HOME HEATING

INSIDE

Low-Tech Ways to Keep Warm

- Wear a sweater and cover exposed skin.
- Set the thermostat as low as comfortable and lower it when away from home for an extended period or at night when sleeping.
- Change filters no less than every two months or once a month, if needed.
- Caulk and seal to reduce air leaks around cracks, windows and doors, fireplaces, small holes, etc.
- Open draperies and shades on south-facing windows if sunshine is available.
- Close all draperies and shades at night to reduce heat loss.
- Change the direction of the ceiling fan from down in the summer to up in the winter.

Keeping You and Your Home Warm

In Arkansas' mixed climate, heating systems account for about half of the cost of maintaining comfort — the other half, of course, is the cost of cooling. Fortunately, there are several cost-effective strategies available that can reduce the loss of heat, keep your winter heating bills down, and keep you warm. These strategies fall into three categories: keep the heat in, reduce the heat loss, and ensure that the heating system efficiently delivers all of the heat where it is needed.

This booklet was designed to answer common questions about heating systems and provide Arkansans with information on how to keep comfortable in the winter while saving energy and money. You will find "low-tech" ideas to reduce the loss of heat, upgrade your current heating system, and detailed information on the various types of heating systems available. Additionally, there are tips on what to look for in a new heating system and information to help you make informed decisions on system types.

We hope you will find this booklet informative and useful. The Home Series publications on *Home Tightening* and *Home Insulation* complement this *Home Heating* brochure. For a copy of these brochures, contact the Arkansas Energy Office at 1-800-558-2633 or visit our web site: www.1800arkansas.com/energy/.

Four Basic Steps

Keeping your home warm and comfortable at an affordable cost can be accomplished in four basic steps.

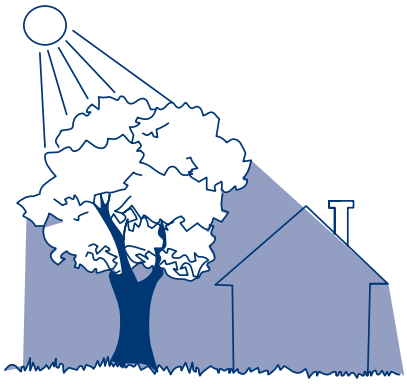
- Explore no cost/low cost methods to keep warm
- Reduce the heat that is escaping from your house
- Increase the efficiency of the heating and duct system
- If necessary, purchase a new, energy efficient heating system

NO COST/LOW COST METHODS TO KEEP WARM

- Efficient thermostat settings are one of the easiest and most effective ways to save money on heating costs. For each degree you lower your thermostat in winter, you can save about 3 percent on your heating bill. Set your thermostat as low as is comfortable (suggested thermostat setting of 68 degrees when the home is

occupied during the day, and 55 degrees at night or during long periods of absence away from home). Keep the temperature fairly constant, as frequent changes will use more energy.

- Install an automatic setback thermostat. Lowering the thermostat at night or during the day while you are away will save about three percent for every one-degree-Fahrenheit per eight hours of setback. Manually resetting the temperature twice a day will not cost anything, but this can be inconvenient. Instead, you can get an automatic setback thermostat to do the work for you. Some are relatively inexpensive and pay for themselves in a very short time.
- Remember to clean and/or change the return air filter (some types of filters can be rinsed out and reused) at least once every two months (once a month is preferable). This can dramatically increase your savings and reduce the load on your heating system. Dirty filters cause your heating system to work harder when circulating air and lead to both higher energy bills and a shortened life span. Consider using newer polyester or pleated filters that have increased filtration surfaces but do not significantly restrict the airflow through the heating/cooling system.
- Clean supply registers, baseboard heaters, and radiators as needed. Make sure supply and return registers are not blocked by furniture, carpeting, or drapes.
- Don't let the heat go up the chimney. Other than emergency circumstances, most fireplaces are for decoration, not heat. Make sure the fireplace flue is closed when you are not using it.
- Caulk windows and weatherstrip doors to prevent drafts. Also, electric outlets on interior and exterior walls let cold air into the house. Remove the outlet covers and insert special insulation gaskets underneath. Use insulating outlet plugs in all outlets that are not being used. Outlet insulating plugs and gaskets may be purchased at your neighborhood home improvement store.
- Use kitchen and bathroom exhaust fans to vent humidity and odors outside. Caution: don’t use exhaust fans any longer then necessary because they can exhaust much of the heated air from your home.
- Keep draperies and shades on south-facing windows open during the heating season to allow sunlight to enter your home — some furniture and building materials will absorb some heat during the sunniest part of the day and release it back a little later as it gets cooler. Close draperies and shades at night to reduce the chill you may feel from cold windows. South facing windows receive three times more sunlight in winter than those that face east or west. North windows receive little winter sun.
- If you use your clothes dryer, make sure it vents to the outside; otherwise the humidity will build up in your house.



