

A close-up photograph of a gas stove burner. The burner is a circular metal grate with a black knob in the center. A bright blue flame is visible, rising from the burner. The background is dark, making the flame and the burner stand out.

Heat and Heat Technology

Section 4 - Heat Technology

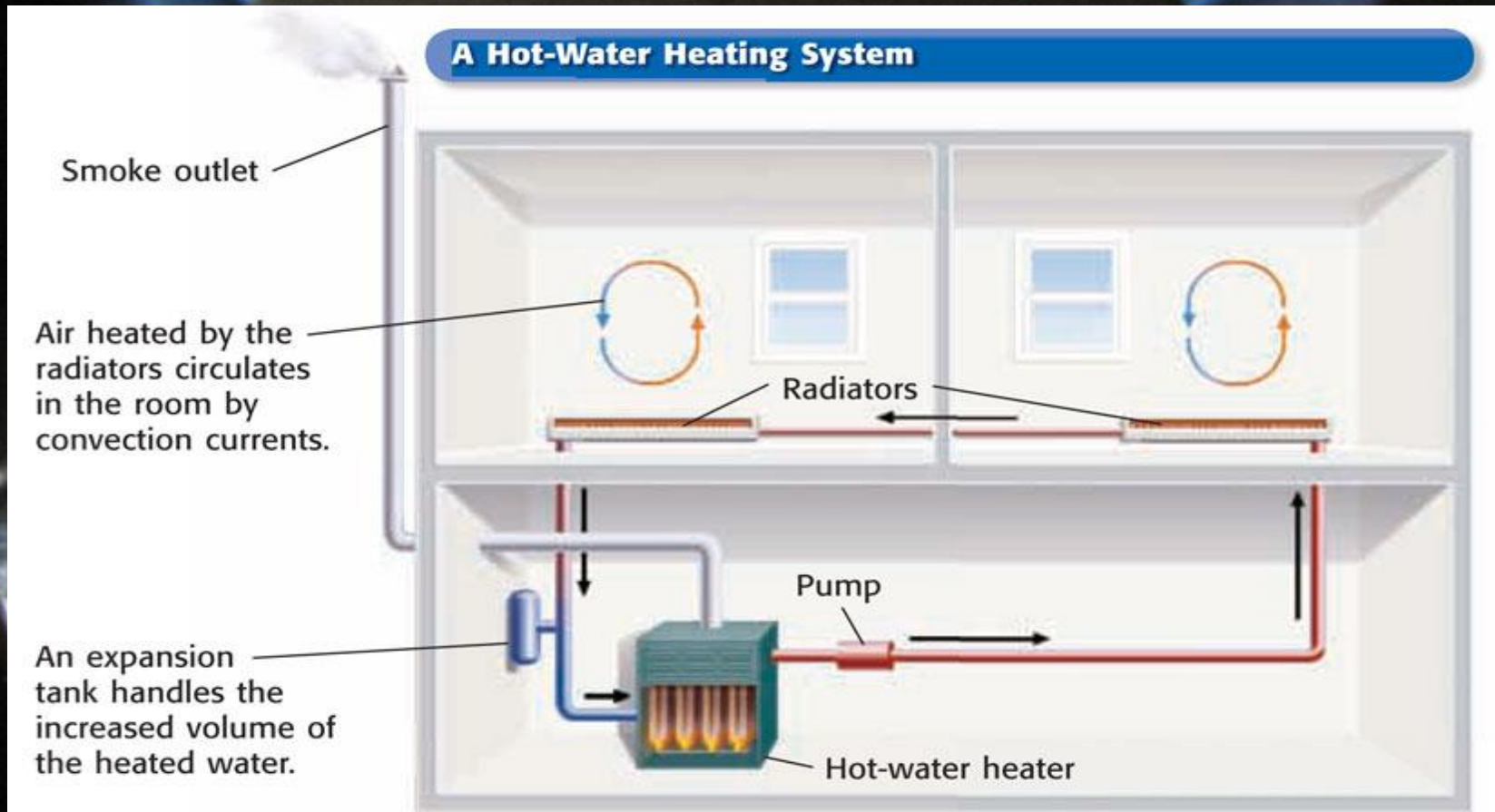
Essential Questions

A close-up photograph of a gas stove burner. The burner is a circular metal grate with a black knob in the center. Blue flames are visible around the burner, indicating it is turned on. The background is dark, making the burner and flames stand out.

