Section 1: Renewable Energy Today

Preview

More

Section 1: Renewable Energy Today

Preview, *continued*

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- Wind Farms
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More

Section 1: Renewable Energy Today

Preview, *continued*

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Section: Renewable Energy Today

Think about how your great-grandparents met their energy needs. Which of these sources were renewable and which were non-renewable? Could any of these sources be used to meet modern needs?

Write your responses in your ***EcoLog***.

Objectives

- **List** six forms of renewable energy, and compare their advantages and disadvantages.
- **Describe** the difference between passive solar heating, active solar heating, and photovoltaic energy.
- **Describe** the current state of wind energy technology.
- **Explain** the differences in biomass fuel use between developed and developing nations.
- **Describe** how hydroelectric energy, geothermal energy, and geothermal heat pumps work.

Renewable Energy

- **Renewable energy** is energy from sources that are constantly being formed.
- Types of renewable energy includes:
  - solar energy
  - wind energy
  - the power of moving water
  - Earth's heat
- Remember, all sources of energy, including renewable sources, affect the environment.

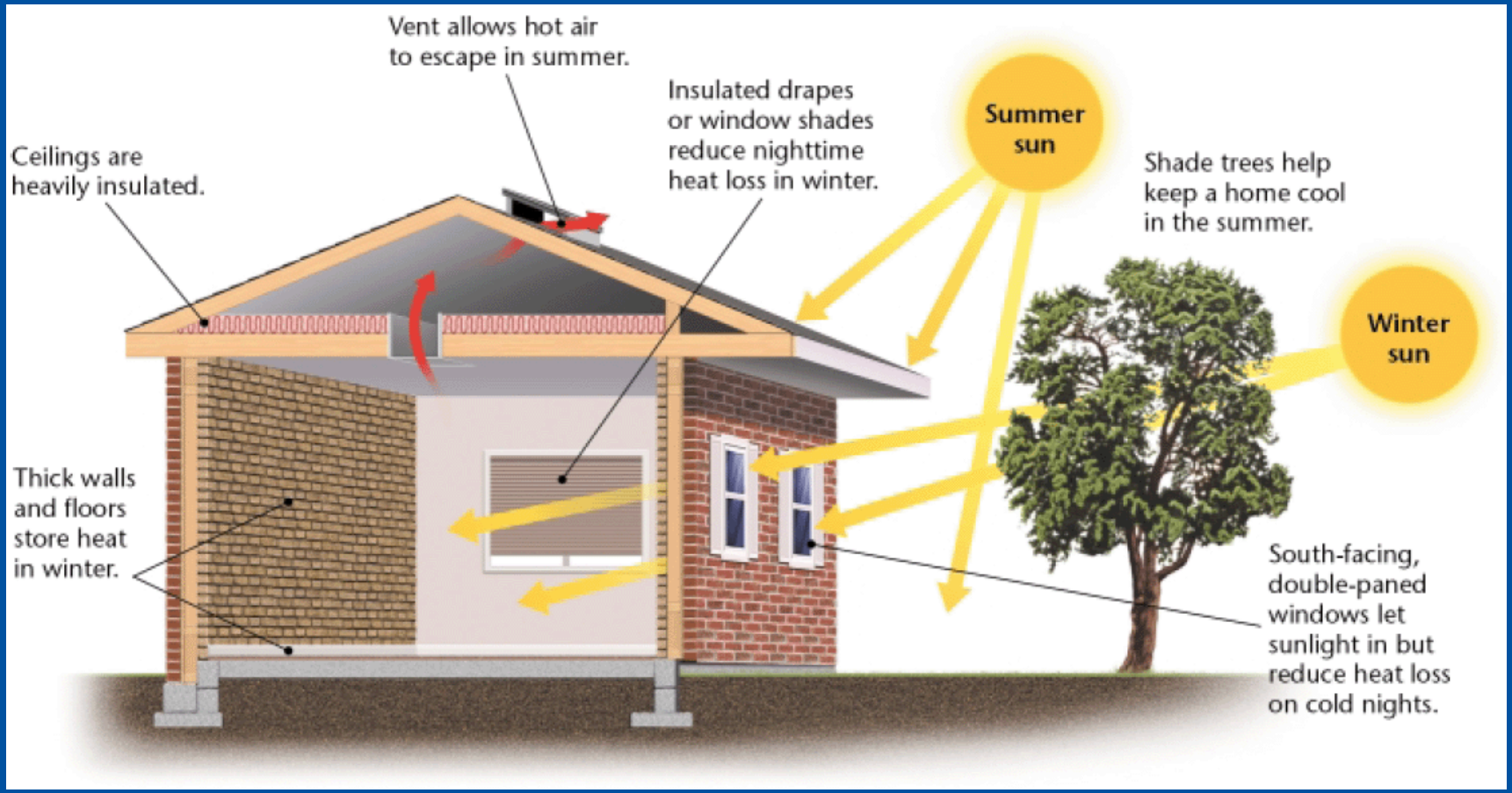
Solar Energy-Power from the Sun

- Nearly all renewable energy comes directly or indirectly from the sun.
- Direct solar energy is used every day, like when the sun shines on a window and heats the room.
- Solar energy can also be used indirectly to generate electricity in solar cells.

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.
- An average household could reduce its energy bills by using any of the passive solar features shown on the next slide.

