

Energy Management Guide

Every home is a complex energy system. It uses a variety of energy sources including; electricity, sun, oil, gas, or other fuel.

Homes use about 1/5 of all energy consumed in the United States to meet the needs of our modern way of life... heating, cooling, lighting, cooking, refrigerating, hot water, and small miscellaneous appliances.

You can become the manager of this energy system. You should take positive steps to:

- Understand how your home's energy system works, and how each part affects the others.
- Detect and correct energy waste, inefficiency, "leaks".
- Maintain peak efficiency with regular maintenance program.
- Use energy wisely by developing habits for energy conservation in everyday living.

By making your home as energy-efficient as possible, you can - save money on energy bills, more important than ever with today's rising costs. Also you can save resources and help preserve the environment. All without sacrificing comfort!

Here's how.....

Your House

If you live in a cold climate, you probably spend something like two-thirds of your energy dollars on heat. Your old furnace or boiler chugs away burning the gas or oil like there's no tomorrow. So should you run right out and buy a new super-efficient one? Not necessarily.

Replacing your existing heating system with one that's more efficient may well be a wise step, but it shouldn't necessarily be your first step. You should try to lower your heating requirements. Tighten up. Weatherize. Insulate. By reducing your heating needs, you may be able to get by with a significantly smaller - and less expensive furnace or boiler.

A tight, well-insulated house saves energy and allows you to get by with a smaller-capacity heating and air-conditioning system, but it is also more comfortable. No more cold drafts at your feet while temperatures at head level are a sweaty 80 degrees. With less of this temperature stratification during the winter months, you'll even find yourself comfortable at a lower thermostat setting than you're used to.

Next, we'll take a look at some of the measures you can take to improve the energy efficiency of your house and thus lower your energy dollars.

Consider an Energy Audit

Find out from a professional where heat is being lost through your home's shell and what you should do about it. Energy auditors may use sophisticated equipment, like a blower door and infrared camera, to help pinpoint air leaks and areas with inadequate insulation, or they may simply make a thorough visual inspection. Depending on the service, you may be able to have your heating or cooling system cleaned, tuned up, and tested at the same time. Some full-service house doctoring companies will even perform caulking and weatherstripping.

If you are a renter, encourage your landlord to have an energy audit conducted and follow

through on the recommended energy improvements. You might offer to help your landlord by arranging for the audit and even doing some of the work in exchange for rent. After all, if you pay for heating, air conditioning, and electricity, energy improvements are very much in your interest. Even if your landlord won't pay for energy conservation projects, many of the suggestions are inexpensive enough that they'll pay for themselves in just a year or two, justifying your out-of-pocket expenditures.

Find and Seal Air Leaks

Hidden air leaks are among the largest heat loss source in most older homes. Some of the most common air leakage sites are listed below:

- Plumbing penetrations through insulated floors and ceilings.
- Chimney penetrations through insulated ceilings and exterior walls.
- Along the sill plate and band joist at the top of foundation walls.
- Fireplace dampers.
- Attic access hatches.
- The tops of interior partition walls where they intersect with attic space.
- Recessed lights and fans in insulated ceilings.
- Wiring penetrations through insulated floors, ceilings, and walls.
- Missing plaster.
- Electrical outlets and switches, especially on exterior walls.
- Window, door, and baseboard moldings.
- Drop ceilings above bathtubs and cabinets.

What you should use in sealing these hidden leaks depends on the size of the gaps and where they are located. Caulk is best for cracks and gaps less than about a quarter inch wide. Expanding foam sealant is an excellent material to use for sealing larger cracks and holes that are protected from sunlight and moisture. Use rigid foam insulation for sealing very large openings such as plumbing chases and attic hatch covers. Sheets of polyethylene can be taped over large holes to block air flow in some situations, but this is usually a fairly temporary

measure, since the poly may disintegrate over time if not protected. Specialized materials such as metal flashing and high-temperature silicone sealants may be required for sealing around chimneys and flue pipes. Check with your building inspector or fire marshal if unsure about fire-safe details in these locations.

Upgrade Inefficient Windows and Doors

About one-third of the home's total heat loss usually occurs through windows and doors. Windows deserve the most attention because they outnumber doors. To reduce heat loss, you can either fix up your windows, or replace them with new energy-efficient units.

New replacement windows will typically cost from \$200 to \$400 apiece, including labor. If you are going to the expense of installing new windows, be sure to spend a few extra dollars necessary to buy high performance units.

If your existing windows are in relatively good shape, it may be hard to justify the expense of window replacement. In that case, there are a number of ways to improve their energy efficiency. The quickest and least expensive option is to weatherstrip all window edges and cracks with rope caulk. Rope caulk may be taken off, stored in foil, and reused for two or three seasons, but once it hardens you should discard it.

A more permanent solution is to weatherstrip the windows. This is more time-consuming and expensive than installing rope caulk, but it only needs to be done once, it permits you to open the window, and the weatherstripping is out of sight.

The next step in improving window energy efficiency is to install some type of storm window. If you have single-glazed windows, storm panels will double their energy efficiency.