Summer

Winter

Figure 1: Deciduous trees provide shade in the summer and warming sun in the winter.

- Plant deciduous trees, the ones that loose their leaves in winter. Deciduous trees allow the sunshine in during the winter, and if they are nearby, provide some shade during the summer. (See Figure 1)
- Ceiling Fans: Ceiling fan direction should be reversed in the winter. In the summer, the fan's downward breeze blows air over exposed skin helping you to feel cool. In the winter, a slowly moving fan is used to gently direct the air up, which mixes the warm air more evenly.

Reducing the Heat Loss

The most cost-effective strategy for reducing heat loss is to reduce air leakage. Caulk, weatherstripping and insulation are some of the best tools for preventing unwanted cold, dry air from entering your home in the winter. They are also important in reducing heat gain in the summer months.

Step 1: Find the leaks: On a windy day, wet your hands and place them near areas of possible air leakage such as where the exterior walls meets the floor, around doors and windows, through electrical switch plates and outlets, down the chimney. *

The following checklist will also help you locate common trouble spots for air leaks.

Air Leak Trouble Spots

THE ATTIC:

- Holes in the attic floor and walls
- Doors and hatches to the attic
- Plumbing stacks
- Attic knee walls/storage drawers

THE BASEMENT:

- Around the sill plate and band joists
- Around basement windows
- Ducts
- Openings in the basement walls and ceiling including dryer vents, electrical wiring, plumbing stacks, etc.

THE MAIN LEVEL:

- Around the chimney and fireplace dampers
- Around windows, doors, trim and baseboards
- Electrical outlets and other exterior wall openings

THE OUTSIDE:

- Cracks in exterior siding
- Around windows and doors
- Around outdoor faucets, vents, electrical outlets

A more precise way to find air leaks is to have a blower door test done on your home. A blower door is a device that depressurizes a house, making it possible to measure the amount of air leakage and pinpointing air leaks that cannot otherwise be seen. This test allows you to actually feel where air loss is occurring.

Blower door tests can also identify health hazards created by backdrafting. These tests are also able to project whether your home has enough natural infiltration-the ability to draw in fresh air-to have good indoor air quality. Contact your heating air conditioning contractor and ask if they provide this service.

Step 2: Stop the leaks: Use inexpensive rope cord caulk, a removable clay like caulk found at your local hardware store, to reduce the air leakage through window and other cracks. This is especially effective around double hung windows that will be opened later in the year. *

Step 3: Inspect your ducts for good sealing and insulation.

Leaks develop in all air ducts over time. Sealing these leaks in ducts can reduce heating costs up to 20 percent with reductions of 10 percent extremely common. Check your ducts for air leaks by first looking for sections that should be joined but have separated and then look for obvious holes. Consult with a professional about repairing duct leaks. All joints, seams and connections must be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded fabric or UL-approved tapes. Standard duct tape is not permitted. When all leaks have been sealed, the supply and return ducts should be covered with an R 5.6 insulation that has an attached vapor barrier. Safe duct repairs require a licensed heating, ventilating, and air-conditioning contractor.

* Ask the Arkansas Energy Office for brochures on *Home Tightening* and *Home Insulation* for ideas, instructions and appropriate products to seal the leaks.

Be Wise: Weatherize

Whether or not you buy a new furnace, it is a good idea to weatherize your home. Adding insulation and strategically caulking and weather-stripping will make your home more comfortable, save energy, and reduce the size of the furnace you need if you are going to purchase a new system. As your heating load decreases, the size and cost of a heating system required to meet that load also decreases. You might consider having a home energy efficiency analysis performed. Sometimes referred to as an "energy audit," this is a detailed examination of your home's energy use often provided at no or low cost by utilities. Check with your utility to see if it provides an audit. It is important to remember that if you tighten your home you must make sure that you have adequate indoor ventilation. For more detailed information, see *Home Tightening* and *Home Insulation* brochures. For a copy of these contact the Arkansas Energy Office at 1-800-558-2633 or visit our web site: www.1800arkansas.com/energy/.