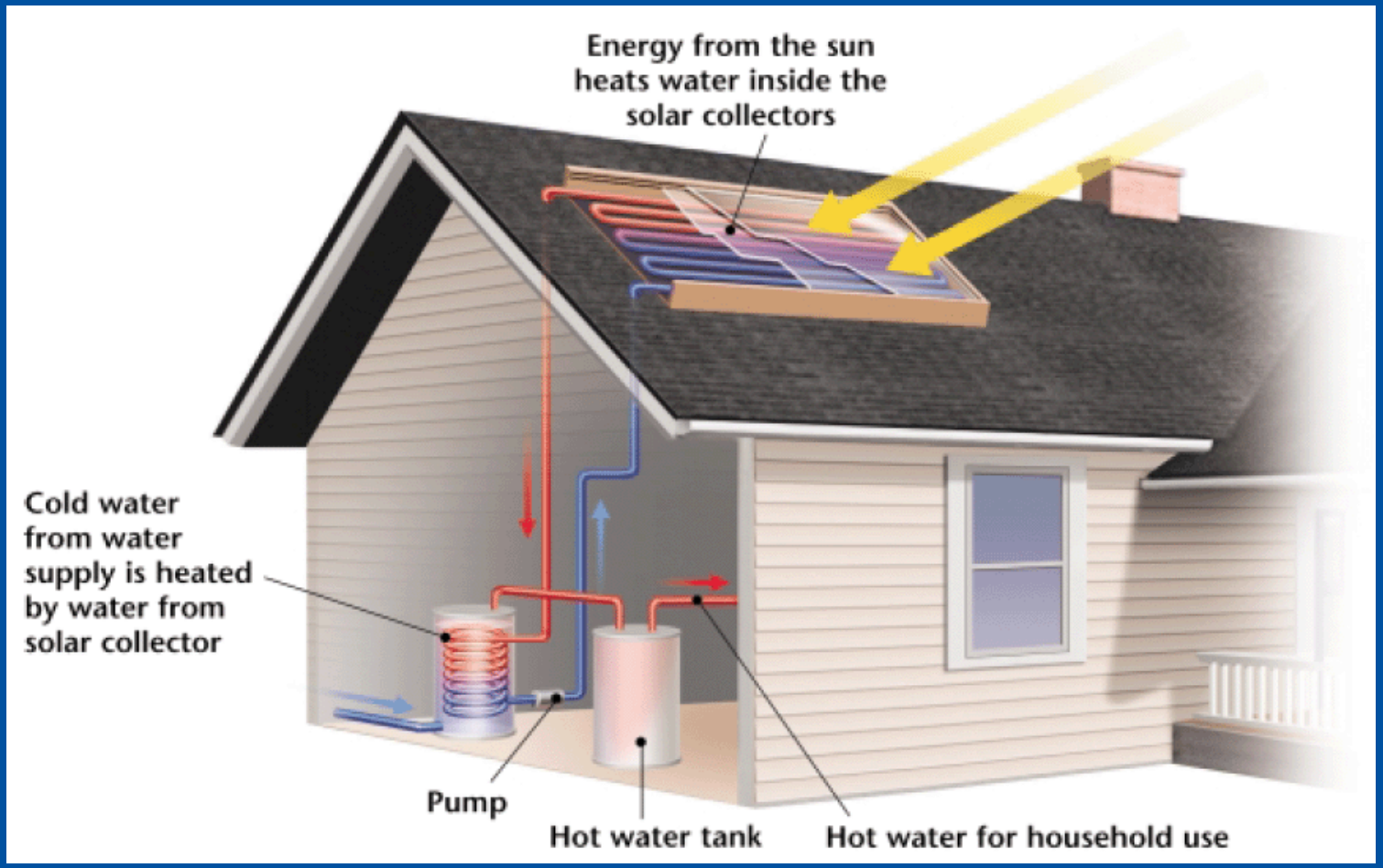
Passive Solar Heating



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.
- Solar collectors, usually mounted on a roof, capture the sun's energy.

Active Solar Heating



Active Solar Heating

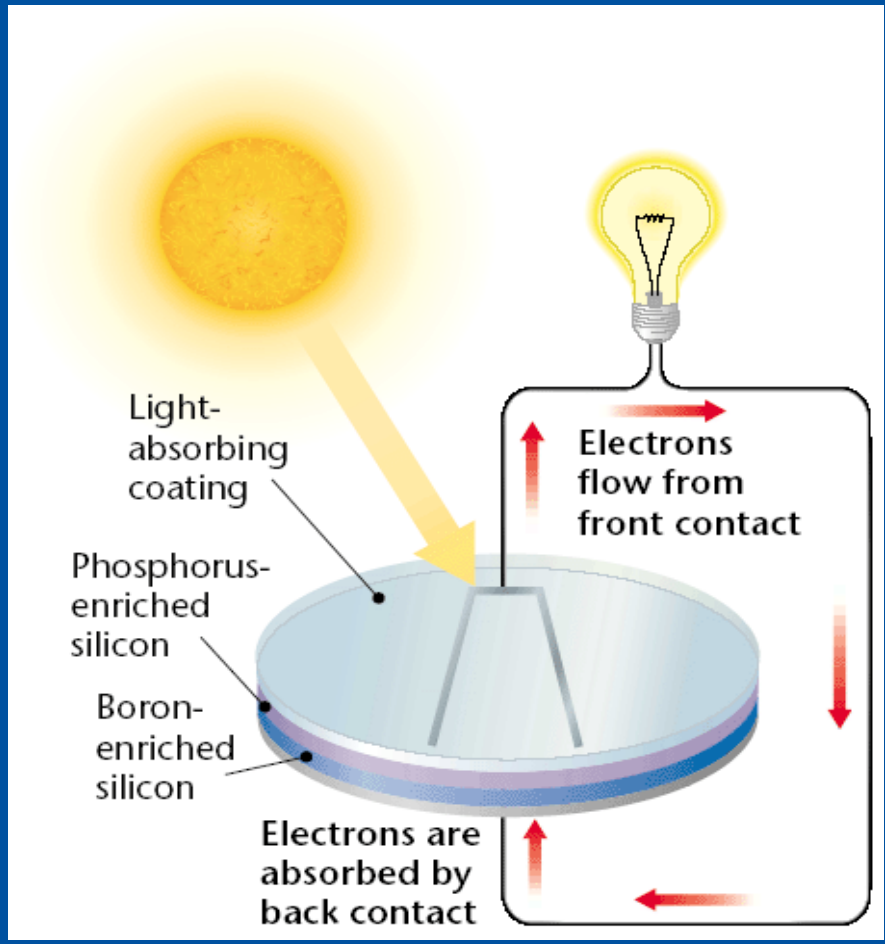
- A liquid is heated by the sun as it flows through solar collectors.
- The hot liquid is then pumped through heat exchangers, which heats water for the building.
- About 8% of the energy used in the United States is used to heat water; therefore, active solar technology could save a lot of energy.

Photovoltaic Cells

- **Photovoltaic cells** are solar cells that convert the sun's energy into electricity.
- Solar cells have no moving parts, and they run on nonpolluting power from the sun.
- However, they produce a very small electrical current. Meeting the electricity needs of a small city would require covering hundreds of acres with solar panels.

