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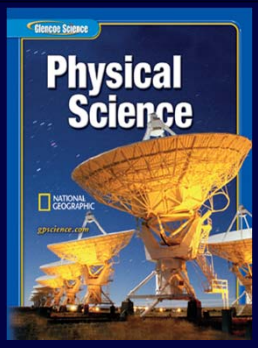

CHAPTER RESOURCES END

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Unit 2: Electricity and Energy Resources

Chapter 9: Energy Sources

9.1: Fossil Fuels

9.2: Nuclear Energy

9.3: Renewable Energy Sources

CHAPTER RESOURCES END

Fossil Fuels

9.1

Using Energy

- You can see energy being used in many ways, throughout the day.
- Furnaces and stoves use thermal energy to heat buildings and cook food.
- Cars and other vehicles use mechanical energy to carry people and materials from one part of the country to another.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Transforming Energy

- According to the law of conservation of energy, energy cannot be created or destroyed.
- Energy can only be transformed, or converted, from one form to another.
- To use energy means to transform one form of energy to another form of energy that can perform a useful function.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Transforming Energy

- Sometimes energy is transformed into a form that isn't useful.
- For example, when an electric current flows through power lines, about 10 percent of the electrical energy is changed to thermal energy.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Transforming Energy

- This reduces the amount of useful electrical energy that is delivered to homes, schools, and businesses

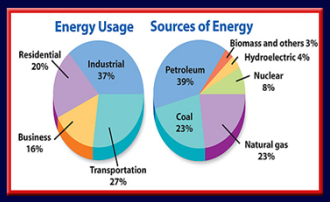
CHAPTER RESOURCES END

Fossil Fuels

9.1

Energy Use in the United States

- More energy is used in the United States than in any other country in the world.
- These circle graphs show where energy is used in the United States and sources of this energy.



CHAPTER RESOURCES END

Fossil Fuels

9.1

Making Fossil Fuels

- It may be hard to believe that it took millions of years to make the fuels that are used to produce electricity, provide heat, and transport people and materials.
- Fuels such as petroleum, or oil, natural gas, and coal are called **fossil fuels** because they are formed from the decaying remains of ancient plants and animals.

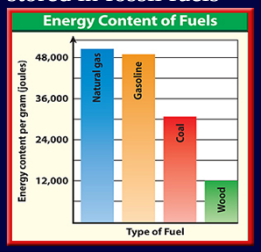
CHAPTER RESOURCES END

Fossil Fuels

9.1

Concentrated Energy Sources

- Compared to other fuels such as wood, the chemical energy that is stored in fossil fuels is more concentrated.
- For example, burning 1 kg of coal releases two to three times as much energy as burning 1 kg of wood.



CHAPTER RESOURCES END

Fossil Fuels

9.1

Petroleum

- Millions of gallons of petroleum, or crude oil, are pumped every day from wells deep in Earth's crust.

- **Petroleum** is a highly flammable liquid formed by decayed ancient organisms, such as microscopic plankton and algae.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Petroleum

- Petroleum is a mixture of thousands of chemical compounds.
- Most of these compounds are hydrocarbons, which means their molecules contain only carbon atoms and hydrogen atoms.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Separating Hydrocarbons

- The many different compounds that are found in petroleum are separated in a process called fractional distillation.
- This separation occurs in the tall towers of oil-refinery plants.
- First, crude oil is pumped into the bottom of the tower and heated.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Separating Hydrocarbons

- The chemical compounds in the crude oil boil and vaporize according to their individual boiling points.
- Materials with the lowest boiling points rise to the top of the tower as vapor are collected
- Hydrocarbons with high boiling points, such as asphalt and some types of waxes remain liquid and are drained off through the bottom of the tower.

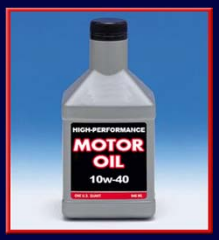
CHAPTER RESOURCES END

Fossil Fuels

9.1

Other Uses for Petroleum

- About 15 percent of the petroleum-based substances that are used in the United States go toward nonfuel uses.
- In addition to fuels, plastics and synthetic fabrics are made from the hydrocarbons found in crude petroleum.