The simplest type of storm window is a plastic film taped to the inside of the window frame. These inexpensive plastic films are especially suitable for apartments and condominiums where exterior improvements are not allowed, or not

practical. Removable or operable storm windows with glass or rigid acrylic panes generally make more sense if you plan to stay in the house for more than a few years. Both exterior and interior storm windows are available, though exterior units are far more common. Most people choose aluminum-framed combination storm/screen windows, which are very convenient to operate.

Finally, you can boost the energy efficiency of windows by installing insulating curtains or drapes on the interior. These can be closed at night to significantly cut down on heat loss. They can also be closed on hot humid days to keep out unwanted heat gain. Look for shades or drapes that fit into tracks to keep air from passing around the edges.

Don't forget about your doors. As with windows, make sure your doors are in good shape. Weatherstrip around the whole perimeter to ensure a tight seal when closed. Install quality door sweeps on the bottom of the doors if they aren't already in place.

Insulate

Insulation is your primary defense against heat loss through the house envelope. However, putting insulation into a house after it is built can be pretty difficult. Because of the large area involved, walls are the most important. If there isn't any insulation, the best option is to bring in an insulation contractor to blow cellulose into the walls.

Adding insulation to an unheated attic is usually a lot easier. If there is no floor in the attic, simply add more insulation, either loose fill or unfaced fiberglass batts. If the existing insulation comes up to the top of the joists, add an additional layer of unfaced batts across the joists. This helps to cover gaps between the first layer of batts.

Heat loss through foundation walls is often neglected even in new homes. But in fact, in an otherwise well-insulated and tight house, as much as 20% of the total heat loss can occur through uninsulated foundation walls. If the basement or crawl space is unheated and you don't have plans

to fix it up, you will do best to insulate between the floor joists instead of around the perimeter walls. If the basement is heated and used, you need to insulate the basement walls instead. The simplest method is to build 2x4 frames against the concrete foundation walls, insulate with fiberglass, and cover with drywall.

Economics

The economics of all these energy improvements will depend on where you live, how large your heating or cooling requirements are, and how much you pay for energy. Most measures described here will pay for themselves in five years or less if you heat with gas or oil. If you have electric heat, the payback will generally be much faster.

Heating Systems

Heating is the largest energy expense in most homes, accounting for around two-thirds of annual energy bills in colder parts of the country. Reducing your energy use for heating, therefore, provides your single most effective way to reduce your home's energy expense. A combination of conservation efforts and a new high-efficiency heating system can often cut your fuel bills in half.

Very basically, a heating system replaces heat that is lost through the shell of your house. How much energy your heating system requires to replace that lost heat depends on four factors: where the house is located (in colder places, the house will lose more heat); how big the house is; the energy efficiency of the house; and how energy-efficient the heating system is.

You cannot do much about the first factor. As for size, the bigger the house, the more energy it will take to heat it. You can do something about energy conservation levels. Improving your home's energy efficiency is an excellent idea and offers the greatest opportunity for savings in heating costs. Some of the most effective measures, such as rope-caulking windows cost next to nothing, while others, such as insulating, can be both expensive and time consuming. That

leaves your heating system itself, the focus of the section. Whether or not you've buttoned up your house, you can probably save a great deal by upgrading your heating system, either by installing a new high-efficiency system or by boosting the efficiency of your present system. Both of these options are addressed.

Should I Replace My Existing Heating System

This can be a difficult question. If you heat with electric heat, rising electricity prices may force you to switch to a gas, oil, or heat pump system that is more affordable. If you currently have a gas or oil fired furnace or boiler, the decision to replace it depends on its age, condition, and performance.

If your furnace or boiler is old, worn out, inefficient, or significantly oversized, the simplest solution is to replace it with a modern high-efficiency model. Old coal burners that were switched over to oil or gas are prime candidates for replacement, as are gas furnaces without electronic ignition or a way to limit the flow of heated air up the chimney when the heating system is off.

A typical heating system will last about 25 years, though some boilers last twice that long. Your heating system technician may be able to help you evaluate your existing system and decide whether replacement is a good idea. If you're not going to replace it, good maintenance and modifications are ways to boost its efficiency and performance.

Upgrading Your Existing Heating System

Even if you aren't about to go out and buy a state-of-the-art, high-efficiency heating system, you can still probably realize substantial savings by boosting the efficiency and performance of your present system. Measures described here fall into two categories: maintenance and modifications.

Proper maintenance can have a big effect on fuel bills and should be performed on a routine basis. Maintenance operations are separated into two groups; those that can be performed by the homeowner or renter, and those that should be

performed by a heating system service technician.

When performing maintenance on hot water and steam heating systems, you may come in contact with dangerously hot water and steam. Use caution. If you're uncertain about how to do something, call a service technician.

