Crude oil is pumped out of the ground, refined, and turned into gasoline, fuel oil, and other oil products.

Nonrenewable Energy Resources

What are the major nonrenewable sources of energy?

Nonrenewable energy resources exist in limited quantities and, once used, cannot be replaced except over the course of millions of years.

Nonrenewable energy resources include oil, natural gas, coal, and uranium.

Nonrenewable Energy Resources

Oil, natural gas, and coal are known as **fossil fuels**.

- They were formed underground from the remains of once-living organisms.
- Fossil fuels account for the great majority of the world's energy use.
- These fuels are not distributed evenly throughout the world.

Renewable Energy Resources

What are the major renewable sources of energy?
Renewable energy resources are resources that can be replaced in a relatively short period of time.

Renewable energy resources include hydroelectric, solar, geothermal, wind, biomass, and, possibly in the future, nuclear fusion.

Renewable Energy Resources

Most renewable energy resources originate either directly or indirectly from the sun.

- The sun and Earth are constantly releasing large amounts of energy.
- This energy could be used for generating electric power, heating buildings, or other purposes.

Renewable Energy Resources

Hydroelectric Energy

Energy obtained from flowing water is known as **hydroelectric energy.**

- As water flows downhill, its gravitational potential energy is converted into kinetic energy.
- This kinetic energy turns turbines connected to electric generators.

Renewable Energy Resources

Most modern hydroelectric plants rely on dams built across rivers. The major advantages of hydroelectric energy include its low cost to produce and lack of pollution.

Dams, however, cause a variety of environmental problems.

Renewable Energy Resources

Hoover Dam was built across the Colorado River on the Arizona-Nevada border.

This 221-meter-tall structure can generate over 2 million kilowatts of power.

Renewable Energy Resources

Solar Energy

- Sunlight converted into usable energy is called **solar energy.**
- In passive solar designs, sunlight heats a building without using machinery.
- In active solar energy systems, sunlight heats flat collection plates through which water flows.

Renewable Energy Resources

- Sunlight can also be converted directly into electrical energy by means of solar cells, also known as photovoltaic cells.
- A few large solar electric plants use mirrors that concentrate sunlight to produce electricity.
- The benefits of solar energy depend on the climate.

Renewable Energy Resources

Geothermal Energy

- **Geothermal energy** is thermal energy beneath Earth's surface.
- In some regions, especially near volcanoes, geothermal energy is used to generate electricity.
- Geothermal energy is nonpolluting but is not widely available.

Renewable Energy Resources

- A solar electric plant uses solar cells to convert sunlight into electricity.
- A geothermal plant in California uses Earth's thermal energy to generate electricity.

Renewable Energy Resources

Other Renewable Resources

The chemical energy stored in living things is called **biomass energy.** Biomass can be converted directly into thermal energy or converted into a high-energy alcohol fuel.

A **hydrogen fuel cell** generates electricity by reacting hydrogen with oxygen. Hydrogen fuel cells can be used to convert energy from renewable resources.

Renewable Energy Resources

A form of hydrogen is also the most likely raw material for another future source of energy, nuclear fusion.

The process of fusion will probably produce little pollution or radioactive waste. Scientists have been working on sustained fusion for years, but many challenges remain.

World Energy Use

Data Analysis

Which energy resources are most commonly used around the world? How is energy use changing over time? The table shows total world energy use in 1991 and 2000. Energy use is measured in British thermal units, or Btu (1 Btu = 1055 J). Note that petroleum includes oil and related fuels.

World Energy Use

Data Analysis

- **Using Tables** What was the world's largest source of energy in 1991? In 2000?

World Energy Use ($\times 10^{15}$ Btu)		
Source	**1991**	**2000**
Petroleum	136.47	154.28
Coal	88.35	94.22
Natural gas	76.03	90.15
Hydroelectric power	23.13	27.80
Nuclear fission	21.29	25.66
Other	1.82	2.99

Answer:

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Answer: Petroleum in both years.

World Energy Use

Data Analysis

- **Analyzing Data** In general, how did usage change from 1991 to 2000?

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Answer: Each type of energy use increased between 1991 and 2000.

World Energy Use

Data Analysis

• **Graphing** Make a circle graph of world energy use by source for the year 2000.

