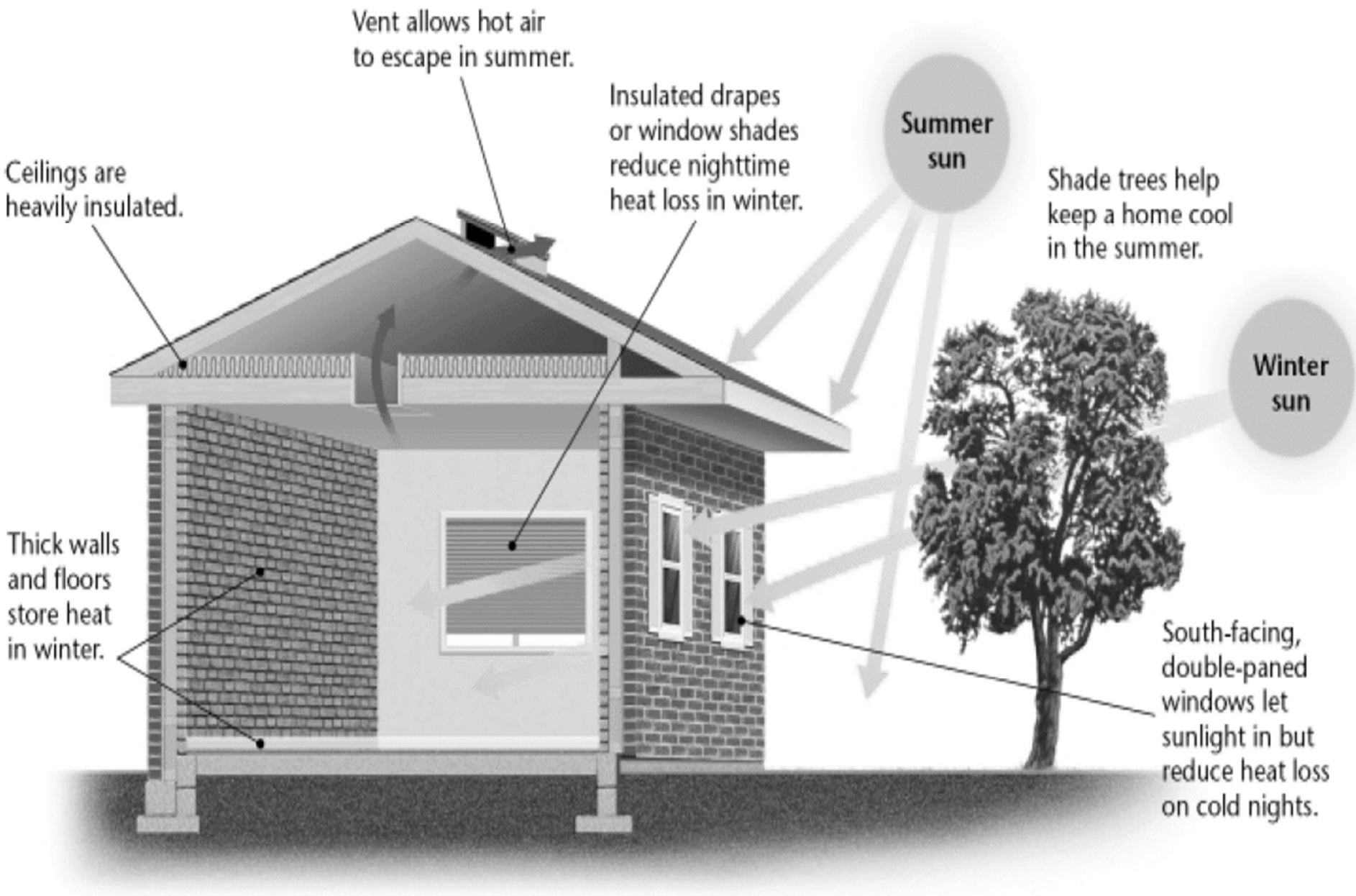
Renewable Alternative Energy

Passive Solar Heating

- **Passive solar heating** is the use of sunlight to heat buildings directly.
- In the Northern Hemisphere, south facing windows receive the most solar energy.
- Therefore, passive solar buildings have large windows that face south.