INCREASE THE EFFICIENCY OF YOUR EXISTING HEATING AND DUCT SYSTEM

Keeping your heating system well maintained and properly adjusted is important for every system — new or old. A qualified service person should periodically check, clean and tune your furnace, not only for energy efficiency but also for safety. It may be a good idea to also ask a heating specialist to balance the heating system.

All combustion furnaces should be tuned every year, unless the manufacturer directs otherwise.

Is duct cleaning necessary?

There is little evidence that duct cleaning is needed, except as a part of an allergy-control program prescribed by a doctor. For more information on duct cleaning check the Environmental Protection Agency pamphlet "Should You Have the Air Ducts in Your Home Cleaned?" at www.epa.gov/iaq/pubs/airduct.html.

Do-it-yourself Maintenance Measures Include:

- Change the furnace filter once a month
- Make sure furniture or draperies do not block registers or radiators
- Avoid locating the indoor thermostat near the door or drafts
- Clean fins on radiators and baseboard heaters
- Check your ducts for air leaks

Professional Heat and Air Company Winter Check-up Should Include:

- Inspect ductwork and check for leakage, insulation and continuous vapor barrier
- Check and adjust belts as required
- Check and adjust thermostat
- Lubricate all moving parts, as required
- Clean blower (if necessary)
- Test fan limit switch
- Measure gas input
- Check pilot
- Tighten all electrical connections
- Check or tighten fan blades
- Inspect burners (clean and adjust as necessary)
- Check combustion air
- Clean heat exchanger
- Check flame baffle
- Measure amperage draw
- Check flue
- Inspect heat exchanger for cracks
- Check start and run capacity
- Test thermocouple (if present)
- Measure temperature differences
- Test operation of all safety devices

Modifying your furnace

If you decide not to replace your furnace, you might think about modifying it to improve efficiency. Warning: Furnaces are designed with safety in mind. Changing the way a furnace operates may upset its operation, which can have dangerous repercussions.

If your furnace is more than 10 years old, the better investment is to put the money proposed for improvement toward a new high efficiency furnace.

Interest in improving efficiency has spawned dozens of devices to modify existing furnaces. Beware of add-on devices that claim to save energy. Some of these products might work, but others will actually raise your fuel bill, damage your heating system, or pose a danger to your family.

Whether or not a device is good or bad depends on the characteristics of your furnace. It is therefore important to consult a qualified heating contractor or service person before using any of these products.

Repair vs. Replacement

If your furnace is old, or has been diagnosed with a serious malfunction that will cost several hundred dollars to fix, it may be wise to replace it.

If your furnace is old but not broken, deciding when to replace it can be difficult. Average life expectancy of furnaces in homes today is between 16 and 20 years. If your furnace is close to this age or older, begin researching the costs and efficiencies of new equipment. Shopping for a replacement furnace in an emergency does not allow time to get fair-market pricing.

The design of your house and the size of your utility bills may be deciding factors. Generally, if you have a large house with high heating bills, it could be more cost-effective to purchase a high-efficiency furnace now rather than wait for your present furnace to wear out or to continue to make costly repairs.

If you decide to repair your furnace, look for a heating professional who has experience with your type of heating system.

WHAT DO AFUE, COP, SEER AND HSPF MEAN?

Understanding Efficiency Ratings

Different fuel types and equipment have a variety of efficiency ratings. The following descriptions of efficiency ratings apply to all fuel and system types. In general, the higher the efficiency the higher the installed cost. However, the additional cost can generally be repaid with lower utility costs over the life of the furnace. The amount of time it takes to repay the additional cost (simple payback) can depend on the size of the home, the size of the unit, the operation (thermostat settings), the level of insulation and air sealing, and your local utility rates.

AFUE (annual fuel utilization efficiency) applies to gas furnaces and measures efficiency over the entire heating season, telling you how much of your fuel dollar is converted into heat. AFUE is similar to a miles-per-gallon rating for your car — the higher the AFUE, the more efficient the furnace. An old, poorly maintained gas forced-air furnace may have an AFUE of only 50 to 60 percent, while the most efficient of the new designs have ratings of higher than 90 percent. The AFUE, does NOT include electrical energy consumption.

