CH15 - Nonrenewable Energy

Energy Use

- The U.S. is the world's second largest energy consumer (behind _____) and the 8th largest energy user per capita.

Renewable & Nonrenewable Energy Resources

- Nonrenewable Resources are those that cannot be replaced - ex. _____ fuels (coal, oil) nuclear (uranium)
- Renewable Energy Resources are continually _____ - ex. solar, wind, hydroelectric, geothermal, biomass

Fossil Fuels

- Fossil fuels are created by the decay and compression of organisms that lived millions of years ago.
- Oil (petroleum) currently provides 36% of the world's energy. This resource will be exhausted in 40-90 years at the current rate of consumption. The only countries that have not already hit peak oil production are in the Middle East. Untapped resources of unknown amounts do exist under the _____ Ocean. Alternative oil sources, including shale oil and tar sands are increasing marketshare over traditional petroleum sources

Oil Recovery

- Primary Oil recovery involves drilling a well and pumping out the oil that flows by gravity into the bottom of the well.
- Secondary oil recovery occurs when _____ is injected into nearby wells to force some of the remaining heavy oil to the surface.
- Tertiary, or enhanced, oil recovery involves the injection of _____ or CO_2 to force some of the remaining heavy oil into the well cavity.

OPEC

- Thirteen countries make up OPEC, the Organization of Petroleum Exporting Countries. OPEC controls 70-80% of the world's proven crude oil reserves.

Oil Alternatives

- Oil shale is a fine grained rock that contains a solid, waxy mixture of hydrocarbon compounds called kerogen. The kerogen can be isolated to form _____ oil. There are large supplies of shale oil but is much more expensive to process.
- The same situation applies with tar sand, which contains _____ (a high-sulfur heavy oil). The source is more plentiful but the processing is expensive. It often takes more energy to produce these oil alternatives than the energy provided.

Coal Use

- Coal provides _____% of the world's energy and will last about 100 years at the current consumption rate.
- Although coal is by far the dirtiest fossil fuel to burn, it is used to generate almost 40% of the world's electricity.
- About 25% of the world's coal reserves are located in the U.S., followed by _____ with 15%.

Coal

- Coal is a solid, rocklike fossil fuel. It is mostly _____ (40-98% depending on the type)
- Each stage of coal formation occurs from increasing pressure and heat:
    - Peat (not a coal) is partially decayed plant matter in swamps and bogs
    - _____ (brown coal) has low heat content
    - Bituminous coal (soft coal) is extensively used because of its high heat content but it has high sulfur content and therefore does not burn clean
    - _____ (hard coal) is the most desirable fuel because of its high heat content and low sulfur content but supplies are limited

Natural Gas

- Natural gas is a mixture of 50-90% _____ (CH_4) with the remaining volume consisting of heavier gaseous hydrocarbons.
- Natural gas use has risen to provide 23% of the world's energy, primarily due to increased fracking in the United States. The world supply of natural gas should last about _____ years.

Fracking

- _____ _____ or fracking is a means of natural gas extraction. Once a well is drilled, millions of gallons of water, sand and chemicals are injected, under high pressure. The pressure fractures the shale and props open fissures that enable natural gas to flow more freely out of the well.
- The U.S. Energy Bill of 2005, commonly called the Halliburton Loophole, exempts natural gas drilling from the Safe _____ _____ Act of 1974.
- Fracking has resulted in extensive groundwater contamination and the release of VOC's (volatile organic compounds) into the air.
- As of May 2011, the NC senate cleared the way for hydraulic fracturing in North Carolina, including _____ County – home of Jordan Lake, which is the water source for Cary.

Pros and Cons of Natural Gas

- Advantages of natural gas over other nonrenewable resources
  - cheaper than _____ and easier to process
  - easy to transport (by pipeline)
  - higher net energy yield (burns hotter)
  - combustion produces less air pollution than any other nonrenewable resource
- Disadvantages of natural gas
  - must be converted to _____ before tanker transport (expensive and dangerous)
  - leaks into the atmosphere
  - The process of _____ is extremely dangerous to both groundwater and air quality

Nuclear Energy (fission)

- Fission of Uranium-235 (Nuclear Power) provides provides about 20% of the electricity used in the U.S. from _____ plants.
- France is the world's nuclear leader, getting 75% of its electricity from nuclear, although the U.S. produces more total power from nuclear power.

Pros and Cons of Nuclear Power

- Advantages: No emission of air pollution, Water pollution and land disruption are minimal
- Disadvantages: Potential reactor _____, Radioactive waste disposal, Currently more expensive than fossil fuels

Nuclear Accidents

- Three Mile Island, Middletown, _____ USA. This is the most significant nuclear accident in U.S. history. On March 28, 1979 this reactor suffered a partial meltdown. No direct injuries or deaths resulted, but sweeping changes by the U.S. Nuclear Regulatory Commission occurred along with a loss of confidence in nuclear energy by the American public.
- _____, USSR. The April 25, 1986 reactor meltdown is the most severe nuclear disaster in world history. There are 56 fatalities attributed to the accident, but approximately 7 million are receiving, or are eligible to receive benefits as "Chernobyl victims". Various forms of cancer are the primary consequences of radiation exposure.

Fukushima, Japan

- On_____, the Tohoku earthquake and tsunami led to the meltdown and release of radioactive material from the Fukushima Daiichi power plant in Japan. The long-term effects of this disaster are yet to be seen.

Nuclear Energy – Fusion

- Nuclear Fusion occurs when lightweight atomic nuclei combine to form a heavier nucleus
  - most often _____ and _____
  - the process of stars, fusion is incredibly powerful. However, atomic nuclei must be maintained at very high concentrations, be properly confined, and achieve temperatures of 100,000,000 ^{o}C