



# Energy Facts

## Choosing the Right Furnace for Your Home

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You can take control of your home heating bill in two ways: by making your house as energy efficient as possible, and by making the heating system more efficient. It's best to address your house first since low cost options exist for saving energy and methods exist to maximize the efficiency of your existing heating system.

But if your furnace is very old, it's wise not to spend money on major furnace modifications. Instead, consider buying a new energy efficient furnace that will save money on heating and air conditioning, conserve fuel, and keep your home consistently warm in winter and cool in summer.

### Selecting the Best Furnace for You

Choosing the ideal heating/cooling system can be challenging. In the final analysis, you may find that issues such as comfort, aesthetics, air quality, or other environmental concerns matter as much, or more, than dollars spent. But invest the time needed to make a considered, informed choice. That is the best insurance to be sure that you meet your home heating, financial, and environmental goals. The major choices involve:

- fuel type
- furnace efficiency
- correct sizing of the unit.

### Fuel Type

The first decision to make when selecting a heating system is fuel type. The choice is often one of personal preference, but it can be dictated by your home's location. For example, if you live in the country, natural gas may not be available as a choice. Gas and oil furnaces and electric heat pumps are comparable options for central forced air heating. Once you decide on fuel type, unit efficiency and the unit size are the next considerations.

### Efficiency

What is efficiency? In brief, an efficiency rating tells you how much of the total energy used is delivered to the home as heat. The higher the efficiency, the better the furnace functions. For example, a furnace that is 80% efficient delivers 80% of the fuel consumed to the house as heat. The rest, 20% or 20 cents on the dollar, goes up the chimney flue. Your heating bill, therefore, depends on the **cost** of the fuel and the **efficiency** of the furnace.

Most gas units use a power burner or an induced draft system to regulate the flow of combustion air. Oil units have flame retention burners and improved heat exchangers that result in a smaller, hotter flame and reduce the amount of hot exhaust gas escaping up the flue. Electric furnaces are considered to be 100%

efficient because the electricity is converted entirely into heat.

Some furnaces are classed as high efficiency and super efficiency. These units recover more heat from the flue gases by condensing water vapor and may use two or more heat exchangers. They also may use outside air for combustion giving significant savings when the furnace is located within the heated space.

## Sizing the Unit

The best way to be sure you purchase a properly sized unit is to calculate the home's heating requirements (Btu/hr). This calculation is fairly easy, but lengthy, and involves determining the area and the insulation level of each part of the home, i.e. floor, ceiling, exterior walls, and windows. You also need to estimate air infiltration. If this calculation is beyond your skills or your desire, consult your furnace dealer or an energy consultant to have this done professionally. Computer programs and web sites are available to help with this calculation as well. The important thing is to take the time to do this or to have it done by a skilled professional.

Just like autos, the actual efficiency of a furnace depends on how it is operated. But an oversized unit will waste energy by excessive cycling on and off, sending even more heat up the flue. An undersized furnace may not provide enough heat for comfort during very cold weather. Most often, units are oversized so beware of this pitfall in order to save fuel, save operating costs, and save money.

Remember—properly matching the size of the furnace to the heat load of the building helps you save money in two ways:

- The furnace unit operates more efficiently saving costs on fuel
- You don't pay for a larger unit than you need.

## Duct Systems and Thermostats

After you select and install just the right furnace, be sure to check your duct work. You will lose money instead of save it if the hot air produced is lost or cooled before it reaches your living space. Ducts should be located inside heated space to minimize conductive heat loss. Avoid putting ducts in unheated crawl spaces and attics. After installation, make sure

all joints are sealed with duct tape to prevent air leaks and insulate any ducts that are located outside heated air spaces.

You might consider investing in a new setback thermostat to save heat and money as well. You can buy a clock thermostat and set it for hourly levels, or buy a programmable thermostat that has more options and it more finely tuned. Or just set the thermostat back by hand each night or when you are away, as long as you remember to set it back up again when you return!

## Furnace Efficiency Ratings

These ratings can be a useful tool to compare different furnace models. But be sure you are comparing the same types of efficiencies. The two most common are Steady State Efficiency and Annual Fuel Utilization Efficiency (AFUE). Steady state efficiency refers to how well the unit performs once it is warmed up and running. The AFUE considers the fact that a furnace cycles on and off, and accounts for the amount of fuel used to heat up the furnace itself. The AFUE will always be lower than steady state efficiency.

Another tool is the yellow Energy Guide label required on all new furnaces. This label provides the AFUE rating, an estimate of annual energy costs, and a comparison of the unit to others of roughly the same size. Also, the Gas Appliance Manufacturers Association (GAMA) publishes a Consumers' Directory of Efficiency Ratings.

## Obtaining Bids and Planning for Maintenance

As with any major purchase, plan to talk with at least three heating contractors and get written bids and copies of warranties. Be sure you are getting bids on comparable units and systems so you won't be surprised when the bill comes. Check references for the contractors' work as well.

Furnace air filters should be changed at least twice a year and once a year, vacuum out the fan blades and lubricate the motor. Be sure your pilot light is properly adjusted or you will waste fuel and lose money at the same time.

## Paybacks and Tradeoffs

To see if you will really save money, you have to analyze two factors: the heat load and fuel price. The

higher efficiency furnaces cost more to begin with, but they may save enough in fuel costs to pay the difference rather quickly. Fuel costs vary from type to type, region to region, season to season, and for other hard to calculate influences that may be political and/or environmental. A general rule of thumb is that the higher the heating load and fuel price, the more you can justify investing in a higher-efficiency furnace.

## How to Figure Payback (in years) on your Purchase

To compare the payback on two gas furnaces, try this method. Unit one costs \$1,800 and is rated at 75% AFUE efficiency. Unit two costs \$2,400 and is rated at 86% AFUE efficiency. To calculate payback, use this equation:

$$\text{Payback (in years)} = \frac{\text{Extra Cost (\$)}}{\text{Annual Savings (\$/year)}}$$

If your annual heating bill is \$800, and your furnace is 75% efficient, your bill could be reduced to \$698 at 86% efficiency ( $\$800 \times .75 / .86$ ). This would save you about \$102 each year, assuming no differences in maintenance costs.

The actual payback in this example would be just under six years ( $\$600 / \$102$  per year = 5.9 years), where \$600 represents the difference in purchase price and \$102 represents the savings by installing a more efficient furnace. If fuel prices rise, paybacks (number of years) will be shorter making the decision to install the more efficient furnace an even better one.

The following chart compares AFUE efficiencies for different types of furnaces:

Type of Furnace	Average Range of Efficiency
Older gas or oil furnace	60-75%
High efficiency gas or oil	75-85%
Super Efficiency gas or oil	85-95%
Electric furnace	100%

## Sources of information:

Washington State University Cooperative Extension Energy Program, Jack Brautigam and Edwin Valbert, EB 1836e.

American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., [www.ashrae.org](http://www.ashrae.org)

Energy Star, Money Isn't All You're Saving, U.S. EPA, <http://www.energystar.gov/consumer.shtml>

Energy Efficiency and Renewable Energy, U.S. DOE, [http://www.eren.doe.gov/consumerinfo/energy\\_savers/](http://www.eren.doe.gov/consumerinfo/energy_savers/)

Environmental Technologies Energy Division, Lawrence Berkley National Laboratory, <http://home-energysaver.lbl.gov/>. Contains the do-it-yourself energy audit tool.

Gas Appliance Manufacturers Association (GAMA), <http://www.gamanet.org/consumer-consumer.htm>, contains the Consumers' Directory of Certified Efficiency Ratings

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