulose or fiberglass that's blown into attics.	Attics and some walls where there's no existing insulation.	Loose insulation fills in around odd shapes and cavities.	Ask a Lowe's associate about blowers to rent or borrow.
SPRAY FOAM	Expanding foam enlarges as it cures; other types cure in the shape they're sprayed.	Where pipes or wires enter a house and around windows where batting can't reach.	Plugs hard-to-fill gaps.	Non-expanding foam around windows and doors prevents bowing the frames.
RIGID FOAM	Sheets of extruded or expanded polystyrene.	Tuck between joists above the basement or crawlspace.	Foam boards insulate while providing a partial vapor barrier.	Seal rigid foam panels between foundation joists using spray foam.
SPECIALTY	Pipe insulation, duct insulation, and water heater jackets.	Around objects that store or distribute hot water and indoor air.	Keeps water hot; insulates ducts that pass through cold attics.	Insulate pipes wherever condensation is a problem.

http://www.lowes.com/cd_Selecting+New+Home+Insulation_1265655714_

Check Crawlspace/Basement Insulation

- If your basement or crawlspace is unconditioned and open to the exterior, determine whether there is insulation under the living area flooring. In most areas of the country, an R-value of 25 is the recommended minimum level of insulation.
- If the basement is intentionally conditioned, the foundation walls should also be insulated to at least R-19.

8.5 INSULATION Picture 1 Typical Loose Insulation

http://www.low-e.com/crawl_space.html

Check Attic/Attic Door Insulation

- Check attic insulation between living space and attic. Measure Thickness. If < R30 (i.e. 11 in of fiberglass batting), you could benefit by adding more
- If the attic hatch is located above a conditioned space, check to see if it is at least as heavily insulated as the attic, is weather stripped, and closes tightly.
- In the attic, determine whether openings for items such as pipes, ductwork, and chimneys are sealed.
- While you are inspecting the attic, check to see if there is a vapor barrier under the attic insulation.
- Make sure that the attic vents are not blocked by insulation. You also should seal any electrical boxes in the ceiling with flexible caulk (from the living room side or attic side) and cover the entire attic floor with at least the current recommended amount of insulation.

http://www.instructables.com/id/Attic-Stair-Cover/

Inspect Heating & Cooling Equipment

- Inspect heating and cooling equipment annually, or as recommended by the manufacturer.
- If you have a forced-air furnace, check your filters and replace them as needed. Generally, you should change them about once every month or two, especially during periods of high usage.
- Have a professional check and clean your equipment once a year.
- If the unit is more than 15 years old, you should consider replacing your system with one of the newer, energy-efficient units. A new unit would greatly reduce your energy consumption, especially if the existing equipment is in poor condition.
- Check your ductwork for dirt streaks, especially near seams. These indicate air leaks, and they should be sealed with a duct mastic. Insulate any ducts or pipes that travel through unheated spaces. An insulation R-Value of 6 is the recommended minimum.

11.4 DUCTWORK Picture 1 Hole in Duct at Crawl Space Door

11.4 DUCTWORK Picture 2 Separated Duct Connection at Trunk

Inspect Heating & Cooling Equipment

Common Air Conditioner Problems

Your unit isn't cooling properly

Refrigerant

Your refrigerant could be low or leaking. Call a trained technician to repair the leak and recharge the system.

Sensor Problems

If you have a window unit, the thermostat sensor could be knocked out of position. Carefully bend the wire holding it in place to properly position it.

Thermostat Issues

Check your thermostat to make sure it is set properly and it is reading the correct temperature.

Drainage Problems

Check your unit's drain to make sure it isn't clogged.

Dirty Filter

A clogged filter restricts airflow through the unit, decreasing its efficiency and reducing its ability to effectively cool the air.

Your unit isn't turning on

Electric Control Failure

Your compressor and fan controls could be worn out from having your system turn off and on too frequently. Contact a professional to check your unit's electrical connections.

Thermostat

Make sure your thermostat is working -- it might need new batteries or might need to be replaced entirely.

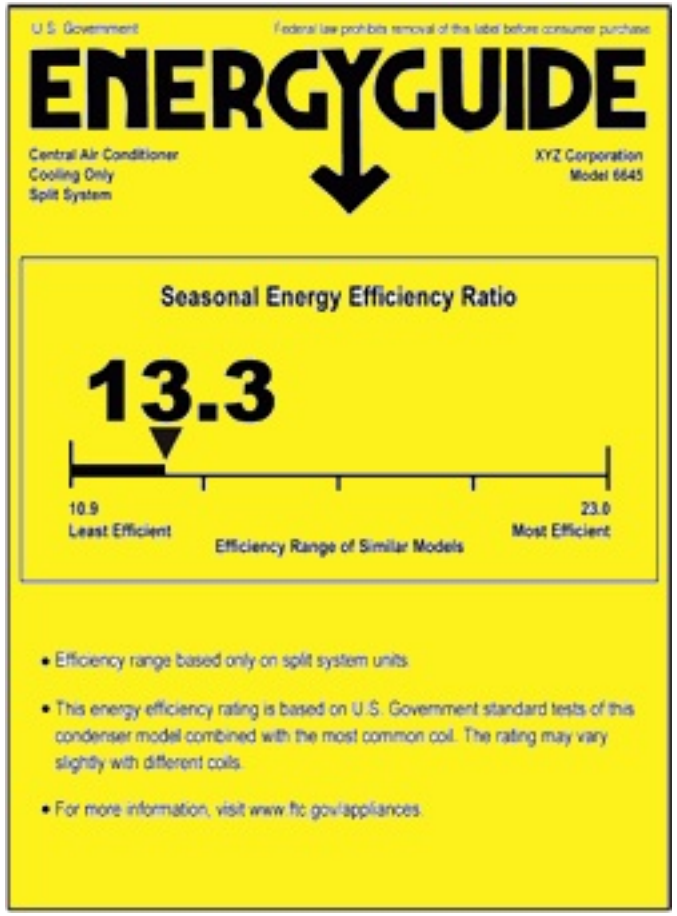
Limited airflow

Ductwork Problems

Your ducts could be leaking air or be clogged or constricted. Work with a professional to clean and air seal your ducts.

Dirty Filter

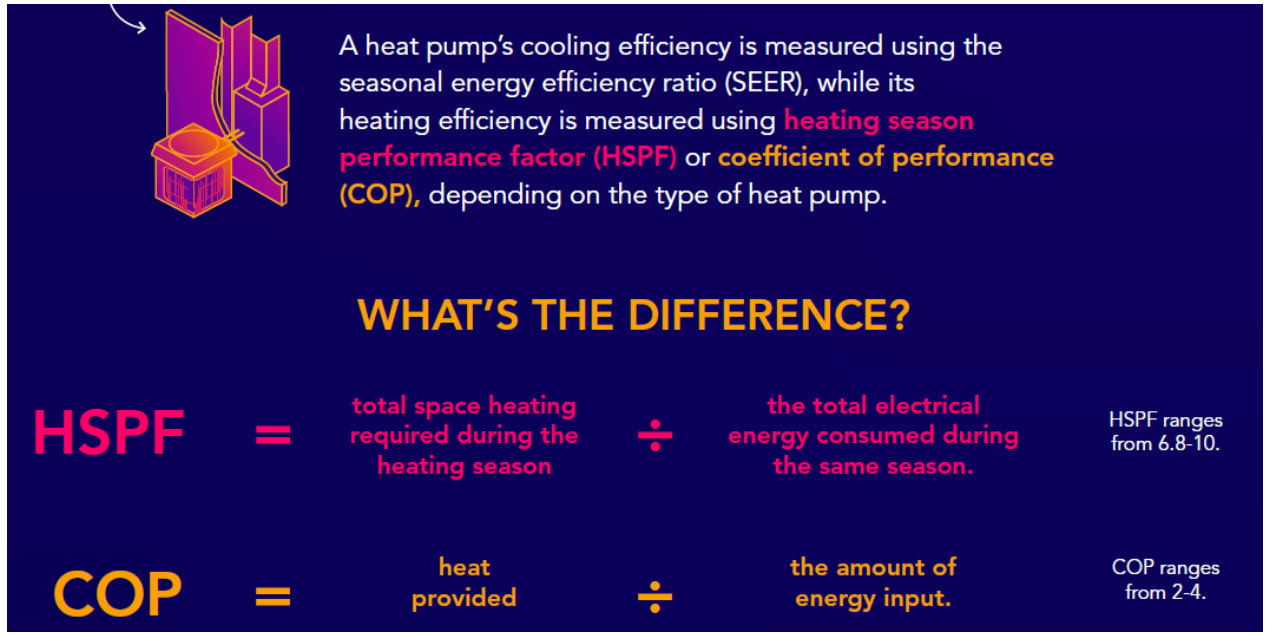
A clogged filter restricts airflow through the unit, decreasing its efficiency and reducing its ability to effectively cool the air.



