

RENEWABLE ENERGY

GEOLOGY IN THE NEWS: New study shows Fukushima reactor still leaking 3 tons of radioactive water into the ocean every day.

- Renewable Energy Sources
 - o Lots of types being studied to help reduce fossil fuel use
 - o General Points:
 - Each has advantages & disadvantages
 - No “magic material” that comes w/o any drawbacks
 - No one source will provide all our energy needs
 - Need a varied approach
- Renewable Energy Advantages
 - o Abundant- not hard to obtain
 - o Produce little pollution
 - o Low maintenance
 - o Safe
- Renewable Energy Disadvantages
 - o Technology still being developed
 - Solar panels aren't at optimum
 - o Expensive
 - Research & development cost money
 - o Infrastructure incompatibility
 - o Acceptance by society

I. SOLAR

- Capture all the sunlight that hits the planet for 1 hour = a year supply of energy
- How can we harness solar energy?
- Solar farms
 - o Use mirrors to focus/reflect sunlight onto a receiver
 - o Tower is filled w/ material w/ a high heat capacity
 - o Energy is stored as heat

- Solar electricity
 - o **Photovoltaics**- converting sunlight directly into electric current
 - Light hits a device covered in a semiconductor
 - Electrons break loose & generate current
- Photovoltaics
 - o **Photovoltaic Cells (PVC)**- device covered in semiconductor
 - o Constantly improving
 - Dates back to 1880s
 - Not very efficient at beginning, but the efficiency is improving over time
 - o New organic materials being studied
 - o Use ~7.5% of the Sahara Desert as solar farms = provide half the world's energy needs
 - o Assumes 10-15% PVC efficiency
 - Most commercial PVC are around 10-15%
- Solar Use
 - o **Energy Payback (EPB)**- the time it is going to take to generate as much energy as the manufacturing process
 - If it takes 1 mil watts to build a solar farm, how long will it take the farm to generate 1 mil watts?
 - o Since 2000, solar's EPB has dropped to 2-3 years
- Solar Disadvantages
 - o Insolation variation
 - The weather changes & reduces light
 - No solar energy at night
 - Means there needs to be either a storage system or a backup
 - o Some pollution from making older photovoltaic cells
 - Ex: cadmium (not being used in new cells)
 - o Where to put solar farms
 - Many businesses want to build them in the southern Midwest on government property (rent free), which would save them money but ruin protected areas

II. HYDROELECTRIC

- Flowing water used to turn turbines that generate electricity
- Hydroelectric Advantages
 - o Accounts for 6% of US power
 - o Doesn't pollute the water
 - o Quick profit
 - ~5 years to recover plant construction costs via sale of electricity
- Hydroelectric Disadvantages
 - o Reservoir creation floods areas
 - People have to be relocated to create the lake
 - Wildlife in the area is destroyed
 - o Dams alter downstream environments
 - Fish population downstream plummets (water is moving faster = washes away eggs)
 - o Site selection
 - Efficiency: water body must have enough water moving through to move a big turbine
 - Safety: people are scared of having dams built near them (ex: What if dam breaks?)
- Case Study: Banqiao Dam
 - o Built to resist a 1000 year flood event
 - o Aug 6-7 1975: 2000 year flood event
 - 41+ inches of rain fell in 24 hours (a full year's worth in 1 day)
 - o 700 mil tons H₂O released in 6 hours
 - Wave 6+ miles wide, 20 feet high
 - o 171,000 people died
- Hydroelectric: Tides & Waves
 - o Convert kinetic energy into electricity
 - o Old devices too complicated
 - Contained intricate components that were battered & destroyed by waves
 - o New buoy system is just 2 components