Some basic maintenance measures that can be done by you:

- Clean air filters. The filters on warm-air furnaces and heat pumps should be checked once a month during the heating season and cleaned or replaced as necessary. Dust blocks the air flow and forces the blower to work harder, which raises electric bills and can lead to blower failure.
- Clean registers. Warm-air registers should be kept clean and should not be blocked by furniture, carpets, or drapes.
- Keep baseboards and radiators clean and unrestricted by furniture, carpets, or drapes. Air needs to freely circulate through them from underneath. Also, do not cover tops of radiators.
- Bleed trapped air from hot water radiators. Trapped air keeps radiators from performing properly. Use a radiator key to bleed air out of hot-water radiators once or twice a season. Hold a pan under the valve and open it until all the air has escaped and only water comes out. If you are unsure, you may want to have the technician show you how to do it the first time.
- Follow prescribed maintenance for steam heat systems, such as maintaining water level, removing sediment, and making sure air vents are working. Check with your heating system technician for specifics on these measures and use caution: steam boilers produce high-temperature steam under pressure.

Oil-fired systems should be tuned up and cleaned every year, gas-fired systems every two years, and heat pumps every two or three years. The company that sells oil or gas usually has trained

technicians who can test your furnace or boiler, clean it and tune it for optimum efficiency.

The service technician will perform a number of tests to determine the system's performance and efficiency. The technician should measure the efficiency of your system both before and after tuning it up and provide you with a copy of the results. Combustion efficiency is determined indirectly, based on some of the following tests: flue temperature, percent carbon dioxide or oxygen, smoke number, carbon monoxide, and draft. These are discussed next:

- *Flue temperature.* High flue gas temperature means that a lot of heat (and money) is being lost up the chimney.
- *Carbon dioxide.* Carbon dioxide is the primary end product of fossil fuel combustion. Too little carbon dioxide indicates incomplete combustion.
- *Smoke.* Smoke indicates lack of complete combustion and is usually not present in gas systems.
- *Carbon monoxide (gas only).* Carbon monoxide indicates incomplete combustion.
- *Draft.* Correct draft promotes complete combustion and reduces net loss up the chimney. If you have a sealed combustion or induced draft system this is less important.

Parts to be cleaned include the burner, combustion chamber, heat exchanger surfaces, oil line filter, and flue pipe. Sediment should be removed from the boiler and steam lines; corrosion inhibitors may be added to the boiler.

Air and fuel flow adjustments will be made based on the results of the efficiency testing. The internal thermostat on the furnace or boiler should be calibrated to turn on and off at the appropriate temperatures.

Heating System Modifications

Even if your heating system is fairly efficient, there are probably still some modifications that could be made to further increase efficiency. Often, it makes more economical sense to modify your

existing system than to replace it, at least if it's in pretty good shape and less than 15 to 20 years old. A service technician should be able to help you decide which approach makes the most sense. Common heating system modifications are described next and divided into those that can be done by the homeowner and those that should be done by a technician.

All of these modifications deal with heat distribution - getting the most heat from your furnace or boiler to the rooms in your house. These should be done regardless of the tested combustion efficiency of the heating system.

- *Pipe insulation.* All hot-water and steam pipes passing through unheated areas should be wrapped with insulation. Use specially made foam or fiberglass pipe insulation.
- *Duct insulation.* First, seal all joints and seams with quality duct tape or mastic to keep hot air from leaking out of the ducts. Secondly, all hot-air ducts passing through unheated spaces should be wrapped with insulation. You can use standard foil faced insulation, keeping the foil facing out and visible; vinyl faced insulation made especially for ducts; or rigid foam insulation.
- *Radiator reflectors.* Radiators are designed to heat the living space, but they can lose a lot of heat into the exterior walls they are installed against. You can reduce this loss by placing reflectors between the wall and the radiator. The reflector should be the same size or slightly larger than the radiator.

All the following measures for boosting the efficiency of your furnace or boiler require a professional with the proper training and tools.

- *Reducing system size.* Having your system constantly turn on and off is like driving in stop-and-go traffic: you don't get very good mileage. A simple way to reduce this waste is by decreasing the rate at which oil or gas is fed into the burner. With some systems, the service technician can install a smaller nozzle, which costs just a few dollars and can cut fuel bills up to 10%.

Consult your technician to find out if size reduction is possible for your system.

- *Draft reduction.* This problem is particularly common in systems that were converted from coal to oil. If the draft is too high, your service technician should install a barometric damper in the flue pipe.
- *New oil burner installation.* If you have an old, inefficient oil burner but are not ready to replace the whole thing, have a flame-retention burner installed. It will mix oil and air more thoroughly, operate with less air flow, and send less heat up the chimney.
- *Pilotless ignition.* Electronic ignition eliminates the pilot light that ordinarily burns constantly.
- *Adjustable radiator vents and valves.* To reduce heat flow to unused rooms, valves on some hot-water radiators may be turned down. Valves on steam radiators should always be completely on or off, not in-between.
- *Clock thermostats.* Setting the thermostat manually works well but is inconvenient. More convenient is a clock thermostat that will turn on the heat a half-hour before your alarm goes off in the morning. Some clock thermostats have several different set-back periods, helping you save energy when you go off to work and the kids leave for school.

