



# **SAVE \$\$: DIY HOME ENERGY AUDIT**


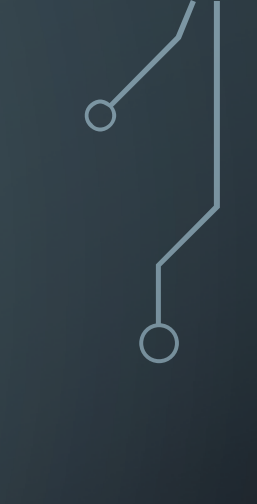
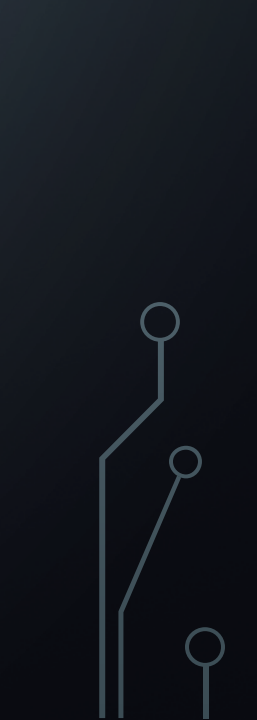
**JOAN HUGHES (NASA, CENTER ENERGY MANAGER); TODD HERBERT (SEI, ENERGY ANALYST)**

**SAFETY AND HEALTH AWARENESS MONTH WORKSHOP**

**JUNE 10<sup>TH</sup>, 2016**



## 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 smallest amount of energy in the US, compared to other states.**
- **This state uses the most energy in the US, compared to other states.**

## Jeopardy!

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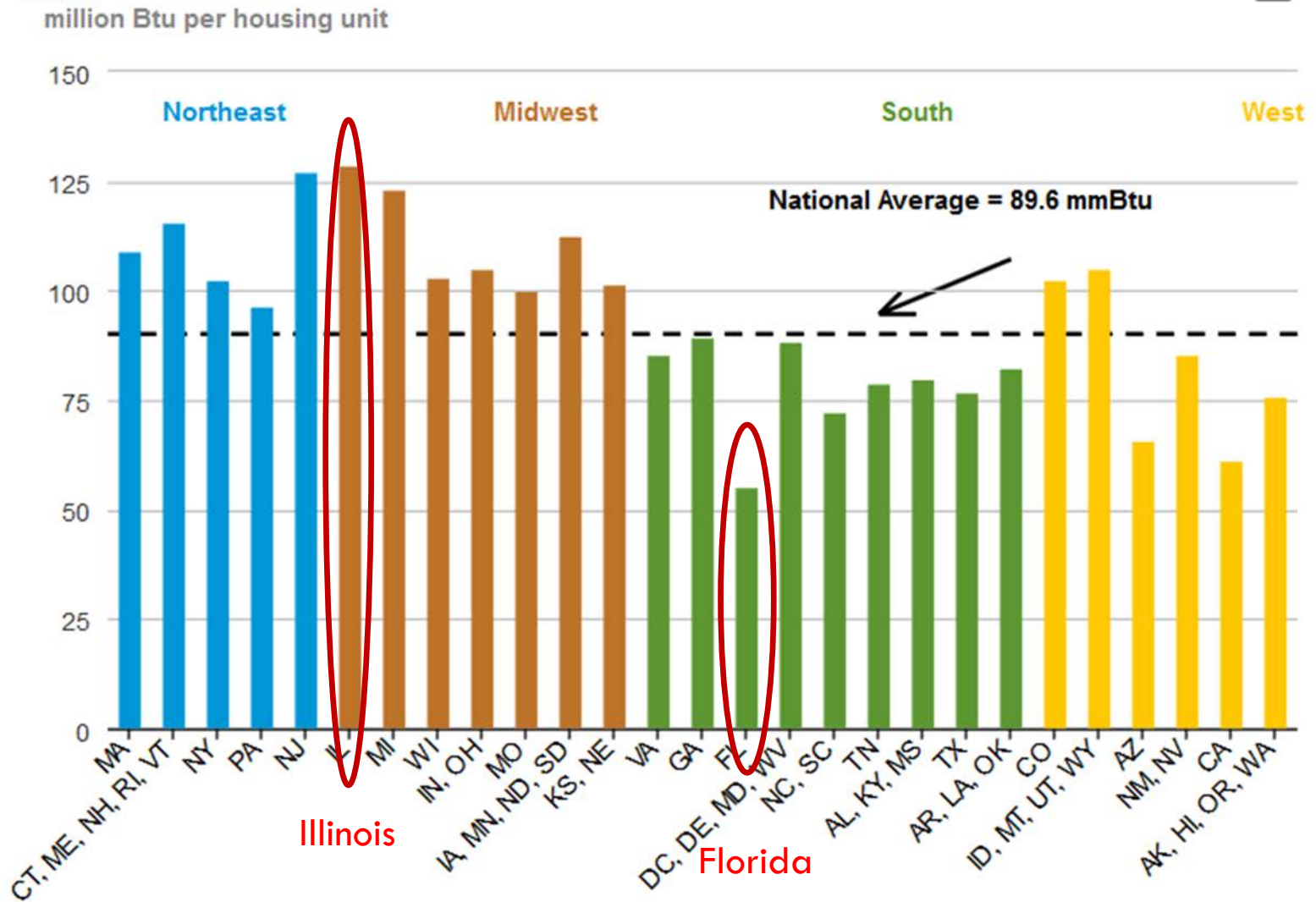
**VA average:  
85.6 MBTU/year**

**MMBtu** = 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.)

**1 kWh = 3,412 BTU**

**Figure 4. Average home energy consumption for selected states, 2009**



Illinois

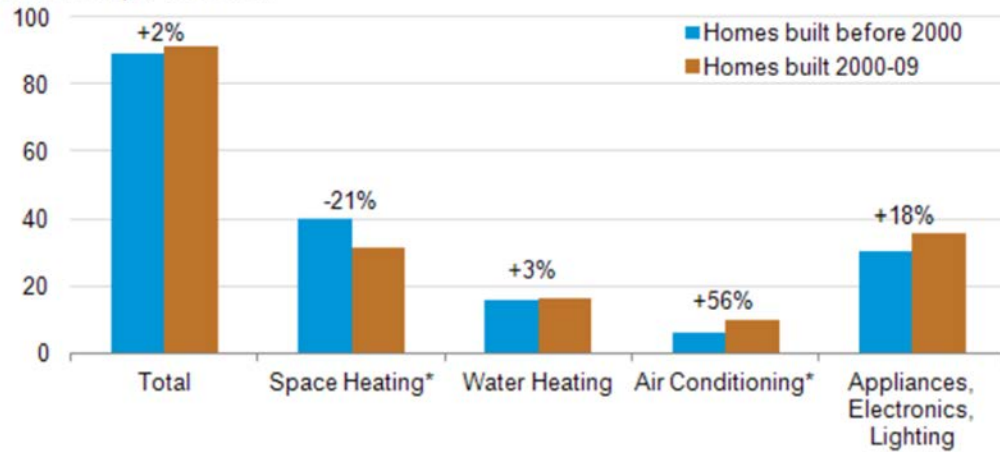
Florida



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

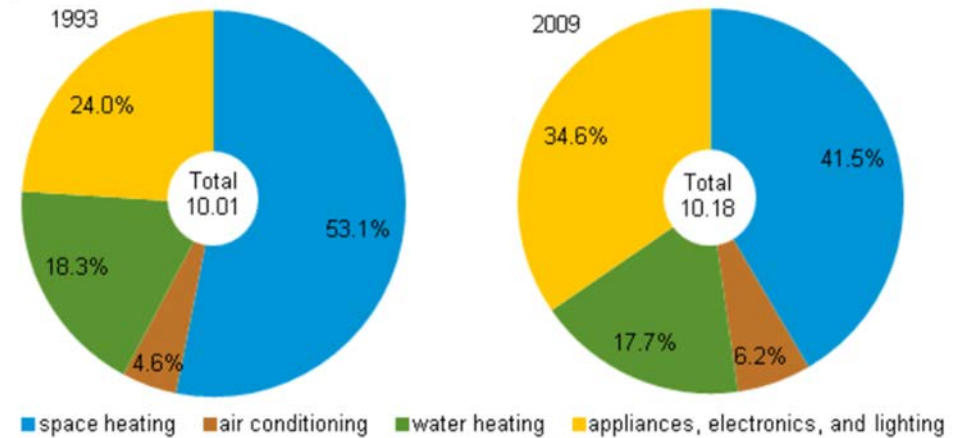
Average household site energy consumption by end use, 2009  
million Btu per household



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

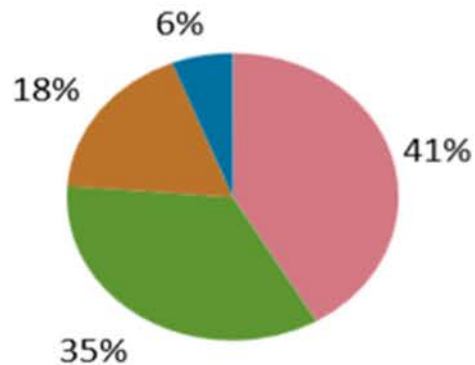
## Heating and cooling no longer majority of U.S. home energy use

Energy consumption in homes by end uses  
quadrillion Btu and percent

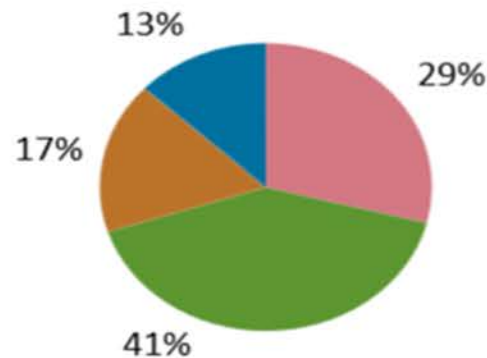


Source: U.S. Energy Information Administration, Residential Energy Consumption Survey.  
Note: Amounts represent the energy consumption in occupied primary housing units.