http://energy.gov/articles/energy-saver-101-infographic-home-cooling

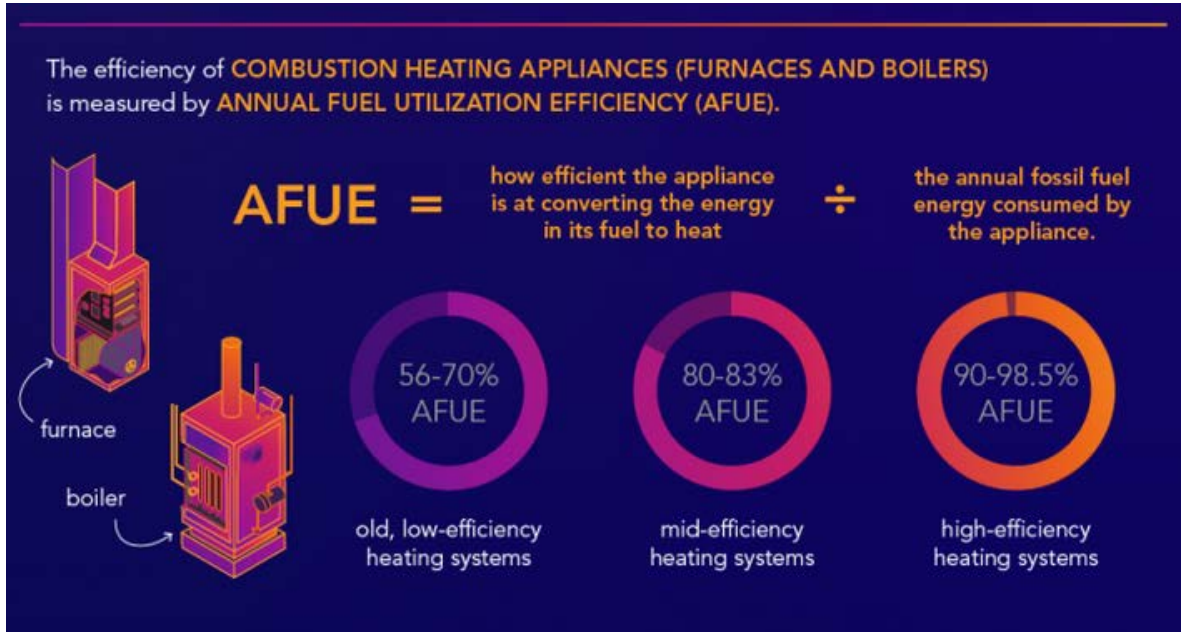
Inspect Heating & Cooling Equipment

Heat Pump



http://energy.gov/articles/energy-saver-101-infographic-home-heating

Furnace/Boiler

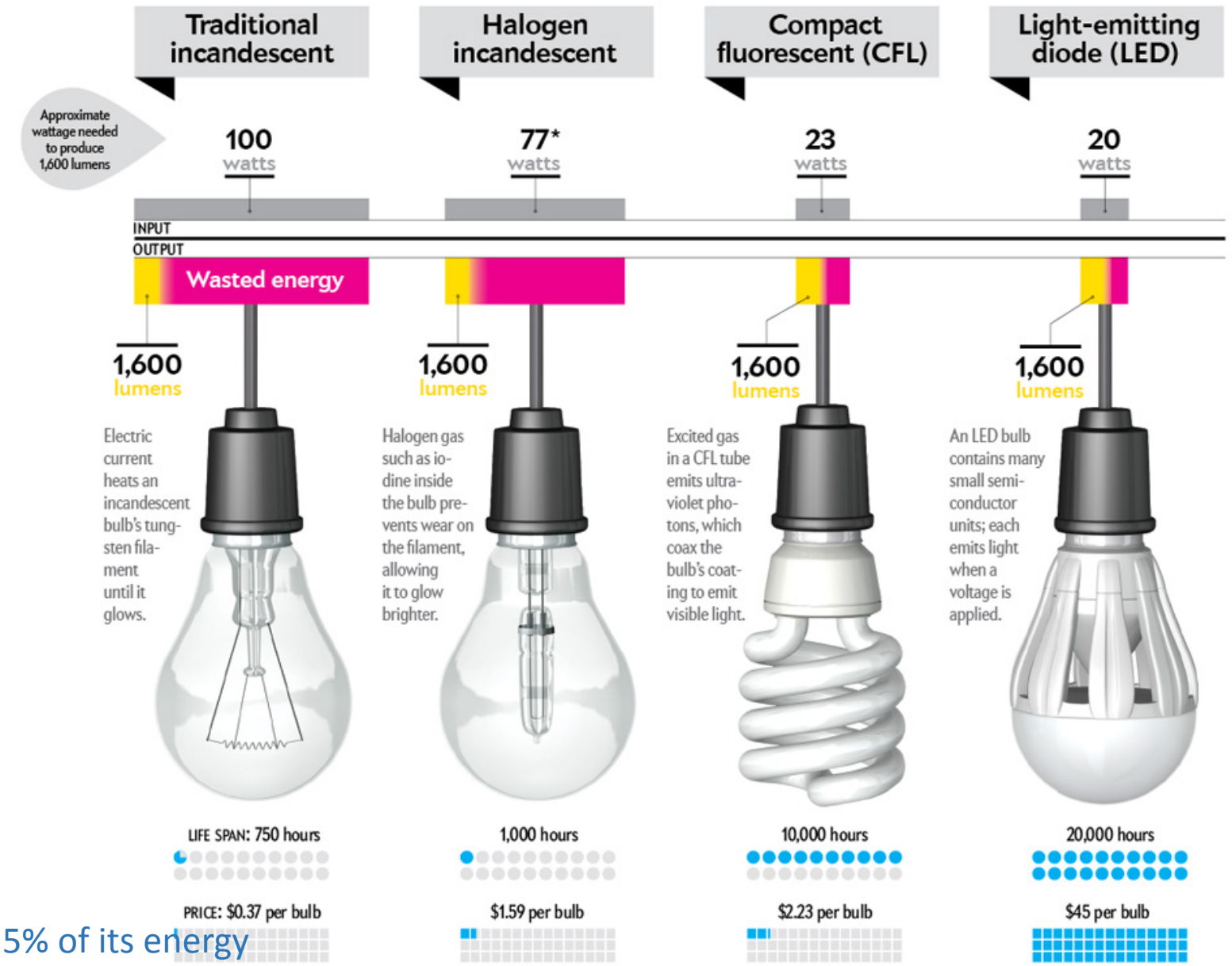


Lighting

Halogen incandescent light bulbs are simply energy-efficient incandescent bulbs and can last up to three times longer than traditional incandescent light bulbs.

CFL Bulbs. CFL bulbs last about 10 times longer and use about one-fourth the energy of traditional incandescent bulbs. A typical CFL can pay for itself in energy savings in less than 9 months and continue to save you money each month.

LEDs: LED bulbs offer similar light quality to traditional incandescents, last 25 times as long, and use even less energy than CFLs.



www.scientificamerican.com

An average household dedicates about 5% of its energy budget to lighting. Switching to energy-efficient lighting is one of the fastest ways to cut your energy bills.

Cree 9.5-watt (60w) LED Light Bulb * 6 Pack * - Soft/warm White (2700

by Cree

532 customer reviews | 42 answered questions

List Price: ~~$74.00~~
Price: $54.99 Prime
You Save: $19.01 (26%)

Note: Available at a lower price from other sellers, potentially without free Prime shipping.

Only 8 left in stock.
Sold by SANTAORNAMENTS and Fulfilled by Amazon. Gift-wrap available.

Want it tomorrow, June 17? Order within **5 hrs 18 mins** and choose **One-Day Shipping** at checkout. Details

Size: **6 pack**

4 pack	6 pack
$33.00 Prime	$54.99 Prime

- Dimmable With Standard Dimmers
- Instant Full Brightness
- All Around Light Distribution
- No Toxic Mercury Or Lead
- Safety Coated Glass

› See more product details

21 new from $46.99 5 used from $42.00

Feit Electric - 60 Watt Replacement - Omni Directional - LED Dimmable - 3 Pack (144799)

by Feit Electric

124 customer reviews | 16 answered questions

Price: $18.60 ($6.20 / Pack) Prime

Note: Available at a lower price from other sellers, potentially without free Prime shipping.

In Stock.
Sold by ecobeam and Fulfilled by Amazon. Gift-wrap available.

Want it tomorrow, June 17? Order within **9 hrs 17 mins** and choose **One-Day Shipping** at checkout. Details

- 3 Pack - Feit Electric
- 60 Watt Replacement - Uses 9.6 Watts
- Omni Directional - LED Dimmable
- Lasts over 22 Years
- Soft White - 2700k - Instant On

› See more product details

44 new from $9.51

Father's Day Deals and Gifts
› Shop now

TCP LA1027KND6 LED A19 - 60 Watt Equivalent Soft White (2700K) Light Bulb - 6 Pack

by TCP

942 customer reviews | 56 answered questions

List Price: ~~$59.99~~
Price: $31.70 ($5.28 / bulb) & **FREE SHIPPING**
You Save: $28.29 (47%)

Note: Not eligible for Amazon Prime. Available with free Prime shipping from other sellers on Amazon.

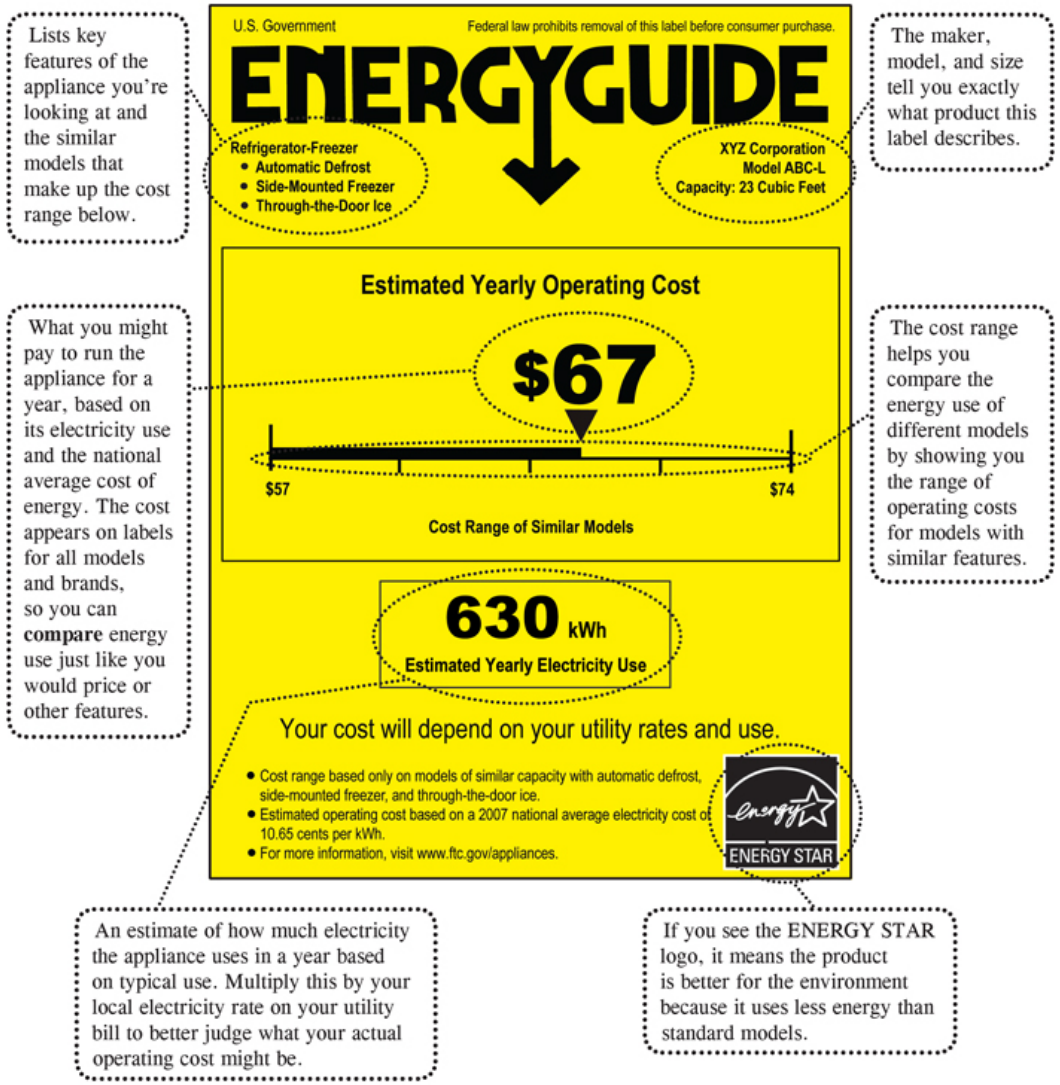
In Stock.
Ships from and sold by Solicom Ltd.