CHAPTER RESOURCES END

Fossil Fuels

9.1

Other Uses for Petroleum

- Lubricants such as grease and motor oil, as well as the asphalt used in surfacing roads, are obtained from petroleum.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Natural Gas

- Natural gas is composed mostly of methane, CH_4, but it also contains other hydrocarbon gases such as propane, C_3H_8, and butane, C_4H_{10}.
- About one fourth of the energy consumed in the United States comes from burning natural gas.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Natural Gas

- Natural gas contains more energy per kilogram than petroleum or coal does.
- It also burns more cleanly than other fossil fuels, produces fewer pollutants, and leaves no residue such as ash.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Coal

- Coal is a solid fossil fuel that is found in mines underground.
- In the first half of the twentieth century, most houses in the United States were heated by burning coal.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Coal

- Now, only about one-fourth comes from coal. About 90 percent of all the coal that is used in the United States is burned by power plants to generate electricity.

CHAPTER RESOURCES

Fossil Fuels

9.1

Origin of Coal

- Coal mines were once the sites of ancient swamps.
- Coal formed from the organic material that was deposited as the plants that lived in these swamps died.

CHAPTER RESOURCES

Fossil Fuels

9.1

Origin of Coal

- Coal also is a complex mixture of hydrocarbons and other chemical compounds.
- Compared to petroleum and natural gas, coal contains more impurities, such as sulfur and nitrogen compounds.
- As a result, more pollutants, such as sulfur dioxide and nitrogen oxides, are produced when coal is burned.

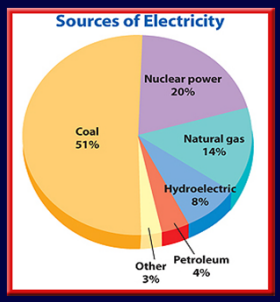
CHAPTER RESOURCES

Fossil Fuels

9.1

Generating Electricity

- This circle graph shows the percentage of electricity generated in the United States that comes from various energy sources.



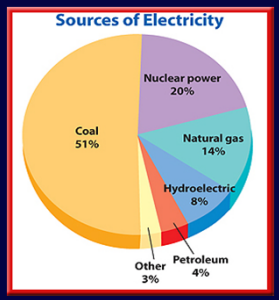
CHAPTER RESOURCES

Fossil Fuels

9.1

Generating Electricity

- How is the chemical energy contained in fossil fuels converted to electrical energy in an electric power station?

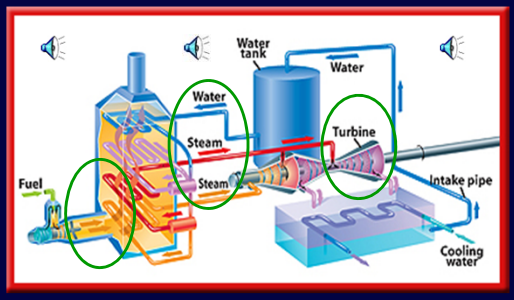


CHAPTER RESOURCES

Fossil Fuels

9.1

Generating Electricity

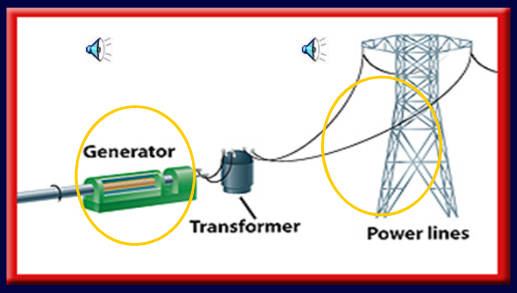


CHAPTER RESOURCES

Fossil Fuels

9.1

Generating Electricity



CHAPTER RESOURCES END

Fossil Fuels

9.1

Efficiency of Power Plants

- When fossil fuels are burned to produce electricity, not all the chemical energy in the fuel is converted to electrical energy.
- Energy is lost in every stage of the process. No stage is 100 percent efficient.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Efficiency of Power Plants

- The overall efficiency of the entire process is given by multiplying the efficiencies of each stage of the process.

