Glossary of Terms

ACH	Air Changes per Hour
AFUE	Annual Fuel Utilization Efficiency
COP	Coefficient of Performance
EF	Energy Factor
GSHP	Ground Source Heat Pump
SEER	Seasonal Energy Efficiency Ratio
SHGC	Solar Heat Gain Coefficient

Air Changes per Hour (ACH)

This is a measure of how many times the air within a defined space (normally a room or house) is replaced. Air changes in a confined space are important for a variety of reasons, mainly though, we need fresh air to live. Without sufficient fresh air exchange, moisture is trapped in a room/home/building, molds can feed, and other allergens and excessive dangerous gases (e.g. Carbon monoxide, Carbon Dioxide, urea formaldehyde), can remain in the home. "Stale" air is unhealthy and, since humans and pets add to it by breathing, sweating, washing, showering and drying, we need to ventilate the home, increasing the number of times the air 'exchanges' in the home with outside fresh air.

An air change does not represent a complete change of all air in the enclosure or structure unless it can be considered plug flow. The actual percentage of an enclosure's air which is exchanged in a period depends on the airflow efficiency of the enclosure and the methods used to ventilate it. The actual amount of air changed in a well mixed ventilation scenario will be 63.2% after 1 hour and 1 ACH. In order to achieve equilibrium pressure, the amount of air leaving the space and entering the space must be the same.

Annual Fuel Utilization Efficiency (AFUE)

The AFUE is the most widely used measure of a furnace's heating efficiency. It measures the amount of heat actually delivered to your house compared to the amount of fuel that you must supply to the furnace. Thus, a furnace that has an 80% AFUE rating converts 80% of the fuel that you supply to heat -- the other 20% is lost out of the chimney. The government's established minimum rating for furnaces is 78%.

Coefficient of Performance (COP)

When one is interested in how well a machine cools, the COP is the ratio of the heat removed from the cold reservoir to input work. However, for heating, the COP is the ratio of the heat removed from the cold reservoir plus the heat added to the hot reservoir by the input work to input work.

Energy Factor (EF)

The energy factor (EF) indicates a water heater's overall energy efficiency based on the amount of hot water produced per unit of fuel consumed over a typical day. This includes the following:

- Recovery efficiency – how efficiently the heat from the energy source is transferred to the water
- Standby losses – the percentage of heat loss per hour from the stored water compared to the heat content of the water (water heaters with storage tanks)
- Cycling losses – the loss of heat as the water circulates through a water heater tank, and/or inlet and outlet pipes.

The higher the energy factor the more efficient the water heater. However, higher energy factor values don't always mean lower annual operating costs, especially when you compare fuel sources.

Product literature from a manufacturer usually provides a water heater model's energy factor.

Energy Star
Energy Star is an international standard for energy efficient consumer products originated in the United States of America. It was first created as a United States government program during the early 1990s, but Australia, Canada, Japan, New Zealand, Taiwan and the European Union have also adopted the program. Devices carrying the Energy Star logo, such as computer products and peripherals, kitchen appliances, buildings and other products, generally use 20%–30% less energy than required by federal standards.

Ground Source Heat Pump (GSHP)
A heat pump is a machine or device that moves heat from one location ('source') at a lower temperature to another location (the 'sink' or 'heat sink') at a higher temperature using mechanical work or a high-temperature heat source. A heat pump can be used to provide heating or cooling. Even though the heat pump can heat, it still uses the same basic refrigeration cycle to do this. In other words a heat pump can change which coil is the condenser and which the evaporator. Normally achieved by a reversing valve. In cooler climates it is common to have heat pumps that are designed only to provide heating.

Photovoltaic panels
Photovoltaics (PV) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. PV power generation employs solar panels composed of a number of cells containing a photovoltaic material. Materials presently used for photovoltaics include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride and copper indium selenide/sulfide. Due to the growing demand for renewable energy sources, the manufacturing of solar cells and photovoltaic arrays has advanced considerably in recent years.

R-value
The R-value is a measure of thermal resistance used in the building and construction industry. Under uniform conditions it is the ratio of the temperature difference across an insulator and the heat flux (heat transfer per unit area) through it. The R-value being discussed is the unit thermal resistance. This is used for a unit value of any particular material. It is expressed as the thickness of the material divided by the thermal conductivity.

For the thermal resistance of an entire section of material, instead of the unit resistance, divide the unit thermal resistance by the area of the material. For example, if you have the unit thermal resistance of a wall, divide by the cross-sectional area of the depth of the wall to compute the thermal resistance. The unit thermal conductance of a material is denoted as C and is the reciprocal of the unit thermal resistance. This can also be called the unit surface conductance and denoted by H. The bigger the number the better the building insulation's effectiveness. R-value is the reciprocal of U-value.

Seasonal Energy Efficiency Ratio (SEER)
The SEER rating of a unit is the cooling output in Btu (British thermal unit) during a typical cooling-season divided by the total electric energy input in watt-hours during the same period. The higher the unit's SEER rating the more energy efficient it is.

For example, consider a 5,000-British-thermal-unit-per-hour (1,500 W) air-conditioning unit, with a SEER of 10 BTU/W·h, operating for a total of 1000 hours during an annual cooling season (e.g., 8 hours per day for 125 days).
The annual total cooling output would be:

Average power = (BTU/h) / (SEER) = 5000 / 10 = 500 W
If your electricity cost is 20¢/kW·h, then your cost per operating hour is:
0.5 kW * 20¢/kW·h = 10¢/h

Solar Heat Gain Coefficient

Solar gain (also known as solar heat gain or passive solar gain) refers to the increase in temperature in a space, object or structure that results from solar radiation. The amount of solar gain increases with the strength of the sun and with the ability of any intervening material to transmit or resist the radiation.

Objects struck by sunlight absorb the short-wave radiation from the light and reradiate the heat at longer infrared wavelengths. Where there is a material or substance (such as glass) between the sun and the objects struck that is more transparent to the shorter wavelengths than the longer, then when the sun is shining the net result is an increase in temperature - solar gain. This effect, the greenhouse effect, so called due to the solar gain that is experienced behind the glass of a greenhouse, has since become well known in the context of global warming.

Tankless Water heater

When there is a demand for hot water (e.g. a hot water tap is opened for a sink, shower, tub, or washing machine) the tankless water heater's water flow turbine senses the flow and starts the heating process.

The water flow turbine sends a signal to the control board that looks at multiple factors: incoming water temperature, desired water temperature as set on the temperature controller and the calculated difference between the two temperatures. Depending on the calculated incoming and desired water temperatures, the gas or electric flow into the burner assembly is modulated and the electronic ignition sequence begins. Water is heated to the desired temperature as it circulates through the copper heat exchanger providing continuous hot water. When the hot water tap is turned off, the tankless water heater shuts down and is placed in a standby mode pending the next call for hot water

U-value

The U-value (or U-factor), more correctly called the overall heat transfer coefficient, describes how well a building element conducts heat. It measures the rate of heat transfer through a building element over a given area, under standardized conditions. The usual standard is at a temperature gradient of 24 °C, at 50% humidity with no wind (a smaller U-value is better).