

Sept 30 class notes, *Environment* chapters 11-13: Focus on Energy

Chapter 11: Fossil Fuels

- How does a energy source's **energy density** relate to the amount of productive work a society can do?
- What is the technical definition of **energy efficiency**? Why don't more energy sources have an efficiency closer to 100%?
- What are three types of **fossil fuels**? How were they formed, and why are they called **nonrenewable resources**?

Coal

- How and when did coal form?
- What distinguishes the four types of coal shown in Table 11.1 on p. 237 (**lignite**, **subbituminous** coal, **bituminous** coal, and **anthracite**)?
- How long would known (and potential) coal reserves last? Where are they located?
- Why is **surface mining** more common than **subsurface mining**? What are the benefits and costs of each, and to whom?
- What are the effects of coal extraction on the land? In the atmosphere?
 - What are some of the different emissions that can cause harm? (whether as **acid deposition** or due to other effects?)
 - § What are some of the effects of acidification?
- What do **scrubbers** do? How can they contribute to **resource recovery**?

Oil

- What different products come from **crude oil**? How are they separated? (see Figure 11.11 on p. 244)
- Why is **liquefied natural gas (LNG)**—and natural gas in general—becoming increasingly important from an environmental perspective? How is it transported, and why are some ports reluctant to ship it? Which countries have the greatest deposits? Why can't natural gas be easily transported in gas form?
- What is **peak oil**?
- The text states that “the world's major oil producers are not its major consumers”. What are some other commodity markets for which this is true, and how might it change the international dynamics?
- **Exxon Valdez** and **ANWR**
- What are **synthfuels**? Where are the world's major **tar sands** located, and why will they become increasingly important in the future?

Chapter 12: Nuclear Energy (pp. 266-268: pros and cons)

Pros

- is (relatively) carbon-free
- can decrease dependence on foreign oil in the future (currently oil only makes up 3% of our electricity, but advances in electric heat pumps and electric cars could change the energy infrastructure in the US)

Cons

- generates radioactive waste (spent fuel)
- high initial costs and a “very long cost-recovery time”
- contributes to possible nuclear arms race
- risk of catastrophic incidents

Chapter 13: Renewable Energy and Conservation

- Re. p. 282: Why would small-scale solar be a good fit for rural Kenya? How is using waste biomass ‘thinking from a systems perspective’?

Direct Solar Energy

- What factors determine the degree and intensity of solar coverage? (Figure 13.1)
- What is an example of **passive solar heating** (13.2)? Of **active solar heating** (13.3)?
- How is **solar thermal electric generation** (13.4) different from other solar power harvested from silicate photovoltaics?
- What are **photovoltaic (PV) solar cells**? Why aren’t they used on a much larger scale (see Table 13.1 on 287...) Why do photovoltaics have such appeal ‘off the grid’ in the developing world?

Indirect Solar Energy: Biomass, Wind, Hydropower

- What is **biomass**, and who around the world uses it as energy? What can biomass be converted into? (Travis Abbott’s talk...)
- The pros and cons of biofuels are being hotly debated right now. What are some of each?
- **Wind** is the fastest-growing energy source, with its efficiency increasing tenfold in the last 25 years (from 40 cents per kilowatt hour to 4 cents). Nonetheless, it still makes up a relatively small percentage of most country’s energy portfolios.
- Of all renewable energy sources, **hydropower** produces the most electricity. See table 13.2 for the pros and cons of hydro. ‘Big dam’ projects are generally opposed by modern environmentalists, but other kinds of hydro power do exist. Why is the **Three Gorges Dam** so controversial?
- How is **geothermal energy** different from direct and indirect solar energy? Where does geothermal energy tend to exist? Why is geothermal energy regarded as ‘better’ than conventional fossil fuel energy?