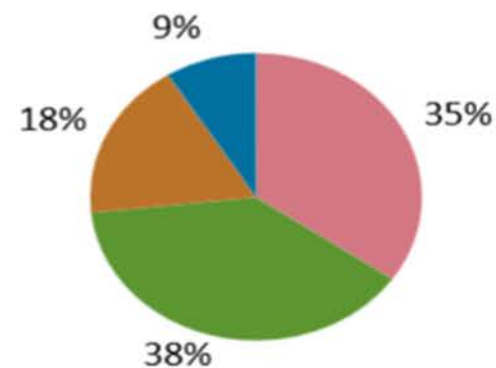
### US



### SoAtl



### VA



## 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.

■ Air conditioning ■ Water heating ■ Appliances, electronics, lighting ■ Space heating



# HOME UTILITY ANALYSIS

ASSESSING ENERGY USE IN THE HOME



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 [?](#)).



**Get Started!**

The Home Energy Yardstick is a basic performance-based home assessment that looks at the actual energy use of your home (based on your last 12 months of utility bills) compared to that of similar homes. To ensure that homes across the country can be properly compared, the Yardstick uses a statistical algorithm to take into account the effects of local weather, home size, and number of occupants on your home's energy use.

[https://www.energystar.gov/index.cfm?fuseaction=HOME\\_ENERGY\\_YARDSTICK.showGetStarted](https://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted)



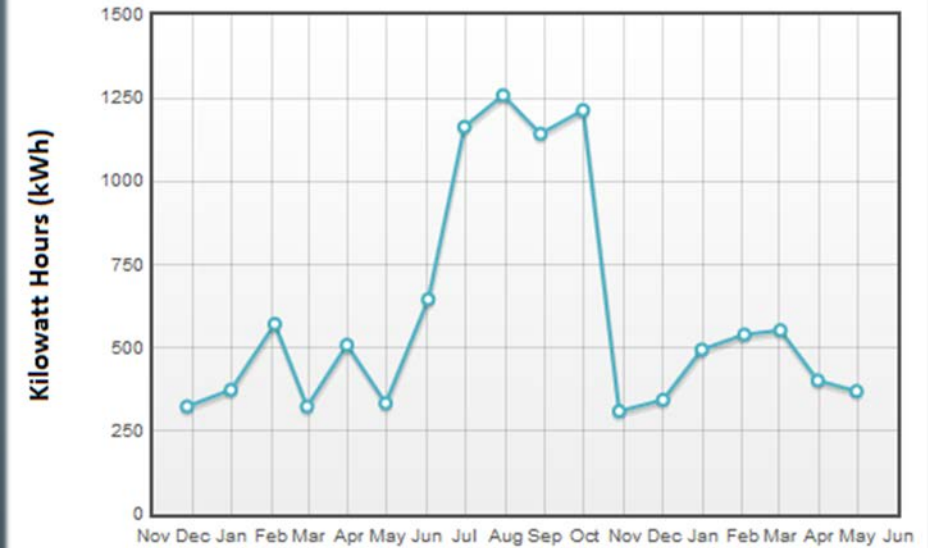
Export To Excel

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
<b>Totals</b>				<b>8774.0</b>		

## Example home

### My Energy Usage



**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.

# Score for example home

## Your Annual Energy Use

Electricity: 6,254 kWh

Natural Gas: 317.07

Therms



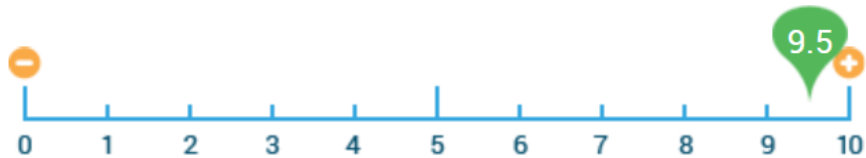
Compare your household's energy use to similar homes and get a score from 0 to 10 (10 being the most energy efficient). An average household scores a 5. [What do I need to get a score?](#) Learn more about [how the Home Energy Yardstick works.](#)

### Your Score<sup>1</sup>

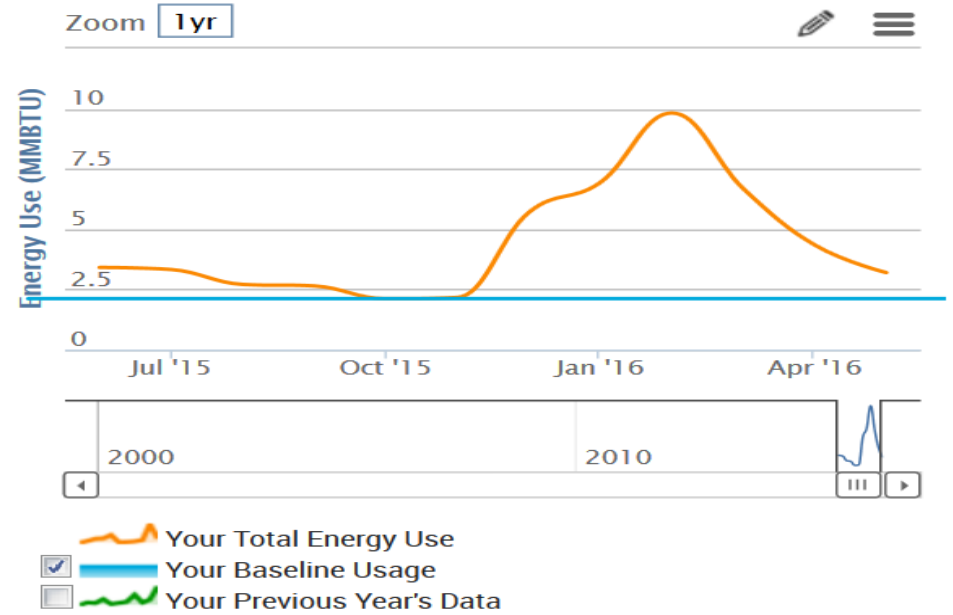
For date range:

June 2015

May 2016



Great work! Your home is among the top performers for energy use over the last 12 months. You could save about \$290 per year by improving your score to a 10.





## 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.

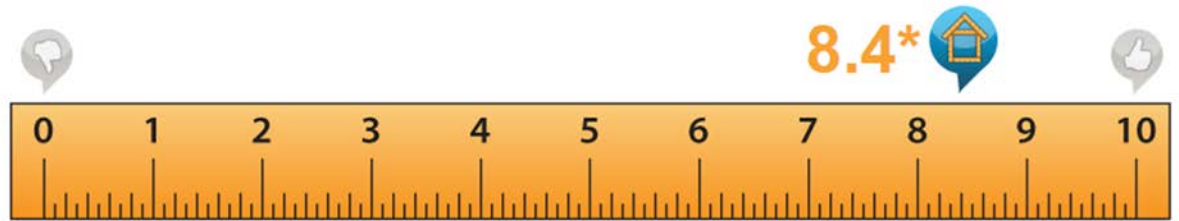
### Your Home

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

### Your Score

May 2014 - April 2015

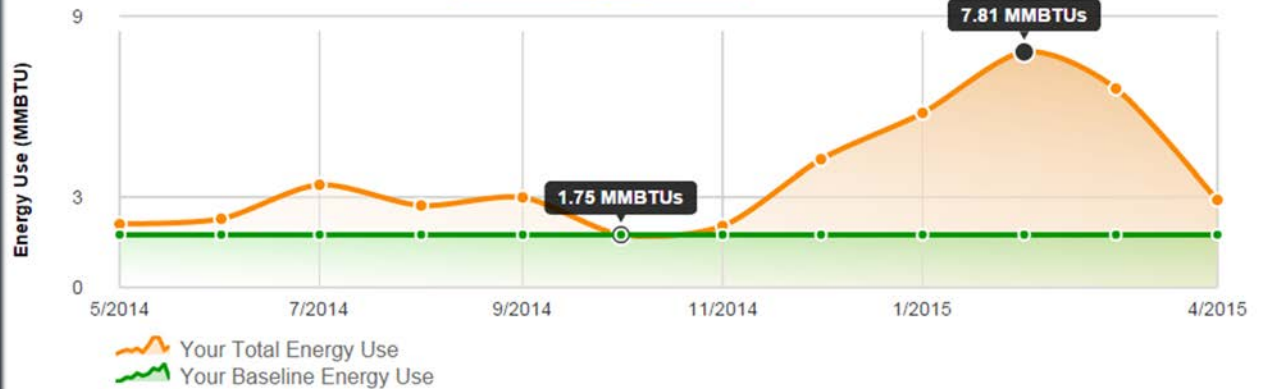
Share:






How do I Improve My Score?

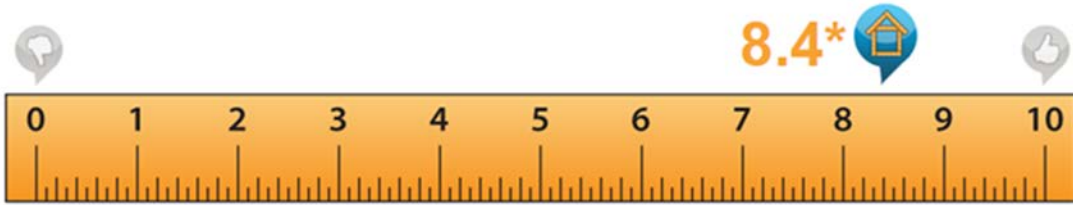
### Monthly Energy Use

[What does this graph tell me?](#) (408KB)






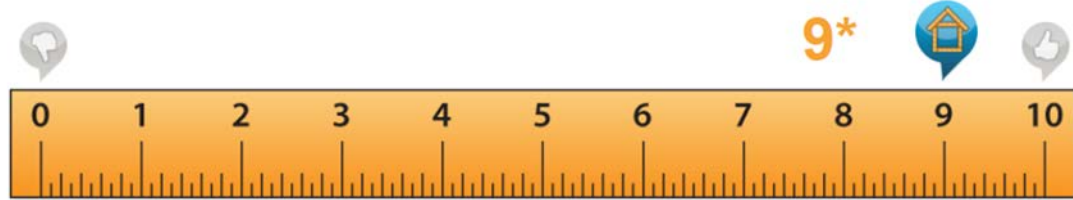
# My Home

Your Score **May 2014 – April 2015** Share:   