Photovoltaic Cells

Sunlight falls on a semiconductor, causing it to release electrons. The electrons flow through a circuit that is complete when another semiconductor in the solar cell absorbs electrons and passes them on to the first semiconductor.



Photovoltaic Cells

- Solar cells require extended periods of sunshine to produce electricity. This energy is stored in batteries, which supplies electricity when the sun is not shining.
- Currently, solar cells provide energy for more than 1 million households in developing countries, where energy consumption is minimal and electricity distribution networks are limited.

Wind Power

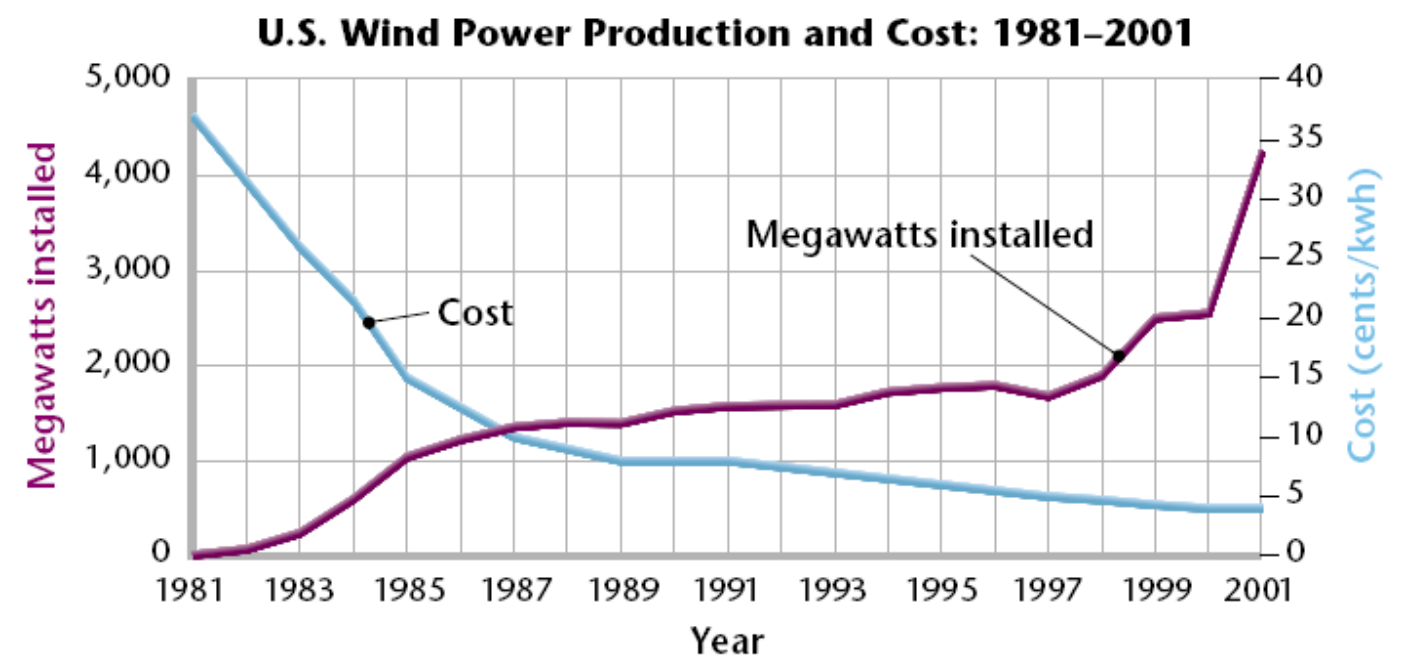
- Energy from the sun warms the Earth's surface unevenly, which causes air masses to flow in the atmosphere.
- We experience the movement of these air masses as wind.
- Wind power, which converts the movement of wind into electric energy, is the fastest growing energy source in the world.

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.
- In windy rural areas, small wind farms with 20 or fewer turbines are also becoming common.
- Because wind turbines take up little space, some farmers can add wind turbines to their land and still use the land for other purposes.

Wind Farms

- The cost of wind power has been steadily falling as wind turbines have become more efficient.