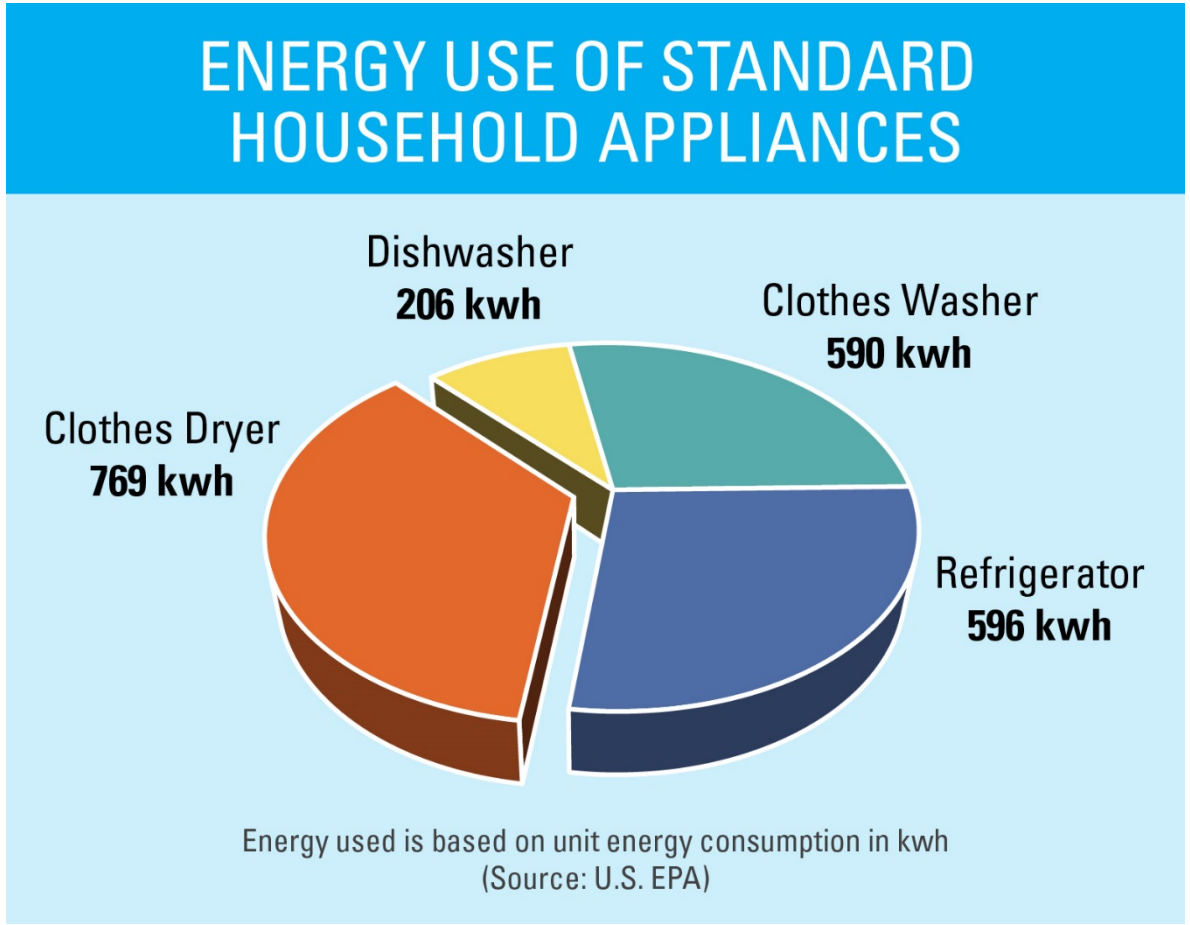
Estimated Delivery Date: June 22 - 25 when you choose Standard at checkout.

Style: **Soft White - 6 Pack**

Daylight 1 - Pack $7.97 Prime	Soft White 1 - Pack $7.49 Prime	Daylight - 2 Pack, Dimmable $18.99 ($9.50 / bulb) Prime	Soft White - 2 Pack, Dimmable $13.03 ($6.52 / bulb)
Soft White - 3 Pack $21.62 ($7.21 / Bulb) Prime	Daylight - 6 Pack $43.20 ($7.20 / bulb) Prime	Soft White - 6 Pack $31.70 ($5.28 / bulb)	

Appliances & Electronics





(Compare to cost per kwh (Ex: Dominion Power cost of .14 per kwh))

http://www.consumer.ftc.gov/articles/0072-shopping-home-appliances-use-energyguide-label

Professional Home Energy Audit

- **Dominion's Home Energy Check-Up** offers incentives for the installation of a variety of energy saving measures, including: compact florescent light bulbs, efficient faucet aerators and showerheads, replacement air filters for air conditioners, door weather-stripping, and smart outlet strips.
- The average one-time incentive is approximately $230, based on the number of energy saving measures installed during the visit.
- *Note: One audit per location.*
- Contact a local, participating contractor
- On the day of the Home Energy Check-Up the contractor will do the following:

* Perform a 2-3 hour walkthrough of your home

* Upon completion of the Home Energy Check-Up, the contractor will generate a personalized report that recommends certain direct install measures that can be completed the day of the check-up and are eligible for rebates as well as project more advanced savings opportunities you can also take advantage of.

Resources, Rebates & Incentives

Federal, State and Local Incentives for Residential Energy Upgrades

DSIRE® | NC CLEAN ENERGY TECHNOLOGY CENTER

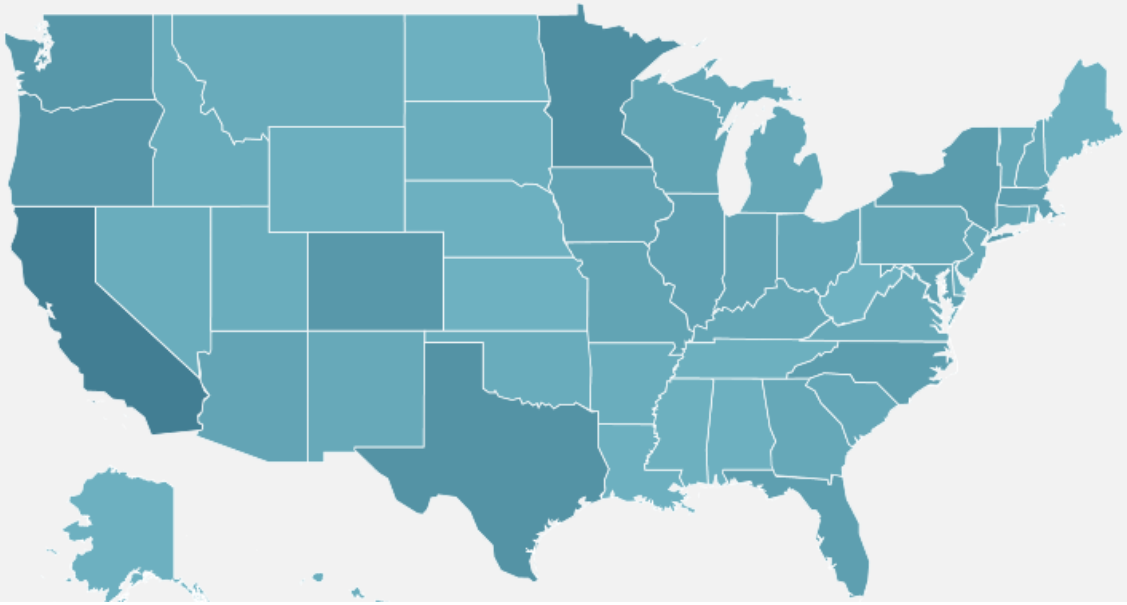
Home Programs Resources Help/Support About Us Contact Us Legal Notice

Database of State Incentives for Renewables & Efficiency® - DSIRE

Database of State Incentives for Renewables & Efficiency®

Find Policies & Incentives Near You | Zip Code | Search

Find Policies & Incentives by State



Database of State Incentives for Renewables & Efficiency® - DSIRE

Database of State Incentives for Renewables & Efficiency®

Find Policies & Incentives Near You | Zip Code | Search

Residential Renewable Energy Tax Credit	US	Financial Incentive	Personal Tax Credit	08/10/2005	05/13/2015
Residential Energy Efficiency Tax Credit	US	Financial Incentive	Personal Tax Credit	01/10/2006	12/22/2014
Income Tax Deduction for Energy-Efficient Products	VA	Financial Incentive	Personal Tax Deduction	09/28/2010	11/07/2014
Residential Energy Conservation Subsidy Exclusion (Personal)	US	Financial Incentive	Personal Tax Exemption	03/05/2002	02/16/2015
Local Option - Residential Property Tax Exemption for Solar					
Local Option - Property Tax Assessment for Energy Efficient Buildings	VA	Financial Incentive	Property Tax Incentive	06/24/2008	11/07/2014
Commercial Solar Property Tax Exemption	VA	Financial Incentive	Property Tax Incentive	07/03/2014	11/07/2014
Local Option- Renewable Energy Machinery and Tools Property Tax Exemption	VA	Financial Incentive	Property Tax Incentive	03/26/2015	04/09/2015

Cities and counties currently offering a solar energy equipment and facilities exemption include: Albemarle, Alexandria, Charlottesvill
Hampton, Hanover, Harrisonburg, Henrico, Isle of Wight, King and Queen, Lexington, Loudoun, Lynchburg, Prince William, Pulaski, F
Spotsylvania, Warren, Winchester and Wise. Please contact your local building inspection officials to check if the exemption is offere

Energy Star Qualified Products Holiday | Virginia Department of Taxation

Virginia Department of Taxation

Federal Tax Credits for Consumer Energy Efficiency

ENERGY STAR distinguishes energy efficient products which may cost more to purchase than standard models, but will pay you back in lower energy bills within a reasonable amount of time, even without a tax credit. **Not all ENERGY STAR certified products qualify for a tax credit**. How do I apply for a Federal Tax Credit?

