Quick Guide for Report Assembly: Tompkins Energy Conservation Corps

This guide is organized to provide uniform language to respond to problems that are commonly found in homes that have been audited in Tompkins County, and provide recommendations for these issues. This guide corresponds to the data collection sheet used during an energy test. For the check boxes on the data collection form, corresponding recommendations are listed below. These recommendations can be copied and pasted into a report. Keep in mind that this is only a guide, and that tailoring each response to the specific home you've visited will be most useful to homeowners.

BUILDING SCIENCE BASICS

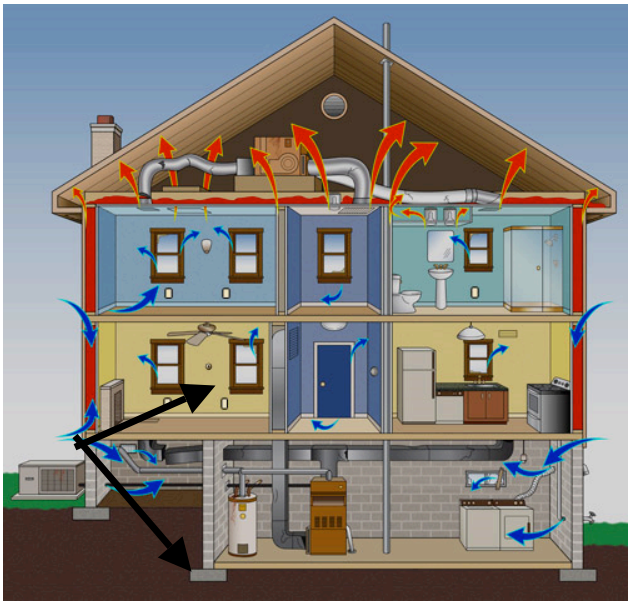
Before we discuss improvements for your house, it is important to understand a few basics of building science and heat transfer in a home.

Types of Heat Transfer

Heat transfer is the movement of heat from indoors to outdoors in the winter and from outdoors to indoors in the summer. Heat moves from regions of high temperature to regions of low temperature. Three types of heat transfer account for the loss and gain of heat in a home: conduction, convection, and radiation. When determining how best to stop heat loss from your home, it is important to understand how these three heat transfer mechanisms interact.

Conduction

Conduction is the transfer of heat through solid materials. Different materials allow conduction to occur at different rates. The use of thermal insulation in a home is designed to cut down on the conductive heat losses in a home through walls, ceilings, and floors.



Convection

Convection is the transfer of heat through air movement. There are three forces that cause air to move in your home: the stack effect, mechanical systems, and wind. The stack effect is described by the phrase "warm air rises". When surrounded by cold air, warm air rises.

When a home is heated in the winter, warm air rises and leaks out of holes at the top of the home will cold air leaks in at the bottom to replace it.

Radiation

Radiative heat transfer is heat transfer from one object to another through space. Radiative heat transfer is best illustrated by the heat flow that occurs from a woodstove to a person standing in front of that heat source.

UTILITY BILL ANALYSIS

GECO Instructions:

Instructions for Accessing NYSEG Bills

Cornell Cooperative Extension of Tompkins County

Note: we must have a signed consent on file.

1. Go to www.nyseg.com
2. Click "For Suppliers and Partners"
3. Under "in the spotlight," click "Secured Services"
4. Enter login "cornell" and password "cor456"
5. Under left sidebar, click "Customer history"
6. Under View Online, click "Customer Use History" checkbox
7. Enter PoD ID and click "Continue"
8. Click "I have read and agree…" checkbox
9. Click "Get History"

PoD ID #

N01 – Electric

N02 – Gas

NYSEG Contact: Tina Campenella 607-762-4838

AIR LEAKAGE

The blower door test sucks air out of the house, causing air from the outdoors to refill the house, which measures how well the building envelope contains pressure. During this test, the house was depressurized to create a 50 Pascal pressure difference between the inside and outside of the house. Because of this pressure difference, air rushes into the house through areas of the building that aren't tightly sealed. This pressure difference simulates the air changes that would occur on a stormy night when 30-40 degree winds are hitting the outside of your home. The blower door not only measures how airtight your house is, but also is very useful in helping identify where air leaks are.

