Geology in the news

- Fukashima reactor still leaking 3 tons of radioactive water into the ocean every day

Lecture 16 Renewable energy

Renewable energy sources

- Lots of types being looked at to help reduce fossil fuels use
- In general:
    - Each has advantages & disadvantages
        - There is no 'magic material'
    - No one source will provide all our energy needs
        - Need a varied approach, use dif things in dif places

Renewable energy advantages

1. Abundant
2. Produce little pollution
3. Low maintenance
4. Safe

Disadvantages

1. Technology still being developed
2. Expensive
3. Infrastructure compatibility
4. Acceptance by society

Pt 1 Solar

- Capture all sunlight for 1 hour= a year's supply of energy
    - Great amount of energy from sunlight
- How do we harness it?
    - Use mirrors to focus/reflect sunlight onto a receiver
- Photovoltaics- light electricity
- Photovoltaic cells (PVCs)- cells to capture this energy
- Very old idea that is constantly improving
- Not very efficient
- New organic materials are being studied
- Use ~ 7.5% of the Sahara desert as solar farms = provide half the world's energy needs
- Assumes 10-15% PVC efficiency

Solar use

- Energy payback (EPB)- the time it will take you to generate enough energy to build your system
- Since 2000 solars EPB has dropped to 2-3yrs

Solar disadvantages

1. Insolation variations (rainy days, nights)
2. Some pollution from making older PV cells
    a. Ex) cadmium
3. Where to put solar farms?

Pt 2 Hydroelectric

- Flowing water used to turn turbines that generate electricity

Hydroelectric advantages

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

Disadvantages

- Reservoir creation floods areas
    - Many people lose their houses
- Dams alter downstream environments
- Site selection
    - Efficiency- cannot build on every stream, need enough water to produce energy
    - Safety- concerns of what if the dam breaks

Case study: Banqiao Dam

- Built to resist a 1,000 yr flood event
- Aug 6-7 1975: 2,000 yr flood event.
- 41+ in rain fell in 24 hours (= a full year's worth in 1 day)
- 700 million tons H_2O released in 6 hrs
- wave 6+ mi wide, 20 ft high
- 171,000 died

Hydroelectric Tides & waves

- Convert kinetic energy into electricity
- Old devices too complicated
- New buoy system is just 2 components

Concerns

- Rough environment
- Changes coastal environments
    - Reduces wave energy
- Some areas far from coasts
- Effects on wildlife

Pt 3 Wind power

- Winds generate ~ 5x more power than total global energy consumption
- N. Dakota could provide 1/3 of US electrical needs
- 2008: wind generates 1.5% of global electrical supply
    - 19% Denmark, 11% Spain & Portugal, 7% Germany & Ireland

Winds advantages

- Cost down 80% in the last 20 yrs (disputed)
- Energy payback only ~ 1 yr

Wind disadvantages

- Not consistent in many areas
    - Areas defined by class 1-7
    - Anything less than class 3, not viable option
- Best sites often far from population centers
- 'not in my backyard' syndrome
    - Home turbine = 30 ft tall, blades 7-25 ft long
    - Industrial turbine = 20 stories tall, blades about 100 ft long

WARP turbines

- Wind amplified rotor platform
- Energy is about the same if not better
- Overcomes the 'not in my backyard'

Is it safe?

- Concerns about birds being killed
- Govt has reduced fines for wind farm bird deaths for the next 30 yrs

Pt 4 biofuels

- Use of biological materials as fuels
- Renewable IF managed properly

Ethanol

- Starch from crops (ex- corn, potatoes) fermented to produce alcohol
- Advantages:
    - 1- Mix w/ regular gas to reduce pollution & the amount of gas needed
    - 2- Big new source of income for farmers
        - 600 million+ bushels of corn/yr