2015 Federal Tax Credits

Tax Credit: 30% or cost with no upper limit
Expires: December 31, 2016
Details: Existing homes and new construction qualify. Both principal residences and second homes qualify. Rentals **do not** qualify.

- Geothermal Heat Pumps
- Small Wind Turbines (Residential)
- Solar Energy Systems

FHA PowerSaver Loan Program

Last Updated December 4, 2014

Program Overview

Implementing Sector:	Federal
Category:	Financial Incentive
State:	Federal
Incentive Type:	Loan Program
Web Site:	http://energy.gov/eere/buildings/powersaver-loans
Start Date:	01/26/2015
Eligible Renewable/Other Technologies:	Solar Water Heat, Solar Photovoltaics, Wind (All), Geothermal Heat Pumps
Eligible Efficiency Technologies:	Water Heaters, Furnaces, Air conditioners, Programmable Thermostats, Energy Mgmt. Systems/Building Controls, Caulking/Weather-stripping, Building Insulation, Windows, Doors, Comprehensive Measures/Whole Building

Applicable Sectors:	Residential
Maximum Loan:	PowerSaver Home Energy Upgrade: $7,500 PowerSaver Second Mortgage: $25,000 PowerSaver Energy Rehab (203(k)): varies by location (up to $217,500 to $625,000)
Loan Term:	Varies

Summary

Federal Housing Administration (FHA) PowerSaver loans provide three financing options for homeowners to make home energy efficiency and renewable energy upgrades or improvements. FHA PowerSaver financing products are insured by the FHA.

PowerSaver started as a 2-year pilot program in 2011. The U.S. Department of Housing and Urban Development (HUD) and the FHA developed PowerSaver as part of the *Recovery Through Retrofit* initiative launched in May 2009.

Eligible Measures

Eligible home energy upgrades include, but are not necessarily limited to, the following:

- A whole home upgrade through Home Performance with ENERGY STAR
- Insulation and air sealing
- Replacing doors and windows
- Upgrading heating, ventilation, and air-conditioning systems and hot water systems
- Home automations systems and controls (e.g., smart thermostats)
- Installing solar photovoltaic (PV) systems, solar thermal hot water systems, small wind power, or geothermal heat pumps

PowerSaver Home Energy Upgrade—Up to $7,500

This unsecured consumer loan is intended for smaller projects (e.g., insulation, air and duct sealing, water heating, replacing heating and cooling equipment, etc.). It does not require a home appraisal or lien on the property. Single-family homeowners may qualify for the loan if they have manageable debt and a credit score of 660 or higher. Interest rates vary, but typically range from 4.99% to 7.75%. PowerSaver participating lenders, markets, and contact information is available here.

PowerSaver Second Mortgage (Title I)—Up to $25,000

This Title I loan is intended for financing larger retrofit projects, including energy efficiency, PV, solar hot water, geothermal, or other renewable energy projects. A home appraisal or equity is generally not required, but PowerSaver lenders may request it if required by their investor. Borrowers cannot currently have an existing home equity loan, a second lien, or second mortgage to qualify for this product. Interest rates vary but typically range from 4.99% to 9.99%, and the maximum loan term is 20 years. PowerSaver Title I participating lenders, markets, and contact information is available here.

PowerSaver Energy Rehab (203(k))—First mortgage up to FHA loan limits

This 203(k) loan is for home purchase or refinance, targeting either home buyers wishing to combine home improvements with a home purchases or to homeowners wishing to include home improvements when refinancing an existing mortgage. It is FHA-insured up to 100% for a home purchase or refinance, plus the cost of a home improvement project. Current loan limits for a single-unit property vary by area from $217,500 to $625,000 (higher amounts are permitted for two-, three- and four-unit properties); specific loan limits for an area can be found at this website. In order to qualify as a 203(k) PowerSaver loan, at least $3,500 of the home improvements must consist of eligible PowerSaver measures. PowerSaver 203(k) participating lenders, markets, and contact information is available here.

The two types of PowerSaver 203(k) loans are Standard and Streamlined. Standard 203(k) loans are for major improvements, where a home improvement project costs at least $5,000 and includes $3,500 in energy upgrades. The Streamlined 203(k) loans are for minor home improvements, where the home improvement project cost must not exceed $35,000. A HUD consultant is only required for oversight of home improvements for Standard 203(k) loans.

Financial Incentives
Energy Efficiency
Renewable Energy
Alternative Fuels for Transportation
Energy & The Environment
Distributed Generation
Green Power
Questions About Energy

Virginia Department of Environmental Quality
P.O. Box 1105
Richmond, VA 23218

Contact Us:
1-(804) 698-4000
1-800-592-5482 (Toll Free in VA)

View Department of Environmental Quality Expenses

Incentives for Virginians

This page lists grants, rebates, tax credits, tax deductions, and utility incentives available to encourage the adoption of energy efficiency measures and renewable/ alternative energy. The incentives may vary by sector, but in general there are programs for all types: residential customers, small and large businesses, and government agencies.

This list is organized by the category of incentive (energy efficiency, renewable energy, alternative fuels and vehicles, and research and development) and then by the organization offering the incentive: the Commonwealth of Virginia (grants, rebates, tax credits); the federal government (mostly tax credits and tax deductions); and the gas and electric utilities (demand response, load management, etc.). To get started, click on one of the categories below and look for incentive programs that apply to your sector: residential, commercial, industrial, or government.

Energy Efficiency | Renewable Energy | Alternative Fuels, Vehicles and Transit | Research and Development

Additional Resources

How to Take Advantage of Tax Incentives to Help Lower Your Energy Costs (BAE Case Study on Developing Energy Management Program) Webinar Find out what tax incentives are available and how to take advantage of them from the webinar recording.

The Alliance to Save Energy website explains the federal tax incentives for energy efficiency and also has many tips and resources to help you save energy.

Energy Efficiency and Energy Conservation

http://www.deq.virginia.gov/Programs/PollutionPrevention/VirginiaInformationSourceForEnergy/FinancialIncentives.aspx#EfficiencyAnchor

Energy Conservation Programs

The time for everyone to get in on the savings is now!!

Stop/Start/Transfer or Add Service
Pay Your Bill
Choosing Natural Gas
Work in Your Neighborhood
Appliances
Energy Savings
- energySMART Rebates
- Free Online Energy Audit
- Conservation Tips
- energySMART Glossary
- Savings Calculator

Energy Assistance
Meter Reading

Free Online Energy Audit and Energy-Savings Kit

Take the first step toward creating a more energy-efficient home by completing our FREE online energy audit. The survey takes as little as 7 minutes to complete and could help save money on your energy costs. Just enter your Virginia Natural Gas account number, and upon completion, you'll receive a comprehensive report with personalized recommendations for saving energy in your home. We'll also send you a free energy-savings kit to help you get started on your path to energy savings!

Take the audit now>

Free Energy-Savings kit

By taking the free online energy audit, you will receive a free energy-savings kit filled with items to help you save energy and money right away. Your kit includes:

One Earth® massage showerhead – you choose chrome or white – with 9 settings

- Conserves 40% more water and energy* while enhancing pressure, performance, appearance and luxury

One dual-spray kitchen faucet aerator w/valve – allows on/off at nozzle

- Swivel spray aerator with pause valve saves 30% more water and energy.

One Econo bathroom faucet aerator

- Bubble spray model provides a full stream of water while using less; saves 55% more water and energy

One roll of plumber's tape

- Used for quick sealing and lubricating of pipe threads of all sizes

Have you received your free energy-savings kit? Start your energy savings now by installing your kit items - it's easy!

- **Click here** for installation instructions (PDF).
- **Click here** for showerhead installation (Video).
- **Click here** for faucet aerator installation (Video).

DOMINION VIRGINIA POWER - RESIDENTIAL ENERGY EFFICIENCY PROGRAMS

< Back

ELIGIBILITY
Low-Income Residential, Multi-Family Residential, Residential

SAVINGS CATEGORY
Heat Pumps, Lighting

PROGRAM INFO

FUNDING SOURCE
Dominion Virginia Power

STATE
Virginia

PROGRAM TYPE
Utility Rebate Program

REBATE AMOUNT
Home Energy Check Up: $50 - $250
Heat Pumps: $200 - $250 Heat Pump Tune Up: $90
Duct Testing/Sealing: $125

Dominion Virginia Power provides a number of rebates to customers for the installation of energy efficient equipment and measures.

The Home Energy Check Up program provides an on-site analysis of energy use, a custom report with upgrade recommendations, financial incentives that cover approved measures, access to prequalified contractors and equipment installation at the convenience of the customer. Measures eligible for incentive payments include pipe insulation, tank wraps, water heater controls, CFL bulbs, HVAC filter replacements, door weatherization and smart strips. Incentive levels are determined by the amount of kWh savings attained by installing new equipment or measures. The incentive range is from $50 - $250.

Incentives are also available for heat pump tune ups, duct testing, duct sealing and upgrading heat pumps to a model that exceeds 14.5 SEER. All equipment and installation requirements must be met in order to participate. Contact Dominion Virginia Power for further details on incentive levels and eligibility.

VALUE YOUR POWER
VIRGINIA ENERGY SENSE

ENERGY STAR PARTNER

RECURSOS EN ESPAÑOL

HOME | ABOUT US | ENERGY 101 | TOOLS & TIPS | PARTNERS & LOCAL PROGRAMS | INCENTIVES | search...