5000	**Thorough air sealing effort should produce impressive energy savings.**
4000	Moderate air sealing effort should produce significant savings
3000	Carefully targeted air sealing should produce some energy savings.
2000	Building air tightness limits without whole house ventilation.
1000	Whole house ventilation recommended or required.
0	

Your home obtained a blower door reading of _____CFM_{50}. This is the number of cubic feet per minute of air that the fan pulls through your front door when there is a pressure difference between the inside and outside of 50 Pascals.

_____CFM_{50} is the lowest blower door number that your home could achieve without needing mechanical ventilation. This number is based on climate, volume of your house, and exposure to wind. You can get your house closer to this building tightness limit by targeting certain air leaks. By making simple do-it-yourself changes, you could reduce your air infiltration number by at least a few hundred, and by getting professional contracting work done, that number can be reduced even more.

1. Calculate building tightness limit

Building Tightness Limits Calculation

This calculation is based on a minimum natural air change rate for a building of 0.35 ACH (air changes per hour). Anything below the calculated building tightness limit increases the likelihood of problems with off-gassing of new materials in a home such as carpeting, or problems with radon. The most energy efficient way to go about air sealing in a home is to make the building as tight as possible and then ventilate mechanically with exhaust or heat recovery fans.

cfm_{50}min = 0.35 X (House Volume) X N/60.

The factor N is the LBL correlation factor shown in the table above. For example, suppose a one story house in New York (Zone 2) with normal exposure (average N = 18.5) and four occupants has a total living space of 2,500 ft^2 and 8 ft ceilings = 2,160.

Zone	*# of stories*	*1*	*1.5*	*2*	*3*
1	*Well Shielded*	*18.6*	*16.7*	*14.9*	*13.0*
	Normal	*15.5*	*14.0*	*12.4*	*10.9*
	Exposed	*14.0*	*12.6*	*11.2*	*9.8*

Blower Door Test Results/Air Sealing

See 'windows and doors' section for explanations on caulking and weatherstripping.

General Air Leakage

- ☐ **Recommend caulking and sealing for areas of infiltration from unconditioned to conditioned space in the following specific locations**

Windows

- ☐ **Recommend weather-stripping and/or caulking for the windows in the following locations**

Doors

☐ **Recommend door sweeps/weather stripping for exterior doors or doors separating conditioned and unconditioned space in the following locations**

Exterior Walls

☐ **Recommend baby proof plugs for exterior wall outlets and interior wall outlets that may be connected to an unconditioned space**

Baby proof plugs for outlets can be used to reduce the air flow in seldom used outlets.

☐ **Recommend foam insulation pads for exterior wall outlets**

Outlet and light switch insulation can be found in any hardware store. They are foam pads that you can simply insert behind the plate to reduce thermal loss and air leakage. We recommend that you install them in all of the outlets and light switches on all exterior walls.

Cost savings Information

Go to: http://hes.lbl.gov/ and input blower door number to calculate estimated cost savings.

Purchasing Tips

- To get the best results, hire a qualified contractor, preferably a "building performance contractor", or "energy auditor" to find out where the leaks are in your home's shell. Make sure the contractor uses a "blower door" test to find the air leaks. An infrared scan can be beneficial in addition to the blower door test. Check with your utility company; some offer no- or low-cost basic energy audits. However, the extra money you would spend to have the audit done by a home performance contractor is often well worth it. [5,6]
- Make sure your contractor tests the leakage rate after completing the sealing, not only to determine the degree of improvement, but also to ensure that the ventilation in your home is adequate. If you don't already have proper mechanical ventilation, consider installing a ventilation system. Proper home ventilation will make your home healthier and more comfortable.
- Make sure your contractor performs a combustion safety test after sealing your home's air leaks. This test checks for backdrafting and carbon monoxide, and will help assure the safety of your home's occupants. [9]
- If you choose to do the work yourself, follow the guidance in ENERGY STAR's Do-It-Yourself Guide to ENERGY STAR Homesealing.

WINDOWS AND DOORS

☐ **Recommend adding storm windows in colder months**

The best way to increase the energy efficiency of older windows is by adding storm windows. Storm windows do little to increase the insulating performance of windows, but they help to reduce air movement in and out of windows. Storm windows can be installed either on the interior or exterior of the primary window. Types range from inexpensive plastic sheets or films that can be used for one heating system, to glass or plastic panel units that can be used for years (www.energysavers.gov).