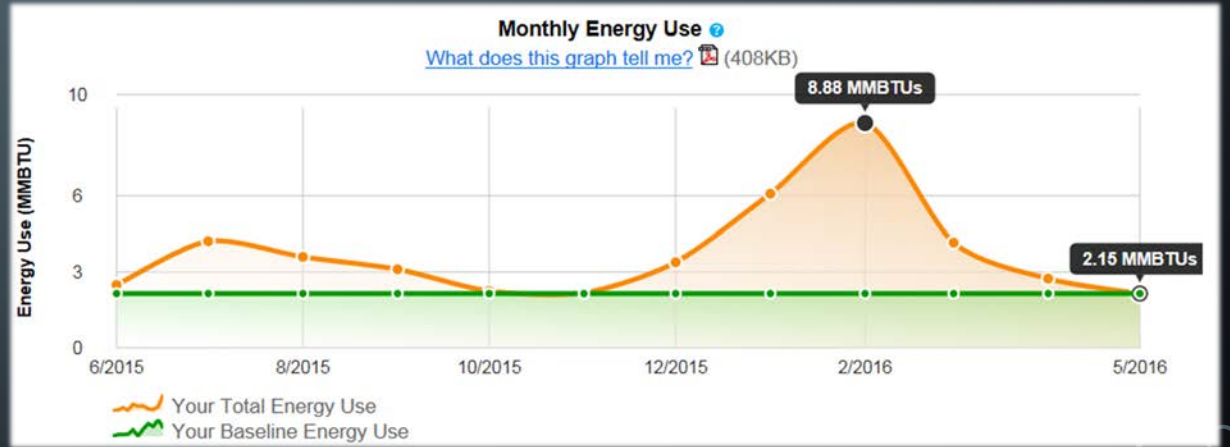
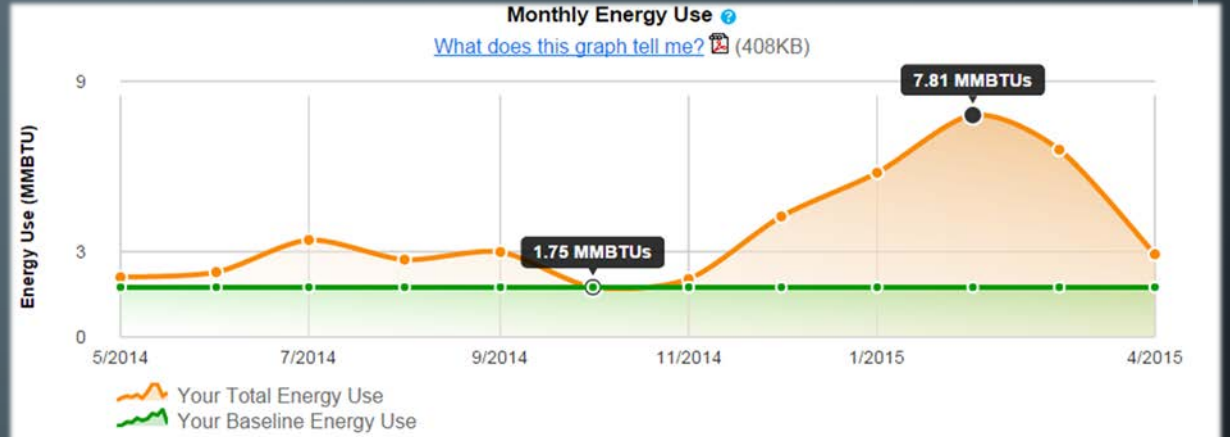


[How do I Improve My Score?](#)

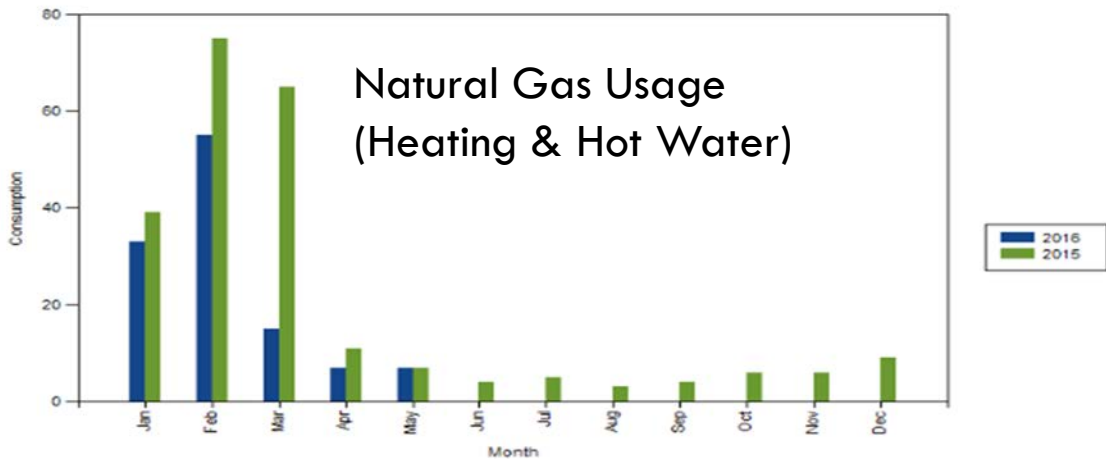
Your Score **June 2015 – May 2016** Share:   



Great work! Your home is among the top performers for energy use over the last 12 months. You could save about \$450 per year by improving your score to a 10.