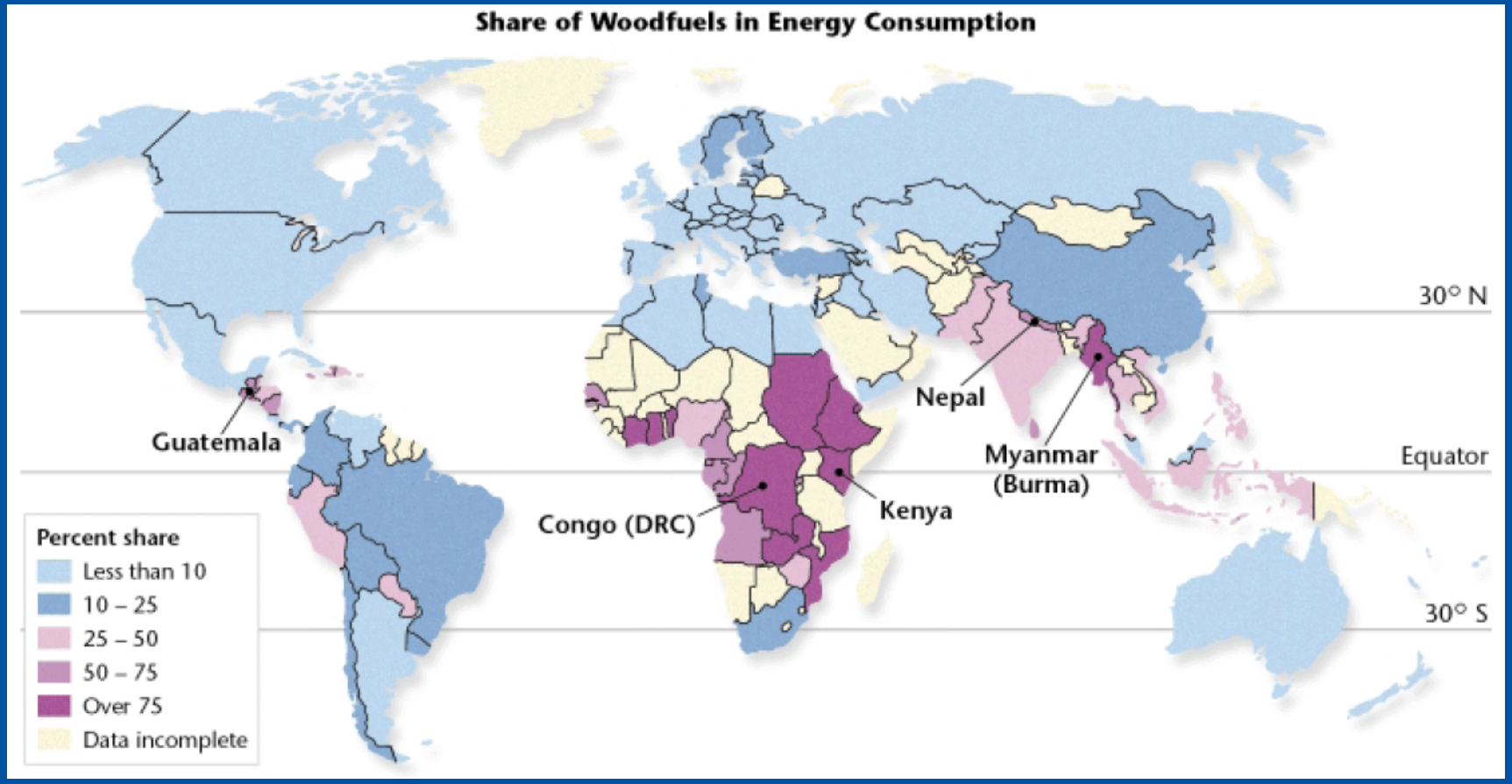
An Underdeveloped Resource

- Scientists estimate that the windiest spots on Earth could generate more than ten times the energy used worldwide.
- In the future, the electricity may be used on the wind farm to produce hydrogen from water.
- Today, all of the large energy companies are developing plans to use more wind power.

Biomass-Power from Living Things

- **Biomass fuel** consists of plant material, manure, or any other organic matter that is used as an energy source.
- Fossil fuels can be thought of as biomass energy sources, although they are nonrenewable.
- 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.