Efficiency of Fossil Fuel Conversion

Process	Efficiency (%)
Chemical to thermal energy	60
Conversion of water to steam	90
Steam-turning turbine	75
Turbine spins electric generator	95
Transmission through power lines	90
Overall efficiency	35

CHAPTER RESOURCES END

Fossil Fuels

9.1

Efficiency of Power Plants

- If you were to do this, you'd find that the resulting overall efficiency is only about 35 percent.

Efficiency of Fossil Fuel Conversion

Process	Efficiency (%)
Chemical to thermal energy	60
Conversion of water to steam	90
Steam-turning turbine	75
Turbine spins electric generator	95
Transmission through power lines	90
Overall efficiency	35

CHAPTER RESOURCES END

Fossil Fuels

9.1

The Costs of Using Fossil Fuels

- Although fossil fuels are a useful source of energy for generating electricity and providing the power for transportation, their use has some undesirable side effects.
- When petroleum products and coal are burned, smoke is given off that contains small particles called particulates.

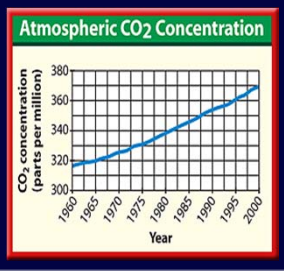
CHAPTER RESOURCES END

Fossil Fuels

9.1

The Costs of Using Fossil Fuels

- Burning fossil fuels also releases carbon dioxide.
- One consequence of increasing the atmospheric carbon dioxide concentration could be to cause Earth's surface temperature to increase.



CHAPTER RESOURCES END

Fossil Fuels

9.1

Using Coal

- The most abundant fossil fuel is coal, but coal contains even more impurities than oil or natural gas.
- Many electric power plants that burn coal remove some of these pollutants before they are released into the atmosphere.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Using Coal

- Mining coal also can be dangerous.
- Miners risk being killed or injured, and some suffer from lung diseases caused by breathing coal dust over long periods of time.

CHAPTER RESOURCES END

Fossil Fuels

9.1

Nonrenewable Resources

- All fossil fuels are **nonrenewable resources**, which means they are resources that cannot be replaced by natural processes as quickly as they are used.
- As the production of energy from fossil fuels continues, the remaining reserves of fossil fuels will decrease.

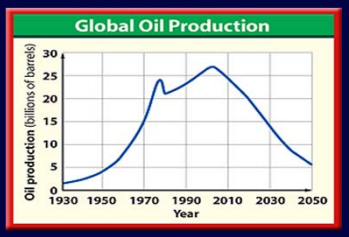
CHAPTER RESOURCES END

Fossil Fuels

9.1

Nonrenewable Resources

- Fossil fuels will become more difficult to obtain, causing them to become more costly in the future.



CHAPTER RESOURCES END

Fossil Fuels

9.1

Conserving Fossil Fuels

- Even as reserves of fossil fuels decrease and they become more costly, the demand for energy continues to increase as the world's population increases.
- One way to meet these energy demands would be to reduce the use of fossil fuels and obtain energy from other sources.

CHAPTER RESOURCES END

Section Check

9.1

Question 1

Compounds in petroleum are separated by fractional distillation based on their _____.

A. boiling point
B. density
C. melting point
D. viscosity

CHAPTER RESOURCES END

Section Check

9.1

Answer

The answer is A. Fractional distillation of petroleum occurs in the tall towers of oil refineries.

CHAPTER RESOURCES

END

Section Check

9.1

Question 2

Which of the following contains the most energy per kilogram?

A. asphalt
B. coal
C. gasoline
D. natural gas

CHAPTER RESOURCES

END

Section Check

9.1

Answer

The answer is D. Natural gas contains more energy per kilogram than either coal or petroleum.

CHAPTER RESOURCES

END

Section Check

9.1

Question 3

State the law of conservation of energy.