Energy Sense For Kids

You're never too young to save! Teach the energy ABCs to kids of all ages.

LEARN MORE

ENERGY STAR® Tip of the Day

ENERGY STAR

Home > ENERGY STAR Websit

Energy Rebates and Incentives

RESIDENTIAL

COMMERCIAL

INDUSTRIAL

Have an update or a new incentive to add? Email us at energysense@scc.virginia.gov

http://www.virginiaenergysense.org/

Home Energy Tips

Understand Your Energy Bill

DIY Energy Assessment

Home Energy Checklist

Buying Energy Efficient Products

VES Power Squad

Smart Appliance Use

Professional Home Energy Audit

Summer Vacation Tips

Tips for Renters

Residential Incentives

Case Studies

Learn from your neighbors and fellow LaRC employees

The Bruce Wielicki Home

- 2850 square foot, 2 story brick, custom built in 1987
- Built to "energy star" standards of its day:
  - R19 attic insulation, R11 walls + R4 insulation sheath, R11 crawl, R6 ducts
  - SEER 10 and 12.5 AC units, natural gas heat (85% efficiency furnace)
- Gas hot water (typical 60% efficiency)
- Electric stove/oven/clothes dryer
- Treed lot: front faces East.
- Room over garage has typical "knee" walls in the attic, no basement

The Wielicki Home

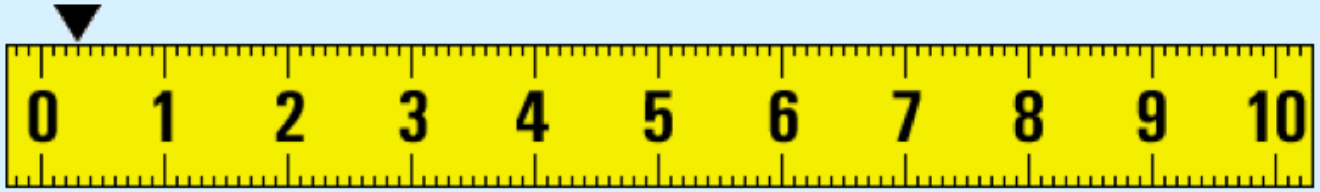
ENERGY STAR Home Energy Yardstick · RESULTS

The Home Energy Yardstick compares a household's energy use to similar homes and gives it a score between 0 and 10 (10 being the most energy efficient). An average household scores a 5.

Yardstick Score: 0.3*

PRINT THESE RESULTS

Annual pollution resulting from energy use in this household is **16 MtCO2eq of greenhouse gas emissions** - the equivalent of **3 cars**.



About Your Home (edit)

Zip code: 23692
People living in your Home: 3
Square Footage: 2,850
Heating Degree Days: 2891
Cooling Degree Days: 1592

Energy Use (edit)

Electricity Use: 22,700 kWh **Cost:** $0
Natural Gas Use: 913 Therms **Cost:** $0
Total Source Energy Consumption: 354,282 kBtu

My score for 2006: 0.3 out of 10: Horrible!

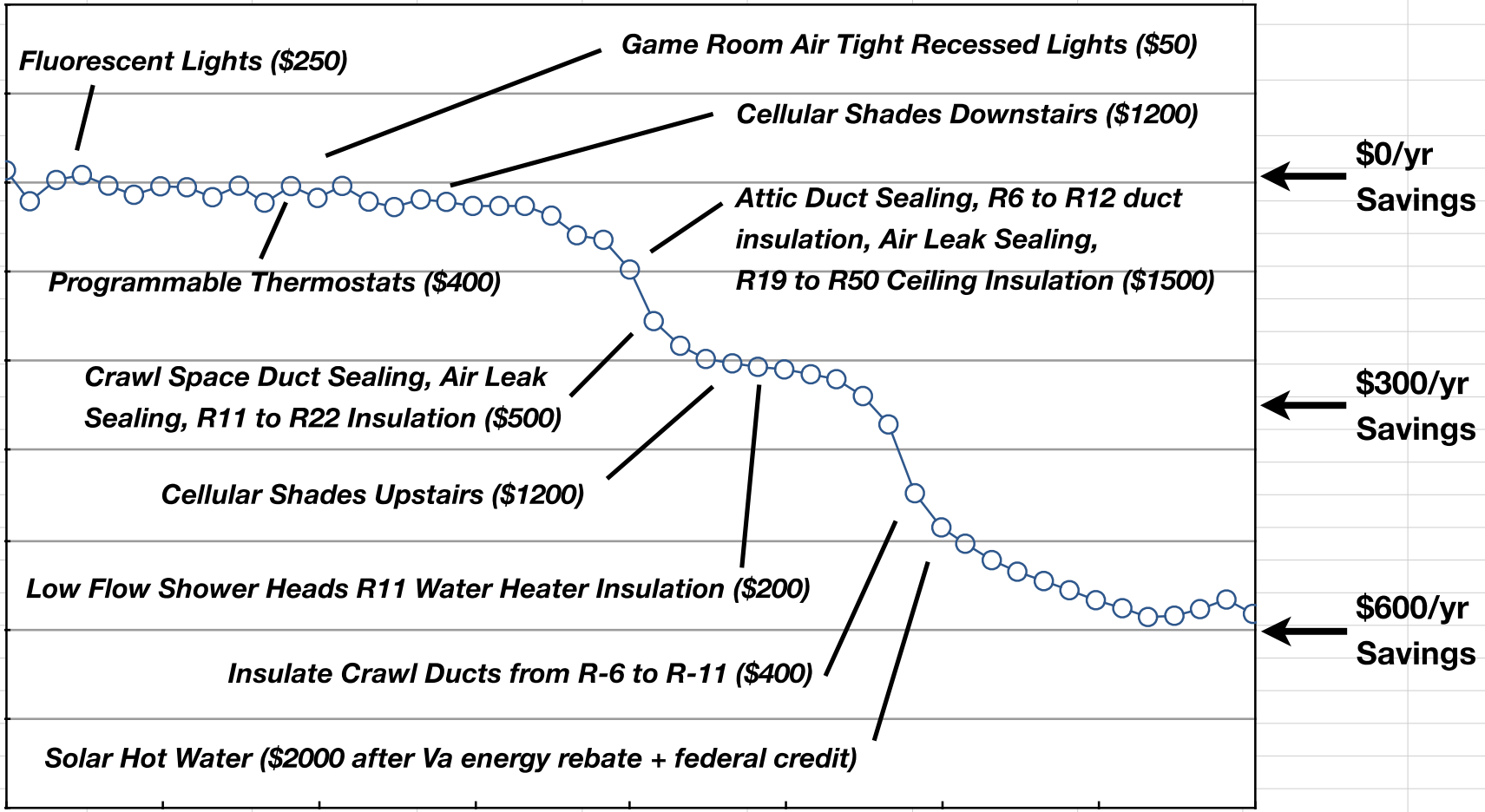
This from a 1987 custom built home that at the time was "energy star" level with R19 attic insulation, R11 floor and walls, R4 wall foam sheathing, thermopane windows

The Wielicki Home: Reducing Electricity

Crawl Duct Insulation R6 to R12 ($400)

$1500/yr
Savings

The Wielicki Home: Reducing Natural Gas



The Wielicki Home in 2011

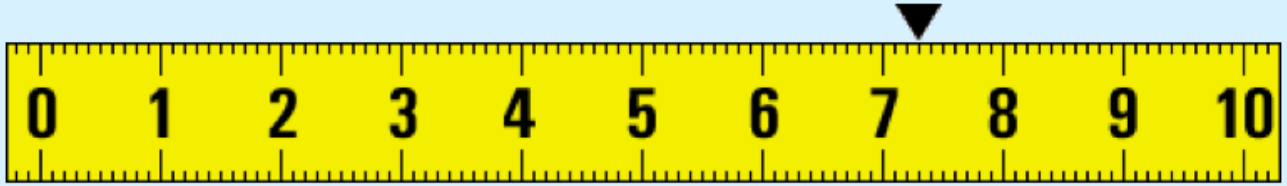
ENERGY STAR Home Energy Yardstick · RESULTS

The Home Energy Yardstick compares a household's energy use to similar homes and gives it a score between 0 and 10 (10 being the most energy efficient). An average household scores a 5.

Yardstick Score: 7.3*

PRINT THESE RESULTS

Annual pollution resulting from energy use in this household is **8 MtCO2eq of greenhouse gas emissions** - the equivalent of **1 car**.



About Your Home (edit)

Zip code: 23692
People living in your Home: 2
Square Footage: 2,850
Heating Degree Days: 3488
Cooling Degree Days: 1995

Energy Use (edit)

Electricity Use: 8,924 kWh **Cost:** $0
Natural Gas Use: 573 Therms **Cost:** $0
Total Source Energy Consumption: 161,692 kBtu