According to federal law, all gas burning furnaces manufactured after January 1, 1992, require a minimum AFUE of 78.2 percent.

COP (coefficient of performance) measures the efficiency of electric- heating equipment. A COP of 1.0 indicates 100 percent efficiency, meaning that the heat energy you receive from the furnace is exactly equal to the energy it consumes. Heat pump equipment usually has a COP of greater than 1.0 because it acquires heat energy from an external source and uses electrical energy to move that heat indoors in winter and outdoors in summer.

SEER (seasonal energy efficiency ratio) measures efficiency of central air conditioning or heat pumps in the cooling mode. Like AFUE, SEER measures how efficiently the equipment operates over the season. The most efficient models have SEERs of 13 to 14 and higher. Up until recently, 10 SEER has been the federally mandated minimum. A new law requires manufacturers to improve the minimum SEER to 12.

HSPF (heating season performance factor) measures the heating efficiency of air source heat pumps. It is the ratio of heating energy produced to energy consumed: it is determined by dividing the seasonal heating output in BTUs by the seasonal power consumption in watts.

PURCHASING A NEW HEATING UNIT

Advances in technology have brought major improvements in heating systems over the past decade, including furnaces that use much less energy. In assessing your present system, compare it with new, improved systems.

Buying a New Furnace

Whenever you purchase a new heating system the primary factors to consider are: the energy source you are going to use, how the heat will be distributed throughout the house (see page 9), what size furnace to buy (see page 10), and the efficiency rating (see page 7).

You should also consider your present heating system in the context of the entire home. If, for example, you have added insulation, tightened up air leaks, or taken other measures to improve energy efficiency, it is critically important the system be sized to match the new heating load which has been reduced by the energy improvements.

Sizing & Installation:

When it comes to furnaces, “Bigger is not Better” (ask the Arkansas Energy Office for a copy of the publication by this name). A furnace that is too small will not keep the house comfortable during very cold weather; however this is seldom the problem. Many times, contractors install furnaces that are too large for the home. A furnace that is significantly larger than needed will cycle on and off more frequently putting more wear on the components, much like stop and go driving in your car. This wastes energy and may cause the temperature to fluctuate too much.

When purchasing cooling and heating products, pay close attention to several things:

- the equipment has been properly sized for your home
- the contractor is experienced and has a history of quality installations
- options for various fuels and efficiencies have been evaluated to ensure that you receive the best value for your investment, long-term energy savings and comfort

Look for quality and value. Have the contractor:

- Show you a layout of where the equipment is going to be installed
- Size and select your new equipment using a procedure called Manual J
- Show calculations of savings for installing high-efficiency, ENERGY STAR® qualified equipment
- Explain the financial benefit of your new equipment
- Diagnose and repair your duct system (supplies and returns), if needed
- Explain the warranty on equipment and parts and labor

Operating Efficiency

There is a wide variety of technologies and efficiencies of available heating systems (see pages 12 through 14).You will want to consider what heating system is the most affordable in the long run. The choice of heating system depends on which energy source is available.

When getting bids for a heating system, ask the vendor to include an estimate of the annual operating energy cost using current, local utility rates. Also ask for the installed and estimated operating costs of a system with a higher efficiency. To make a quick evaluation of the total lifetime costs, assume that a system might last for 20 years. Multiply the annual estimated operating cost times 20 and add this to the installed purchase price. This will be an estimate of the total lifetime cost of the system.Use the formula below to compare the lifetime cost of heating system options.

The American Council for an Energy Efficient Economy has a list of the current "best of the best" energy efficient models and brands of appliances including heating systems. The web site is: www.aceee.org/consumerguide/.

	Annual energy Cost estimate		20 year energy cost		Installed ` cost		Lifetime cost
Option 1	_____	x 20 =	_____	+	_____	=	_____
Option 2	_____	x 20 =	_____	+	_____	=	_____

Heat Distribution

Consider the opportunities offered by different distribution systems. The primary difference between "furnaces" and "boilers" is that a furnace uses air to distribute heat throughout the house and a boiler uses water. Forced-air systems allow easy installation of traditional central air conditioning, since the same ductwork can be used to distribute warm or cool air. This makes a forced-air systems more economical if you plan to install central air conditioning.