Answer

The law of conservation of energy states that energy cannot be created or destroyed. It can only be transformed.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

Using Nuclear Energy

- A nuclear power plant generates electricity using the energy released in nuclear fission.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

Using Nuclear Energy

- In nuclear fission, an extremely small amount of mass is converted into an enormous amount of energy.
- Today almost 20 percent of all electricity produced in the United States comes from nuclear power plants.
- Overall, nuclear power plants produce about eight percent of all the energy consumed in the United States.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

Nuclear Reactors

- A **nuclear reactor** uses the energy from controlled nuclear reactions to generate electricity.
- Although nuclear reactors vary in design, all have some parts in common.

CHAPTER RESOURCES END

Nuclear Energy

9.2

Nuclear Reactors

- They contain a fuel that can be made to undergo nuclear fission; they contain control rods that are used to control the nuclear reactions; and they have a cooling system that keeps the reactor from being damaged by the heat produced.

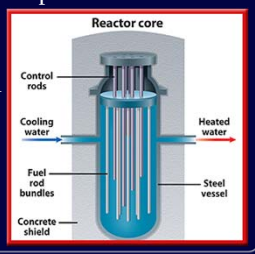
CHAPTER RESOURCES END

Nuclear Energy

9.2

Nuclear Reactors

- The actual fission of the radioactive fuel occurs in a relatively small part of the reactor known as the core.
- The core of a nuclear reactor contains the fuel rod bundles. Control rods that absorb neutrons are inserted between the fuel rod bundles.



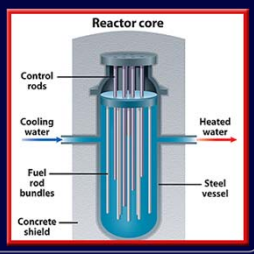
CHAPTER RESOURCES END

Nuclear Energy

9.2

Nuclear Reactors

- Water or another coolant is pumped through the core to remove the heat produced by the fission reaction.



CHAPTER RESOURCES END

Nuclear Energy

9.2

Nuclear Fuel

- Only certain elements have nuclei that can undergo fission.
- Naturally occurring uranium contains an isotope, U-235, whose nucleus can split apart.
- As a result, the fuel that is used in a nuclear reactor is usually uranium dioxide.

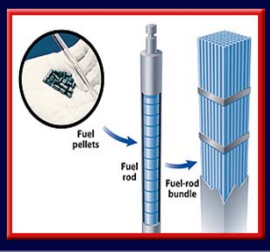
CHAPTER RESOURCES END

Nuclear Energy

9.2

The Reactor Core

- The reactor core contains uranium dioxide fuel in the form of tiny pellets.
- The pellets are about the size of a pencil eraser and are placed end to end in a tube.
- The tubes are then bundled and covered with a metal alloy.



CHAPTER RESOURCES END

Nuclear Energy

9.2

The Reactor Core

- The core of a typical reactor contains about a hundred thousand kilograms of uranium in hundreds of fuel rods.
- For every kilogram of uranium that undergoes fission in the core, 1 g of matter is converted into energy.
- The energy released by this gram of matter is equivalent to the energy released by burning more than 3 million kg of coal.

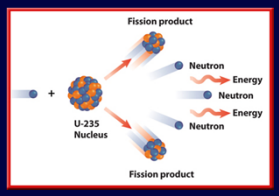
CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Fission

- When a neutron strikes the nucleus of a U-235 atom, the nucleus splits apart into two smaller nuclei.
- In the process two or three neutrons also are emitted. The smaller nuclei are called fission products.



CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Fission

- Because every uranium atom that splits apart releases neutrons that cause other uranium atoms to split apart, this process is called a nuclear chain reaction.
- As a result, an enormous number of nuclei can be split after only a small number of stages.

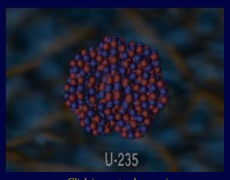
CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Fission

- Nuclear chain reactions take place in a matter of milliseconds.
- If the process isn't controlled, the chain reaction will release energy explosively rather than releasing energy at a constant rate.