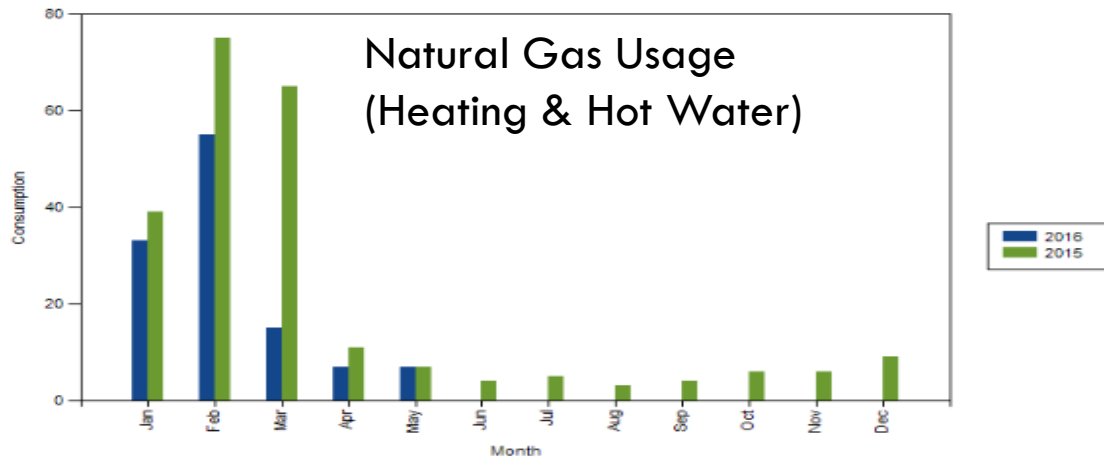


Monthly Usage Comparison

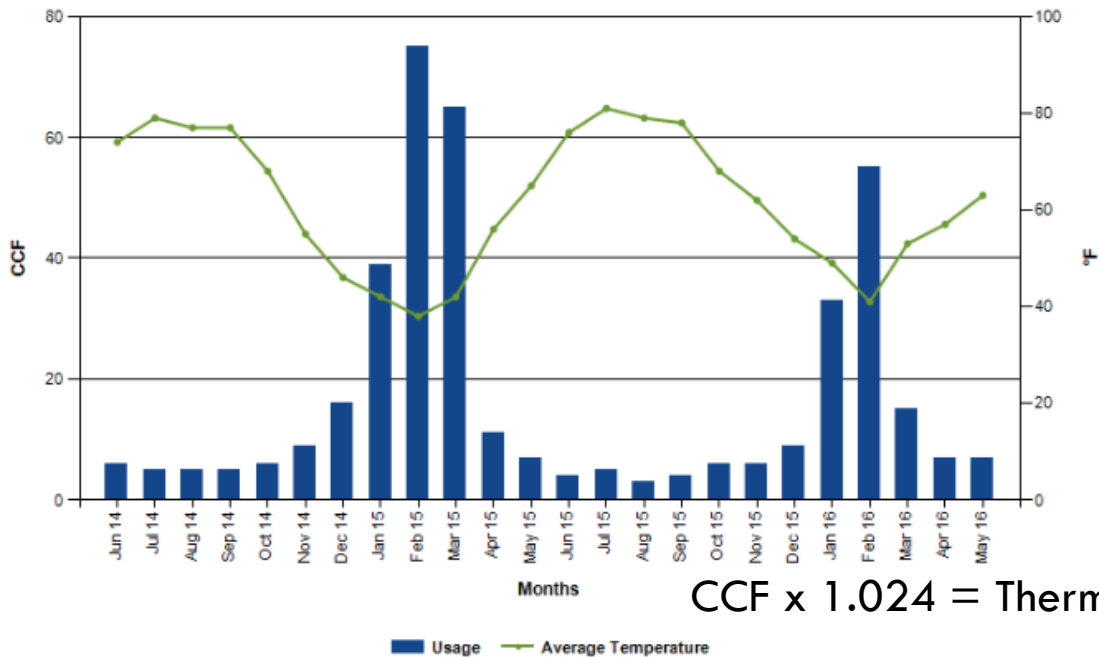


# My Home – Natural Gas Usage

Monthly Usage Comparison



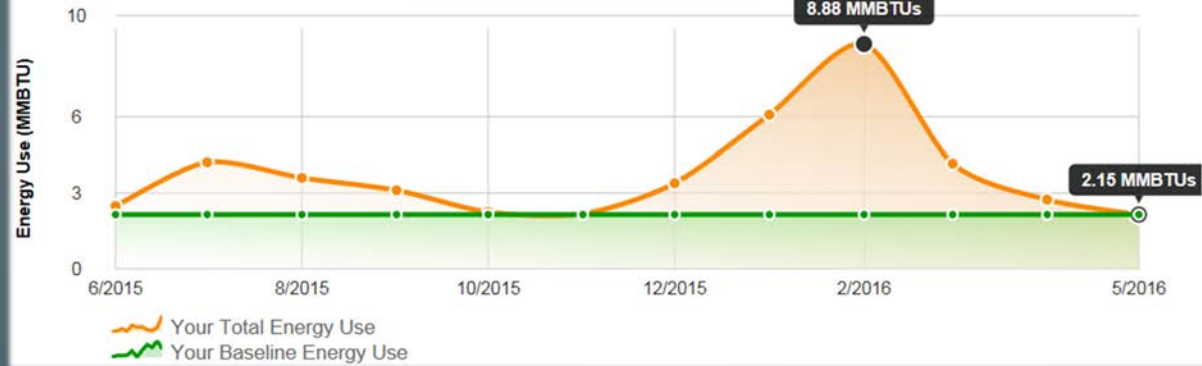
Usage History vs. Average Temperature



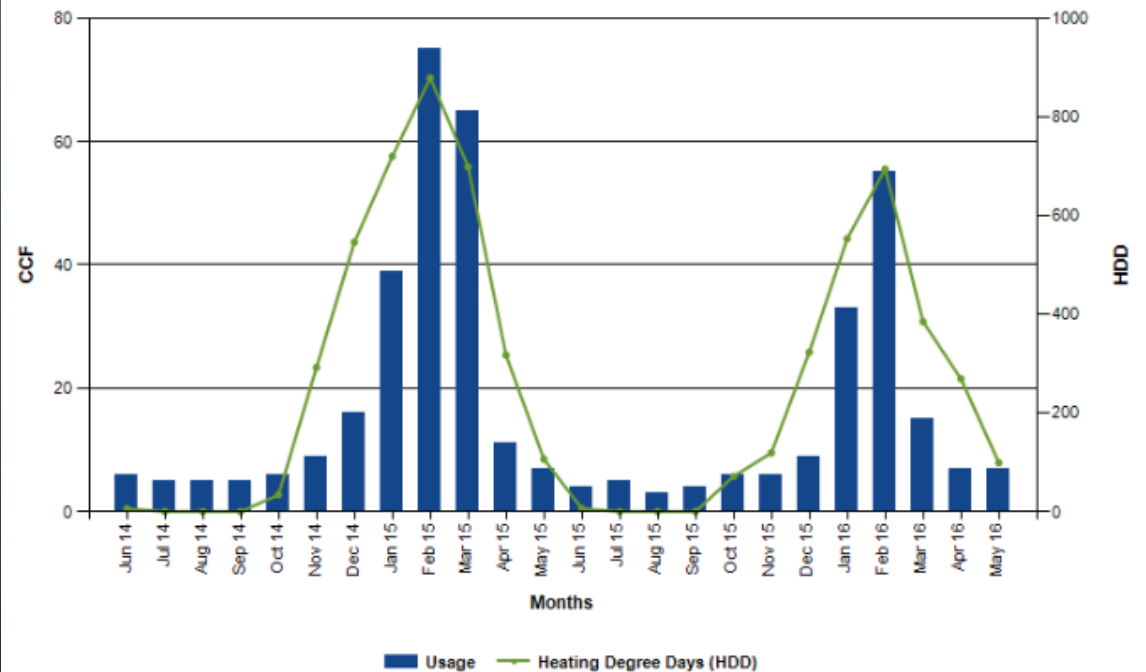
$CCF \times 1.024 = \text{Therm}$

Monthly Energy Use

What does this graph tell me? (408KB)



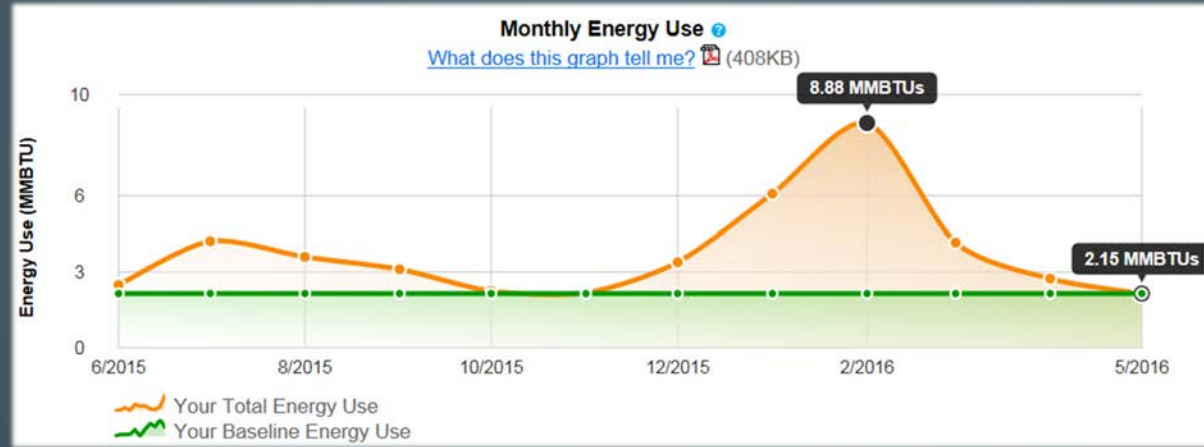
Usage History vs. Heating Degree Days (HDD)



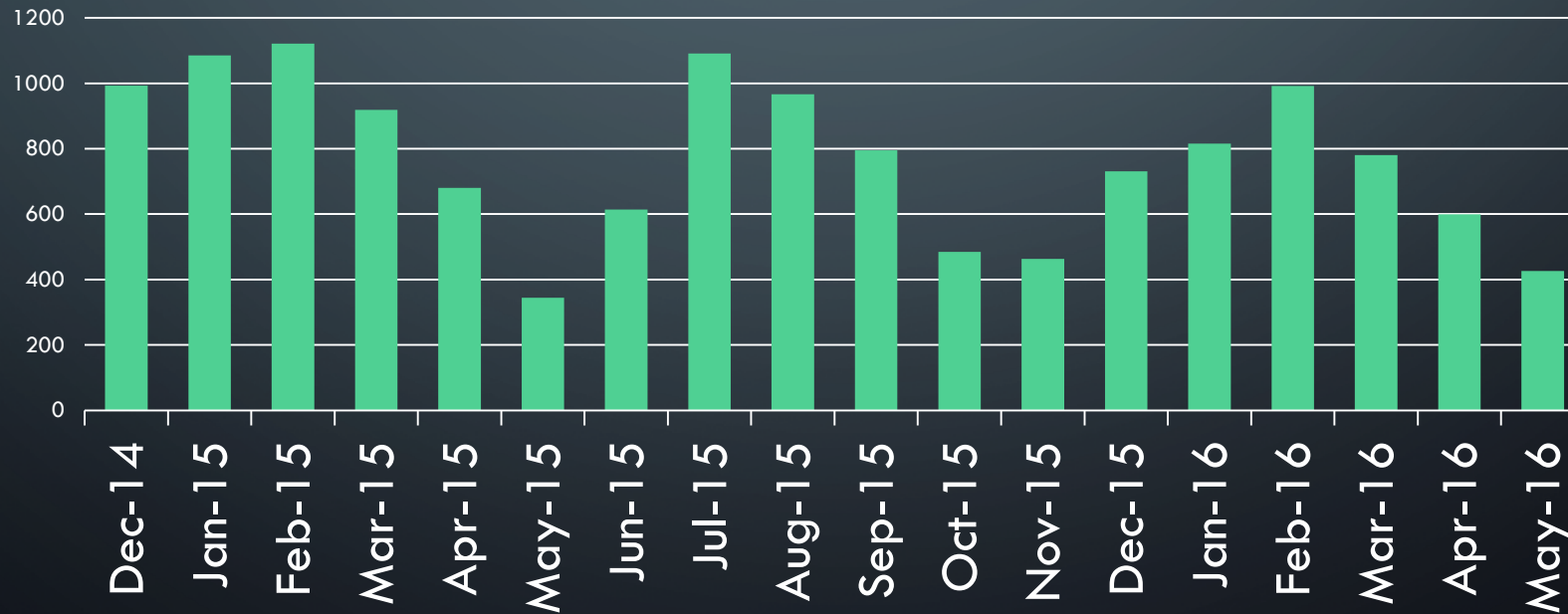
HDD = avg of a day's high and low temperatures and subtract from 65.

(i.e. if the day's average temperature is 50° F, its HDD is 15)

# My Home – Electricity Usage



kWh



# 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](#)

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

# 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:

## Home Advisor in three simple steps



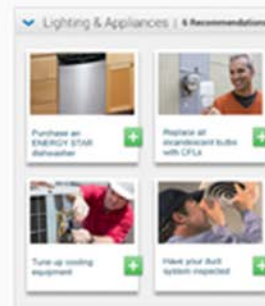
### Create your home's energy profile.

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



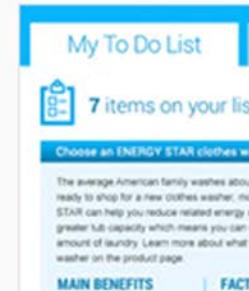
### Get custom recommendations.

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.](#)



#### My Home Basics

Not Started

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

Norfolk, VA  
23509

#### GENERAL BUILDING:

**CERTIFICATIONS OR RATINGS:**

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

#### NOTES:

[Add some notes!](#)

## 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.



#### 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.



#### Lighting & Appliances

Fully Complete

Age and efficiency of products in your home.



#### Building Envelope

Partially Complete

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



#### Heating & Cooling

Fully Complete

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



#### Other Home Features

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.