Make sure that your installation contractor :

- Sizes your equipment using ACCA Manuals
- Uses ACCA Manual D to design an air-distribution (duct) system that is appropriate for your home
- When possible, locates ducts inside the living area rather than the attic or crawl space
- Avoids using building cavities as a part of the duct system
- Ensures that the ducts are installed without kinks or restrictions and with a minimum number of bends and turns
- Connects all joints in the ductwork with mechanical fasteners
- Seals all joints in the ductwork with UL-approved duct sealing mastic — cloth duct tape is not allowed
- Seals the return duct plenum and any penetrations in the plenum with mastic or caulk
- Seals the duct supply boots to the floor or drywall
- Seals the connections and openings at the air handler. Use mastic(preferred) for the return and supply duct connections, and use UL-181 duct tape at the filter, service and other access panels.

Furnace Size

Furnace size is almost as important as the efficiency rating. The most common mistake is buying a heating system too large for your home. Remember, the notion that "bigger is better" does not apply to heating or air conditioning systems. If your heating system is oversized, it can create large temperature swings in your home and reduce comfort. When considering a new furnace, request a Manual J heating/cooling load analysis from your heat and air contractor to verify that the heat and air systems have been properly sized for your home. Well-designed heating and cooling systems are not based only on the square footage of your house.

Unfortunately, there are no simple rules for furnace sizing. The Arkansas Energy Office and the Arkansas Department of Health - HVAC Section recommend that you ask a heating professional to do a heat-loss calculation to ensure that you are buying the right size. Many municipalities require a heat-loss calculation at the time the contractor requests a permit to install your heating system. A heat-loss calculation includes factors such as the window area, type of windows, insulating properties of the ceiling, walls and floor, and the amount of heat loss through air leakage. Discuss any remodeling plans with your contractor. Ask any contractor who bases estimates solely on the square footage of your house to do a true heat-loss calculation. If you are considering buying a central air conditioner at the same time as a new furnace, be sure that the air conditioner is sized properly. If your cooling unit is oversized, it will not do a good job of dehumidifying and you will not be as comfortable.

It Pays to Compare

It may be tempting to simply buy the cheapest heating system and ignore the operating costs, but this strategy will be costly in the end. Often the least expensive heating systems are the more expensive to operate.

A helpful and reliable tool is the EnergyGuide label (Figure 2) displayed on heating systems and other major appliances. This label shows the yearly energy cost of operating an appliance and compares it to the energy costs of competing brands and models of a similar size with the same features.

The types of EnergyGuide labels found on heating systems are called energy cost labels. The large number in the center of the label is an estimate of the annual cost of the energy required to operate the system, based on a national average of electricity or natural gas rates. The bar beneath it shows the range of operating

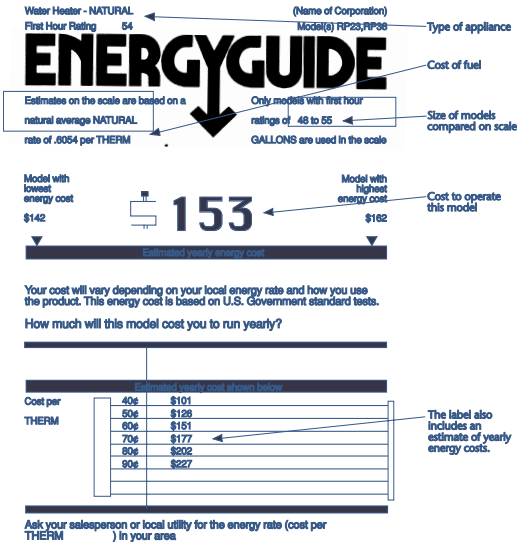


Figure 2: Sample EnergyGuide.

Figure 3: Sample ENERGY STAR® label.

costs of competing brands and models of similar size and features. This allows you to quickly compare the model you are considering to others.

At the bottom of the label is a chart that allows you to determine more precisely what your cost to operate that appliance will be, based on your local utility rate. See section on "Operating Efficiency" on page 9.

Efficient Models Save Money

Along with the type and size, energy efficiency is an important consideration. Buying an *inefficient* model will guarantee high energy bills over the unit's lifetime, which could be many years. To further increase energy savings look for ENERGY STAR® labeled products (see Figure 3). ENERGY STAR® labeled heating systems can help save money on utility bills through superior designs that require less money and energy to keep your home warm and comfortable.

