Heating

What is the difference in the efficiencies of different types of gas furnaces?

There are three basic levels of efficiencies of propane or natural gas fuel burning furnaces: high, mid, and conventional. The efficiency of the furnace depends on several factors,
including the type of ignition system, the type and shape of the heat exchanger, the number of heat exchangers, and the type of airflow into and out of the furnace for combustion and exhaust venting.

- An ignition system is required to light the burners when the thermostat calls for heat. This can be done by having a small flame constantly burning (a pilot light) or by electronically lighting the flame when the burners are needed. A pilot light that is always lit wastes fuel all year, while an electronic ignition system only uses energy when the furnace is required to heat the home.
- The heat exchanger is the metal chamber where combustion occurs. The flames burn inside the heat exchanger, while air from the home flows over the outside of the heat exchanger and picks up the heat that is absorbed by the metal. In addition to transferring heat from the burner flames to the air in the home, the heat exchanger separates the exhaust gases from the house air so that exhaust fumes do not enter the home. The shape and material makeup of the heat exchanger dictates the amount of heat transfer from the burning gas into the home. A heat exchanger that has a very basic shape and does not limit the exhaust gas flow will allow a significant amount of heat to be lost through the chimney. A more complicated heat exchanger with a larger overall surface area will allow more heat to be extracted from the combustion process. Some furnaces have a secondary heat exchanger to extract even more heat from the exhaust gases.
- Any combustion appliance requires air for burning the fuel (combustion air) and in some cases, air for helping the exhaust gases travel through the chimney (draft air). In older systems, this air comes from inside the home and can enter the furnace naturally through openings beside the burners and where the exhaust gases exit the heat exchanger to travel through the chimney This situation causes excess air to enter the heat exchanger and flow up the chimney when the furnace is both operating and in standby mode (not in operation). In this situation, heat is constantly being lost through the chimney and a significant amount of energy is wasted. Alternately, furnaces can be designed with fans that control the amount of air that enters or

exits (or both) the heat exchanger. In some cases, the fan will push or pull the required amount of air for combustion into the heat exchangers and the exhaust gases travel through the chimney naturally using draft air. In other cases, the fan pulls the required amount of air into the heat exchanger and also pushes the exhaust gases out of the furnace at a controlled rate, eliminating the need for natural draft air. A damper on the fan mechanism prevents air from entering the chimney when the furnace is not in operation. This type of configuration helps reduce the amount of energy that is wasted up the chimney.

Conventional furnaces have a standing pilot light, very basic shaped heat exchangers, and no control over the amount of combustion or draft air that enters or exits the system. Mid and high efficiency furnaces have electronic ignition devices, more complicated heat exchangers (longer), and they limit the amount of combustion and draft air entering and exiting the furnace to only what is required by using a draft fan which reduces the amount of warm house air that is lost through the chimney. In addition, by controlling and limiting the rate at which the exhaust gases are removed from the home, more heat can be extracted from the exhaust gases making the system more efficient. These combined improvements increase the efficiency significantly. The difference between a mid and high efficiency furnace is that a high efficiency, or condensing furnace not only extracts heat from the flames, but also has a secondary heat exchanger that extract a significant amount of heat from the exhaust gases immediately before they are discharged. This second heat exchanger cools the exhaust gases sufficiently for the moisture in the exhaust gases to condense into water. The change of state from water vapour to liquid water creates even more heat (the latent heat of vapourization) that can ultimately be transferred to the house air. So much extra heat is extracted from the exhaust gases of a high efficiency furnace that they do not require a chimney that can handle high temperature exhaust and can be vented through plastic piping that usually pass through an exterior wall of the house.

The efficiencies of other heating systems vary.

Electric furnaces are close to 100% efficient, however for example, the cost of electricity is approximately double the cost of gas for the equivalent amount of energy making basic electric heating systems cost inefficient.

Wood furnaces and stoves have become much more efficient in recent years due to new technological advances. The efficiencies, however, also depend on the type of wood that is burned. For example, a cubic metre (slightly less than a face cord) of dried wood can produce anywhere from 35 million to 80 million BTU's, depending on the type of wood being used.

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