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

Upgrade to Energy Star and Energy Efficient Lighting

Assess Your Home | 1 Recommendations

Lighting & Appliances | 3 Recommendations



Choose ENERGY STAR certified light bulbs



Replace your ceiling fan with ENERGY STAR



Choose an ENERGY STAR certified bathroom vent fan



Seal Leaks, Improve Insulation, Energy Star Doors and Windows

Building Envelope | 5 Recommendations



Seal the leaks in your home



Add insulation to your home to improve comfort and efficiency



Consider ENERGY STAR certified windows when replacing



Consider ENERGY STAR certified doors when replacing



Consider ENERGY STAR certified roof products



[View your profile for Building Envelope](#)

Heating & Cooling | 3 Recommendations



Find and seal leaks in your duct systems



Consider replacing your heat pump



Install and properly set a programmable thermostat

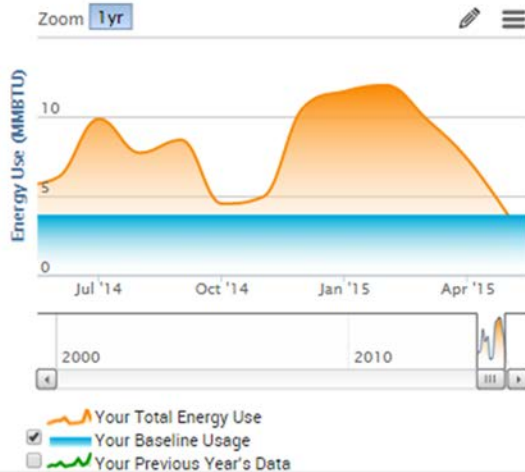


Check for duct leaks, replace HVAC, programmable thermostat

## Your Annual Energy Use

Electricity: 9,033 kWh

2014-2015

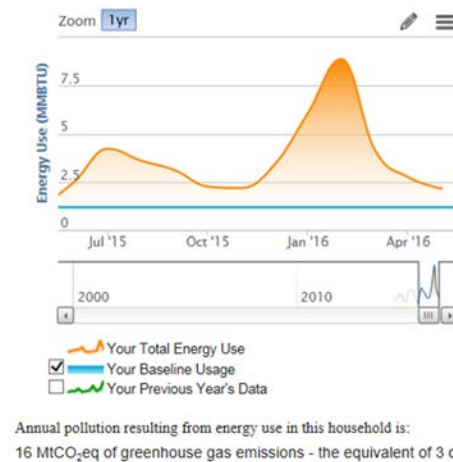


## Your Annual Energy Use

Electricity: 8,760 kWh  
Natural Gas: 154 Therms

2015-2016

What does this graph tell me? (345KB)



Annual pollution resulting from energy use in this household is: 16 MTCO<sub>2</sub>e of greenhouse gas emissions - the equivalent of 3 cars.



# 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



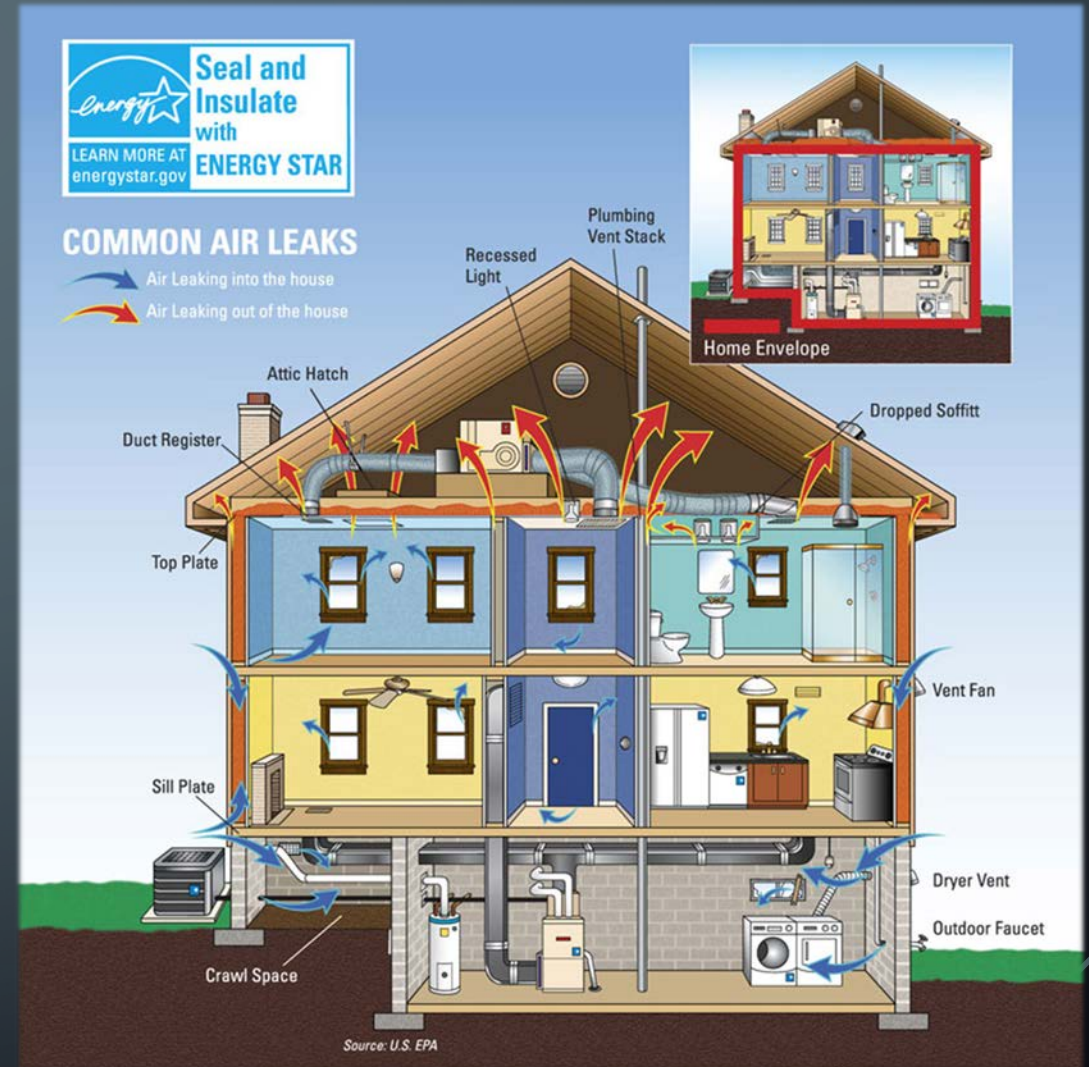
# CHECK FOR AIR LEAKS

## 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
- Check for indoor air leaks, such as gaps along the baseboard or edge of the flooring and at junctures of the walls and ceiling.
- 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
- Seal cracks and holes in the mortar, foundation, and siding
- Seal leaks around windows and doors.



# 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
 <b>BATTING</b>	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.
 <b>BLOWN-IN</b>	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.
 <b>SPRAY FOAM</b>	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.
 <b>RIGID FOAM</b>	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.
 <b>SPECIALTY</b>	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.

# 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



# 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.



# INSPECT HEATING & COOLING EQUIPMENT

- Have [heating and cooling](#) equipment inspected 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.

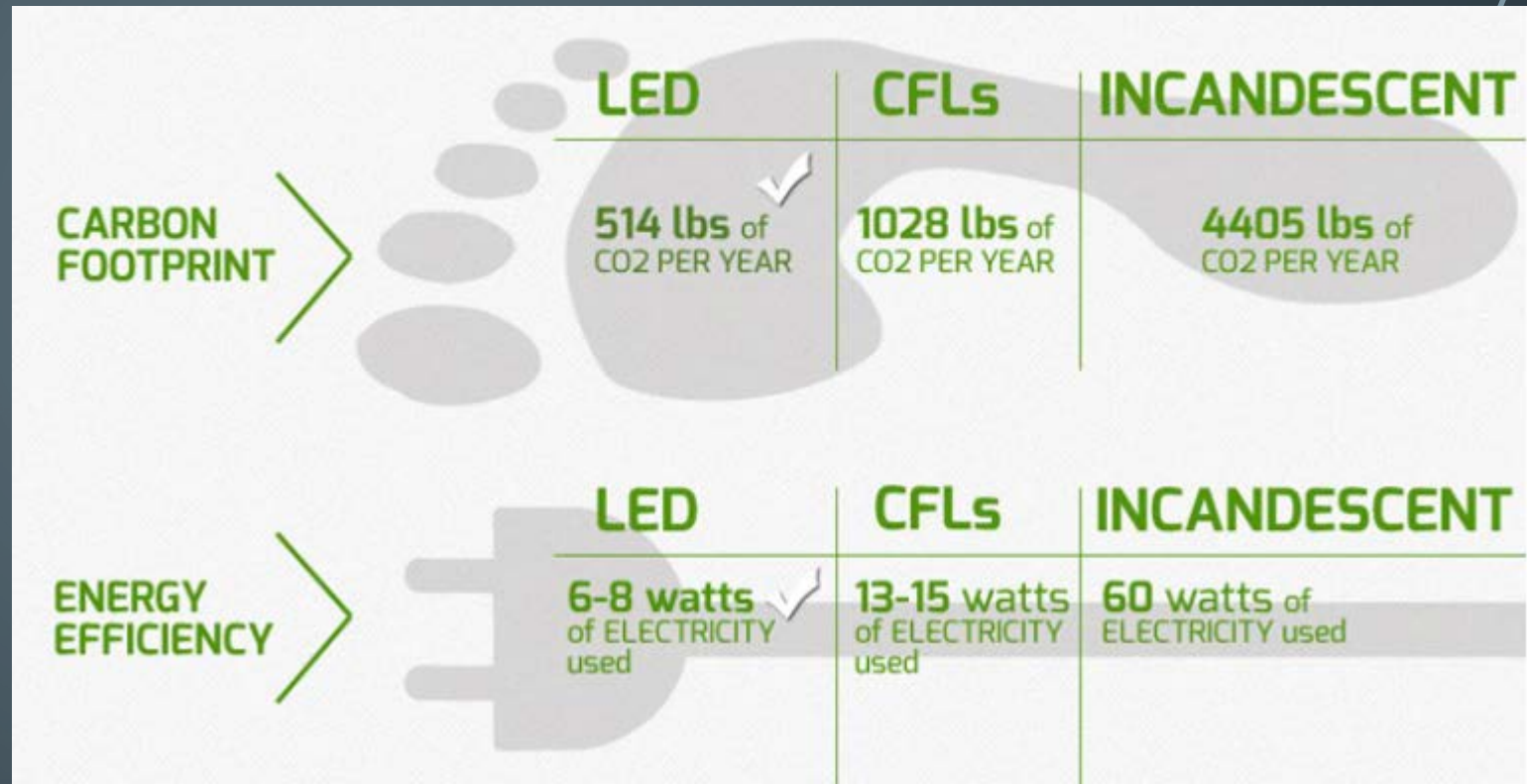
#### Dirty Filter

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

# LIGHTING

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

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.