☐ **Recommend weather stripping and/or caulking in specific locations.**

Weather stripping can be used in your home to seal air leaks around operable windows. There are many different types of weather stripping that are available to withstand friction, weather, temperature changes, and general wear and tear related to the location.

Caulking can be used to seal cracks, gaps or joints that are less than ¼ inch wide. Expandable foam is best for larger cracks.

To determine what type of weather stripping to use for specific locations, refer to Table 1: Common weather stripping
http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11280

If homeowner is interested in what type of caulk or foam to use, refer to Table 1: Common Caulking Compounds.
http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11270

☐ **If homeowner interested in replacement window recommend: low-e, argon-filled window for the replacement**

When selecting windows for your home, there are many types of glazing or glass you can use to improve your home's energy efficiency.

- **Gas Fills:** some double paned windows have gases in between the two panes. The gases most commonly used, argon and krypton, have a higher resistance to heat flow than air, which increases the thermal performance of the windows.
- **Low-emissivity (Low-E) coatings**: these coatings control heat transfer through windows that have insulated glazing. The coating is a microscopic coating of metallic oxide that reduces the infrared radiation from a warm pane of glass to a cooler pane. Low-E coatings can increase the price of windows by 10-15% , but can reduce energy loss by 30-50% (www.energysavers.gov).

NOTE: *Replacing windows is one of the most costly energy improvements that a homeowner can do, so normally we don't want to recommend that homeowners replace windows. However, if they are already seriously considering replacing windows, the following things are good to recommend.*

☐ **Recommend latching windows securely**

Latching windows securely will significantly cut down on air leakage, by drawing the sashes (moveable panels) in together to eliminate the gap between them.

Doors

☐ **Recommend adding storm doors in colder months**

Storm doors can reduce air leakage from your doors if the door is old but still in good condition. Adding a door to a newer, insulated door, however is probably not worth the investment because it won't save you much energy (www.energysavers.gov).

☐ **Recommend weather stripping doors with visible gaps to exterior**

(see weather stripping windows info)

To determine what type of weather stripping to use for specific locations, refer to Table 1: Common weather stripping.
http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11280

INSULATION

Insulation is measured in R-values – the higher the R-value, the better your walls and roof will resist the transfer of heat. Insulation aids in preventing the conductive loss of heat through walls, ceilings, and floors. According to local heating and cooling costs, and climate conditions in different areas of the country, the Department of Energy has recommended ranges of R-values for different parts of your home.

Insulation guidelines for Tompkins County

Variations are due to differences in heating costs associated with different energy, i.e. whether the home is heated with gas, electricity, etc.

- Attic: R49 to R60
- Cathedral Ceiling: R30 to R60
- Wall Cavity: R13 to R21
- Wall Insulation Sheathing: R5 to R6
- Floor: R25 to R30
- Rim Joists: R25
- Unheated basement: basement ceiling insulated from R30 to R40

Insulation recommendations

Walls:
A wall with no insulation typically has an R-value of R-4 to R-5. Existing walls can be filled with blown-in insulation to increase the R-value of a wall to R-13. This increase will cut conductive heat loss through wall by about 70%.

To increase the R-value of a 2x4 wall any more, contractors/ homeowners would need to go to more extreme measures like stripping the exterior wall, inserting a layer of foam, and then replacing siding. Not cost effective, so don't recommend, unless homeowner is interesting in making an ultra-efficient home.

Attics:
An attic floor that is completely un-insulated typically has an R-value of 1. Attics are often one of the easiest places in a home to insulate. The Department of Energy recommends installing between R-49 and R-60 insulation for this geographic area. Typically loose fill or batt insulation is installed in attics.

Before insulating an attic, it is important to seal all areas where air is leaking from the home to the attic. Most insulation does not cut down on air leakage, and will not be effective if air leaks aren't sealed first.

DOE recommends approx R-50 for this climate. Reach R-50 by adding addtl cellulose on top of the fiberglass. Payback for this can be fairly long (15-20 years), especially if there is already R-20 insulation in the attic. Big benefits come from insulating the currently un-insulated areas and sealing the leaks in the attic floor.

Basements:
Look at on a case by case basis…
Refer to the following website for guidance:
http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11470

LIGHTING

☐ **Recommend replacing incandescent bulbs with CFLs**

Compact fluorescent light bulbs (CFLs) use only 25-30% of the energy that incandescent bulbs use to provide the same amount of light (www.energysavers.gov).

