

April 16, 2015

GEOLOGY 1010-002 (Notes)

Lecture 16 - Renewable Energy

Geology in the News

- New study shows Fukushima reactor still leaking 3 tons of radioactive water into the ocean everyday (radiation can be found in waters near California)

Renewable Energy Sources

- Lots of types being studied to help reduce fossil fuel use
- General Points:

① 1 - Each has advantages and disadvantages

- No "magic material" that comes without any drawbacks (contamination, pollution, etc.)

② 2 - No one source will provide all our energy needs

- Need a varied approach (based on location, etc.)

Renewable Energy Advantages

- 1 - Abundant
- 2 - Produce little pollution (no problems with CO₂ in atmosphere)
- 3 - Low maintenance (as compared to nonrenewable energy)
- 4 - Safe (no massive health problems arising, etc.)

Renewable Energy Disadvantages

- 1 - Technology still be developed
- 2 - Expensive
- 3 - Infrastructure compatibility (Current infrastructure not compatible)
- 4 - Acceptance by society

Solar

- Capture all the sunlight for 1 hour = a year's supply of energy
- How can we harness solar energy?

Solar Farms

- Use mirrors to focus/reflect sunlight onto a receiver (store as heat energy at large energy plants)
 - ① Tower has/made of a material with high heat capacity

Solar Electricity

- Photovoltaics (PV) - turning light into electricity
 - ① Sunlight hits semi-conductor that knocks electrons off. The flow of electrons creates electricity

Photovoltaics

- Photovoltaic Cells (PVCs) - A cell that contains a semiconductor that converts light energy into electricity
 - ① Not efficient at converting sunlight into mechanical energy (electricity) → 1% conversion
 - ② Constantly improving (15% efficiency under perfect laboratory conditions)
 - ③ New organic materials being studied

Photovoltaics

- Use ~7.5% of the Sahara desert as solar farms = provides half the world's energy needs
- Assumes 10-15% PVC efficiency

Solar Use

- Energy Payback (EPB) - how much time to generate some amount of power that it took to build (solar farms) → Talking about energy amount, NOT money
 - ① Since 2000, solar's EPB has dropped to 2-3 yrs



Solar Disadvantages

- 1- Intermittent Variations (Weather & Nighttime)
- 2-3- Some pollution from making older PV cells } New solar cells use diff materials besides Cd for semi-conductor
 - ① Ex. Cadmium (toxic as you move up food chain)
- 3- Where to put solar farms?
 - ① Want in SW of America (lots of gov't land)

Hydroelectric

- Flowing water used to turn turbines that generate electricity
- Generates 6% of all electricity in US

Hydroelectric Advantages

- 1- Doesn't pollute the water
- 2- Quick profit
 - ① ~5 yrs to recover plant construction costs via sale of electricity

Hydroelectric Disadvantages

- 1- Reservoir creation floods alter
 - ① Lots of ppl displaced & landscape drastically changed
- 2- Dams alter downstream environments
 - ① Kills off fish population
 - ② Impacts wildlife
 - ③ Water moving faster = lots of erosion (no place to lay eggs for fish)
- 3- Site Selection
 - ① Efficiency - Have to use large rivers (can't use water from small sites)
 - ② Safety - "Not in my backyard effect"

Case Study: Banguiao Dam

- Built to resist a 1,000 yr flood event
- Aug 6-7 1975: 2,000 yr flood event
 - ① 41" in rain fell in 24 hrs (= a full yr's worth in 1 day)