Recommendations

Try to button up your house as much as possible before installing new heating equipment, because you might be able to buy a smaller, less expensive system. Energy conservation is cheaper than burning expensive fossil fuels.

Other modifications that can improve efficiency on older systems include barometric damper in the flue modulating aquastats, automatic flue dampers, adjustable radiator vents and valves, and clock thermostats.

All heating systems must have regular maintenance. Residents should change filters on warm air furnaces, make sure radiators and registers are not blocked, check steam boiler

water levels, and maintain radiators. A heating system technician should clean and tune oil burners each year and gas burners every two or three years. The technician should measure efficiency before and after the tune-up.

Keep your thermostat set at the lowest comfortable level. Don't heat unused rooms. Turn the thermostat down at night and when no one is home. Increase comfort levels at lower thermostat settings by maintaining humidity, stopping cold air leaks, and covering windows at night. Set aquastats to lower temperatures in milder weather. Set back the fan thermostat on warm air furnaces.

Cooling Systems

Air conditioning, or cooling, is more complicated than heating. Instead of using energy to create heat, air conditioners use energy to take heat away. The most common air conditioning system uses a compressor cycle to transfer heat from your house to the outdoors.

Picture your house as a refrigerator. There is a compressor on the outside filled with a special fluid called a refrigerant. This fluid can change back and forth between liquid and gas. As it changes, it absorbs or releases heat, so it is used to "carry" heat from one place to another, such as from the inside of the house to the outside. Simple, right?

Well, no. And the process gets quite a bit more complicated with all the controls and valves involved. But its effect is quite remarkable. An air conditioner takes heat from a cooler place and dumps that heat in a warmer place, seemingly working against the laws of physics. What drives the process, of course, is electricity - quite a lot of it, in fact.

Two-thirds of all U.S. households have air conditioners, whose energy consumption amount to 5% of all the electricity produced in the U.S. for all purposes. A switch to high-efficiency air conditioners and implementation of measures to reduce cooling loads in homes can reduce this

energy use by 20-50%.

The information listed below on reducing cooling loads include; guidelines on the selection of a new system, upgrading of existing air conditioners, operating air conditioner for maximum efficiency, and finally, strategies to reduce the need for air conditioning.

- Reduce the cooling load by employing cost-effective conservation measures. Provide effective shade for east and west windows. When possible, delay heat-generating activities such as dishwashing until evening on hot days.
- Over most of the cooling season, keep the house closed tight during the day. Don't let in unwanted heat and humidity. Ventilate at night either naturally or with fans.
- Use ceiling fans to increase comfort levels at higher thermostat settings.
- If you have an older central air conditioner, consider replacing the outdoor compressor with a modern, high-efficiency unit. Make sure it is properly matched to the indoor unit.
- If buying a new air conditioner, be sure that it is properly sized. Get assistance from an energy auditor or air conditioning contractor.
- Buy a high-efficiency air conditioner: for room air conditioners, the EER should be above 9; for central air conditioners, look for a SEER above 12.
- In hot, humid climates, make sure that the air conditioner you buy will adequately get rid of high humidity. Models with variable or multi speed blowers are generally best. Try to keep moisture sources out of the house.
- Make sure that compressors are well shaded, both for central and room air conditioners. This may be difficult with room air conditioners, but do your best.
- Try not to use a dehumidifier at the same time your air conditioner is operating. The dehumidifier will increase the cooling load and force the air conditioner to work harder.

- Seal all air conditioner ducts with mastic or duct tape, and insulate ducts that run through unheated basements, crawl spaces, and attics.
- Keep the thermostat set at 78 degrees or higher if using ceiling fans. Don't air-condition unused rooms.
- Maintain your air conditioner properly to maximize efficiency.

Water Heating

Next to heating and cooling, water heating is typically the largest energy user in the home. As homes have become more and more energy efficient during the past 20 years, the percentage of energy used for water heating has steadily increased. The following list takes a look at reducing your water heating costs with your present water heater as well as suggestions when purchasing a new one.

- Plan ahead. Don't wait until your existing water heater fails before you look into a replacement. It often makes very good economic sense to replace an old inefficient model with a high-efficient one before the old one fails.
- Take into account life-cycle costs when you're choosing a water heater. Don't be tempted to simply buy the lowest price model available.
- With storage water heaters, buy an efficient model, do your homework.
- Implement water conservation strategies. You'll save energy and money whether you're buying a new system or not. Install low-flow showerheads and faucet aerators.
- Insulate your water heater if it's a storage model. Even new energy-efficient models should generally be insulated.
- Insulate hot water pipes.
- Lower the temperature settings on your water heater to about 120 degrees.

Food Storage

The energy use of refrigerators and freezers has improved dramatically in the past 20 years, but they are still among the largest energy consumers in the home. A typically new refrigerator today uses less than 800 Kwh per year, while the typical model in 1974 used over twice as much. Moreover, the typical unit today is larger and has better controls. This increase in efficiency has been achieved through more insulation, tighter door seals, larger coil surface area, and improved compressors and motors.