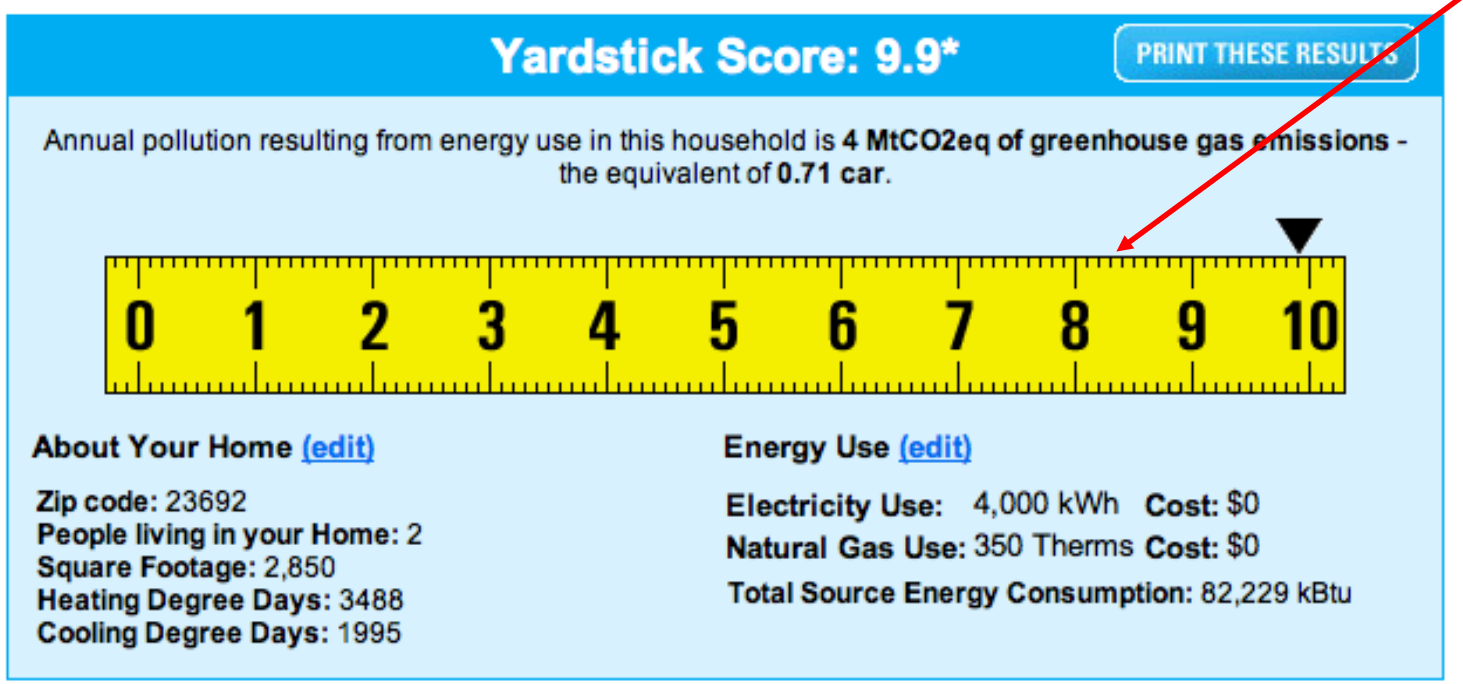
My score for 2011: 7.3 out of 10: Dramatically Better.

Same home with lots of small improvements: no change in AC or Heating furnaces and compressors nor any change in windows.

The Wielicki Home: 2015 Projection

- Electricity down from 21,700 in 2006 to 4,000 in 2015: 80% reduction
- Natural gas down from 950 in 2006 to 350 in 2015: 65% reduction
- Total Savings per year: $1950 electric, $800 in natural gas: $2750/yr total
- Home value increase: 20*$2750 = $55,000
- Energy Star Yardstick Rating:

Status as of Spring 2015: ~8.4



- CO_2 Emissions down from 54,800 lbs to 12,200 lbs: 78% reduction
- Investment return on this is last efficiency increase is still positive but lower: about 4% per year over 10 years: but still risk free and tax free.

The Wielicki Home: 2015 Actual

Wielicki Home Energy Use, 2006 v. 2015:
60% reduction in electricity and 60% reduction in natural gas use
$2000 savings per year

Changes since 2011:
- more efficient refrigerator
- CFL lighting changed to LED lighting
- more efficient washer/dryer (higher speed spin cycle cuts drying time in half)
- better insulation of the garage door and room over the garage.
- **A major bonus was when it was time to change the old HVAC system: since we had cut our energy use in half, we only needed one HVAC system (zoned for up/downstairs) instead of two systems: allowed us to get the highest efficiency Carrier Greenspeed (20 SEER, 12.5 HSPF) heat pump system and still save money over buying 2 cheaper less efficient systems. And maintaining one HVAC system is half the cost of maintaining two. This was an unexpected pleasant surprise: one of many we have seen going into energy saving mode.**

What next?
- reduce air leaks by sealing the room corners where the floor meets the walls (when replacing old carpet)
- Once we have sealed other leaks, we then install an energy recovery ventilation system (save about 10% of total energy use, reduce dust, fresher air)
- In 5 years or so, solar PV (including battery storage likely from the Tesla Gigafactory) is likely to be cheaper than Dominion Power, and that would be the the ultimate step to get us beyond 80% reduction in CO_2 emissions.

In the end, reaching the goal should still save us a lot of money, give us a much more comfortable and clean home, and continue to save us money every year thereafter.

Ruth Amundsen Solar Panels & Solar Hot Water

Amundsen Home: Solar Payback Times

PV solar system – 4000 Watts

Cost:	$30,000	
Federal tax credit (30%)	$9,000	
remainder	$21,000	
SREC income per year	$1,575	4-5 SRECs per year
Electricity offset income per year	$715	
Total annual income	$2290	
Years to pay off investment	9	

Equivalent to 9% tax-free investment!!

Plus, if you sell your house, you can make this back

The Good News:
We paid ~$10/W, cost is now $3/W

The Bad News:
SREC market is much lower now than in 2009

Solar hot water

Cost:	$9,000	
Federal tax credit (30%)	$2,700	
remainder	$6,300	
SREC income per year	$1,500	4 SRECs per year
NG offset income per year	$300	
Total annual income	$1800	
Years to pay off investment	4	

PV payback time now ~8 yrs

Solar Considerations

- South-facing roof best, must be within 45° of S
  - No shade 10-3 desired; take photos before installation
- 30% federal tax credit to decrease in 2016
  - Consider timing of install, budget for tax credit
- Financing available
- Cost drop from $10/W installed in 2009 to $3/W today
  - Can use co-op method for install at $1.50/W
    - Suntern Solar
  - Dominion SPP: $0.15/kWhr
  - SREC market lower than in 2009

Amundsen Green Roof Pictures

Installed in June 2005, still doing great in 2014

Green Roof Financial Benefits

- Savings from avoiding new roof installation
  - Grass roof lasts 50+ years versus ~10 for asphalt
  - Vegetation/soil protect roof membrane
- Air Conditioning and heating savings
  - 20% AC savings in first month after roof installed
- Tax rebates
  - Federal tax rebate for homeowner, plus potential state property tax benefits
- Stormwater management savings
- Pays for itself in ~10 years

Amundsen Energy Saving Tips

We…

- Use solar power!
- Use fluorescent or LED light bulbs
- Use LED Christmas lights (and replaced halogens with LED)
- Maximize time that we have heating and A/C turned off -- goal is 3 months in spring and 3 months in fall
- Use a whole house fan
- Don't dry clothes all the way in dryer -- hang dry after short time in dryer
- Turn oven off before end of cooking time
- Use just enough water to cover when cooking pasta (not 6 quarts!)

Bill & Linda Goad Home: Solar & Geothermal Systems

PV solar system **(10,000 Watts: largest system allowed by DVP without paying standby charges)**

Cost:	$43,000	Cost of $4.30/W
Federal tax credit (30%)	$13,000	
remainder	$30,000	
SREC income per year (estimated)	$800	~24 SRECs per year
Electricity offset income per year (est.)	$2200	PA SREC markets still open to new systems
Total annual income	$3000	
Years to pay off investment	10	

Ground Source Heat Pump **(aka "geothermal")**

Cost:	$27,000	5 wells (~1 ton cooling/well), $7000 to drill; HVAC system $20,000; 10-year warranty parts & labor
Federal tax credit (30%)	$9,000	
remainder	$18,000	

- No supplemental heating/cooling required
- Replaced all-electric system
- 20+ year lifespan for heat pumps, 25-50 years for wells

solaredge

Home Welcome William Goad

Dashboard Layout

Overview

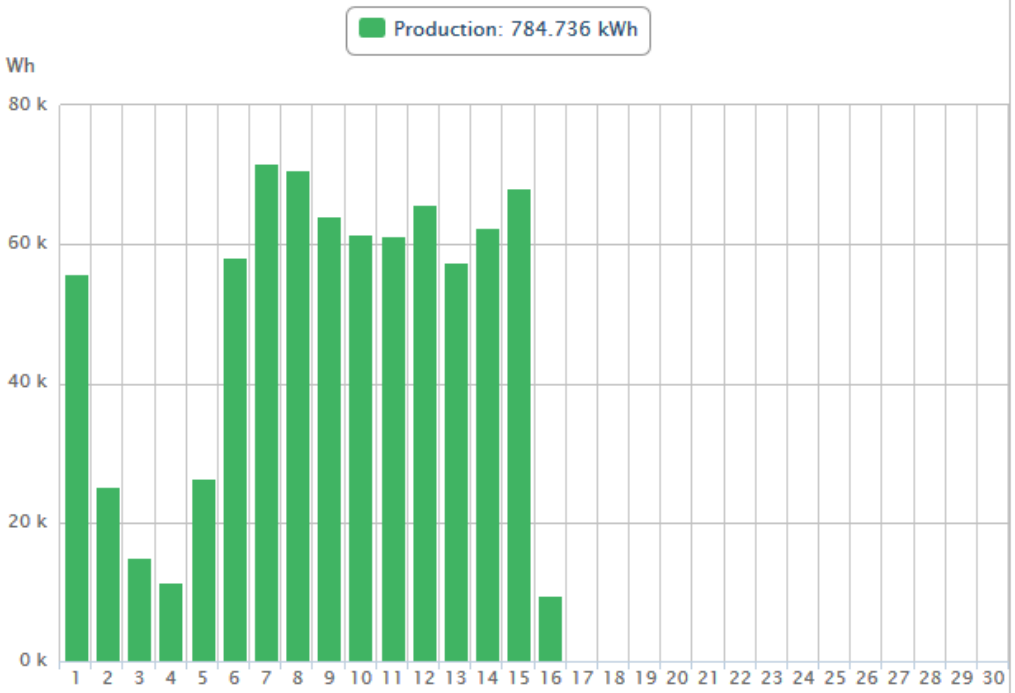
Current Power	Energy today	Energy this month	Lifetime energy
6.13 kW	9.38 kWh	784.74 kWh	2.38 MWh

solaredge

Power and Energy

Week **Month** Year

06/01/2015 - 06/30/2015



Jun 2015 Apply

Previous month | Next month

Site summary

Id:	115492
Name:	Bill Goad
Country:	United States
State:	Virginia
Installed:	04/30/2015
Last updated:	06/16/2015 10:45
Peak power:	12 kWp
Address:	Blue Heron Dr 189