- Analyze several kinds of heating systems.
- Describe how a heat engine works.
- Explain how a refrigerator keeps food cold.
- List some effects of heat technology on the environment.

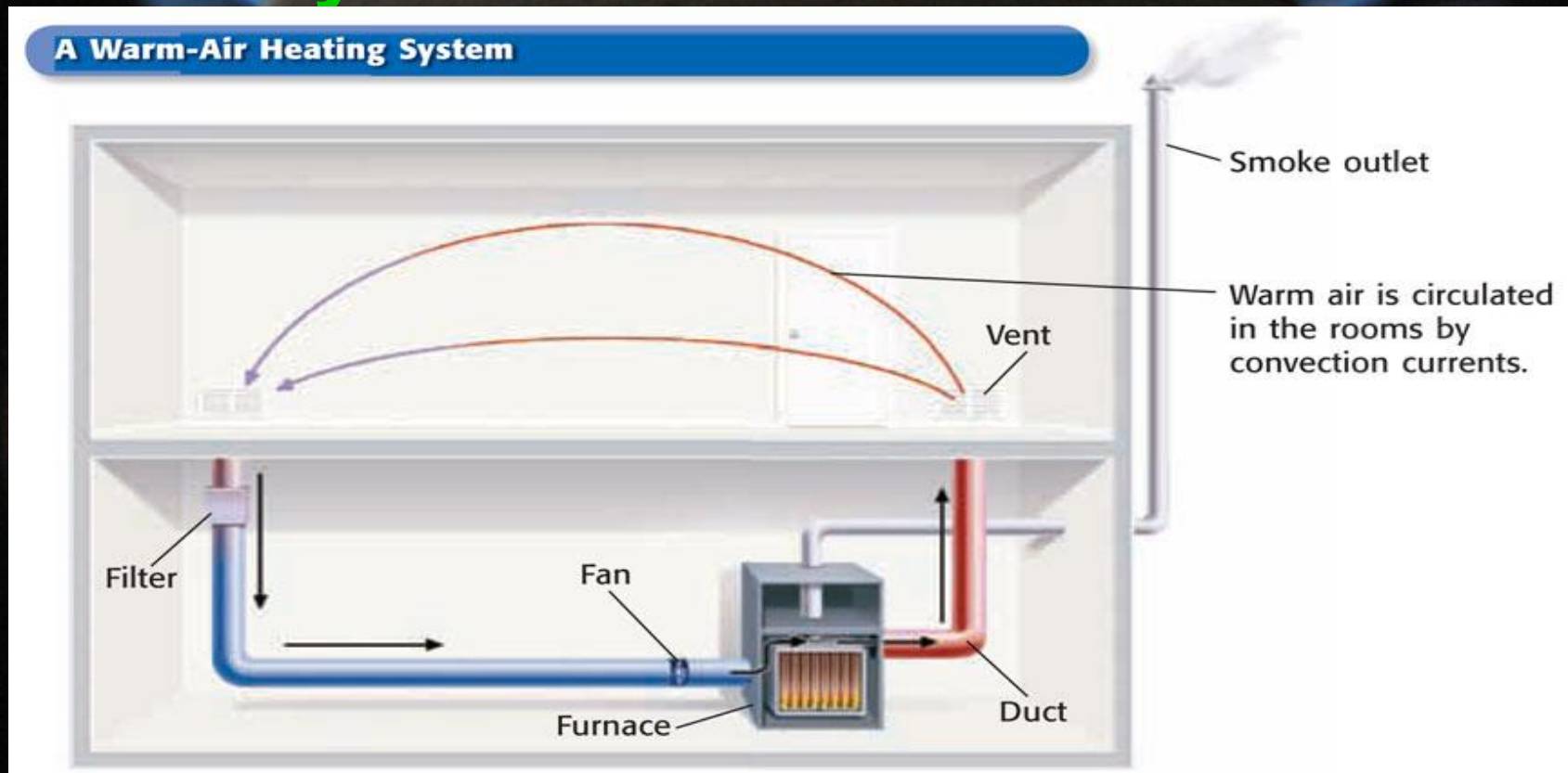
Heating Systems

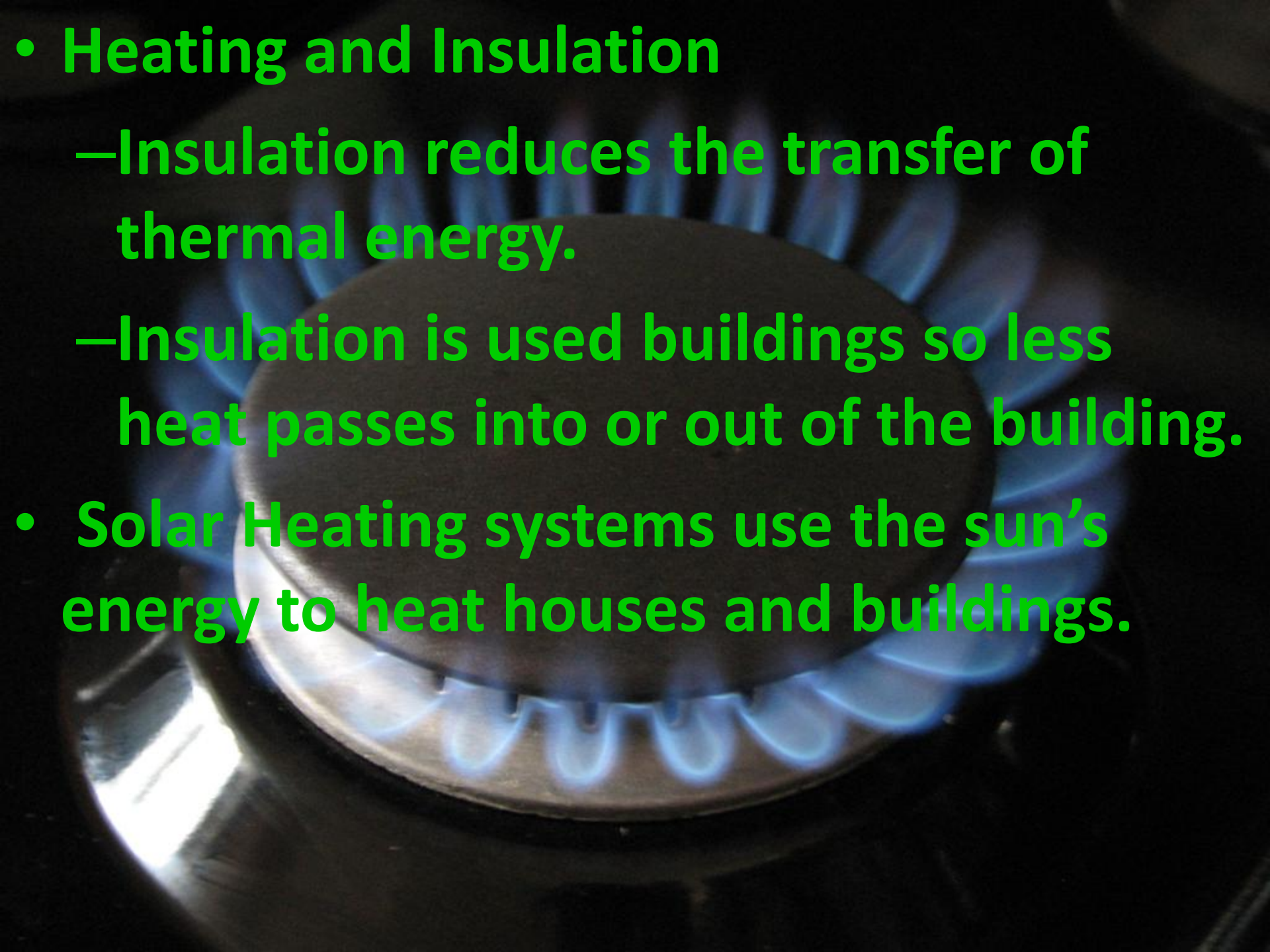
- **Hot-Water Heating** - the high specific heat of water makes it useful for heating systems.