Passive Solar Heating



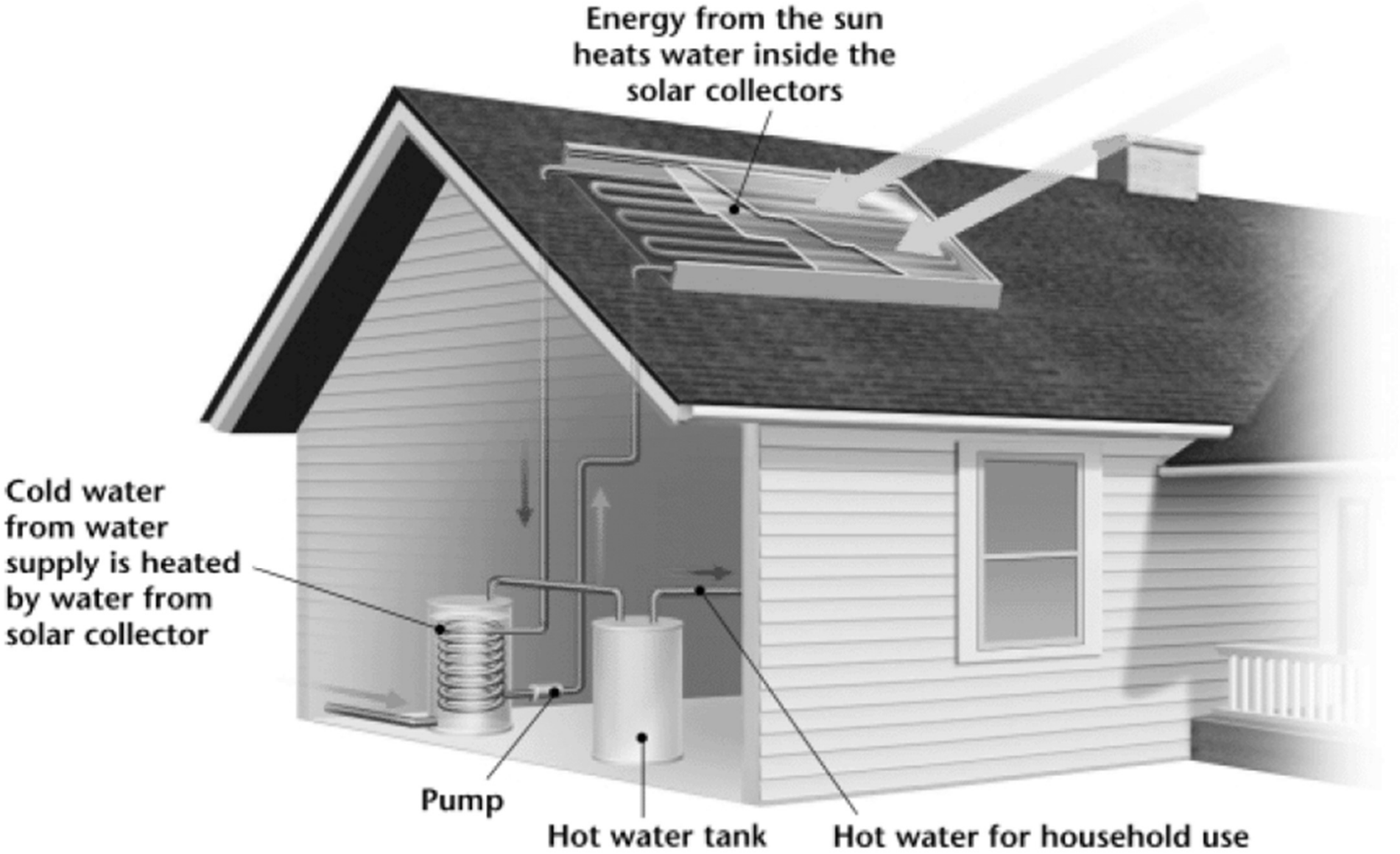
Active Solar Heating

Active solar heating is the gathering of solar energy by collectors that are used to heat water or heat a building.

More than 1 million homes in the United States use active solar energy to heat water.

Photovoltaic cells are solar cells that convert the sun's energy into electricity.

Active Solar Heating



Wind Farms

- Wind turbines are used to capture the energy from the wind.
- Large arrays of wind turbines are called **wind farms**. Large wind farms supply electricity to thousands of homes.
- Because wind turbines take up little space, some farmers can add wind turbines to their land and still use the land for other purposes.

Biomass-Power from Living Things

- **Biomass fuel** consists of plant material, manure, or any other organic matter that is used as an energy source.
- Renewable biomass fuels, such as wood and dung, are major sources of energy in developing countries.
- More than half of all wood cut in the world is used as fuel for heating and cooking.

Methane

- When bacteria decompose organic wastes, one byproduct is **methane gas**.
- Methane can be burned to generate heat or electricity.
- Some landfills in the United States generate electricity by using the methane from the decomposition of **trash**.

