

Nonrenewable Energy Resources

5.1

I. Energy

- Some energy resources on Earth are being used faster than nature can replace them – these are called *nonrenewable energy resources*
- Most of the energy resources used to generate electricity are nonrenewable

II. Fossil Fuels

- Fossil Fuels are fuels such as coal, oil, and natural gas that form from the remains of plants and other organisms that were buried and altered over millions of years

Uses of Fossil Fuels

- Coal
 - To Generate electricity
- Oil
 - To produce gasoline and other fuels
 - As lubricants
 - To make plastics, home shingles and other products
- Natural Gas
 - To Heat Buildings
 - As a source of Sulfur

A. Coal

a. Coal is the most abundant fossil fuel in the world

– If we continue to use coal at the rate we do now we will run out in 250 years

b. Coal is a sedimentary rock that contains at least 50% plant remains from swampy areas

B. Synthetic Fuels

a. Synthetic fuels are extracted from solid organic material

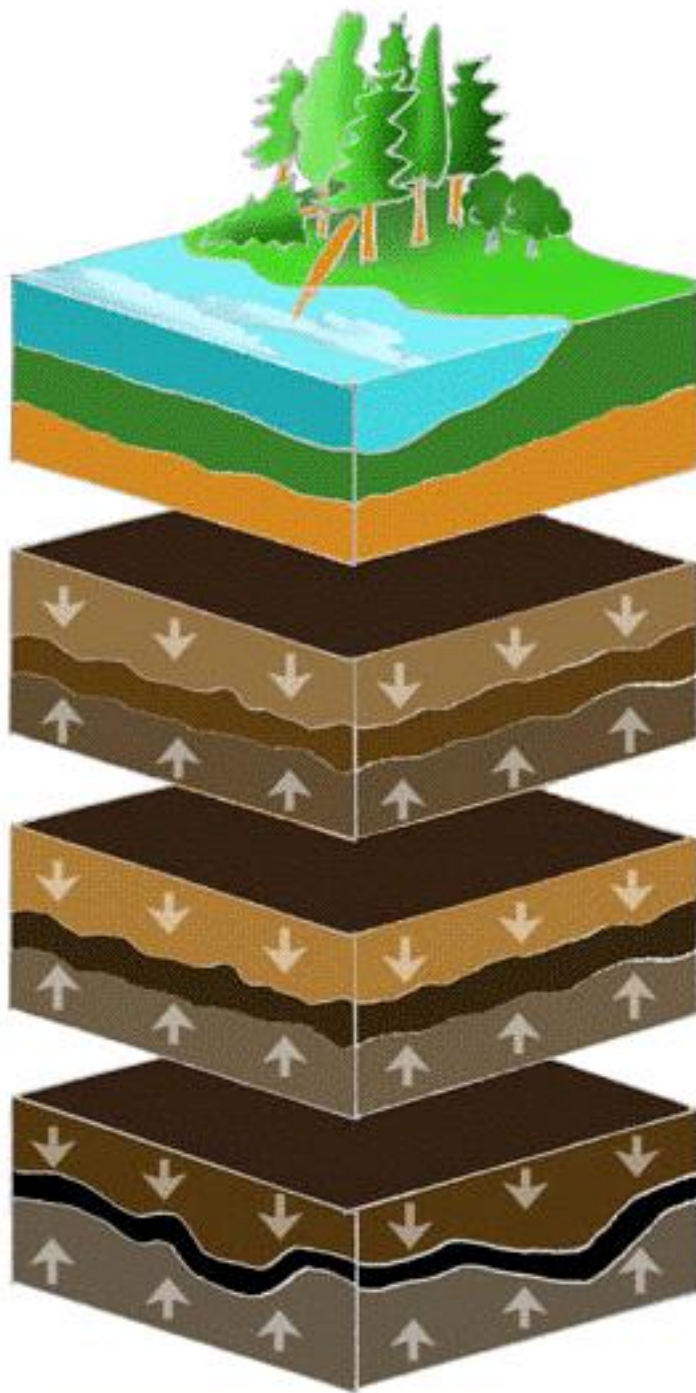
- They can be created from Coal

C. Stages of Coal Formation

1. Plant materials buried under sediments decay to form peat, a compressed mass of plant remains.
2. Compaction forces water out of the sediments to form lignite, a soft, brown coal.