Warm-Air Heating

- Air cannot hold as much energy as water can.
- Warm-air heating systems are used in many homes & offices in the U. S.



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- **Heating and Insulation**
 - Insulation reduces the transfer of thermal energy.
 - Insulation is used buildings so less heat passes into or out of the building.
 - **Solar Heating systems use the sun's energy to heat houses and buildings.**

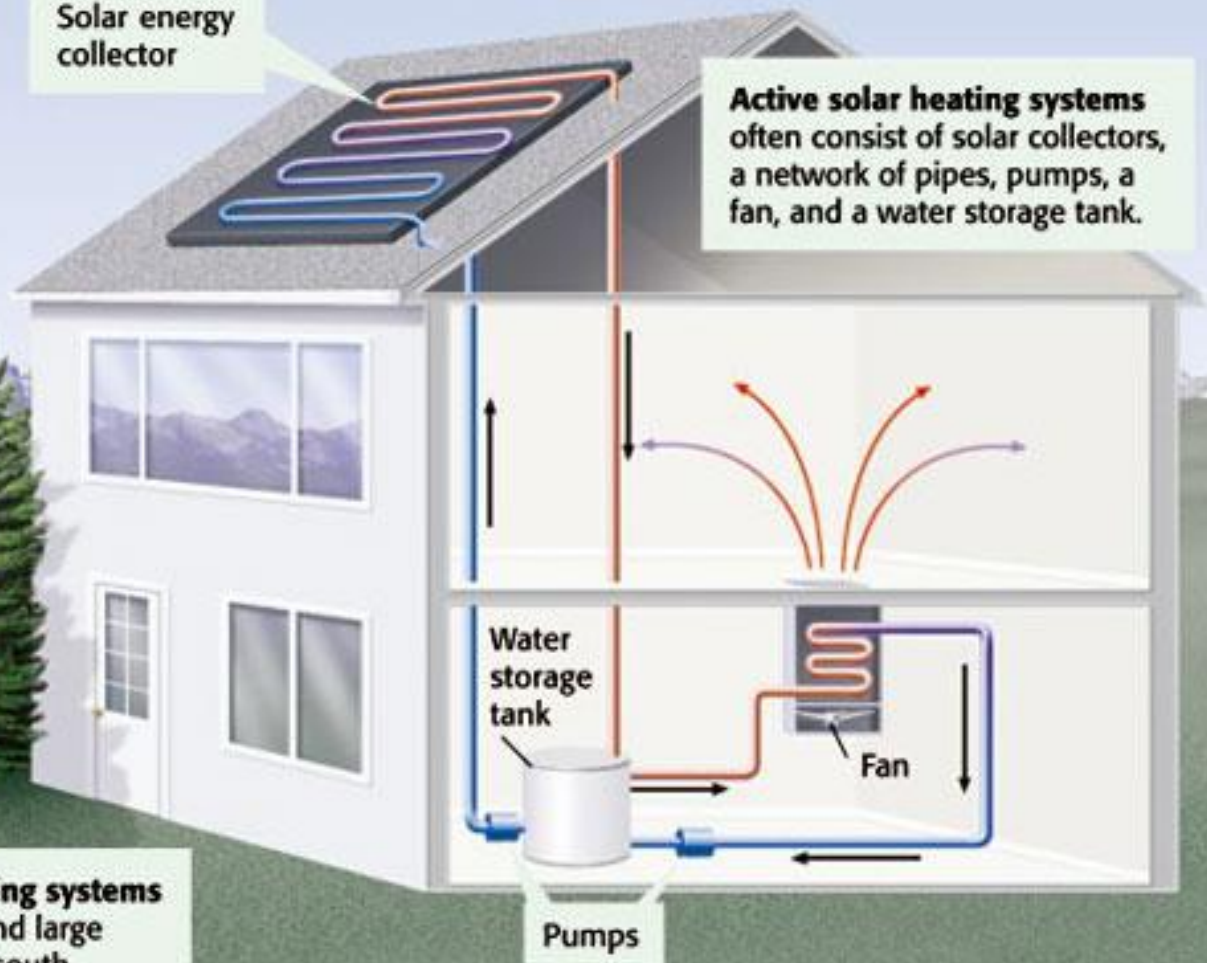
Solar Heating Systems



Solar energy collector

Active solar heating systems often consist of solar collectors, a network of pipes, pumps, a fan, and a water storage tank.

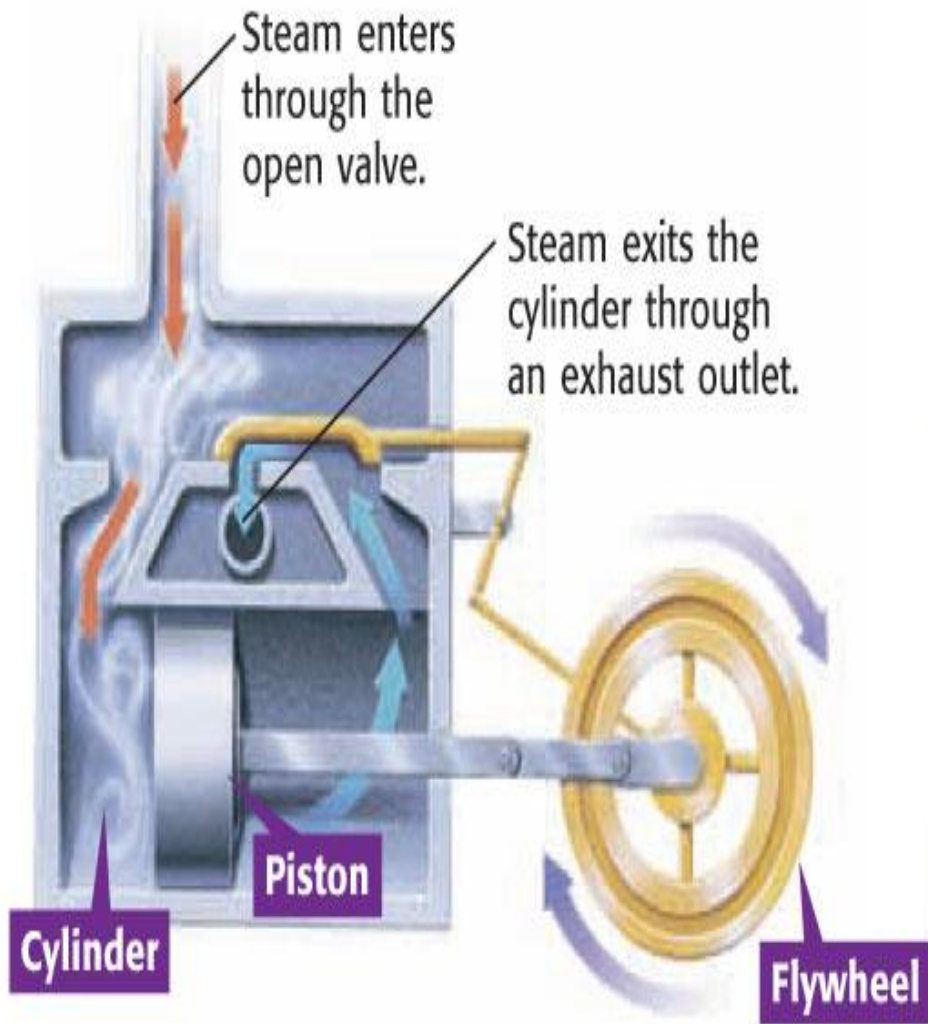
Passive solar heating systems utilize thick walls and large windows that face south.



