

Energy Resources

1. Sources of Energy
 - a. Nonrenewable sources
 - i. Petroleum (38%)
 - ii. Coal (22%)
 - iii. Natural Gas (25%)
 - iv. Nuclear (8%)
 - b. Renewable sources
 - i. Hydroelectric (4%)
 - ii. Biofuels (?)
 - iii. Solar
 - iv. Wind
 - v. Tidal
 - vi. Geothermal
2. Trends in Energy Usage
3. Coal
 - a. Organic materials that have escaped oxidation in the carbon cycle.
 - b. Plant material that is rapidly buried
 - c. Rank – amount (%) of carbon (C) in coal, heat content
 - d. Coal Ranking & Formation
 - i. Peat (pre coal) – soft brown mass of compressed, largely non-decomposed plant material, ~50% C
 - ii. Lignite – decomposed peat that has been compressed, ~70% C
 - iii. Bituminous coal – burial increases the pressure and temperature on the lignite and causes a conversion, ~80-90% C
 - iv. Anthracite coal – complete metamorphism, >93% C
 - e. World-wide distribution of coal
 - f. U.S. Coal Reserves
 - g. Illinois Coal Reserves
4. Hydrocarbons
 - a. Composed of hydrogen and carbon linked together in chains and rings
 - i. Natural Gas – simple organic molecules
 - ii. Crude Oil – complex chains and rings
 - b. Hydrocarbon Formation
 - i. Water borne plankton escape oxidation/decomposition before burial
 - ii. Plankton is deposited in mud (shale) – Source Rock
 - iii. Source rock is overlain by more sediment – increasing the pressure (P) & temperature (T) on the source rock
 - iv. Increase in P & T, breaks down organic debris
 - v. Oil forms at 50°C
 - vi. Methane at 100°C
 - vii. Hydrocarbons migrates upwards to a reservoir rock (high porosity, high permeability rock)
 - viii. Migration is stopped by either an impermeable rock or a structural trap

- ix. Structural Traps – 4 common types
 - 1. Anticline Trap
 - 2. Salt Dome
 - 3. Fault Trap
 - 4. Angular Unconformity Trap
- c. Distribution of Oil and Gas
 - i. Found in rocks less than 500 million years old
 - ii. 85% of oil and gas occur in less than 5% of producing fields
 - iii. Generally, near Tectonic belts, active in the past 60-70 million years
- 5. Nuclear Power - Uranium
 - a. Uranium (U) – used for nuclear power
 - b. Has a Minimum Concentration Factor > 1000
 - c. Source Rock – Igneous
 - d. U is leached (dissolved) into groundwater
 - e. Deposit Types
 - i. Sandstones that have been enriched with U minerals (groundwater enrichment)
 - ii. U-bearing minerals in rock fractures
 - iii. Placer Deposits
- 6. Hydroelectric and Tidal Power
 - a. Movement of water drives turbines
 - b. Dams – gravity key force
 - c. Tidal – tidal force, need a tidal range of > 8 m (nearly impractical)
- 7. Geothermal Energy
 - a. Temperature increases with depth ~ 3°C/ 100 m
 - b. Geothermal energy concentrated where magma is near the surface
 - c. Circulation of groundwater allows water to heat up
 - d. Hot groundwater drives turbines