ENERGY STAR® estimates that, on average, a properly sized and installed ENERGY STAR® labeled heating system will be at least 20% more efficient than old furnaces. However, results will vary based on use and climate, with colder regions likely realizing greater savings.

To find out more about ENERGY STAR® labeled products, call the toll-free ENERGY STAR® Hotline for more information at1-888-STAR-YES (1-888-782-7937) or http://www.energystar.gov.

Choosing a Heating Contractor

A new heating system typically costs from $2,000 to more than $4,500. When buying a new heating system, you should compare prices. It isn't unusual for bids to differ by as much as several hundred dollars. You should receive written bids on the cost of equipment and installation from at least three contractors, and ask each for the names of customers who have had their heating system for a few years. When evaluating bids, look at prices but also pay attention to and compare quality, energy savings, and warranties. If you are putting in a high efficiency furnace, ask if the contractor has special training in this type of installation. If you think your old heating system is covered with asbestos insulation, discuss this with the contractor. Make sure they follow the proper procedures in dealing with asbestos removal. A new heating system must be installed properly. Furnaces should be tuned and a combustion efficiency test performed after installation.Arkansas requires heating and cooling contractors to be licensed by the state. The Arkansas Department of Health, HVACR Section may be a good resource for information on contractors in your area.

HEATING SYSTEM TYPES

Natural Gas and Propane

When replacing a gas or propane furnace, the savings can be significant. The economic benefits can be surprising. The heating efficiency of a gas furnace is measured by the AFUE (Annual Fuel Utilization Efficiency—see page 7 and 8). Note: the national and state requirements for minimum efficiency is 78% AFUE. Gas and propane furnaces range from 78% AFUE to 90% plus AFUE. The higher the AFUE the greater the savings. For example, if you change from a furnace with 60 percent efficiency to a furnace with a 90 percent AFUE or higher efficiency, it is possible to save 30 to 40 percent on your annual fuel costs. Depending on whether you heat with natural gas, or propane, savings could be $250 to $500 per year.

Also, a high efficiency furnace with sealed combustion or mechanical venting saves you money over the life of the furnace, reduces the chances of back-drafting furnace gases into the home, and contributes to a healthier environment.

Some of the features to look for in a new furnace are described below:

Mechanical Vent Forced draft or induced draft is used on new, conventional gas furnaces. This refers to the use of a fan or blower to push or pull the exhaust gases out of the vent rather than relying on natural draft. The term "mechanical draft" is also used to describe this feature. Forced draft is necessary in today's high efficiency furnaces. As more heat is extracted from combustion gases, they are cooled and become less likely to rise naturally up the vent. The exhaust of indoor air by other appliances compounds the problem. Bath and kitchen exhaust fans, cook top exhaust systems, clothes dryers, and loss of indoor air through attic bypasses all contribute to the danger of an inadequate supply of indoor air. Forced draft is an important feature to look for in any furnace, or water heater. Some forced draft furnaces provide for venting combustion gases out the wall rather than up the vent. If you purchase that type of furnace and you have a combustion water heater, the water heater exhaust vent may need to be readjusted (see "one important caution" under Sealed combustion below).

Sealed combustion is especially recommended. This feature dramatically increases safety and efficiency since there is no mixing of the air in the furnace with the air in your house. You will not be using your warm room air for combustion. Because the exhaust is usually vented directly out the sidewall through a plastic pipe, you do not need a traditional metal vent connection. This allows more flexibility in where you place your furnace. Sealed combustion also keeps indoor air pollutants from entering the furnace, causing corrosion or other damage to the furnace. One important caution: if you replace your furnace with a furnace that is vented out the side of the house, it is especially important to have your heating contractor assess and readjust, if necessary, the flue or vent on the water heater to help safeguard against back drafting.

Variable rate furnaces use considerably less electricity - as much as 60 percent less - than other forced-air furnaces. Features include microprocessor controls, which automatically adjust airflow to achieve maximum efficiency. In addition to saving energy, these furnaces are quieter in operation and increase comfort by eliminating the rush of cold air (cold shot) when the furnace cycles on. Some variable rate furnaces also have

a variable heat output that further increases the efficiency and comfort by automatically varying the amount of heat the furnace delivers.