Biomass-Power from Living Things



Biomass-Power from Living Things

- Although materials like wood are a renewable resource, if trees are cut down faster than they grow, the resulting habitat loss, deforestation, and soil erosion can be severe.
- In addition, harmful air pollution may result from burning wood and dung.

Methane

- When bacteria decompose organic wastes, one byproduct is methane gas.
- Methane can be burned to generate heat or electricity.
- In China, more than 6 million households use biogas digesters to ferment manure and produce gas for heating and cooking.
- Some landfills in the United States generate electricity by using the methane from the decomposition of trash.

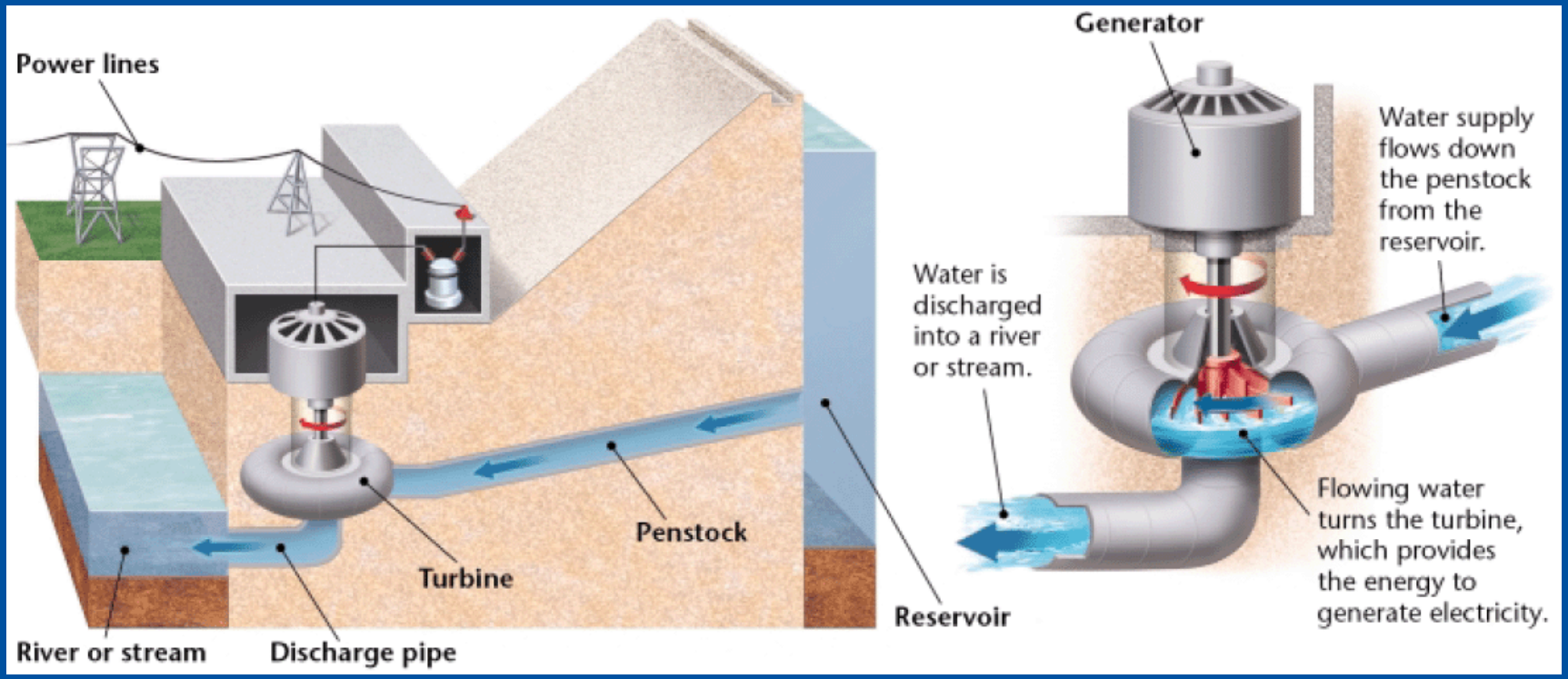
Alcohol

- 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.
- Some states require the use of gasohol in vehicles as a way to reduce air pollution.