Boosting the Efficiency of Your Existing Units

From an energy standpoint, you will save the most by replacing your existing refrigerator or freezer with a new, more efficient model. If it is more than 15 years old, it may be so inefficient that a new one would pay for itself in energy savings in just a few years. Unfortunately, that is often not practical. Refrigerators cost a lot. If your present one is working fine, it's hard to justify running out to buy a new one. So here are a number of ways to boost energy efficiency and performance of refrigerators and freezers.

Check door seals or gaskets on your refrigerator/freezer. These can deteriorate over time, greatly increasing heat gain and decreasing energy performance. Put a dollar bill in the door as you close it; if it is not held firmly in place, the seals are probably defective. The dealer you purchased the refrigerator or freezer from should be able to install new seals. New seals aren't cheap, though. If the seals are bad, you might want to evaluate whether it's time to buy a new, high-efficiency model.

Check the temperature inside your refrigerator and freezer with an accurate thermometer. The refrigerator compartment should be kept between 36 and 38 degrees, with the freezer compartment between 0 and 5 degrees. If the temperature is outside these ranges, adjust the thermostat control. Keeping temperatures 10 degrees lower than recommended levels can increase energy use by as much as 25%.

Take a look at where the refrigerator is located. If it's in the sunlight or next to your stove or dishwasher, it has to work harder to maintain cold temperatures. If you can move it to a cooler location, you'll boost energy performance. Also, make sure that air can freely circulate around the condenser coils. If that air flow is blocked, energy performance will drop.

Many refrigerators have small heaters built into the walls to prevent moisture from condensing on the outer surface - as if the refrigerator doesn't have to work hard enough already! On newer units, this feature can be turned off with an energy-saver or power-saver switch. Unless you have noticeable condensation keep this switch on the energy-saving setting.

Manual defrost and partial automatic defrost refrigerators and freezers should be defrosted on a regular basis. The buildup of ice on the coils inside the unit means that the compressor has to run longer to maintain cold temperatures, wasting energy. If you live in a very hot, humid climate and don't use air conditioning, defrost may be required quite frequently with a manual defrost model. After defrosting, you might be able to adjust the thermostat to a warmer setting, further saving energy.

Recommendations

Avoid putting hot foods directly in the refrigerator or freezer. Let them cool in the room first.

Cover foods, especially liquids. Otherwise they will release moisture into the refrigerator compartment, increasing energy use by the refrigerator.

A full freezer will perform better than nearly empty freezer. This can be especially true in the event of a power outage. If your freezer isn't full, fill plastic containers with water and freeze them.

If you have a freezer or second refrigerator that's nearly empty, turn it off. You'll do no harm to your refrigerator or freezer by turning it on and off periodically. If you won't be using it at all, unplug it and remove the door to be sure that

children can't accidentally get trapped inside.

Mark items in the freezer for quick identification so that you don't have to stand there with the door open.

Dishwashing

Most of the energy used by a dishwasher goes towards heating the water. In fact water heating accounts for approximately 80% of total energy use by dishwashers. Models that use less water therefore use less energy. Older dishwashers use between 8 and 14 gallons of water for a complete wash cycle. Dishwashers built since the mid-1994 use only 7-10 gallons per cycle, due to national efficiency standards. Along with water use, a number of important features effect energy use of dishwashers. These should be considered when shopping.

- *Booster Heater.* Some dishwashers have built-in heaters to boost water temperature up to 140-145 degrees, the temperature recommended by manufactures for optimum dishwashing performance. Some models will automatically boost water temperature if it is not hot enough, while other models require preselecting the feature before starting the cycle. The advantage to the booster heater is that you can turn down your water heater thermostat, significantly reducing water heating costs.
- *Energy-Saving Wash Cycles.* Most dishwashers have several different wash cycle selections. If a load of dishes is only lightly soiled, a "light wash" cycle will save energy by using less water and operating for a shorter period of time.
- *Energy-Saving "No-Heat" Dry* - An electric heating element is generally used to dry dishes at the end of the final rinse cycle. Most new dishwashers now offer an energy-saving no-heat drying feature. At the end of the rinse cycle, if the feature is selected, room air is circulated through the dishwasher by fans, rather than using an electric heating element to bake the dishes dry.

Recommendations

Using energy-saving cycles whenever possible.

If your dishwasher has a booster heater, turn down your water heater thermostat. Most dishwasher booster heaters can raise the water temperature at least 20 degrees, so a setting of 120 degrees for your water heater should work fine. The washing cycle will take longer if the dishwasher has to boost the temperature, but unless you need to wash several loads in a row, this shouldn't be a problem.

Use the no-heat air-dry feature on your dishwasher if it has one. If you have an older dishwasher that doesn't include this feature, you can turn the dishwasher off after the final rinse cycle is completed and open the door to allow air drying. Using the no-heat dry feature or opening and air drying the dishes will increase the drying time, and it could lead to increased spotting, according to some in the industry. But try this method sometime to see how well it works with your machine.