Compact fluorescent light bulbs have improved to the point that you can barely tell the difference between an incandescent and compact fluorescent. Many different models characterized by different styles, wattage types, and lighting color are now available for costs that have gone down significantly since CFLs first came out on the market.

- 100W incandescent = 23W CFL
- 60W incandescent = 13W CFL
- 40W incandescent = 8W CFL

CFLs for lighting locations where homeowners might not have known CFLs were available for:

- Dimmable lighting fixtures
- Recessed lighting fixtures
- Outdoor flood lighting

☐ **Recommend transitioning from CFLs to LED bulbs**

While CFLs use 1/3 of the energy of an incandescent light bulb, LED light fixtures use up to 1/10 of the energy that a typical incandescent bulb uses. Also, some of the latest LED light bulbs will work for 100,000 hours. That's over 11 years of light if the bulb was left on continuously.

Cost Savings Calculator

1) Lawrence Berkley Home Energy Saver: http://hes.lbl.gov/
2) CFL payback period calculator: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=LB

APPLIANCES

Primary and Secondary Refrigerators

Current refrigerator: _____

(year, make, model, cubic feet, energy star?)

☐ **Recommend Energy Star replacement, if 6 years old or older**

When it is time to replace your refrigerator, consider choosing an Energy Star rated model. The goal of the Energy Star program is to make appliances that use 50% less energy than their 6-year-old equivalents.

If your current refrigerator was made before 1993, it uses about twice the amount of energy used by new models. A new Energy Star qualified refrigerator uses less energy than a 60-watt light bulb run continuously. Additionally, Energy Star qualified refrigerator models use at least 20% less energy than required by current federal standards (www.energystar.gov).

☐ **Recommend cleaning the coils at least once a year**

Cleaning the condenser coils at least once a year will help your refrigerator run more efficiently. Condenser coils are located either under or behind the refrigerator.

☐ **Recommend unplugging unused/seasonal freezers and refrigerators**

Unplug unused or seasonal freezers and refrigerators when they are not in use. Also, filling a freezer as full as possible prevents the appliance from using extra energy to keep the interior space cool.

Cost Savings

1) Lawrence Berkley Home Energy Saver: http://hes.lbl.gov/

2) Energy Star energy saving calculator for refrigerators:
http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator
*Need to know electricity price, basic type of fridge (freezer on top, side, bottom, etc), approximate model year, capacity or size OR model number. I think we could add these calculations in to the report when recommending a new refrigerator. We might also be able to put something like this on a resource page at the end of the report for people who might want additional information.

Dishwasher

Current dishwasher: _____

(year, make, model, energy star?)

☐ **Recommend replacing dishwasher w/Energy Star model if older than 2000**

If you are replacing your dishwasher, consider an Energy Star model, which can save energy and water. The goal of the Energy Star program is to make appliances that use 50% less energy than their 6-year-old equivalents.

Cost Savings Information

1) Lawrence Berkley Home Energy Saver: http://hes.lbl.gov/
2) http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=DW
   *This is an excel spreadsheet that you plug the different values into. It is on the right sidebar of the page ("savings calculator").
   *Need to know: electric rate, water rate, gas rate, average number of loads per week, type of water heating, estimated initial retail price (Energy Star vs. conventional), unite electricity consumption (KWh/year), and unit water consumption (gallons/year).

☐

☐ **Recommend general energy saving practices**

Save water by scraping dishes instead of rinsing them before loading in the dishwasher. Run your dishwasher with a full load and use the air-dry option if available (www.energystar.gov).

Rinsing dirty dishes before loading your dishwasher uses a lot of water and energy. Most dishwashers today can thoroughly clean dishes that have had food scraped, rather than rinsed, off — the wash cycle and detergent take care of the rest. To make the most efficient use of your dishwasher's energy and water consumption, run the dishwasher only when enough dirty dishes have accumulated for a full load (www.energystar.gov).

Clothes Washer

☐ **If homeowner is considering getting a new washer, recommend a new, front-loading Energy Star model**

If you are preparing to replace your clothes washer, it is worth investing in a new energy efficient clothes washer. Many new models are much more efficient than those manufactured 10–12 years ago. Energy Star qualified clothes washers reduce energy use by about 30% compared to standard washers to clean clothes. They also reduce water consumption by over 50%, and have a better spin cycle allowing for less drying time.

