

April 9, 2015

Gen 114 - 2015 (11)

Lecture 15 - Nonrenewable Energy

* Geology in the News *

- Oxygen-breathing microbes found in deep sediments at the bottom of the Pacific Ocean (considered one of the "deadliest" places on Earth's surface)

Energy Resources

- Why do we care?
 - ① Money - helps support way of life (humans dependent on)
 - ② Technology
 - ③ Global politics - relationships with other countries

Energy Sources

- Renewable - Natural resources that can be replenished in a short period of time (not time scale → usable by humans)

① Ex. Solar, Wind, Water, Geothermal, Biomass

- Nonrenewables - Natural resources that can't be re-made or re-grown at a scale comparable to its consumption (or replaced slowly → too slow for human use)

① Ex. Coal, oil, natural gas, nuclear energy

Once used up, won't have more for 1000s of years

Fossil Fuels (FFs)

- Ca 82% of energy consumption in the US and globally (2006 #s below)

① Coal = 22.6%

② Oil = 36.8%

③ Natural gas = 22.9%

④ Hydroelectric = 6.3%

⑤ Nuclear = 6.0%

⑥ All others = ~1.4%

} Big 3 (Most of FFs)

How Much Is There?

- Reserve - Amount of material that is immediately ready to be used
 - Resource - Includes all material you know of whether you can use it right now or not (includes reserves) → Sometimes know they're present, but can't use them (-too deep, etc.)
- ① Higher # than Reserve

FFs: General Advantages

- 1- Historically cheap & abundant
 - 2- Technology well developed
 - 3- Infrastructure built to run on them
- ① Need to take a realistic view of finding new energy sources → might have to change infrastructure

FFs: General Disadvantages

- 1- Nonrenewable
- 2- Deposits not uniformly distributed (causes conflicts)
- 3- Costs going up (people become less interested)
- 4- Environmental damage (Sacrifice health for lots of energy?)

FF #1 - Hydrocarbons } Best place to form

- Combustible H-C Compounds
- Requires 2 conditions to form:
 - ① Area of high biological productivity
 - FFs made from this (Ex. plankton)
 - ② Relatively low oxygen in waters/sediments
 - Oxygen causes organisms to rot
 - Water deep enough to eliminate oxygen

Hydrocarbons

- Methane (AKA Natural Gas)

- Advantages

- ① 1- Resources (not reserves) growing in recent yrs

- ② 2- Burns much cleaner than other FFs

- 30% less CO₂ emitted per unit energy

Compared to oil

- ③ 3- Price often cheaper than oil

Methane - Disadvantages

- 1- Safety issues

- ① Sour gas (contains H₂S) - contaminated in methane

- ② NG (Natural Gas) heat system malfunctions can create CO (toxic)

- ③ Can cause houses to burn down

- 2- Still contributes to atmospheric CO₂ buildup

Hydrocarbons

- Oil Window - window of opportunity where conditions of temp & depth are appropriate for forming oil

- ① Ex. 2-5 km, < 150°C → organic compounds turn into oil

World Oil Supply

- 62% is in the Middle East

- ① 22% in Saudi Arabia alone

- ② 2.5% in the US

US Oil Production & Consumption

- 2010: US had to import 61% of the oil we needed

- Cost = \$337 billion

- ① \$640,000 per minute

- ② \$48 million during this class