Don't pre-rinse dishes before putting them in the dishwasher. Modern dishwashers do a superb job of cleaning even heavily soiled dishes. Scrape off food and empty liquids - the dishwasher will do the rest. If you must rinse dishes first, at least use cold water.

Wash only full loads. The dishwasher uses the same amount of water whether it's half-full or completely full. Putting dishes in the dishwasher throughout the day and running it once in the evening will use less water and energy than washing the dishes by hand throughout the day.

Load dishes according to manufacturer's instructions. Completely fill the racks to optimize water and energy use, but allow proper water circulation for adequate cleaning.

Cooking

Choosing cooking appliances is a lot more complex and confusing today than it was 20 years ago. Along with the standard range with four top burners and an oven or two, we now have down-vented ranges with pop-out grills, fancy cook tops, separate ovens, microwave ovens, convection ovens, and a host of other smaller cooking appliances from slow-cook crockpots and bread ovens to high-tech toaster ovens. Whether or not you plan to buy a new range or other cooking appliances, you can probably save a lot of energy just by modifying your cooking habits. A few tips for energy-efficient cooking are listed below:

- Full-size ovens are not very efficient when cooking small quantities of food. When cooking small to medium sized meals it generally pays to use smaller microwave ovens, toaster ovens, or slow-cook crockpots.
- If you have two ovens, use the smaller one whenever you can.
- For soups and stews that require long cooking periods, using a crockpot will save a substantial amount of energy.
- For stove-top cooking, consider using a pressure-cooker. By building up steam pressure, they cook at a higher temperature, reducing cooking timer and energy considerably.
- Use the smallest pan necessary to do the job. Smaller pans require less energy.
- With electric cook-tops, match the pan size to the element size. For example, a 6" pan on an 8" burner will waste over 40% of the heat produced by the burner.
- Consider copper-bottom pans. These heat up faster than regular pans.
- Keep the burner pans clean and shiny so they'll be more effective at reflecting heat up to the cookware. Blackened burner pans absorb a lot of heat, reducing burner efficiency.
- With electric burners, solid disk elements, and radiant elements under ceramic glass, use flat-bottomed cookware that rests evenly on the burner surface. The ideal pan has a slightly concave bottom - when

it heats up, the metal expands and the bottom flattens out. An electric element is significantly less efficient if the pan does not have good contact with the element.

- With electric burners, you can turn off the burner just before the cooking is finished. The burner will continue radiating heat for a short while.
- With gas burners, make sure you're getting a bluish flame. If the flame is yellow, the gas may not be burning efficiently. Have your gas company check it out.
- To reduce cooking time, defrost frozen foods in the refrigerator before cooking.
- With conventional ovens, keep preheat time to a minimum. Unless you're baking breads or pastries, you may not need to preheat the oven at all.
- Try to avoid peeking into the oven lot as you cook. Each time you open the door, a significant amount of heat escapes. Food takes longer to cook and you waste energy. Use your oven light and inspect through the window in the oven door instead.
- Food cooks more quickly and more efficiently in ovens when air can circulate freely. Don't lay foil on the racks. If possible, stagger pans on upper and lower racks to improve air flow if you're baking more than one pan at a time.
- Cook double portions when using your oven, and refrigerate or freeze half for another meal. It doesn't take as much energy to reheat the food as it does to cook it - not to mention the saved preparation time.
- Use glass or ceramic pans in ovens. You can turn down the temperature about 25 degrees and cook foods just as quickly.
- Use meat thermometers and timers to avoid overcooking. Overcooking not only spoils the taste and reduces nutritional value but also wastes energy.
- If you have a self-cleaning oven, use the feature just after you've cooked a meal-that way, the oven will still be hot and

the cleaning feature will require less energy. Try not to use the self-cleaning feature too often, and operate the ventilation fan when it's on.

- With microwave ovens, keep the inside surface clean to allow more efficient microwave cooking. You can often cook foods right in their serving dishes, thus saving time and reducing the amount of hot water needed for dishwashing.

Laundry

Washing Machines

Like dishwashers, most of the energy used by washing machines is for heating the water. Water heating accounts for about 90% of the energy use-even more than with dishwashers. The primary energy conservation strategies, therefore, involve using cooler wash and rinse cycles, and reducing water use. Unlike dishwashers, washing machines can use cooler temperature water with perfectly adequate results for most clothes.

There are a number of easy ways to save energy with washing machines, whether you're buying new or not. Follow these suggestions whenever possible to keep energy use to a minimum.

- Use lower temperature settings. Use warm or cold water for the wash cycle instead of hot, and only use cold for rinses. Experiment with different laundry detergents to find one that works well with cooler water. By presoaking heavily soiled clothes, a cooler wash temperature may be fine. The temperature of the rinse water does not affect cleaning, so always set the washing machine on cold water rinse.
- Turn down the thermostat on your water heater. A setting of 120 degrees is adequate for most home needs. By reducing your hot water temperatures, you will save energy with either hot or warm wash cycles.
- If washing lightly soiled clothes, use the suds-saving feature if it's available on your washing machine. This saves the wash

water to be reused in the next load. Only use this feature, though, if the second load is to be washed right away.