☐ **General energy saving practices**

Wash your laundry with cold water whenever possible. To save water, try to wash full loads or, if you must wash a partial load, reduce the level of water appropriately.

Hot water heating accounts for about 90 percent of the energy your machine uses to wash clothes — only 10 percent goes to electricity used by the washer motor. Depending on the clothes and local water quality (hardness), many homeowners can effectively do laundry exclusively with cold water, using cold water laundry detergents. Switching to cold water can save the average household more than $40 annually (with an electric water heater) and more than $30 annually (with a gas water heater). Washing full loads can save you more than 3,400 gallons of water each year (www.energystar.gov).

Cost Savings Information

1) Lawrence Berkley Home Energy Saver: http://hes.lbl.gov/
2) Energy Star Calculator
http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CW

This is an excel spreadsheet that you plug the different values into. It is on the right sidebar of the page ("savings calculator").

Need to know: what kind of fuel is used, oil rate ($/gallon), square footage of home, year the home was built, when the existing boiler was installed, estimated initial retail price (Energy Star vs. conventional), use with programmable thermostat (Yes/No)

Note: This spreadsheet compares buying a new energy star appliance with a new conventional appliance

Clothes Dryer

☐ **Recommend keeping lint filter clean**

A clothes dryer's lint trap is an important energy saver. Dryers work by moving heated air through wet clothes, evaporating and then venting water vapor outside. If the dryer cannot provide enough heat, or move air sufficiently through the clothes, they will take longer to dry, and may not dry at

all. One of the easiest things you can do to increase drying efficiency is to clean the lint trap before each and every load. This step can save you up to $34 each year (www.energystar.gov).

☐ **Recommend general energy saving tips**

Don't over-dry your clothes. If your dryer has a moisture sensor that will automatically turn the machine off when clothes are done, use it to avoid over drying. Remember to clean the lint trap before every load. Dry full loads, or reduce drying time for partial loads.

It's easy to over dry your clothes, if one setting is used for various fabric types. Try to dry loads made up of similar fabrics, so the entire load dries just as the cycle ends. Many dryers come with energy-saving moisture or humidity sensors that shut off the heat when the clothes are dry. If you don't have this feature, try to match the cycle length to the size and weight of the load. A dryer operating an extra 15 minutes per load can cost you up to $34, every year (www.energystar.gov).

Dehumidifier

☐ **Recommend replacing dehumidifier with an Energy Star model**

If you are considering replacing your dehumidifier, choose an Energy Star model. Energy Star models remove the same amount of moisture from the air as regular models, but use 10-20% less energy doing so. Energy Star models have more efficient refrigeration coils, compressors, and fans than regular models (www.energystar.gov).

The average ENERGY STAR qualified dehumidifier can save consumers more than $20 per year. Over the life of the unit, that's more than $230 in savings! (www.energystar.gov)

Stove/Range

If fuel used is gas: Keep the burners clean on your gas range to ensure maximum efficiency. Blue flames mean good combustion; yellow flames mean service may be needed to ensure the gas is burning efficiently.

Other appliances/electronics

☐ **Recommend turning off electronics (TV, computer, stereos) when not in use**

☐ **Recommend installing power strips with switch or unplug electronics when not in use (eliminate phantom load)**

Home electronics use energy when they are switched off to power features like clock displays and remote controls. Anything with a remote control stays on continuously, in order to receive the signal from the remote. By unplugging electronics when not in use or installing power strips with switches to entirely cut the power use from these appliances, the “phantom load”, or unnecessary electricity use can be eliminated.

☐ **Recommend changing power settings on computer to sleep or hibernate**

Instead of leaving your computer on at home or at work during the hours you are not using it, switch the machine to a "sleep" or "hibernate" setting which puts the computer in a power saving state that allows the computer to preserve what you were working on in memory. On a PC, "sleep" uses a small amount of power to maintain the memory, while "hibernate" writes the current settings and content of the memory to the hard disk and then completely powers down the system.

☐ **Recommend avoiding use of electric space heater**

Because electricity is more expensive than other energy sources used to heat your home, electric space heaters should be used sparingly to cut down on energy costs.