ENERGY & ENVIRONMENT

### **G.E. to Phase Out CFL Bulbs**

By DIANE CARDWELL FEB. 1, 2016



Just a few years ago, the compact fluorescent light was the go-to choice for customers seeking an inexpensive, energy-efficient replacement for the standard incandescent bulb. But as the light quality of LEDs improved and their cost plummeted, manufacturers and retailers began shifting their efforts in that direction.

# APPLIANCES & ELECTRONICS

U.S. Government Federal law prohibits removal of this label before consumer purchase.

## ENERGYGUIDE

Refrigerator-Freezer  
 • Automatic Defrost  
 • Side-Mounted Freezer  
 • Through-the-Door Ice

XYZ Corporation  
 Model ABC-L  
 Capacity: 23 Cubic Feet

The maker, model, and size tell you exactly what product this label describes.

Estimated Yearly Operating Cost

**\$67**

Cost Range of Similar Models: \$57 to \$74

The cost range helps you compare the energy use of different models by showing you the range of operating costs for models with similar features.

Estimated Yearly Electricity Use

**630 kWh**

Your cost will depend on your utility rates and use.

- Cost range based only on models of similar capacity with automatic defrost, side-mounted freezer, and through-the-door ice.
- Estimated operating cost based on a 2007 national average electricity cost of 10.65 cents per kWh.
- For more information, visit [www.ftc.gov/appliances](http://www.ftc.gov/appliances).

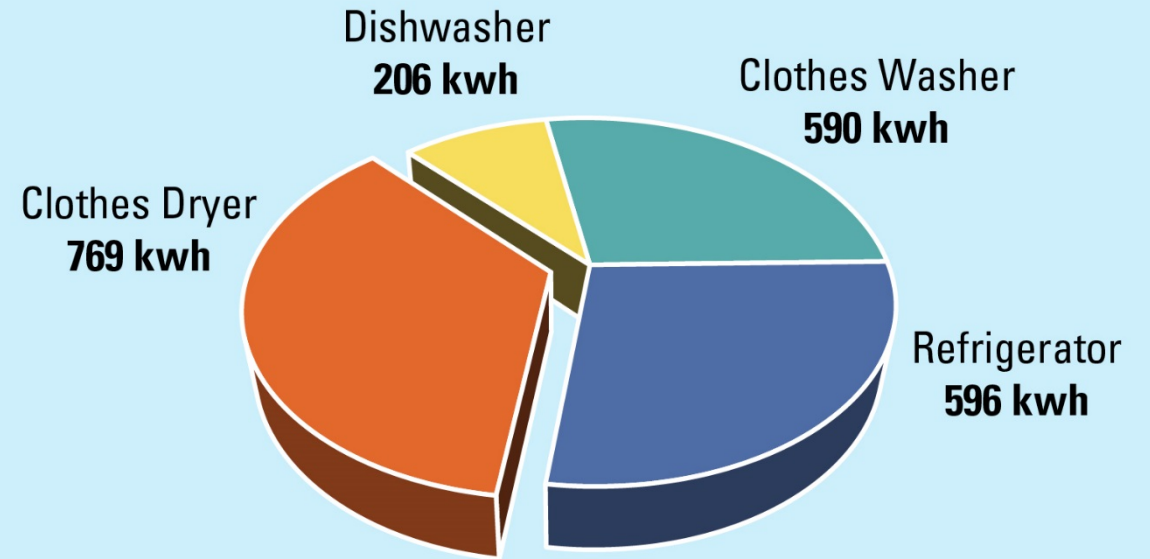
ENERGY STAR

What you might pay to run the appliance for a year, based on its electricity use and the national average cost of energy. The cost appears on labels for all models and brands, so you can compare energy use just like you would price or other features.

An estimate of how much electricity the appliance uses in a year based on typical use. Multiply this by your local electricity rate on your utility bill to better judge what your actual operating cost might be.

If you see the ENERGY STAR logo, it means the product is better for the environment because it uses less energy than standard models.

## ENERGY USE OF STANDARD HOUSEHOLD APPLIANCES



Energy used is based on unit energy consumption in kWh  
 (Source: U.S. EPA)

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

# 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.



The screenshot shows the Dominion Virginia Power website. At the top left is the Dominion logo, and to its right is the text "Dominion Virginia Power". Below this is a navigation bar with links for "Customer Service", "Outage Center", "Safety", "Ways to Save", "In the Community", and "News". The "Ways to Save" link is highlighted. Below the navigation bar is a breadcrumb trail: "Dominion Virginia Power > Ways to Save > Energy Conservation Programs > Home Energy Check-Up". The main heading is "Home Energy Check-Up". Below the heading is a large image of a hand holding a miniature house. To the right of the image is the text: "Get a Home Energy Check-Up and we'll serve up the savings".



# RESOURCES, REBATES & INCENTIVES

FEDERAL, STATE AND LOCAL INCENTIVES FOR RESIDENTIAL ENERGY UPGRADES

# Database of State Incentives for Renewables & Efficiency® - DSIRE

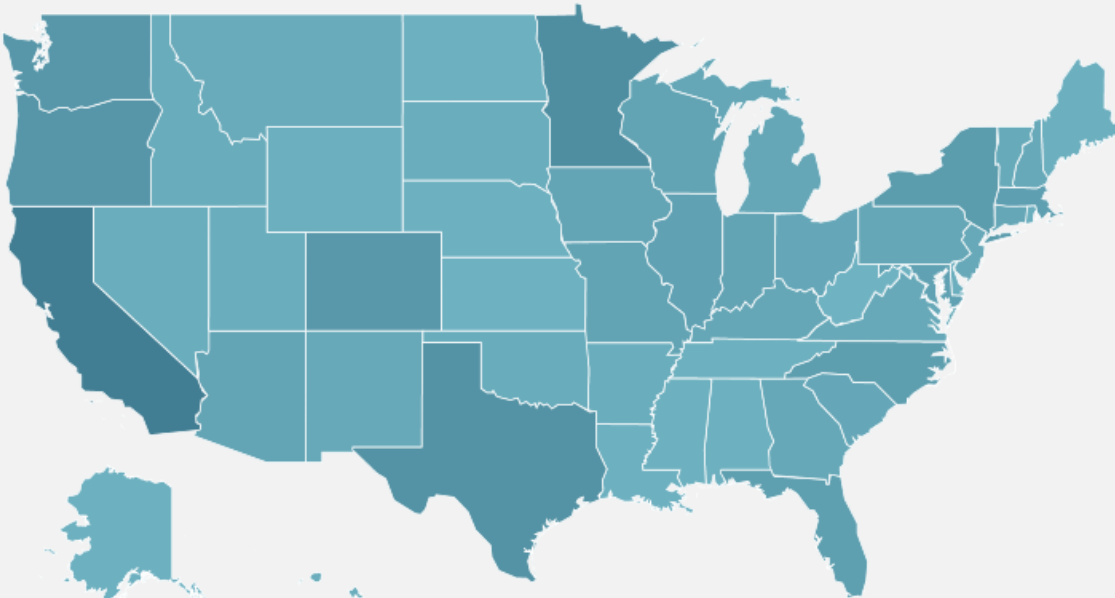
## Database of State Incentives for Renewables & Efficiency®

Find Policies & Incentives Near You

Zip Code

Search

### Find Policies & Incentives by State



## Database of State Incentives for Renewables & Efficiency®

Find Policies &amp; Incentives Near You

 Zip Code 
 

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
<u>Local Option - Residential Property Tax Exemption for Solar</u>	Cities and counties currently offering a solar energy equipment and facilities exemption include: Albemarle, Alexandria, Charlottesville, Hampton, Hanover, Harrisonburg, Henrico, Isle of Wight, King and Queen, Lexington, Loudoun, Lynchburg, Prince William, Pulaski, Rappahannock, Shenandoah, Spotsylvania, Warren, Winchester and Wise. Please contact your local building inspection officials to check if the exemption is offered.				
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

# Sales Tax Holiday/Tax-Free Weekend

## August 5-7, 2016



Virginia Department of Taxation

### Energy Star™ and WaterSense™ Items:

Qualifying items carrying either the Energy Star™ or WaterSense™ label with a sales price of \$2,500 or less purchased for noncommercial home or personal use.

- Qualifying Energy Star™ items include dishwashers, clothes washers, air conditioners, ceiling fans, light bulbs, dehumidifiers, and refrigerators
- Qualifying WaterSense™ items include bathroom sink faucets, faucet accessories such as aerators and shower heads, toilets, urinals, and landscape irrigation controllers
- [Detailed list of Energy Star™ and WaterSense™ items](#)

### Energy Star Qualified Products



Air Conditioners  
Ceiling Fans  
Dehumidifiers  
Washing Machines/Clothes Washers

Dishwashers  
Light Bulbs  
Refrigerators

### WaterSense Qualified Products



Bathroom Sink Faucets  
Faucet Accessories  
Showerheads

Toilets  
Urinals  
Landscape Irrigation Controllers



# Federal Income Tax Credits for Energy Efficiency

A number of tax credits for residential energy efficiency have been renewed. These tax credits are available for purchases made in 2016, as well as [retroactive to purchases made in 2015](#). ENERGY STAR products eligible for tax credits are independently certified to save energy, save money and protect the environment. Use up to 30% less energy in your home by outfitting it with [ENERGY STAR products](#) available across more than 70 categories. \*

## 2016 Federal Tax Credits

**Tax Credit:** 10% of cost up to \$500 or a specific amount from \$50-\$300.

**Expires:** December 31, 2016

**Details:** Must be an existing home & your [principal residence](#). New construction and rentals **do not** apply.

[Biomass Stoves](#)

[Air Source Heat Pumps](#)

[Central Air Conditioning \(CAC\)](#)

[Gas, Propane, or Oil Hot Water Boiler](#)

[Gas, Propane or Oil Furnaces and Fans](#)

[Insulation](#)

[Roofs](#)

[Water Heaters \(non-solar\)](#)

[Windows, Doors & Skylights](#)

**Tax Credit:** 30% of cost with no upper limit

**Expires:** December 31, 2016

*\* (Tax credits for Solar Energy Systems are available at 30% through December 31, 2019.*