Weather

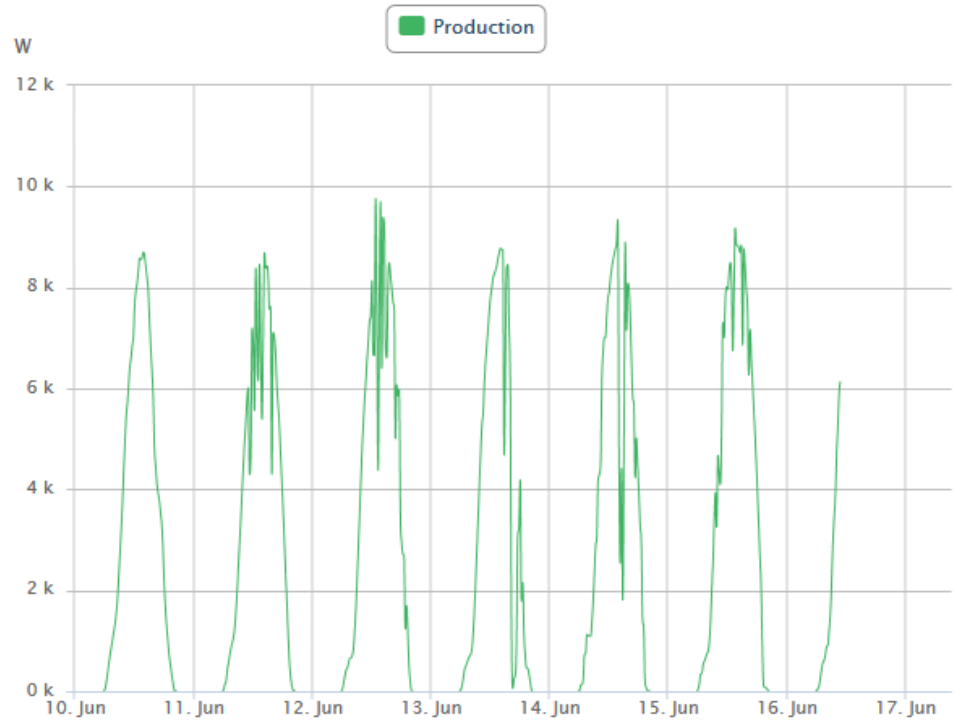
Temperature 93.73 °F
Mostly Sunny
Feels like 104 °F
Wind W, 1.98 MPH
Humidity 52.4 %
Sunrise at 05:47
Sunset at 20:29

Tuesday	Wednesday	Thursday
96.8 - 77 °F	87.8 - 73.4 °F	93.2 - 78.8 °F
Hot and Humid	Partly Cloudy	70% Chance of Storms

Power and Energy

Week | Month | Year

06/09/2015 - 06/16/2015

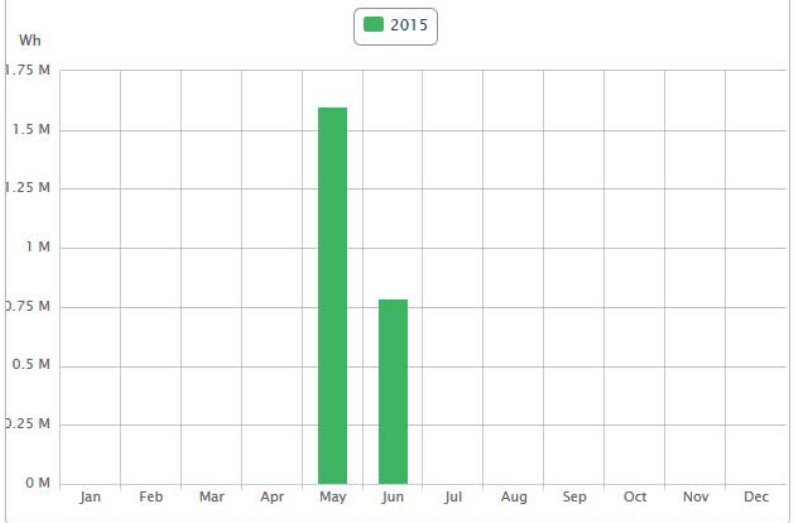


From: 06/09/2015

Previous week | Next week

Comparative Energy

Month | Quarter | Year



Site Image

Environmental Benefits

CO2 Emission Saved:
3,622.17 lb

Equivalent Trees Planted:
93.01

Light Bulbs Powered
7,226.7 For a day

Additional information

1. Vampire Electricity: 5 to 10%

- Payback time is month or two....
- Estimate your total house electricity use (http://michaelbluejay.com/electricity/measure.html)
- Buy a "Kill-a-Watt" meter (~ $18) to learn what computers, printers, TVs, gaming systems, etc. use in electricity when ***on, sleep, or off*.**

Cox HD set top box uses 45W of power even when the front panel power button is "OFF". That's 400 KW-Hr of electricity per year or about $45 per year in vampire electricity cost. We don't watch TV that much so we turn it off. Takes a minute or two to come on when we want to watch.

2. Fluorescent or LED Lights: 10-15%

- LEDS are the new and improved alternative to CFLs.
- LEDS use ~1/2 to 2/3 the energy of CFLs, last 2-4 times longer.
- LEDs now available in “cool” or “warm” light temperatures.
- Use Color Rendering Index (CRI) of 82 or higher (color accuracy).
- A 6W LED bulb is ~ the light of a 13W compact fluorescent bulb, but use lumens for best comparison.
- LEDs are approaching price parity with CFLs.
- LEDs more durable than CFLs (solid state).
- Both are available to replace everything including indoor and outdoor.
- LEDs are instant on, instant full brightness. CFLs may take time to come to full brightness
- LEDS are dimmable, CFLs often are not.
- CFLs contain small amounts of mercury (special disposal requirements).
- Frequent switching not a problem for LEDs but will wear out CFLs.
- LEDS good for temperature extremes and not affected by humidity. CFLs more sensitive to hot/cold/wet.

3. Install programmable thermostats: 10%

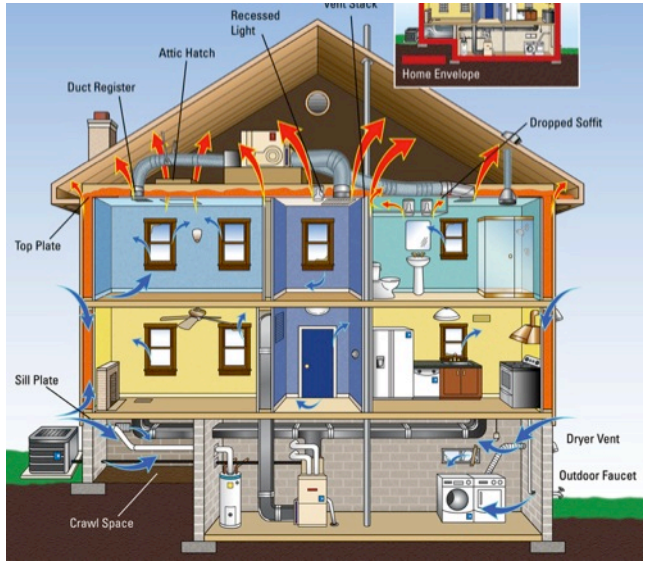
- Payback time is 1 to 3 years. They cost $50 to $100: Lowes or amazon.com. You can install them yourself if you get a compatible unit (I used a Trane TCONT800 for my Trane system which new cost ~ $100 on Ebay): its actually a Honeywell unit rebranded as Trane. You can have your AC/Heating guys install it: check their prices.
- I recommend getting one with 7-day programming, 4 periods per day, and touch screen to make it easy to use. For example in winter: temp setting drops when you go to bed, warms up for an hour or two getting ready for work, then drops during the day while you're gone, warms up just before you get home in the evening.
- Some also are remotely controllable, even from your cell phone, but costs will go up.
- For our typical heating season, reducing temperatures by even 4F for just half the day can yield 10% heating savings.
- Our winter settings example: 68F when we are home, 65F at night, and 60F if we are away from the house on travel or at work.

4. Heating/AC Duct Sealing: ~ 10%

- Typical payback time 1 to 3 years.
- If your house is more than 5 or 10 years old, the duct work is likely leaking at the floor/ceiling vents, return vents, connections to major duck trunks, connections to the furnace, etc. Duct Loss Metric: Temperatures of a) return air, b) first vent, c) last vent give 5 to 10 min of running to stabilize, pick cold/hot day.
- This lost air is typically being replaced with outside air from your crawl space or your attic: which is not at your inside temperature.
- The Energy Star web site has brochures on how to do this yourself (see also my document summary for web links) or you can call your AC/Heating contractor and get an estimate.
- Best way to seal joints is with UL-181 rated mastic (gummy) and UL-181 rated duct tape. See web links for do it yourselfers....
- Make sure NOT to use the silver cloth "duct tape" most of us are used to! This tape cannot take the heat/cold temperature swings: it dries out, cracks, and fails. Use instead the newer shiny silver metallic/plastic duct tapes that are UL-181 rated for "Class 1 duct". You can find these at Home Depot, Lowes, etc. An example is "Shurtape DC 181". They can "take the heat".

5. Seal Air Leaks: ~ 10%

- All homes exchange inside air with the outside many times per day.
- For healthy air to breathe, you want an exchange of the air in your house at least once every 2 or 3 hours. New homes built to very tight air exchange reach this level and even actively control it (varies with wind and temperature)
- Estimates of an average U.S. home is that it exchanges its air every 30 minutes to 1 hour: a lot of lost heat/cooling, and makes a house less efficient.
- So the average U.S. home can make significant energy improvements by reducing air exchange with the outside.
- Check the Energy Star web site for brochures on how to reduce air leaks: most are around windows/doors, recessed lights in the ceiling below the attic and through electrical and plumbing holes into the crawl space or attic. They can be sealed with caulk or foam insulation. A common one is older recessed light cans: when replacing them, make SURE to get air tight cans that can handle the wattage of the bulbs you use, and ideally are ok for insulation near them.
- You can get a "blower door" test to determine your homes actual air leak exchange rate: costs are about $100 to $300.