HOT WATER

ELECTRIC WATER HEATERS

How you can tell:
- No flu/vent pipe
- Wire goes in
- Hot cold connections on top

GAS WATER HEATERS

How you can tell:
- Draft hood
- Flu pipe
-Pilot light sometimes visible underneath storage heater

Hot Water

Current hot water heating system:_____

(type, manufacturer, model number, year, fuel, water heater volume)

☐ **Recommend new heater if current hot water heater is older than 10 years**

Stand-alone water heaters, which are most common, have a life of approximately 12-15 years. When it is time to replace your hot water heater, there are multiple options to consider based on energy efficiency, price range, and your existing heating system.

On-Demand Tankless Water Heaters

Tankless water heaters provide hot water as it is needed, reducing the standby energy losses that occur with storage water heaters. For homes that use 41 gallons or less of hot water daily, demand water heaters can be 24%–34% more energy efficient than conventional storage tank water heaters. They can be 8%–14% more energy efficient for homes that use a lot of hot water—around 86 gallons per day (www.energysavers.gov).

Tankless Coil and Indirect Water Heaters

A tankless coil water heater uses a heating coil or heat exchanger installed in a main furnace or boiler. When a hot water faucet is turned on, the water flows through the heat exchanger,

providing hot water on demand without a tank. Since they rely on the furnace or boiler to heat the water directly, tankless coil water heaters work most efficiently during cold months when the heating system is used regularly.

Indirect water heaters use the main furnace or boiler to heat a fluid that is circulated through a heat exchanger in the storage tank. The energy stored by the water tank allows the furnace to turn off and on less often, which saves energy. An indirect water heater is used with a high-efficiency boiler and well-insulated tank can be the least expensive means of providing hot water (www.energysavers.gov).

☐ **Recommend pipe sleeves made with polyethylene or neoprene foam, insulated to R-3 to R-7, if hot water pipes are un-insulated and run through unconditioned space**
Insulating hot water pipes can cut down on convective heat losses through pipe walls. The most common pipe insulation is made from polyethylene and is readily available at hardware/home improvement stores and is easy to install.

☐ **Recommend low-flow showerheads**
☐ **Recommend faucet aerators**
Installing low-flow showerheads and faucet aerators is an easy, low cost solution to help cut down on the amount of water used when showering and dishwashing, which will reduce the amount of energy you need to use to heat water.

☐ **Potentially replace electricity for a fuel (natural gas, propane), only recommend if the house already has utilities for that fuel (Infrastructure costs associated with laying new pipes are not cost-effective)**
Another factor worth considering when you are looking to replace your water heating system is the fuel used. Electricity is a significantly more expensive energy source to use for heating water.

HEATING

Current Heating System: *list findings here* .
(Type, fuel, manufacturer, model number, year, input capacity, annual efficiency)

Furnace

Recommendations:

☐ **Replace your furnace with a more efficient model if it is older than 20 years.**
Although furnaces can last for 30+ years, changing a boiler that is 20+ years old is usually a good investment.

Look for a sealed combustion model, which draws air from the outside directly into the burner, and releases flue gases directly to the outside. Models that are not sealed combustion draw heated air into the unit for combustion and then release warm air up the chimney, wasting heated air (www.energysavers.gov).

The Energy Star program certifies oil and gas furnaces that are 85% and 90% efficient or greater, respectively.

New high efficiency furnaces:

- 90% efficiency is standard for natural gas (96% for a high-efficiency model)
- 83% efficiency is standard for oil (95% for a high-end model)

Cost Savings Information:

1) Lawrence Berkley Laboratory Energy Savers Site: http://hes.lbl.gov/

2) Energy Star Cost Calculator

http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=FU

*This is an excel spreadsheet that you plug the different values into. It is on the right sidebar of the page ("savings calculator").

*Need to know: what kind of fuel is used, gas rate ($/gallon), square footage of the home, year the home was built, year existing furnace was installed, estimate retail price

☐ **Change furnace filter every 30 – 90 days**

☐ **Recommend sealing ducts**

Sealing air leaks in an air duct distribution system can have a large effect on furnace efficiency in a home. Duct sealing can be done using duct mastic, a latex-based compound that is used to seal holes, cracks, and seams in ductwork. All joints in supply and return duct systems should be sealed with mastic to prevent air leakage.

