Lecture 5 Feb 2, 2012.
Environmental science FFY471, Env physics FYP350

In this lecture the first hour was devoted to chapter 16 and the second hour to an introduction to the problem package 3 on carbon capture and storage.

Chapter 16 on energy efficiency and renewable energy.

As energy is a limited resource we should use it efficiently.
That is in practise not the case. The situation has however improved considerably during later decades, in particular in Europe and Sweden. But there are still much to do.

A reason for the inefficiency has been the abundant and cheap supply of energy. Now the situation is changing.

As examples of the waste of energy are given the inefficiency of

- incandescent lights
- furnaces
- industrial motors
- coal and nuclear power plants
- motor vehicles
- poorly insulated buildings

Study section 16-1 and 16-2 thoroughly and note the cogeneration systems for heat and power generation.

Section 16-3 on solar energy.
Focus on the advantages and disadvantages figures.

Section 16-4 on hydropower.
Read through rapidly.

Section 16-5 on Wind-power.
Focus on advantages and disadvantages figures

Section 16-6 on Biomass.
Study thoroughly.

Section 16-7 on Geothermal energy.
You can omit this section.

Section 16-8 on hydrogen as an energy source.
Study thoroughly.

Section 16-9 on the transition to a more sustainable energy future.
Contain some useful issues and questions.

Carbon dioxide capture and storage (CCS)

Problem package 3 is on CCS and this lecture untended to introduce the topic.

CO_2 emission into the atmosphere is one the most threatening problems facing the humanity today, many will say, it is the most threatening due to the impact on the climate.

There are two ways to manage the problem, to reduce the use of fossil fuel or to prevent the emission to the atmosphere of CO_2 by "burying" it.

The total emissions of CO_2 to the atmosphere is about 30 000 million tonnes per year.
Most CO_2 comes from energy supply, in particular coal power plants (30%). The total CO_2 emissions from transportation is far lower than that, but raising.

According to information in the literature a single large coal plant can emit 10 000 tons of CO_2 in one day. (It sounds amazing but seems to be correct.)

A typical car has an CO_2 emission of about 150 g/km.

The concentration of CO_2 in the global atmosphere is today about 390 ppm. (ppm is parts per million and is a volume quantity.) The concentration was about 280 ppm at the turn of the 1800-1900 century.

The cause of the carbon dioxide emission is the carbon containing hydrocarbons.
A general formula for a hydrocarbon in fossil fuel is $C_mH_n(OH)_p$.
In a complete combustion these molecules are oxidized to water, nitrogen and carbon dioxide.

The further discussion in the lecture did follow the article
http://e40-hjh-server1.mit.edu/pdf/2009_CO2_Capture_and_Storage_Ch13_book.pdf
quite closely.

The steps in the carbon dioxide remove process are
- capture (usually in a single place. A large power plant i.e.)
- transport of the captured CO_2
- injection of CO_2 into the geological formation
- monitoring to check that CO_2 stay deep underground.

Read about these steps in linked article and find more specific information in other sources.
Then answer the problem package 3 questions extensively.