- Load the washing machine to capacity when possible. Most people tend to underload rather than overload their washers. Check your machine's load capacity in pounds, then weigh out a few loads of laundry to get a sense of how much laundry 10 or 18 or 20 pounds represent. Then use your eye to judge the volume of clothes for a load. Washing one large load will take less energy than washing two loads on a low or medium setting. Don't go to the other extreme and overload your machine though. The clothes won't get clean and you may end up having to wash them again. When you don't have a full load, match the water level to the size of the load. Most washing machines, even older ones, offer several different settings.

- Dry two or more loads in a row, taking advantage of the heat still in the dryer from the first load.
- Clean the dryer filter after each use. A clogged filter will restrict air flow and reduce dryer performance.
- Dry full loads when possible, but be careful not to overfill the dryer. Drying small loads wastes energy. Overloading causes wrinkling and uneven drying. Air should be able to circulate freely around the drying clothes. If your washer and dryer properly matched, a full load will be about the right size for the dryer as well.
- Check the outside dryer exhaust vent. Make sure it is clean and that the flapper on the outside hood opens and closes freely. If the flapper stays open, cold air will blow into your house through the dryer and increase heating costs. Replace the outside dryer vent hood with one that seals tightly.

Dryers

Dryers work by heating and aerating clothes. Operation of both electric and gas fired models is pretty straightforward. In terms of energy use, gas dryers are generally much less expensive to operate than electric models.

Whether or not you plan on purchasing a new dryer, you can probably save a lot of energy just by changing a few of your drying habits. A few ideas for cost cutting are listed below:

- When drying, separate your clothes and dry similar types of clothes together. Lightweight synthetics, for example, dry much quicker than bath towels and natural fiber clothes.
- Don't overdry clothes. Take clothes out while they are still slightly damp to reduce the need for ironing-another big energy user. Overdrying also causes shrinkage, generates static electricity, and shortens fabric life. If your dryer has a setting for auto-dry, be sure to use it instead of the timer to avoid wasting energy.
- Don't add wet items to a load that is already partially dried.

Lighting

Lighting accounts for 5-10% of total energy use in the average American home and costs \$50 to \$150 per year in electricity. That's not a huge amount, but it's enough to justify doing something about-especially when the advantages of energy-efficient alternatives are considered. Tips for saving energy and money with lighting will be discussed in the following paragraphs.

Nothing's nicer than natural light, and in terms of energy use, nothing's more efficient. A single skylight or properly positioned window can provide as much light as dozens of light bulbs during the daylight hours. To benefit more from natural lighting you may need to rearrange your rooms somewhat - putting your favorite reading chair over by the south window, for example. Or you may want to go to more effort and install one or more skylights. To help get that light deeper into the room, you can paint your walls a light color and use reflective louvers or venetian blinds.

You can save a lot of energy by concentrating light just where it's needed and reducing

background or ambient light levels. This strategy-called task lighting-is widely used in office buildings, but it makes just as much sense at home. Install track or recessed lights to illuminate your desk or the kitchen table where you do the crossword puzzle, and keep the ceiling lights off.

Most of the lighting currently provided by incandescent lights can be provided just as well with compact fluorescent lamps. Replacing your incandescent lamps with compact fluorescents is the best way to save lighting energy in the average home.

Higher-wattage incandescent light bulbs are more efficient than lower-wattage bulbs. It takes two 60-watt bulbs or four 40-watt bulbs to provide as much light as a single 100-watt bulb. In a fixture that holds several bulbs, you'll save by using a higher-wattage bulb instead of several smaller bulbs.

Get into the habit of turning off lights when you leave a room. If you're forgetful, consider buying occupancy sensors that automatically turn lights off when you leave a room.

Other Energy Uses In The Home

When we think about saving energy in the home, we generally focus on the obvious energy uses: heating, cooling, water heating, refrigerators, and so on. In many homes though there are miscellaneous uses of energy that are for the most part overlooked; such as waterbed heaters, well-water pumps, pool filtering systems, engine block heaters, hot tubs, and even aquariums for tropical fish.

While the energy use of each of these products is relatively small on a national level, it can be quite large in individual houses. In fact, it is not too uncommon to find that one or more of these miscellaneous products can account for more energy use than your refrigerator, water heater, or even the heating system. When these miscellaneous products are looked at collectively

on a nationwide level the energy consumption is very significant: 14% of all energy used in homes.

As you consider energy-saving opportunities in the home, look over this list. If you have a lot of these or other miscellaneous energy users in the home, there may be opportunities for savings. Recommendations are listed below for reducing energy use of a few of these household products.

Furnace fans. If your furnace is improperly sized, or if the fan thermostat is improperly set, the fan may operate longer than it needs to. If you're getting a lot of cold air out of the warm-air registers after the furnace turns off, this may be the case. Along with making you uncomfortable, the fan is wasting energy. On the other hand, if the fan shuts off too soon, heat from the furnace will be wasted. Have a service technician check the fan thermostat setting if you're unsure.