Ductwork that runs through an unconditioned space should be insulated. Insulation with an R-Value of R-6 to R-10 should be used to insulate ducts. Keep in mind that ducts should be tightly air sealed with mastic before they are insulated, otherwise insulation will not be effective.

Boiler

Recommendations:

☐ **Replace your boiler with a more efficient model if it is older than 20 years.**

Although boilers can last for 30+ years, changing a boiler that is 20+ years old is usually a good investment. Boilers that were made before probably have an Annual Fuel Utilization Efficiency (AFUE) of 65% or less. Federal standards promulgated in 1992 required all boilers on the market to be at least 80% efficient (http://aceee.org/).

Look for a sealed combustion model, which draws air from the outside directly into the burner, and releases flue gases directly to the outside. Models that are not sealed combustion draw heated air into the unit for combustion and then release warm air up the chimney, wasting heated air (www.energysavers.gov).

The Energy Star program certifies boilers that are 85% efficient or greater.

New high efficiency boilers:

- 85% - 95% efficiency is standard for natural gas or propane
- 80% - 87% efficiency is standard for oil
- Energy Star models have an Annual Fuel Utilization Efficiency (AFUE) of at least 85%

Find the annual estimated savings per $100 of fuel costs for furnaces and boilers using this chart and/or include chart in reports.

Table 1. Annual Estimated Savings for Every $100 of Fuel Costs by Increasing Your Heating Equipment Efficiency*

Existing System AFUE	New/Upgraded System AFUE								
	55%	60%	65%	70%	75%	80%	85%	90%	95%
50%	$9.09	$16.76	$23.07	$28.57	$33.33	$37.50	$41.24	$44.24	$47.36
55%	----	$8.33	$15.38	$21.42	$26.66	$31.20	$35.29	$38.88	$42.10
60%	----	----	$7.69	$14.28	$20.00	$25.00	$29.41	$33.33	$37.80
65%	----	----	----	$7.14	$13.33	$18.75	$23.52	$27.77	$31.57
70%	----	----	----	----	$6.66	$12.50	$17.64	$22.22	$26.32
75%	----	----	----	----	----	$6.50	$11.76	$16.66	$21.10
80%	----	----	----	----	----	----	$5.88	$11.11	$15.80
85%	----	----	----	----	----	----	----	$5.55	$10.50
90%	----	----	----	----	----	----	----	----	$5.30

*Assuming the same heat output

(www.energysavers.gov)

☐ **Bleed air out of radiators at least twice a year**

At the beginning of each heating system, turn the bleed valve on each radiator slightly to allow air to escape, until water starts to escape from the valve.

Cost Savings Information
1) Lawrence Berkley Lab: http://hes.lbl.gov/
2) Energy Star Calculator
http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=BO
This is an excel spreadsheet that you plug the different values into. It is on the right sidebar of the page ("savings calculator").
Need to know: what kind of fuel is used, oil rate ($/gallon), square footage of home, year the home was built, when the existing boiler was installed, estimated initial retail price (Energy Star vs. conventional), use with programmable thermostat (Yes/No)
Note: This spreadsheet compares buying a new energy star appliance with a new conventional appliance

Other Heating System Recommendations

☐ **Recommend replacing electricity for a fuel (natural gas, propane) for certain appliances such as water heater or dryer**

Electricity is a much more expensive way to *heat water/run the dryer* in your home. In this area, it is currently more expensive per BTU (British Thermal Unit) of heat produced by electricity than it is for gas and propane.

But only recommend if the house already has utilities for that fuel and if the homeowner is thinking about replacing that appliance.

☐ **Oil: Recommend cleaning and tuning every year (twice a year is best)**
☐ **Natural gas or propane: Recommend cleaning or tuning every 2 years**

Choose the heating system found in the home and include this information from www.energysavers.org about the type of maintenance the homeowner or a maintenance professional should be doing on the heating system.

All systems:

- Check the condition of your vent connection pipe and chimney. Parts of the venting system may have deteriorated over time. Chimney problems can be expensive to repair, and may help justify installing new heating equipment that won't use the existing chimney.
- Check the physical integrity of the heat exchanger. Leaky boiler heat exchangers leak water and are easy to spot. Furnace heat exchangers mix combustion gases with house air when they leak—an important safety reason to have them inspected.
- Adjust the controls on the boiler or furnace to provide optimum water and air temperature settings for both efficiency and comfort.
- If you're considering replacing or retrofitting your existing heating system, have the technician perform a combustion-efficiency test.