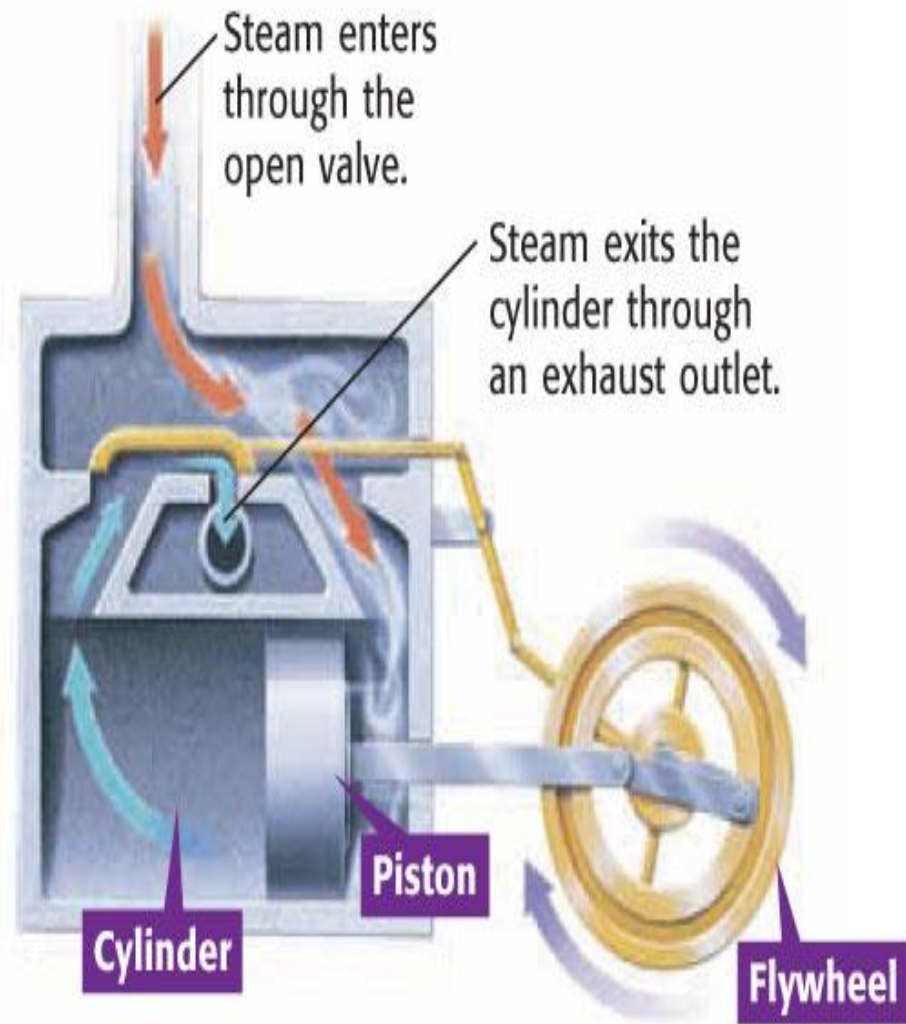
Heat Engine



- Heat engine - a machine that transforms heat into mechanical energy, or work.
- *Combustion* – how heat engines use fuel
- External Combustion Engines – burns fuel outside the engine
 - Ex: steam engine