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.

Hydroelectricity-Power from Moving Water



The Benefits of Hydroelectric Energy

- Hydroelectric dams are expensive to build, but relatively inexpensive to operate.
- Unlike fossil fuel plants, hydroelectric dams do not release air pollutants that cause acid precipitation.
- Hydroelectric dams also tend to last much longer than fossil fuel-powered plants.
- Dams also provide other benefits such as flood control and water for drinking, agriculture, industry, and recreation.

Disadvantages of Hydroelectric Energy

- A dam changes a river's flow, which can have far-reaching consequences.
- A reservoir floods large areas of habitat above the dam. Water flow below the dam is reduced, which disrupts ecosystems downstream.
- For example, many salmon fisheries of the northwestern United States have been destroyed by dams that prevent salmon from swimming upriver to spawn.

Disadvantages of Hydroelectric Energy

- When the land behind a dam is flooded, people are often displaced. If a dam bursts, people living in areas below the dam can be killed.
- River sediments build up behind the dam instead of enriching land farther down the river, making farmland below the dam less productive.
- Recent research has also shown that the decay of plant matter trapped in reservoirs can release large amounts of greenhouse gases-sometimes more than a fossil-fuel powered plant.

Modern Trends

- While in developing countries the construction of large dams continues, in the United States, the era of large dam construction is probably over.
- One modern trend is **micro-hydropower**, which is electricity produced in a small stream without having to build a big dam. The turbine may even float in the water, not blocking the river at all.
- Micro-hydropower is much cheaper than large hydroelectric dam projects, and it permits energy to be generated from small streams in remote areas.

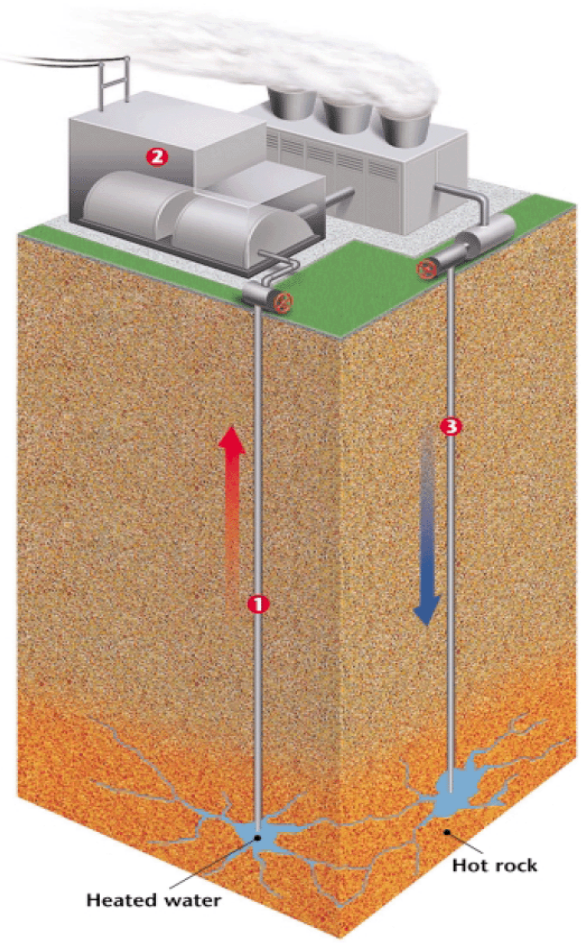
Geothermal Energy-Power from the Earth

- 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.
- Although geothermal energy is considered a renewable resource, the water that is used must be managed carefully so that it is not depleted.

Geothermal Energy-Power from the Earth

- Geothermal power plants generate electricity using the following steps
  - Steam rises through a well
  - Steam drives turbines, which generate electricity
  - Leftover liquid is pumped back into the hot rock
- The leftover liquid, water, is returned to Earth's crust because it can be reheated by geothermal energy and used again.