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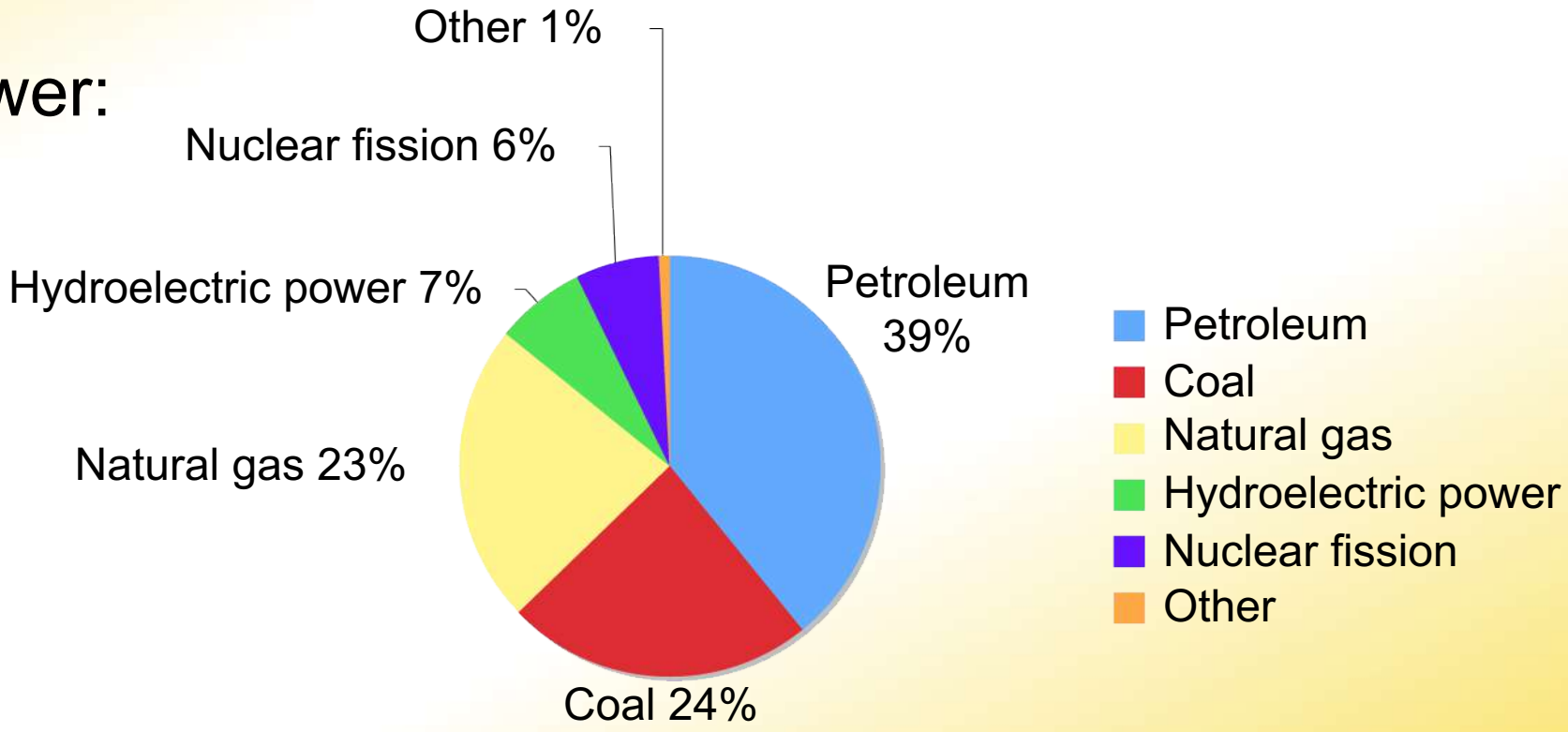

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Answer: Approximately 86%.

World Energy Use

Data Analysis

• **Predicting** How might total world energy use be different in 2020? Explain.

Answer:

World Energy Use

Data Analysis

• **Predicting** How might total world energy use be different in 2020? Explain.

Answer: Based on the trend between 1991 and 2000, the total world energy use will likely be significantly higher in 2020 than it was in 2000. The percentage of energy resources in the "other" category will increase by 2020.

Conserving Energy Resources

How can energy resources be conserved?

Energy resources can be conserved by reducing energy needs and by increasing the efficiency of energy use.

Conserving Energy Resources

Finding ways to use less energy or to use energy more efficiently is known as **energy conservation.**

- Making appliances, cars, and even light bulbs more energy efficient is a way of reducing energy use.
- Energy-efficient purchases often cost more initially, but can save money in fuel costs over time.

Conserving Energy Resources

Mass transportation systems include buses, trains, and streetcars.

Using mass transit can reduce energy use.

Assessment Questions

- Which of the following is a nonrenewable energy resource?
  - geothermal energy
  - hydroelectric energy
  - hydrogen fuel cells
  - natural gas

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  - increase usage of mass transit
  - reduce the cost of energy production
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