*The credit decreases to 26% for tax year 2020; drops to 22% for tax year 2021 then expires December 31, 2021)*

**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 \\*](#)

[https://www.energystar.gov/about/federal\\_tax\\_credits](https://www.energystar.gov/about/federal_tax_credits)

Financial Incentives

Energy Efficiency

Renewable Energy

Alternative Fuels for  
Transportation

Energy & The Environment

Distributed Generation

Green Power

Questions About Energy

## 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.

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



## Energy Efficiency and Energy Conservation

[Customer Service](#)[Outage Center](#)[Safety](#)[Ways to Save](#)[In the Community](#)[News](#)[Dominion Virginia Power](#) > [Ways to Save](#) > [Energy Conservation Programs](#)[j](#) [h](#) [i](#)

# Energy Conservation Programs

## Ways to Save

### Energy Conservation Programs

[Smart Cooling Rewards](#)[Income-Qualifying Home Improvement](#)[Home Energy Check-Up](#)[Heat Pump Tune-Up](#)[Heat Pump Upgrade](#)[Duct Sealing](#)

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



# 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.



## Take the 10% Challenge: Take the Pledge Today to Reduce Your Use!

PLEDGE TODAY

### Energy Sense For Kids



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

LEARN MORE

<http://www.virginiaenergysense.org/>

### ENERGY STAR® Tip of the Day



ENERGY STAR  
product  
also  
ENERGY  
PARTNER

Home > ENERGY STAR Website

### Energy Rebates and Incentives

- RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL

Have an update or a new incentive to add? Email us at [energysense@scc.virginia.gov](mailto:energysense@scc.virginia.gov)



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

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).



# 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

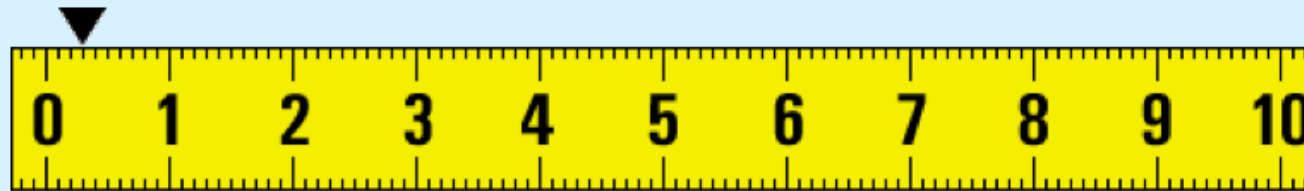
## ENERGY STAR Home Energy Yardstick · RESULTS

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 MtCO<sub>2</sub>eq 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!**

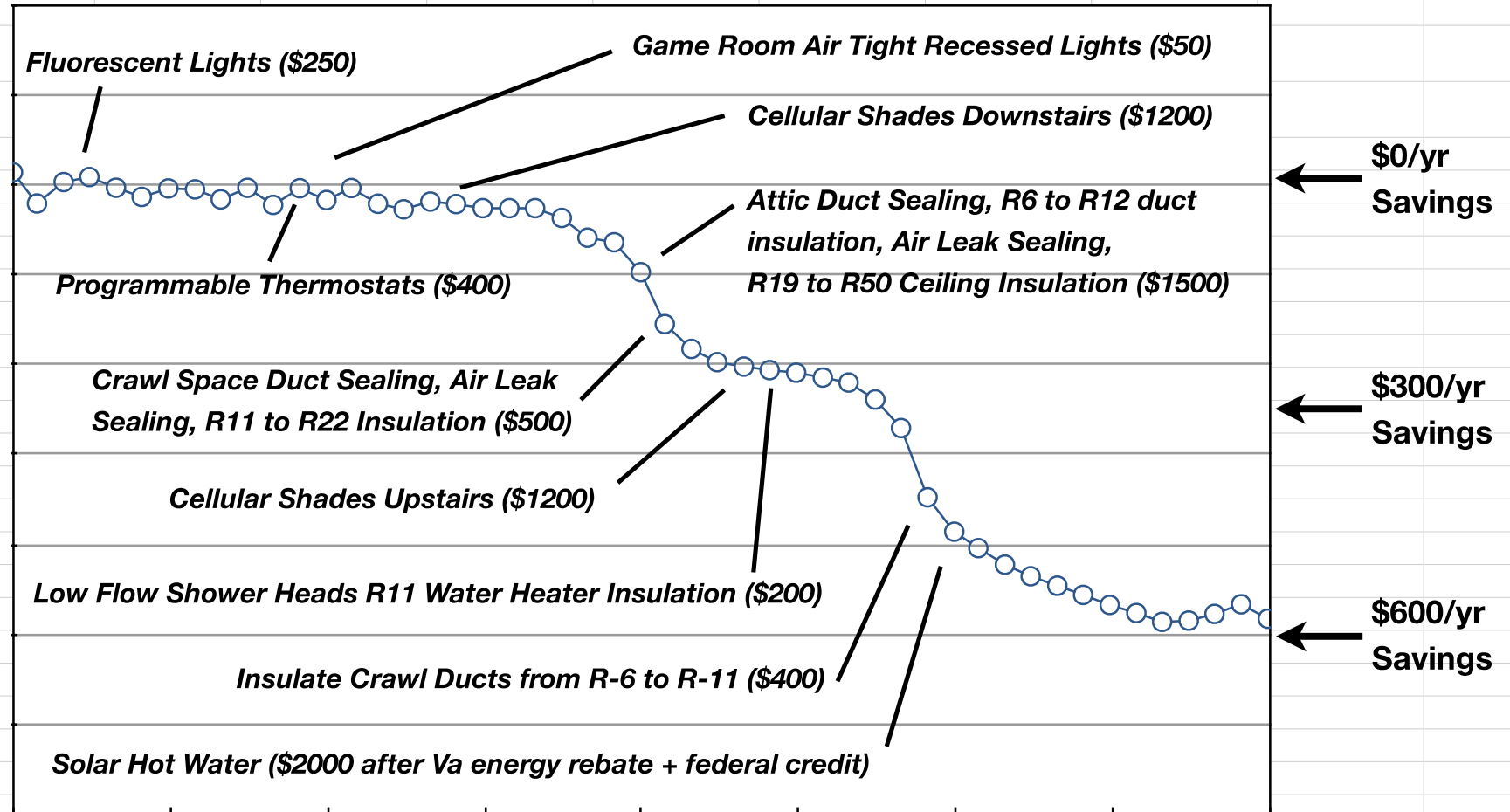
*This from a 1987 custom built home that at the time was "energy star" level with R19 attic insulation, R11 floor and walls, R4 wall foam sheathing, thermopane windows*

# 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 MtCO<sub>2</sub>eq 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.**

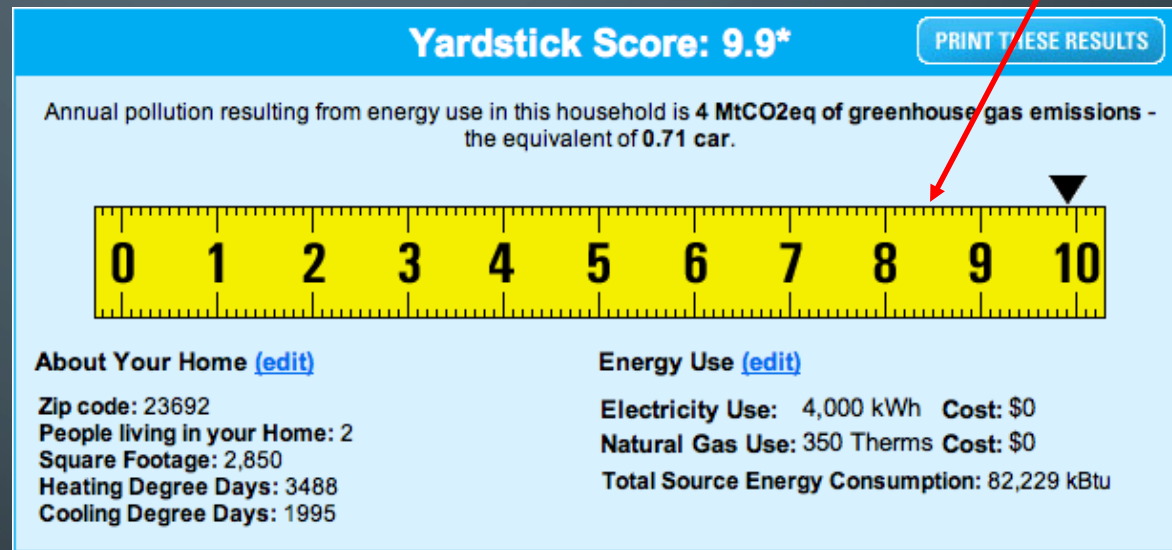
*Same home with lots of small improvements: no change in AC or Heating furnaces and compressors nor any change in windows.*

# 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:  $20 * \$2750 = \$55,000$
- CO<sub>2</sub> 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.

Energy Star Yardstick Rating:

Status as of Spring 2015:  
~8.4



# 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 CO2 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:

Federal tax credit (30%)

remainder

\$30,000

**\$9,000**

\$21,000

The Good News:

We paid ~\$10/W, cost is now \$3/W

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

The Bad News:

SREC market is much lower now than in 2009

Equivalent to 9% tax-free investment!!

