

### What is a resource?

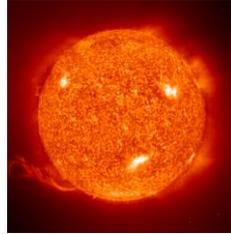
Materials that are used to make something or provide **energy**

### What is energy?

*The ability to do work  
(create a change in a system)*

### Sources of energy in the Earth system

#### 1. Solar energy



In 3 days, Earth receives equivalent energy from sun as is in all our fossil fuel reserves

### Sources of energy in the Earth system

1. Solar energy
2. Energy from gravity



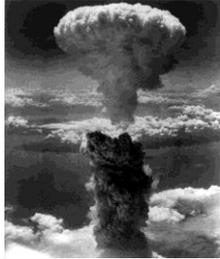
### Sources of energy in the Earth system

1. Solar energy
2. Energy from gravity
3. Energy from chemical reactions



## Sources of energy in the Earth system

1. Solar energy
2. Energy from gravity
3. Energy from chemical reactions
4. Energy from nuclear reactions



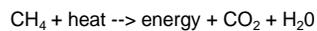
## Sources of energy in the Earth system

1. Solar energy
2. Energy from gravity
3. Energy from chemical reactions
4. Energy from nuclear fission
5. Energy from Earth's interior



## Fossil Fuels

- Hydrocarbons
  - Oil, natural gas, coal
  - Over 86% of world's energy



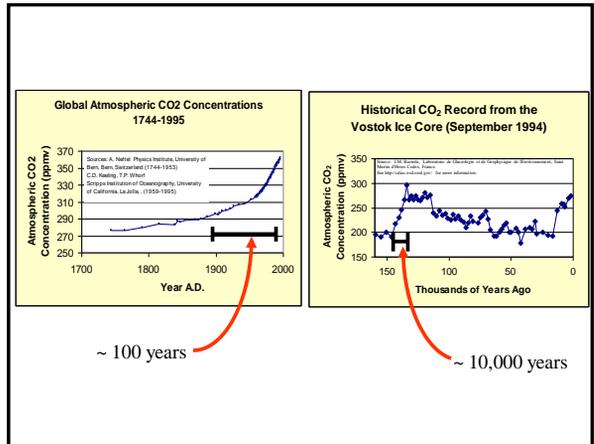
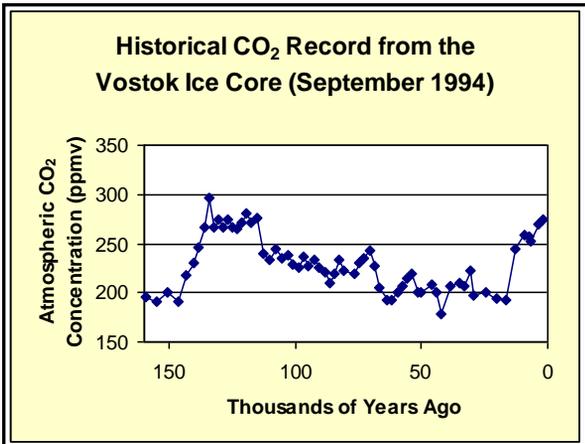
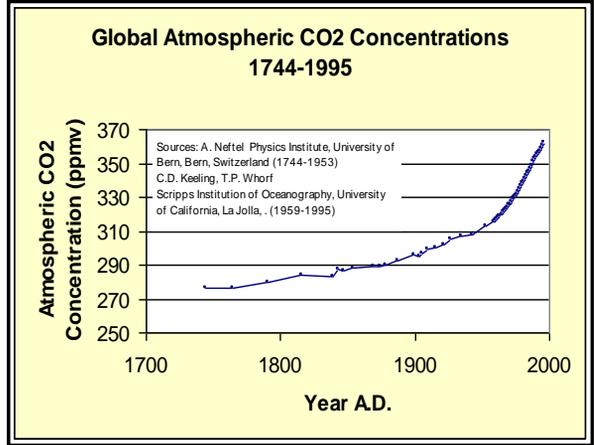
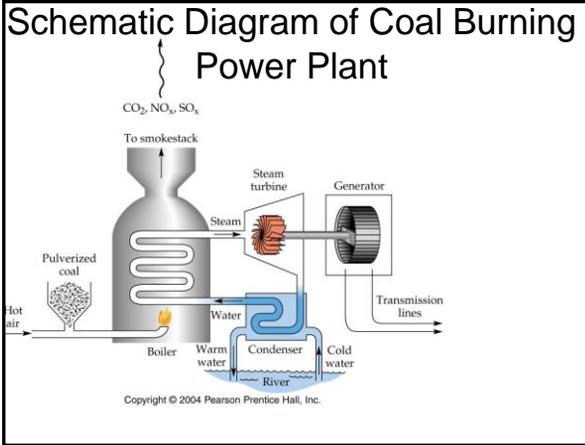
## Rate of Usage of Fossil Fuels

- Nonrenewable source of energy
- Using about 50,000 times faster than can be replenished

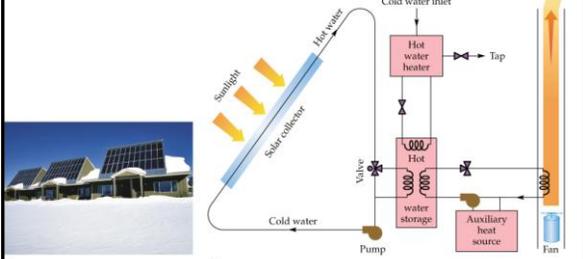
## FOSSIL FUEL RESERVOIR SIZES AND BURNING RATES

<u>Reservoir</u>	Size ( <i>Gton C</i> )	Burning Rate ( <i>Gton C/yr</i> )
Coal	3500	2.4
Oil	670	2.7
Natural Gas	500	1.3

SOURCE: <http://www.eia.doe.gov/emeu/international/enviro.htm#IntCarbon>



## Solar Heating



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## Biomass

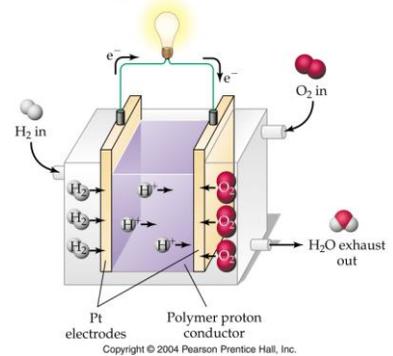
- Use plant material as energy source
- Can use directly
  - Burn
- Can convert to another form
  - Make alcohol from grains (ethanol)



## Hydrogen

- Burns very cleanly
- Chemically tied up in other compounds
  - Requires energy to separate from water
- Fuel cells

## Hydrogen Fuel Cell

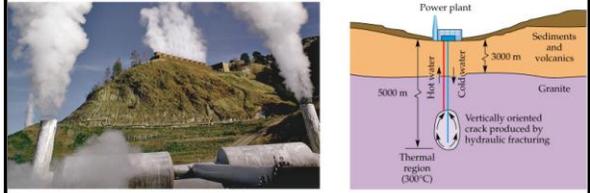


## Wind and Water Power

- Wind power uses moving air to turn turbines
  - Clean, free, and abundant
- Water Power
  - Use moving water to turn turbines

## Geothermal Power

- Use heat of interior of Earth to heat water
- Used widely in Iceland, New Zealand, and Italy



(a)

(b)

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