Forced-air Systems:

- Check the combustion chamber for cracks

- Test for carbon monoxide (CO) and remedy if found
- Adjust blower control and supply-air temperature
- Clean and oil the blower
- Remove dirt, soot, or corrosion from the furnace or boiler
- Check fuel input and flame characteristics, and adjust if necessary
- Seal connections between the furnace and main ducts.

Hot-water Systems:

- Test pressure-relief valve
- Test high-limit control
- Inspect pressure tank, which should be filled with air, to verify that it's not filled with water
- Clean the heat exchanger.

Steam Systems:

- Drain some water from the boiler to remove sediments. This improves the heat exchange efficiency
- Test low-water cutoff safety control and high-limit safety control
- Drain the float chamber to remove sediments. This prevents the low-water cutoff control from sediment clogs
- Analyze boiler water and add chemicals as needed to control deposits and corrosion
- Clean the heat exchanger

(cite www.energysavers.org)

☐ **Recommend repairing leaks or spots that have become corroded**
☐ **Recommend proper and safe removal of asbestos**

[section complete]

AIR CONDITIONING

Current air conditioning system: _____
(*central air or room conditioning, year, number of units, location/space, total output capacity, SEER/EER*)

☐ **Central AC: Recommend if it is older than 10 years a model with 14-15 SEER (seasonal energy efficiency ratio)**

If you have a central air conditioning system that is more than 20 years old, replacing your system with a new, energy efficient model will pay for itself in energy savings. High efficiency systems on the market today are almost twice as efficient as systems from the early 1980s. If you have a system that is less than 10 years old, it is probably more cost effective to keep it running as efficiently as possible through properly maintaining it until it wears out.

New central air conditioning systems are rated for energy performance with a Seasonal Energy Efficiency Rating (SEER). The higher the SEER, the more efficient the system is. New central air conditioners are required to have a SEER rating of at least 10, while the most efficient units on the market today have a rating of 16 or more (Taunton's Insulate and Weatherize, p. 142).

☐ **Room AC: Recommend an Energy Star replacement if units are older than 7 years**

If you are considering purchasing a new room air conditioning unit, consider purchasing an Energy Star model. Energy Star room air conditioning units use at least 10% less energy than conventional models, and often include timers for better temperature control.

☐ **Recommend better maintenance, clean the filter every 30 days, and inspect every couple of years**

Proper maintenance on your air conditioner will increase the efficiency and life of the equipment. Routine service on an air conditioning unit should include testing the controls, cleaning the blower, cleaning the condenser and evaporator coils, checking the insulation the refrigerant lines, and checking the condensate drain system (Taunton's Insulate and Weatherize, p.141).

Cost Savings

1) http://hes.lbl.gov/

2) Energy Star Calculator

http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CA

*This is an excel spreadsheet that you plug the different values into. It is on the right sidebar of the page ("savings calculator").

*Need to know: number of units, electric rate ($/kWh), initial estimated retail cost (Energy Star vs. conventional), seasonal energy efficiency ratio (SEER) rating, use with programmable thermostat (Yes/No)

*Note: This spreadsheet compares buying a new energy star appliance with buying a new conventional appliance

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[section complete]

THERMOSTATS

☐ **Recommend programmable thermostat**

Install an Energy Star programmable thermostat, and program it to change the temperature settings when you are away from home and at night. The EPA estimates that Energy Star programmable thermostats can save consumers 10-15% on heating and cooling bills when used properly. It costs less to warm up a cool house than it does to keep the house at a constant higher temperature.

Programmable thermostats allow a homeowner to set multiple daily settings (six or more temperature settings a day) that you can manually override without affecting the rest of the daily or weekly program. If you would like the house to be warm when you arrive home from work in the evening, for example, you can set the thermostat so that it begins warming your home an hour before you arrive.

- ☐ **Recommend turning down thermostats to 58º F when away from the house for trips and vacations**

Consider reducing the temperature of your home by a few degrees when the house is unoccupied. This can either be done manually, before leaving the house for work/vacation, or by installing a programmable thermostat.

Cost Savings Information

1) Lawrence Berkley Lab: http://hes.lbl.gov/

2) For every degree a thermostat is set back for 8 hours you save approximately 1% on your heating bill.

For more information:
http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats_guidelines