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CHAPTER RESOURCES

Nuclear Energy

9.2

Controlling the Chain Reaction

- To control the chain reaction, some of the neutrons that are released when U-235 splits apart must be prevented from striking other U-235 nuclei.
- These neutrons are absorbed by rods containing boron or cadmium that are inserted into the reactor core.

CHAPTER RESOURCES

Nuclear Energy

9.2

Controlling the Chain Reaction

- Moving these control rods deeper into the reactor causes them to absorb more neutrons and slow down the chain reaction.
- Eventually, only one of the neutrons released in the fission of each of the U-235 nuclei strikes another U-235 nucleus, and energy is released at a constant rate.

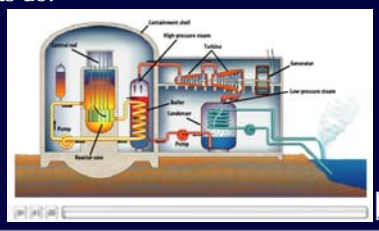
CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Power Plants

- Nuclear fission reactors produce electricity in much the same way that conventional power plants do.



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CHAPTER RESOURCES

END

Nuclear Energy

9.2

The Risks of Nuclear Power

- Nuclear power plants do not produce the air pollutants that are released by fossil-fuel burning power plants.
- The nuclear generation of electricity, however, has its problems.
- The mining of the uranium can cause environmental damage.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

The Risks of Nuclear Power

- Water that is used as a coolant in the reactor core must cool before it is released into streams and rivers.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

The Release of Radioactivity

- One of the most serious risks of nuclear power is the escape of harmful radiation from power plants.
- The fuel rods contain radioactive elements with various half-lives.
- Some of these elements could cause damage to living organisms if they were released from the reactor core.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

The Disposal of Nuclear Waste

- After about three years, not enough fissionable U-235 is left in the fuel pellets in the reactor core to sustain the chain reaction.
- The spent fuel contains radioactive fission products in addition to the remaining uranium.
- **Nuclear waste** is any radioactive by-product that results when radioactive materials are used.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

Low-Level Waste

- Low-level nuclear wastes usually contain a small amount of radioactive material. They usually do not contain radioactive materials with long half-lives.
- Products of some medical and industrial processes are low-level wastes.

CHAPTER RESOURCES

END

Nuclear Energy

9.2

Low-Level Waste

- Low-level wastes usually are sealed in containers and buried in trenches 30 m deep at special locations.
- When dilute enough, low-level waste sometimes is released into the air or water.

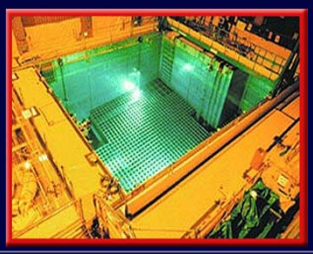
CHAPTER RESOURCES

Nuclear Energy

9.2

High-Level Waste

- High-level nuclear waste is generated in nuclear power plants and by nuclear weapons programs.
- After spent fuel is removed from a reactor, it is stored in a deep pool of water.



CHAPTER RESOURCES

Nuclear Energy

9.2

High-Level Waste

- Many of the radioactive materials in high-level nuclear waste have short half-lives.
- However, the spent fuel also contains materials that will remain radioactive for tens of thousands of years. For this reason, the waste must be disposed of in extremely durable and stable containers.

CHAPTER RESOURCES

Nuclear Energy

9.2

High-Level Waste

- One method proposed for the disposal of high-level waste is to seal the waste in ceramic glass, which is placed in protective metal-alloy containers.
- The containers then are buried hundreds of meters below ground in stable rock formations or salt deposits.

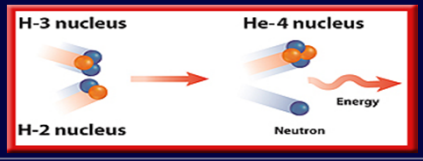
CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Fusion

- The Sun gives off a tremendous amount of energy through a process called thermonuclear fusion.
- Thermonuclear fusion is the joining together of small nuclei at high temperatures.



CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Fusion

- In this process, a small amount of mass is converted into energy.
- Fusion is the most concentrated energy source known.

CHAPTER RESOURCES

Nuclear Energy

9.2

Nuclear Fusion

- An advantage of producing energy using nuclear fusion is that the process uses hydrogen as fuel.
- Hydrogen is abundant on Earth.
- Another advantage is that the product of the reaction is helium. Helium is not radioactive and is chemically nonreactive.

CHAPTER RESOURCES END

Nuclear Energy

9.2

Nuclear Fusion

- One disadvantage of fusion is that it occurs only at temperatures of millions of degrees Celsius.
- Research reactors often consume more energy to reach and maintain these temperatures than they produce.
- Another problem is how to contain a reaction that occurs at such extreme conditions.

CHAPTER RESOURCES END

Section Check

9.2

Question 1

What is the function of the control rods in a nuclear reactor?

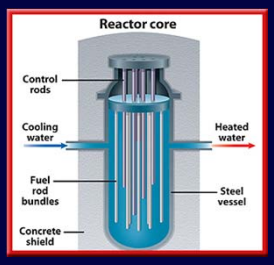
CHAPTER RESOURCES END

Section Check

9.2

Answer

The control rods in a nuclear reactor absorb some of the neutrons released by the nuclear chain reaction, preventing an explosive release of energy.



CHAPTER RESOURCES END

Section Check

9.2

Question 2

Describe the fuel found in a nuclear reactor.

Answer

Uranium dioxide pellets are placed end to end in tubes; the tubes are bundled and covered with a metal alloy and inserted into the reactor core.

CHAPTER RESOURCES END

Section Check

9.2

Question 3

How does a nuclear reactor produce electricity?

Answer

Nuclear fission reactors produce electricity by using the thermal energy released during fission to heat water and produce steam. The steam drives a turbine that rotates an electrical generator.

CHAPTER RESOURCES END

Energy Options

- The demand for energy increases continually, but supplies of fossil fuels are decreasing.
- As a result, other sources of energy that can meet Earth's increasing energy demands are being developed.

Energy Options

- Some alternative energy sources are renewable resources.
- A **renewable resource** is an energy source that is replaced nearly as quickly as it is used.

Energy From the Sun

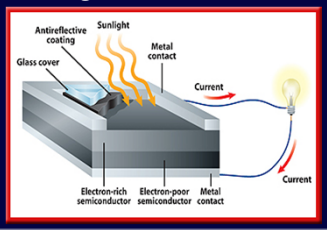
- Because only about one billionth of the Sun's energy falls on Earth, and because the Sun is expected to continue producing energy for several billion years, solar energy cannot be used up.
- Solar energy is a renewable resource.

Energy From the Sun

- Many devices use solar energy for power including solar-powered calculators.
- These devices use a **photovoltaic cell** that converts radiant energy from the Sun directly into electrical energy.

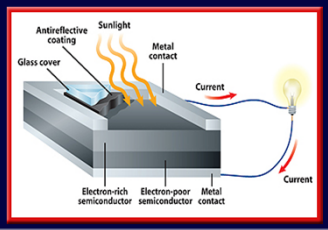
How Solar Cells Work

- Solar cells are made of two layers of semiconductor materials sandwiched between two layers of conducting metal.
- One layer of semiconductor is rich in electrons, while the other layer is electron poor.



How Solar Cells Work

- When sunlight strikes a solar cell, electrons are ejected from the electron-rich semiconductor. These electrons can travel in a closed circuit back to the electron-poor semiconductor.



Using Solar Energy

- In remote areas where electric distribution lines are not available, the use of solar cells is a practical way of providing electrical power.
- Currently, the most promising solar technologies are those that concentrate the solar power into a receiver.

Using Solar Energy

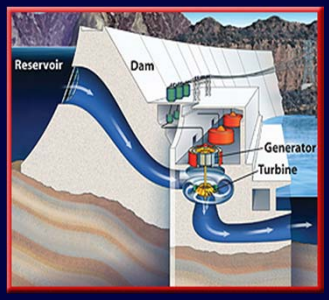
- One such system is called the parabolic trough.
- The trough focuses the sunlight on a tube that contains a heat-absorbing fluid such as synthetic oil or liquid salt.
- The heated fluid is circulated through a boiler where it generates steam to turn a turbine, generating electricity.