Ignition systems take the place of the energy consuming pilot lights typically found on older models. New furnaces save energy by providing intermittent, direct spark, or hot-surface ignition to ignite the burners.

Chimney liners An oversized chimney wastes heat and drafts poorly. One solution is to put in a correctly sized metallic liner to reduce airflow. A liner also extends the life of masonry chimneys by preventing deterioration from the flue gases. Liners must be properly installed and tested by a qualified service person to make sure combustion gases do not spill into the living space. This is especially important if you are replacing your furnace but not the combustion water heater; in some cases the chimney liner may have to be replaced to reduce the risk of back drafting (see the caution under the description of sealed combustion furnaces earlier). If you have a gas furnace with a masonry chimney, you must have a metallic liner. Have your contractor inspect for this.

Electric Systems

Electric Baseboard resistance heaters do not depend on ductwork and allow heating of individual rooms (zoned heating) instead of the whole house. Electric or gas boilers may also be used for steam or hot water baseboard heating systems.

Electric furnaces, in addition to supplying heat, also allow for central air conditioning to be added.

Radiant heating. Electric heating cables, in the past mainly installed in ceiling or wall panels, are now more often installed to provide radiant heat in floors. In-floor radiant heating also can be provided by water, heated by a boiler or ground source heat pump. The heated water circulates through plastic tubing fastened beneath a wood floor, in a cement floor, or in a lightweight cement overlay on an existing floor. In-floor radiant heating provides more uniform heat than baseboard heaters, allows for a lower thermostat setting, but also takes a longer time to adjust to changes in temperature. Radiant heating is most easily installed during new construction or major remodeling and is appropriate for energy saving zoned heating.

Heat pumps. Heat pumps transfer heat from one place to another, much like your refrigerator does. To accomplish home heating, a pump extracts heat from the ground, air, or water and distributes warm air to your house, usually through a forced air system. Heat pumps can be reversed to provide air conditioning in the summer. The heating performance of air source heat pumps is rated by the HSPF (heating season performance factor), ground source heat pumps by the COP (coefficient of performance). HSPF is determined by the estimated seasonal heating output divided by the seasonal power consumption for the average U.S. climate. Look for a HSPF of 8.5 or higher for an air source heat pumps-and a COP of 3.2 or higher for a ground source closed loop heat pump.

An air source heat pump performs at higher efficiencies when the outdoor temperature is above freezing. When the outdoor temperature is too cold for an air-to-air heat pump, a back-up system (electric, gas or propane) is used to maintain comfort. A ground source or geothermal heat pump is more efficient because it utilizes more constant earth or water temperatures and can operate at more extreme air temperatures.

Keep in mind that whenever your heat pump or air conditioner is serviced, the refrigerant should always be recovered and properly recycled and never vented into the air.

Recent advances in technology have produced some totally new types of heating systems. These include:

Combined space heating/water heating systems combine water and space heating into a single unit. Although the cost of space heating remains about the same as with a high efficiency furnace, the cost of water heating is significantly reduced — up to 40 percent. If your household uses a lot of hot water (if you have teenage children, for example), this type of system could bring considerable savings.

BIBLIOGRAPHY

American Council for an Energy-Efficient Economy (ACEEE) 6th edition, *The Most Energy Efficient Appliances* from 1001 Connecticut Avenue N.W. Suite 801, Washington, D.C. 20036, 202-429-0063 or www.aceee.org

Energy Information Center publications are available free. They include *Combustion Air, Home Energy Guide; Drafthood Test for Combustion Air*, a check for homeowners; and *Furnace and Boiler Tune-Up*, a checklist for homeowners.

Excerpts provided by the Minnesota Department of Commerce Energy Information Center http://www.commerce.state.mn.us/pages/Energy/InfoCenter/pdfs/homeheat.pdf.

Excerpts provided by U.S. Department of Energy.

ADDITIONAL RESOURCES

- U.S. DOE Energy Star: http://www.energystar.gov/
- ADED Energy Unit: www.1800ARKANSAS.com/energy/
- Florida Solar Energy Center: www.fsec.ucf.edu

This is an Iowa Energy Center publication.

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This publication has been updated and modified for use in Arkansas by the Arkansas Department of Economic Development – Energy Unit.

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This publication is distributed by:

ARKANSAS

Arkansas Department of
Economic Development
Energy Unit
One Capitol Mall
Little Rock, AR 72201

PRINTED WITH SOY INK