Color televisions. While new color televisions no longer have instant-on features, many older models in homes do. The instant-on feature keeps the tubes warmed up all the time. New solid-state TVs do not take as long to warm up, so they don't need this feature. If you have an older TV that stays warm even when it's not turned on, consider installing a switch on the cord, or at least unplugging it when you go away for any length of time.

Waterbeds. As many as 20% of homes have waterbeds, and most are heated with electric coils underneath. Waterbeds can be the largest electricity user in a home - exceeding even the refrigerator and water heater!

Simple habits can significantly reduce energy waste from waterbeds. Regularly making the bed with a comforter can save more than 30%; insulating the sides of the bed can save over 10%. You might consider putting the waterbed heater on a timer so that it doesn't waste energy throughout the day.

Well pumps. Well pumps are very common in rural areas. The amount of energy they use is dependent on how deep the well is, the pump quality, and the pressure controls. If the pump

seems to be switching on more often than it should, there may be a leak in the system somewhere, or the pressure switch may not be functioning properly. Have the system checked out. You can also save on the well pumping electricity cost by reducing your water use.

Electric blankets. Each electric blanket in a house uses an average of 150 Kwh per year, according to various studies. If you use an electric blanket and frequently forget to turn it off in the morning, you can save energy by buying a simple timer control. Putting a second blanket or quilt over the electric blanket also saves energy, but be sure to check the electric blanket instructions for possible precautions against this practice. It is worth noting that electric blankets may actually save energy by allowing you to turn your thermostat down further at night.

Spas and hot tubes. If you have one, keep it covered with a tight-fitting insulated cover when it's not in use. If installing a spa or hot tub, insulate it well around the sides and bottom.

Computers and home office equipment. More and more people are working at home. As home office use increases, so does energy use by such equipment as computers, printers, copiers, and fax machines. Some of this equipment (especially color monitors and laser printers) consumes a great deal of energy. In most cases, though, any increase in household energy use when you work at home is more than made up for by reduced energy use for transportation. In fact, the trend towards more home offices may have a very significant impact on energy use for commuting.

Block heaters. If you live in a cold area and use a block heater to help your car start on cold mornings, you might be surprised at how much energy it draws. A 5-amp block heater could be using 14 Kwh per day if you leave the car plugged in all the time. You will probably find that using the block heater for just a half-hour or so before you start the car will warm it up perfectly well.

Saving energy with many of these incidental energy-consuming products-and with the other products throughout the house-is very easy. Most

of the time, it just takes some common sense. If we all become a little more aware of the energy we use, we might just begin to solve some of our major environmental problems, and we'll end up with a little more money in our pockets as well.

Home Energy Checklist For Action

To Do Today

- Turn down the temperature of your water heater to the warm setting (120 degrees). You'll not only save energy, you'll avoid scalding your hands.
- Check if your water heater has an insulating blanket. An insulating blanket will pay for itself in one year or less.
- If you have one of those "silent guzzlers", a waterbed, make your bed today. The covers will insulate it, and save up to one-third on the energy it uses.
- Start using energy saving settings on refrigerators, dishwashers, washing machines, and clothes dryers.
- Survey your incandescent lights for opportunities to replace them with compact fluorescents. These new lamps can save three-quarters of the electricity used by incandescents. The best targets are 60-100W used several hours a day. Measure the clearance in the fixtures to make sure they will accommodate compact fluorescents, which are slightly bigger than incandescents.
- Check the age and condition of your major appliances, especially the refrigerator. You may want to replace it with a more energy efficient model before it dies.
- Clean or replace furnace, air-conditioner, and heat-pump filters.
- Rope caulk the very leaky windows.

To Do This Month

- Collect your utility bills. Separate electricity and fuel bills. Target the biggest bill for energy conservation remedies.

- Crawl into your attic or crawlspace and inspect for insulation. Is there any? How much?
- Insulate hot water pipes and ducts wherever they run through unheated areas.
- Seal up the largest air leaks in your house—the ones that whistle on windy days, or feel drafty. The worst culprits are usually not windows and doors, but utility cut-throughs for pipes, gaps around chimneys and recessed lights in insulated ceilings, and unfinished spaces behind cupboards and closets. Better yet, hire an energy auditor with a blower door to point out where the worst cracks are. All the little, invisible cracks and holes may add up to as much as an open window or door, without you ever knowing it!
- Install a clock thermometer to set your thermostat back automatically at night.

To Do This Year

- Insulate. If your walls aren't insulated, have an insulation contractor blow cellulose into the walls. Bring your attic insulation level up to snuff.
- Replace aging, inefficient appliances. Even if the appliance has a few useful years left, replacing it with a top-efficiency model is generally a good investment.
- Upgrade leaky windows. It may be time to replace them with energy efficient models or to boost their efficiency with storm windows and weatherstripping.
- Reduce your air-conditioning costs by planting shade trees and shrubs around your house - especially on the west side.
- Know that you are making a difference!