Energy from Water

- Just as the expansion of steam can turn an electric generator, rapidly moving water can as well.
- The gravitational potential energy of the water can be increased if the water is retained by a high dam.
- This potential energy is released when the water flows through tunnels near the base of the dam.

Energy from Water

- Rushing water spins a turbine, which rotates the shaft of an electric generator to produce electricity.



Using Hydroelectricity

- Electricity produced from the energy of moving water is called **hydroelectricity**.
- Currently about 8 percent of the electrical energy used in the United States is produced by hydroelectric power plants.
- Hydroelectric power plants are an efficient way to produce electricity with almost no pollution.

Using Hydroelectricity

- Bodies of water held back by dams can form lakes that can provide water for drinking and crop irrigation.
- After the initial cost of building a dam and a power plant, the electricity is relatively cheap.

Renewable Energy Sources

9.3

Energy from the Tides

- Each day, the level of the ocean on a coast rises and falls continually.
- Hydroelectric power can be generated by these ocean tides.
- As the tide comes in, the moving water spins a turbine that generates electricity.

CHAPTER RESOURCES END

Renewable Energy Sources

9.3

Energy from the Tides

- The water is then trapped behind a dam.
- At low tide the water behind the dam flows back out to the ocean, spinning the turbines and generating electric power.

CHAPTER RESOURCES END

Renewable Energy Sources

9.3

Energy from the Tides

- Only a few places on Earth have large enough differences between high and low tides for tidal energy to be a useful energy source.
- Tidal energy probably will be a limited source of energy in the future.

CHAPTER RESOURCES END

Renewable Energy Sources

9.3

Harnessing the Wind

- Windmills can use the energy of the wind to generate electricity.
- Wind spins a propeller that is connected to an electric generator.

CHAPTER RESOURCES END

Renewable Energy Sources

9.3

Harnessing the Wind

- However, only a few places on Earth consistently have enough wind to rely on wind power to meet energy needs.
- Also, windmills are only about 20 percent efficient on average.

CHAPTER RESOURCES END

Renewable Energy Sources

9.3

Energy from Inside Earth

- Heat is generated within Earth by the decay of radioactive elements.
- This heat is called geothermal heat.
- Geothermal heat causes the rock beneath Earth's crust to soften and melt.
- This hot molten rock is called magma.
- The thermal energy that is contained in hot magma is called **geothermal energy**.

CHAPTER RESOURCES END

Renewable Energy Sources

9.3

Energy from Inside Earth

- Perhaps you have seen a geyser shooting steam and hot water.
- The water that shoots from the geyser is heated by magma close to Earth's surface.
- In some areas, this hot water can be pumped into houses to provide heat.

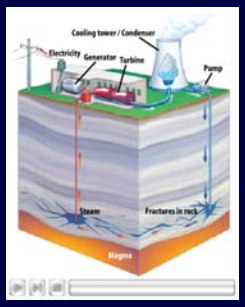
CHAPTER RESOURCES

Renewable Energy Sources

9.3

Geothermal Power Plants

- A geothermal power plant converts geothermal energy to electrical energy.



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CHAPTER RESOURCES

Renewable Energy Sources

9.3

Alternative Fuels

- The use of fossil fuels would be greatly reduced if cars could run on other fuels or sources of energy.
- Cars have been developed that use electrical energy supplied by batteries as a power source.

CHAPTER RESOURCES

Renewable Energy Sources

9.3

Alternative Fuels

- Hydrogen gas is another possible alternative fuel.
- It produces only water vapor when it burns and creates no pollution.

CHAPTER RESOURCES

Renewable Energy Sources

9.3

Biomass Fuels

- Biomass can be burned in the presence of oxygen to convert the stored chemical energy to thermal energy.