3. Further compression and aging turn lignite into bituminous coal, a soft, black coal.

4. Heat and pressure metamorphose bituminous coal to anthracite, a hard coal that is almost pure carbon.
 - Anthracite coal contains the highest amount of carbon of all forms of Coal and therefore is the cleanest burning type of coal



HUGE FORESTS GREW AROUND
300 MILLION YEARS AGO
COVERING MOST OF THE EARTH

THE VEGETATION DIES AND
FORMS PEAT

THE PEAT IS COMPRESSED BETWEEN
SEDIMENT LAYERS TO FORM LIGNITE

FURTHER COMPRESSION
FORMS BITUMINOUS AND
SUBBITUMINOUS COAL

EVENTUALLY ANTHRACITE FORMS



D. Oil and Natural Gas

- a. Oil and Natural Gas provide large quantities of the energy used today
- b. Oil is a thick, black liquid formed from the buried remains of microscopic marine organisms
- c. Natural gas forms under similar conditions and often with oil, but in a gaseous state

E. Formation of Oil and Natural Gas

- a. Oil and natural gas are often found in layers of rock that have become tilted or folded
- b. Because they are less dense than water, oil and natural gas are forced upward
- c. Rock such as shale can trap oil and gas underground. This layer of rock is called the *reservoir rock*

III. Removing Fossil Fuels from the Ground

- The two most common methods of excavating coal from the ground is:
 1. Strip mining (open-pit mining)
 2. Underground mining
- Oil and Natural gas are removed by pumping them out of the ground

A. Coal Mining

- a. *Strip Mining* – layers of soil and rock above coal are removed
- b. Exposed coal is removed and loaded into trucks or trains and transported elsewhere
- c. The open pit is covered with top soil, trees and vegetation are planted and animals are reintroduced to the area
- d. Strip mining is used only when the coal deposits are close to the surface

e. Underground coal mining – tunnels are dug and pillars of rock are left to support the rocks surrounding the tunnels



- f. Drift mining is the removal of coal that is not close to Earth's surface through a horizontal opening in the side of a hill or mountain

- g. Slope mining is an angled opening and air shaft are made in the side of a mountain to remove coal



B. Drilling for Oil and Gas

- a. Oil and natural gas are fossil fuels that can be pumped from underground deposits
- b. Wells are dug through rock and lined with pipe to prevent the well from caving in
- c. The fluids usually flow up easily and must be capped so that they can be pumped up in a controlled manner

Oil Drilling



IV. Fossil Fuel Reserves

- A Reserve is the amount of fossil fuel that can be extracted at a profit using current technology
- A fossil fuel resource has fossil fuels that are concentrated enough that they can be extracted at a useful amount
- A resource is not a reserve unless the fuel can be extracted economically

A. Methane Hydrates

- a. There is enough natural gas located in the U.S. to last about 60 more years

- b. Methane hydrates are stable molecules found hundreds of meters below sea level in the ocean floor sediment
 - Form from low temperatures and high pressure

- c. Large deposits are thought to exist of the Eastern coast to the U.S.
 - More Carbon is contained in methane hydrates than in all current fossil fuels

B. Conserving Fossil Fuels

a. Coal provides 25% of energy used worldwide

– Coal provides 22% of energy used in U.S.

b. Oil and Natural Gas provide almost 61% of the World's energy

– and about 65% of U.S. energy supply

c. At this rate we will run out of fossil fuels at some point

V. Energy From Atoms

- Nuclear energy is an alternate energy source produced from atomic reactions
- When the nucleus of a heavy element is split, lighter elements form and energy is released – this is called nuclear fission
- Nuclear fission is carried out in nuclear power plants using the element uranium as fuel

A. Electricity from Nuclear Energy

- a. Nuclear power plants provide the 17% of the world's electricity
- b. Nuclear power plant has a large chamber called a nuclear reactor

B. How Nuclear Energy is Created

1. Uranium is concentrated and put into long metal pipes called fuel rods
2. The fuel rods sit in a chamber called the nuclear reactor – which has a pool of cooling water
3. Neutrons are fired into the fuel – this starts a chain reaction that releases heat
4. The heat is used to boil water to make steam
5. The steam drives a turbine – turning the generator which produces electricity



Nuclear Power Plant

C. Fusion

- a. Fusion occurs when materials of low mass are fused together to form a substance of higher mass
- b. Fusing together Helium and Hydrogen would be safe and would not create nuclear waste
- c. The technology does not exist to control this type of fusion – but it would be an inexhaustible and renewable energy resource if it becomes possible