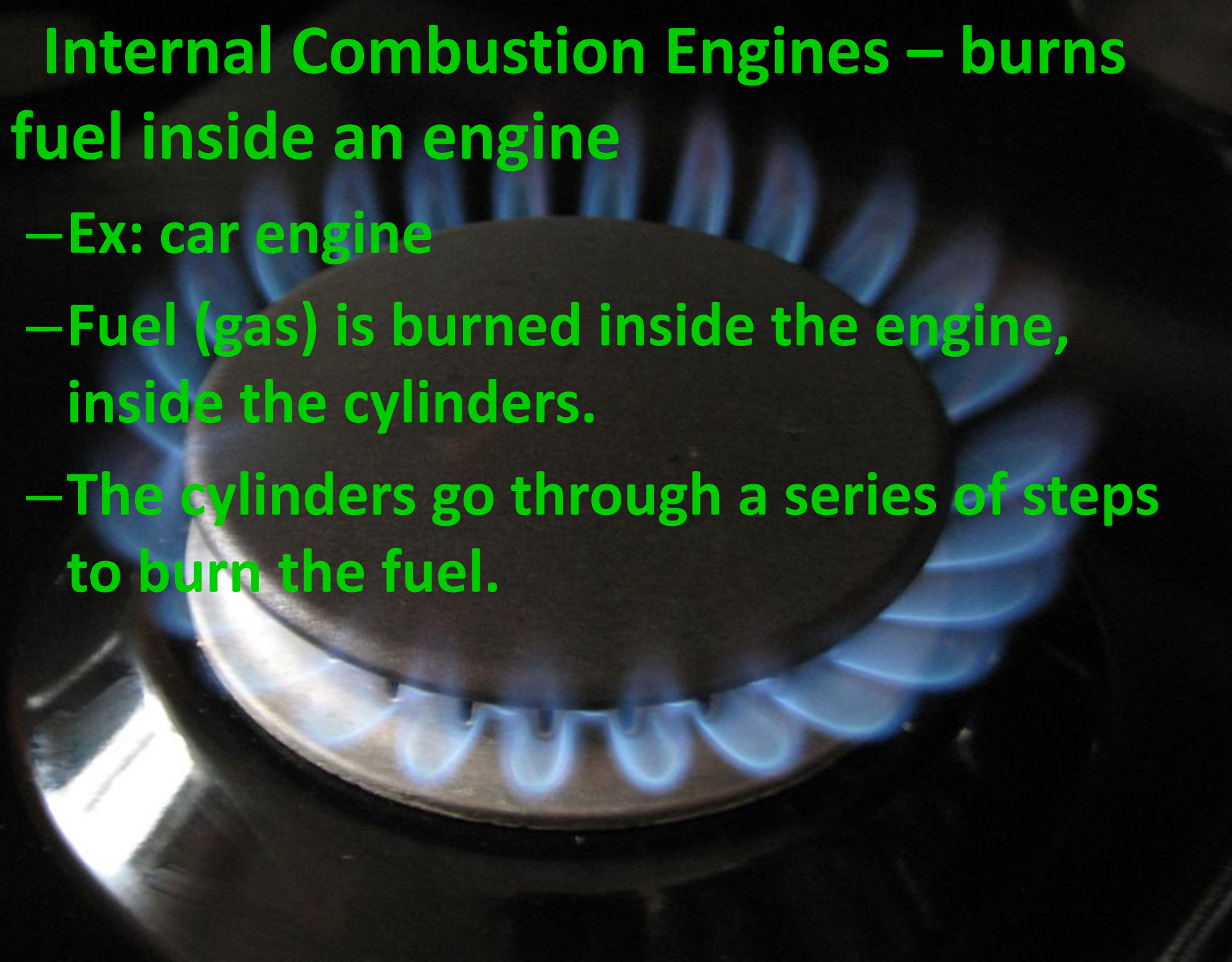


- 1** The expanding steam enters the cylinder from one side. The steam does work on the piston, forcing the piston to move.