CHAPTER RESOURCES

Renewable Energy Sources

9.3

Biomass Fuels

- Biomass can be burned in the presence of oxygen to convert the stored chemical energy to thermal energy.
- **Biomass** is renewable organic matter, such as wood, sugarcane fibers, rice hulls, and animal manure.
- Converting biomass is probably the oldest use of natural resources for meeting human energy needs.

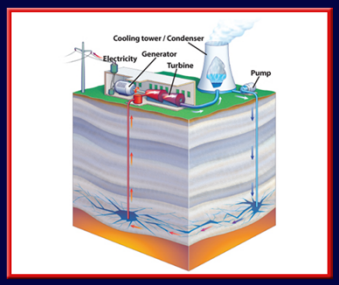
CHAPTER RESOURCES

Section Check

9.3

Question 1

Describe how this power plant generates electrical energy.



CHAPTER RESOURCES

END

Section Check

9.3

Answer

Geothermal energy is converted to electrical energy when water is changed to steam by the hot rock. The steam is pumped to the surface where it turns a turbine attached to a generator.

CHAPTER RESOURCES

END

Section Check

9.3

Question 2

What is the function of a photovoltaic cell?

CHAPTER RESOURCES

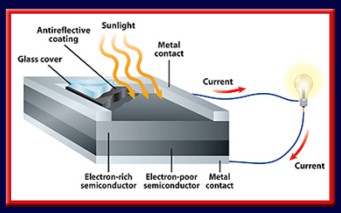
END

Section Check

9.3

Answer

A photovoltaic cell converts radiant energy from the Sun directly into electrical energy.



CHAPTER RESOURCES

END

Section Check

9.3

Question 3

Energy produced from the energy of moving water is _____.

A. hydroelectricity
B. geothermal energy
C. nuclear energy
D. solar energy

CHAPTER RESOURCES

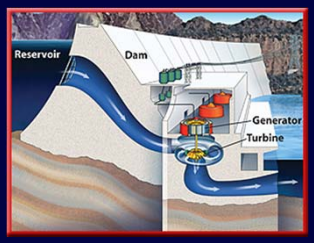
END

Section Check

9.3

Answer

The answer is A. Hydroelectricity is produced from the energy of moving water.



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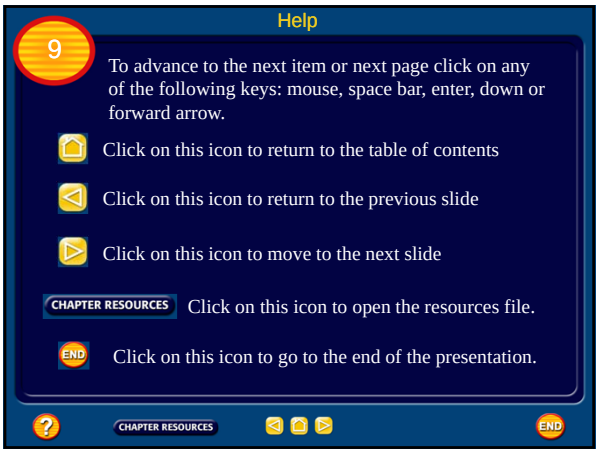
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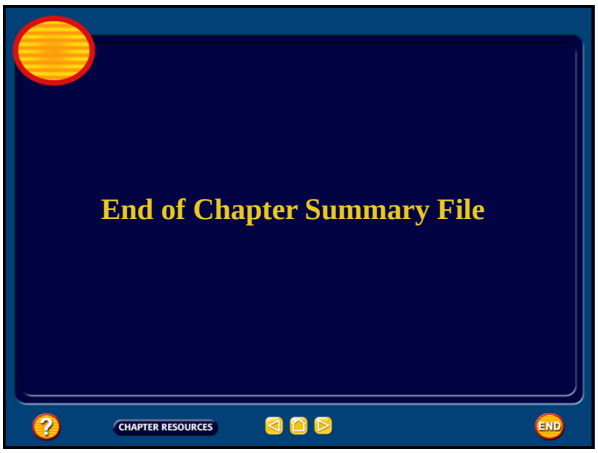
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