7. Cellular Blinds: 10%

- The insulation or R value of a typical double thermopane window is R 1.7 (including the wood frame)
- Windows tend to be a major loss of heat in the winter, and source of heat in the summer (solar absorption and outside temperature)
- Cellular blinds have an R value of about 2 to 3 depending on the blind.
- When you have cellular blinds drawn over a window, they can cut the heat loss or gain through the windows by more than a factor of two
- Cellular blinds can also reflect sunlight back out of the house in the summer and avoid added heat load to the house.
- If you have newer high insulation value windows (R3 to R10) the value of cellular blinds will be much less. (e.g. triple pane, argon, low emissivity)
- Costs for cellular blinds are about $50 to $200/window depending on size, style (cord versus cordless, single vs double cell) and quality.
- We used single cell cordless blinds (~ $100 each) and used room darkening on bedrooms (white reflective color outside, varying colors inside), and light filtering diffuse transmissive in all other windows (these reflect about 50% of sunlight and leave the rest through to light the room in daytime).
- In summer leave blinds up in the day in rooms we are using: down in other rooms. In fall/spring leave up during the day in any room. In winter leave blinds up on all but very cloudy very cold days when solar heating is less than heat loss.

7. Add Insulation: Varies greatly

- Adding insulation varies greatly depending on how well insulated your home already is, and how easy it is to insulate more.
- A web site that lets you understand insulation and heat loss is the "Home Heat Loss Calculator" at http://www.builditsolar.com/References/Calculators/HeatLoss/HeatLoss.htm. Use it to evaluate how much you could save by increasing insulation values.
- Attic is often the easiest and most effective place to add insulation. I added R30 on top of the R19 I had before. I even buried the attic ductwork under R-11 insulation. If you have a floor in your attic for storage: you can use blue foam insulation (R5 per inch) with a layer of plywood or particle board over it to increase insulation.
- Crawl space is less effective since temperature is much less extreme: but I increased mine to R22 (added R11 to previous R11).
- Be careful not to block key ventilation or to cause moisture issues:
  - Make sure attic insulation does not block airflow from eave vents to roof vents (this is mainly an issue where the roof meets the ceiling
  - In the crawl space: do NOT use fiberglass insulation or any other breathable insulation along the band (or "rim") joist: it will cause condensation in the winter when this board gets very cold. You can use rigid foam board insulation that moist air can't get behind to allow condensation. google "band joist" to see discussions

8. What about other changes?

- **What about insulating ducts?** R-6 insulation is enough on ducts: and its commonly on most ducts already. If no insulation: add R-6.
- **What about replacing windows with high efficiency ones?** In general, this is ONLY worth doing when the windows need to be replaced anyway (e.g. rot or appearance reasons). Then go for higher efficiency ones and payback will likely be good, but only for the difference between less efficient and more efficient windows. Will have to estimate the cost/payback for your house situation (see later section).
- **What about more efficient AC/Heating?** Older systems will have SEER air conditioning efficiency ratings of 8 or 10, and natural gas furnace efficiency ratings of 80 to 85%. Newer units can reach 15 to 20 for SEER (proportional to efficiency: twice the SEER is about half the cooling cost), and up to 95% gas furnace efficiency. But like windows: this makes sense primarily when you have to replace old units because they are worn out. The idea is to factor in the cost of added efficiency over roughly a 10 year period: and then buy as much increased efficiency as you can afford. Most AC/Heating systems will last 10 to 20 years.

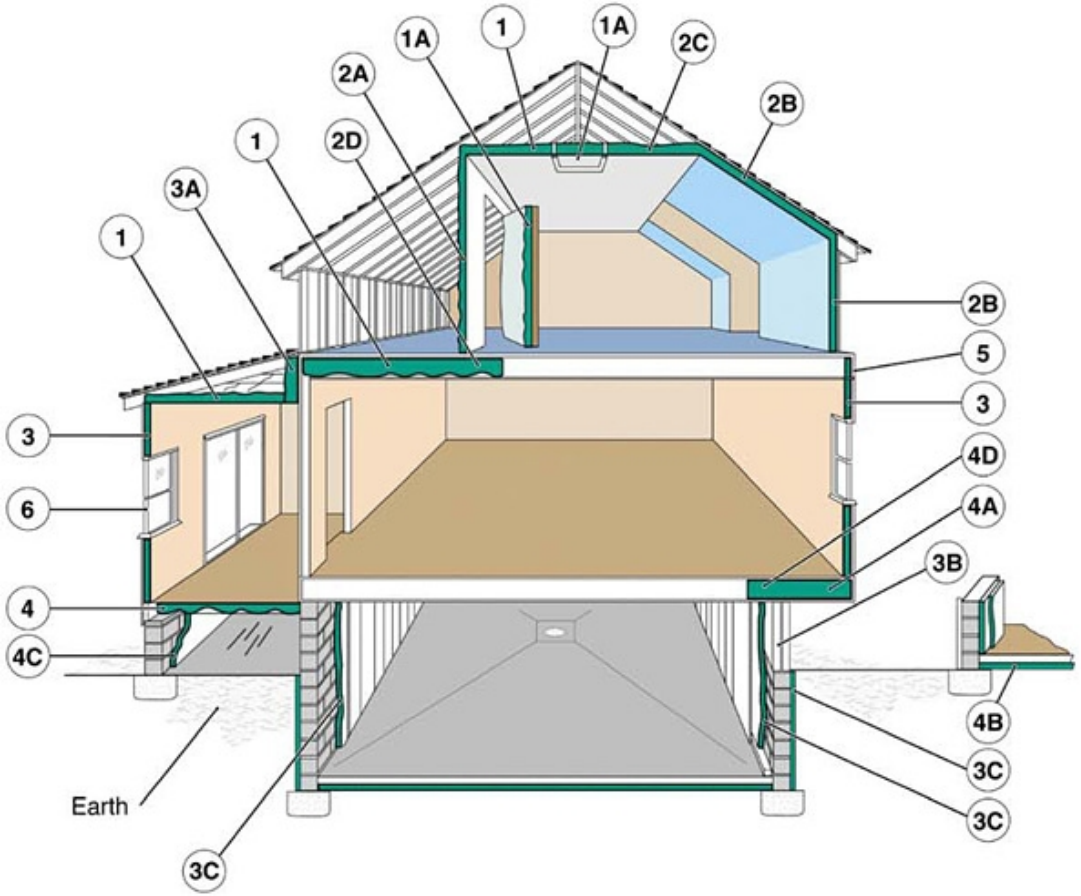
9. What about other changes?

- **What about hot water?** Natural gas is less expensive and less carbon emissions than electric hot water: about a factor of 2. Low flow shower heads can drop the use of shower hot water by 30 to 50% (check online reviews for best ones). There are detergents that work great in cold water clothes washing (e.g. 2X Ultra Tide Cold Water). Add R-11 insulation blanket to your hot water heater.
- **What about refrigerators?** Newer Energy Star refrigerators can be 30% to a factor of 2 more efficient than older ones (depending on age). Picking higher efficiency units when replacing older units is usually not much more expensive: so watch Energy Star labels.
- **What about wine coolers?** These tend to be very inefficient (factor of 2 to 4 less than refrigerators) because there are no Energy Star ratings or standards. Cannot find energy use even on the web. Best option is your own highly insulated "cellar" (small closet with above door small AC unit) or buy an inexpensive unit meant for under-cabinet use and add extra insulation around it: but make sure heat can escape from the compressor area (which gets hot): the under-counter models have an air vent below the unit just like a normal refrigerator

That's great for your house, but:
How do I decide what is best for my house?

- DEQ Incentives for Virginians - http://www.deq.virginia.gov/Programs/PollutionPrevention/VirginiaInformationSourceForEnergy/FinancialIncentives.aspx#EfficiencyAnchor
- DOE "Home Energy Saver" - http://hes.lbl.gov/consumer/
- DSIRE Website - http://www.dsireusa.org/
- Energy Star Home Advisor - https://www.energystar.gov/campaign/assessYourHome
- Energy.gov Do It Yourself Home Energy Audits - http://energy.gov/energysaver/articles/do-it-yourself-home-energy-audits
- Energy.gov Energy Saver - http://energy.gov/energysaver/energy-saver
- Energy.gov Home Cooling Infographic - http://energy.gov/articles/energy-saver-101-infographic-home-cooling
- Energy.gov Home Heating Infographic - http://energy.gov/articles/energy-saver-101-infographic-home-heating
- Home Heat Loss Calculator" - http://www.builditsolar.com/References/Calculators/HeatLoss/HeatLoss.htm
- "Home Energy Yardstick" - https://www.energystar.gov/index.cfm?fuseaction=home_energy_yardstick.showgetstarted
- Virginia Natural Gas Free Online Energy Audit and Energy Savings Kit - http://virginianaturalgas.com/residential/energy-savings/free-online-energy-audit
- Dominion Virginia Power Energy Conservation Programs - https://www.dom.com/residential/dominion-virginia-power/ways-to-save/energy-conservation-programs
- Dominion Home Energy Check Up - https://www.dom.com/residential/dominion-virginia-power/ways-to-save/energy-conservation-programs/appliance-recycle
- Virginia Energy Sense - http://www.virginiaenergysense.org/at-home/
- Home Energy Audit Checklist - http://www.seattle.gov/Documents/Departments/OSE/GreenHomeGuide-FYIenergyaudit.pdf

Where to Insulate



- 1. In unfinished attic spaces, insulate between and over the floor joists to seal off living spaces below. If the air distribution is in the attic space, then consider insulating the rafters to move the distribution into the conditioned space. (1A) attic access door
- 2. In finished attic rooms with or without dormer, insulate (2A) between the studs of "knee" walls, (2B) between the studs and rafters of exterior walls and roof, (2C) and ceilings with cold spaces above. (2D) Extend insulation into joist space to reduce air flows.
- 3. All exterior walls, including (3A) walls between living spaces and unheated garages, shed roofs, or storage areas; (3B) foundation walls above ground level; (3C) foundation walls in heated basements, full wall either interior or exterior.
- 4. Floors above cold spaces, such as vented crawl spaces and unheated garages. Also insulate (4A) any portion of the floor in a room that is cantilevered beyond the exterior wall below; (4B) slab floors built directly on the ground; (4C) as an alternative to floor insulation, foundation walls of unvented crawl spaces. (4D) Extend insulation into joist space to reduce air flows.
- 5. Band joists.
- 6. Replacement or storm windows and caulk and seal around all windows and doors.

Source: Oak Ridge National Laboratory