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

## Solar hot water

Cost:

Federal tax credit (30%)

remainder

\$9,000

**\$2,700**

\$6,300

PV payback time now ~8 yrs

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



# SOLAR CONSIDERATIONS

- South-facing roof best, must be within  $45^\circ$  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
Federal tax credit (30%)	<b>\$13,000</b>
remainder	\$30,000

Cost of \$4.30/W

SREC income per year (estimated)	\$800
Electricity offset income per year (est.)	\$2200
Total annual income	\$3000
Years to pay off investment	10

~24 SRECs per year

PA SREC markets still open to new systems

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

Cost:	\$27,000
Federal tax credit (30%)	<b>\$9,000</b>
remainder	\$18,000

5 wells (~1 ton cooling/well), \$7000 to drill; HVAC system \$20,000; 10-year warranty parts & labor

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





Dashboard



Layout

Overview

Current Power <b>6.13 kW</b>	Energy today <b>9.38 kWh</b>	Energy this month <b>784.74 kWh</b>	Lifetime energy <b>2.38 MWh</b>
---------------------------------	---------------------------------	--	------------------------------------



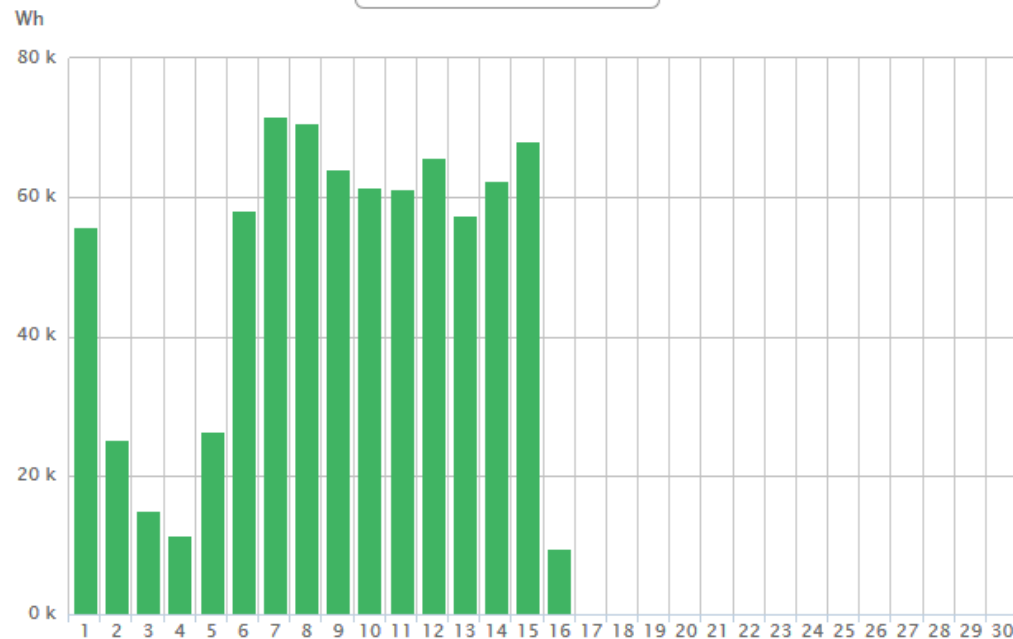
Power and Energy



Week **Month** Year

06/01/2015 - 06/30/2015

Production: 784.736 kWh



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**  
 96.8 - 77 °F  
 Hot and Humid



**Wednesday**  
 87.8 - 73.4 °F  
 Partly Cloudy

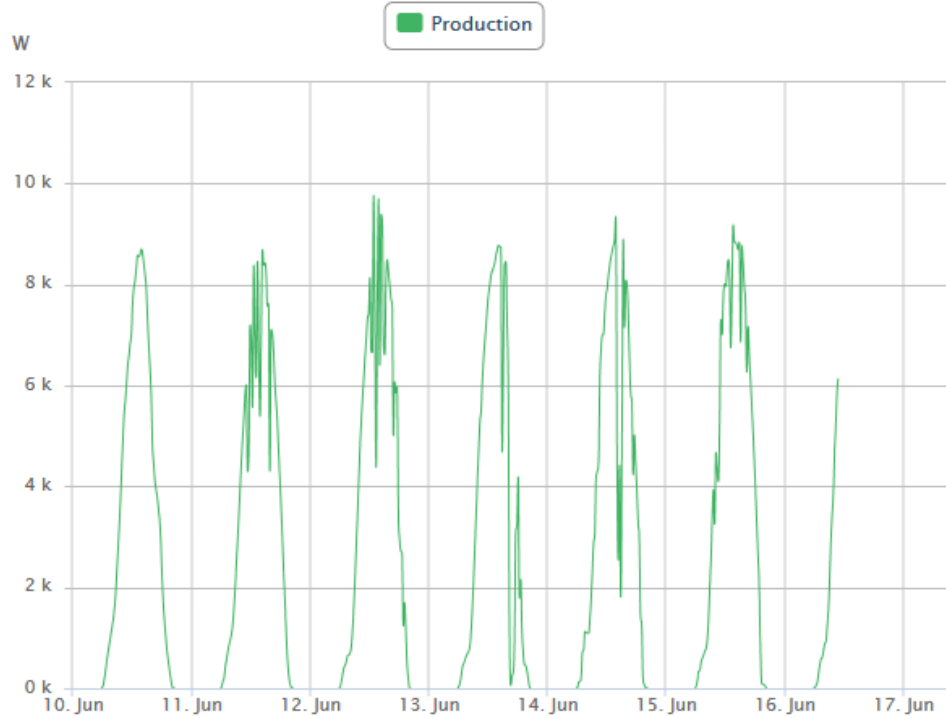


**Thursday**  
 93.2 - 78.8 °F  
 70% Chance of Storms

### Power and Energy

Week Month Year

06/09/2015 - 06/16/2015

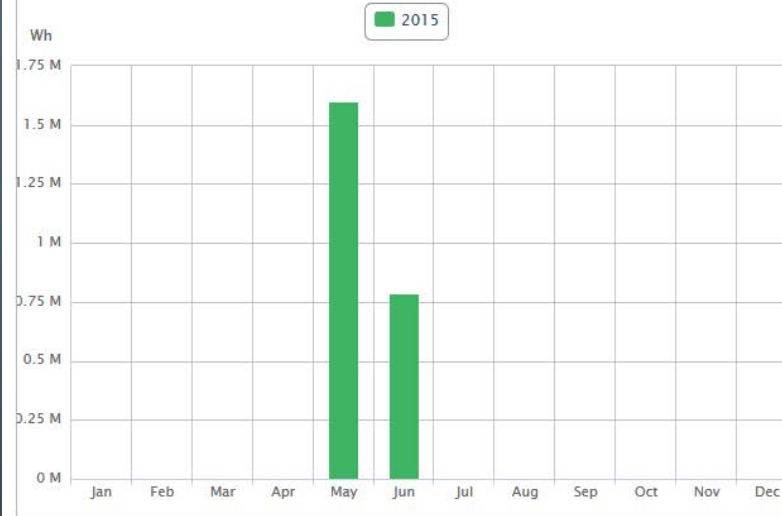


From: 06/09/2015

◀ 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**



The image features a dark blue background with white, stylized circuit board traces in the corners. These traces form various geometric shapes and paths, some ending in small circles, resembling a network or data flow diagram. The central text is a bold, lime green color.

# Additional information

# 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:	<a href="http://energy.gov/eere/buildings/powersaver-loans">http://energy.gov/eere/buildings/powersaver-loans</a>
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

# 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  $\sim 1/2$  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  $\sim$  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.



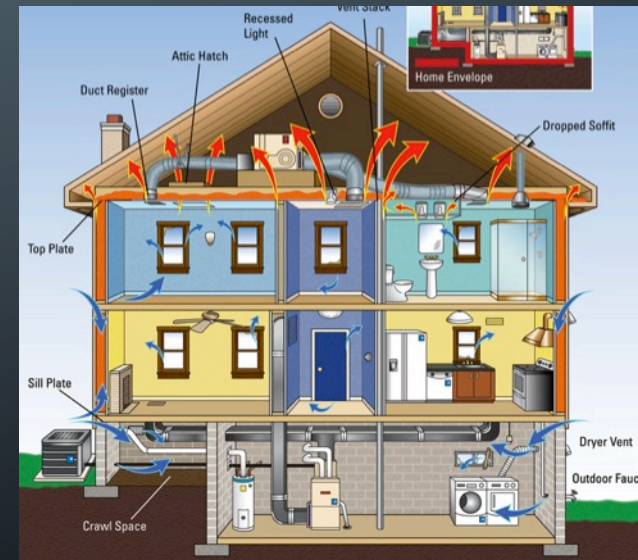
## 4. HEATING/AC DUCT SEALING: ~ 10%

- 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 duct 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.buiditsolar.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.

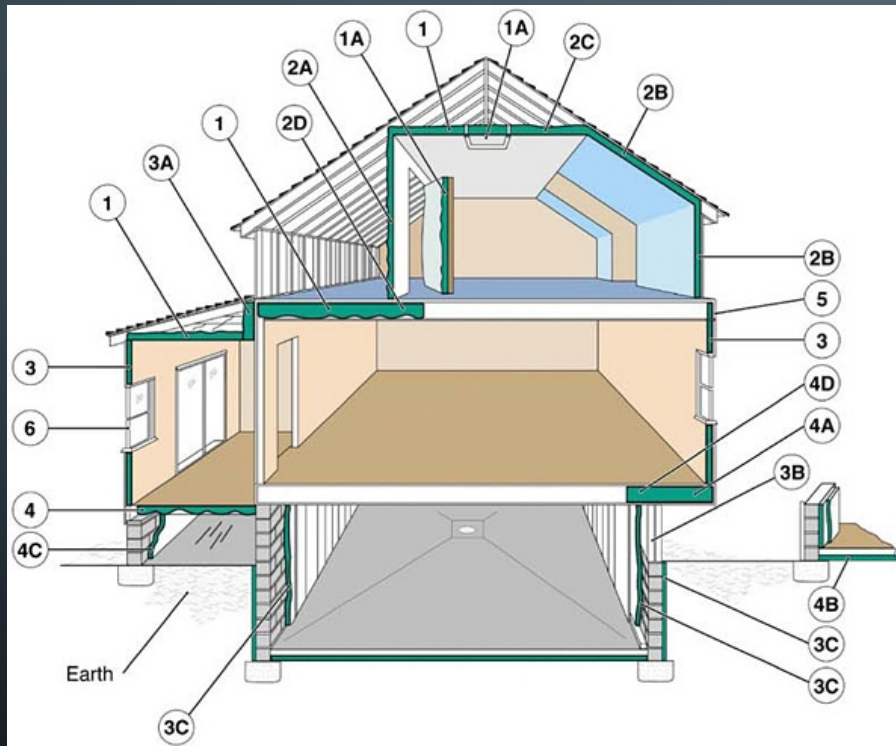
## 9. WHAT ABOUT OTHER CHANGES?

- **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](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-FY1energyaudit.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