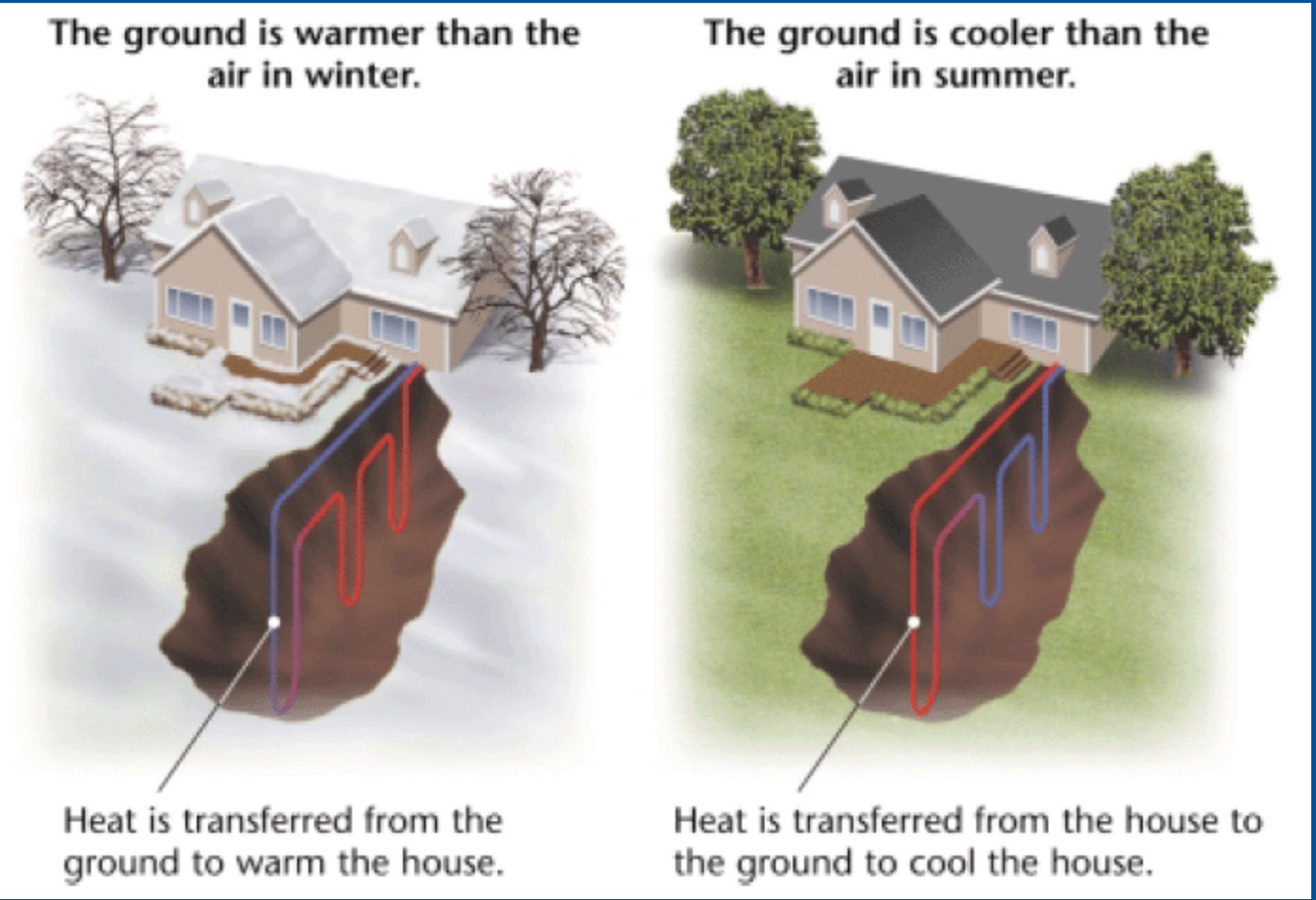
Geothermal Energy-Power from the Earth



Geothermal Heat Pumps: Energy for Homes

- More than 600,000 homes in the United States are heated and cooled using geothermal heat pumps.
- A **geothermal heat pump** uses stable underground temperatures to warm and cool homes because the temperature of the ground is nearly constant year-round.
- A heat pump is simply a loop of piping that circulates a fluid underground.

Geothermal Heat Pumps: Energy for Homes



Geothermal Heat Pumps: Energy for Homes

- In the summer, the ground is cooler than air and the fluid cools the home.
- In the winter, the ground is warmer than air, and the fluid warms the home.