Alcohol

- **Liquid fuels can also be derived from biomass.**
- **For example, ethanol, an alcohol, can be made by fermenting fruit or agricultural waste. In the United States, corn is a major source of ethanol.**
- **Cars and trucks can run on ethanol or gasohol, a blend of gasoline and ethanol. Gasohol produces less air pollution than fossil fuels.**

Hydroelectricity- Power from Moving Water

- **Hydroelectric energy** is electrical energy produced by falling water.
- Hydroelectric energy accounts for 20% of the world's electricity.
- Large hydroelectric power plants have a dam that is built across a river to hold back a reservoir of water.
- The water in the reservoir is released to turn a turbine, which generates electricity.

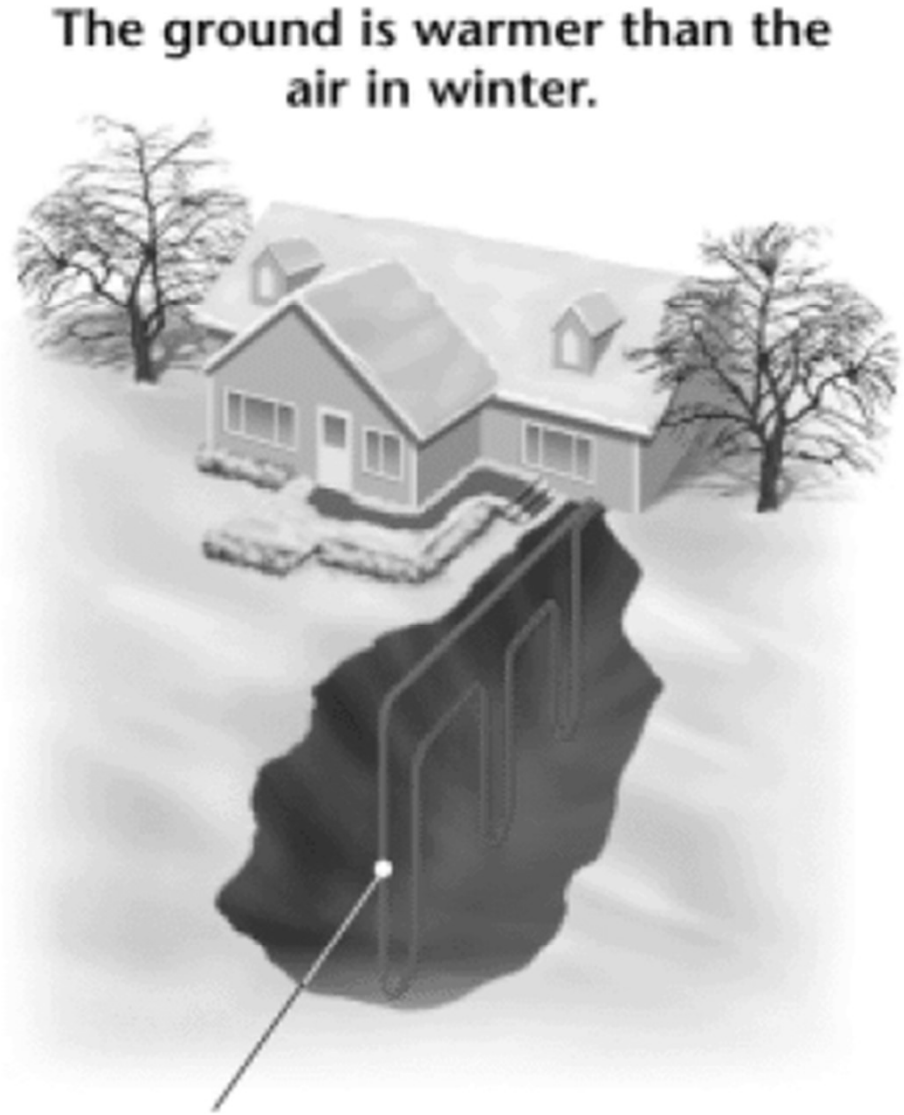
Geothermal Energy

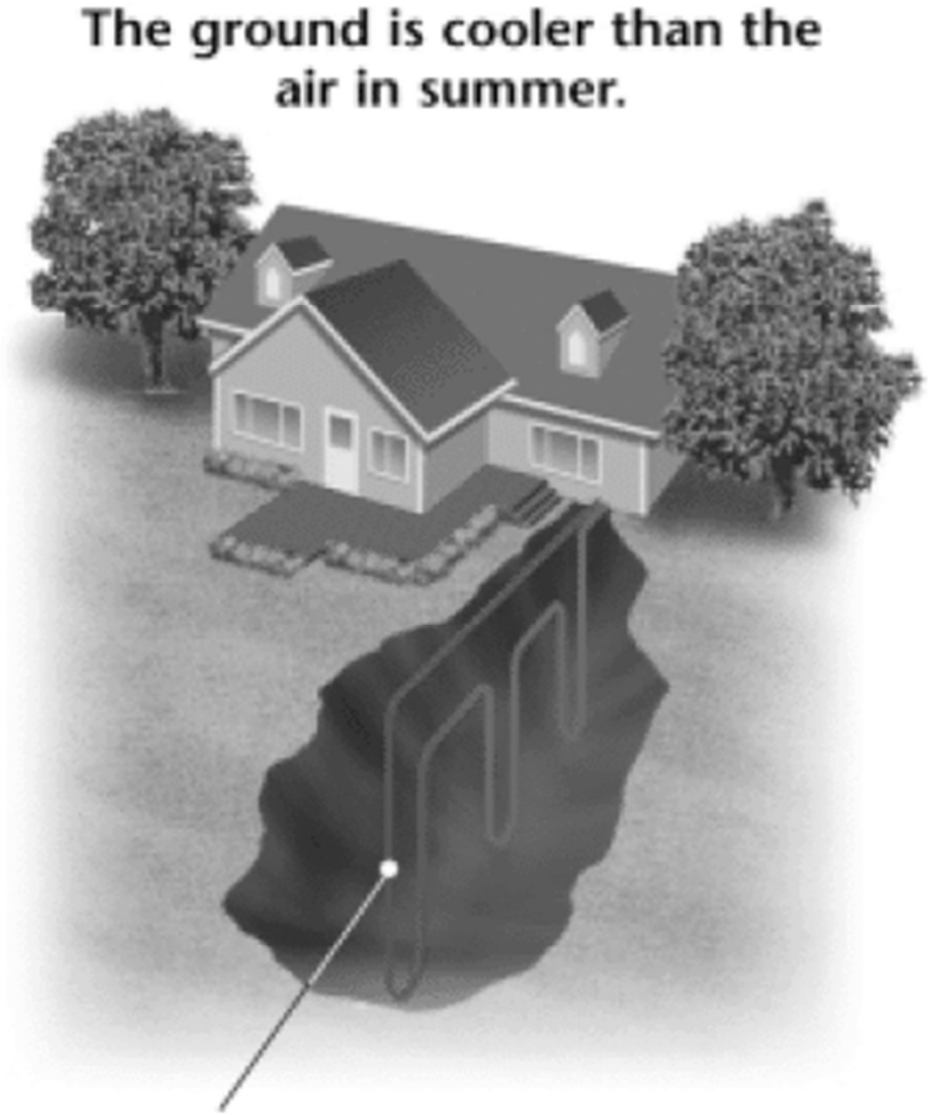
In some areas, deposits of water in the Earth's crust are heated by geothermal energy.

Geothermal energy is the energy produced by heat within the Earth.

The United States is the world's largest producer of geothermal energy.

Geothermal Heat Pumps: Energy for Homes





Ocean Thermal Energy Conservation

- In the tropics, the temperature difference between the surface of the ocean and the deep ocean waters can be as much as 24ºC (43ºF).

- **Ocean thermal energy conservation (OTEC)** is the use of temperature differences in ocean water to produce electricity.

Alternative Energy

- To achieve a future where energy use is sustainable, we must make the most of the energy sources we already have and develop new sources of energy.
- **Alternative energy** describes energy that does not come from fossil fuels and that is still in development.

Hydrogen-A Future Fuel Source?

- Hydrogen, the most abundant element in the universe, can be burned as a fuel.
- Hydrogen does not contain carbon, so it does not release pollutants associated with burning fossil fuels and biomass.
- When hydrogen is burned in the atmosphere, it combines with oxygen to produce water vapor, a harmless byproduct, and small amounts of nitrogen oxides.

Fuel Cells

- A **fuel cell** is a device that produces electricity chemically by combining hydrogen fuel with oxygen from the air.
- When hydrogen and oxygen are combined, electrical energy is produced and water is the only byproduct.
- Fuel cells can be fueled by anything that contains plenty of hydrogen, including natural gas, alcohol, or even gasoline.