- 2** As the piston moves to the other side, a second valve opens, and steam enters. The steam does work on the piston and moves it back. The motion of the piston turns a flywheel.

- **Internal Combustion Engines – burns fuel inside an engine**
 - Ex: car engine
 - Fuel (gas) is burned inside the engine, inside the cylinders.
 - The cylinders go through a series of steps to burn the fuel.



Cooling Systems



- Cooling systems move heat OUT of an area
- Cooling and Energy - The *compressor* does the work of cooling by compressing the refrigerant. The *refrigerant* is a gas that has a boiling point below room temperature, which allows it to condense easily.

How a Refrigerator Works

3 When the liquid passes through the expansion valve, it goes from a high-pressure area to a low-pressure area. As a result, the temperature of the liquid decreases.

Low pressure

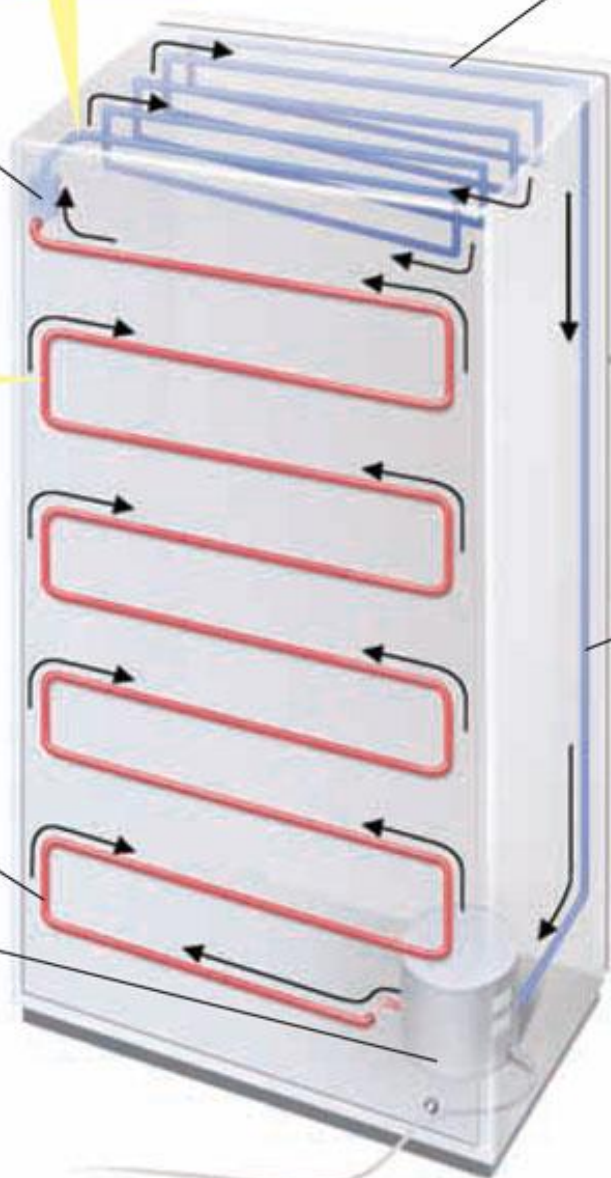
High pressure

2 The hot gas flows through the condenser coils on the outside of the refrigerator. The gas condenses into a liquid, transferring some of its thermal energy to the coils.

1 The compressor uses electrical energy to compress the refrigerant gas. This compression increases the pressure and temperature of the gas.

4 As the cold liquid refrigerant moves through the evaporating coils, it absorbs thermal energy from the refrigerator compartment, making the inside of the refrigerator cold. As a result, the temperature of the refrigerant increases, and it changes into a gas.

5 The gas is then returned to the compressor, and the cycle repeats.



Heat Technology and Thermal Pollution

- A negative effect of thermal energy is thermal pollution, the excessive heating of a body of water.
- Thermal pollution can happen near large power plants, which are often located near a body of water
 - It can effect the ecosystem in the area