Energy Efficiency

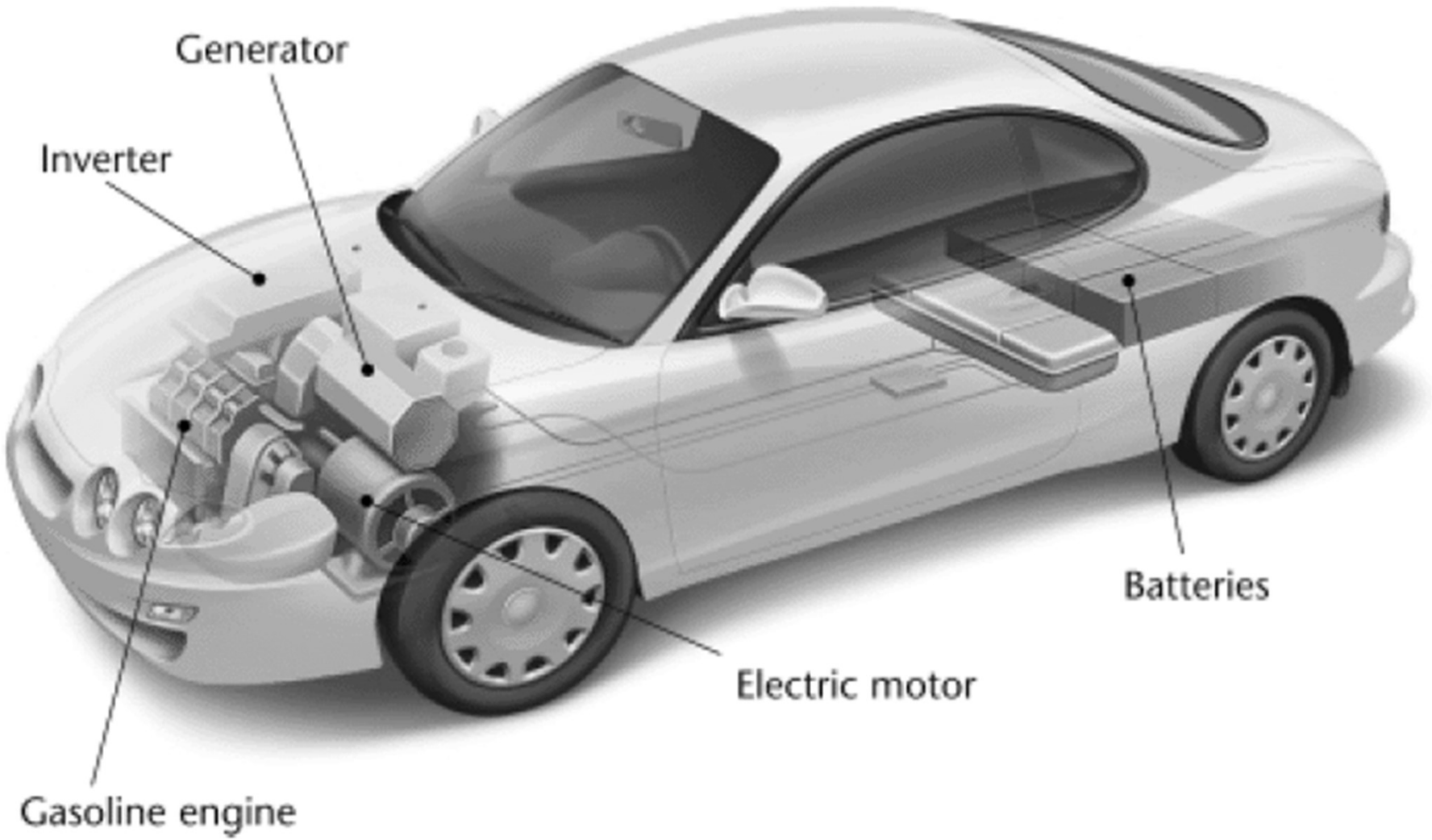
- There are two main ways to reduce energy use:
  - lifestyle changes
  - increases in energy efficiency
- **Energy efficiency** is the percentage of energy put into a system that does useful work.
- Energy efficiency can be determined by this equation:

$$\text{energy efficiency (in \%)} = \text{energy out/energy in} \times 100$$

Hybrid Cars

- Hybrid cars are examples of energy-efficient vehicles.
- Hybrid cars use small, efficient gasoline engines most of the time, but they also use electric motors when extra power is needed, such as while accelerating.
- Hybrid cars do not cost much more than conventional vehicles, they cost less to refuel, and they produce less harmful emissions.

Hybrid Cars


Generator
Inverter
Batteries
Electric motor
Gasoline engine

Conservation Around the Home