

What is a resource?

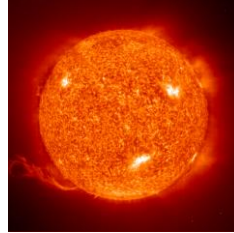
Materials that are used to make something or provide **energy**

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



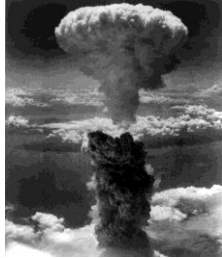
Sources of energy in the Earth system

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



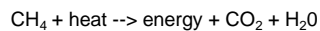
Sources of energy in the Earth system

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

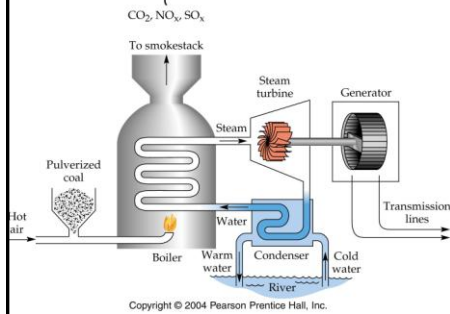
- Nonrenewable source of energy
- Using about 50,000 times faster than can be replenished

FOSSIL FUEL RESERVOIR SIZES AND BURNING RATES

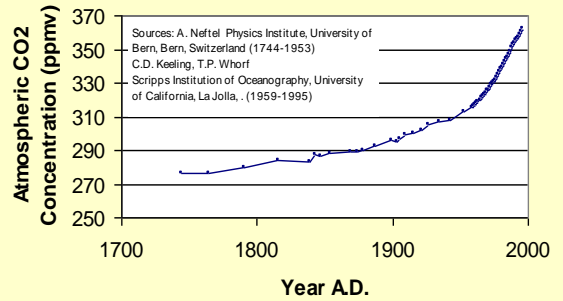
<u>Reservoir</u>	Size (<u>Gton C</u>)	Burning Rate (<u>Gton C/yr</u>)
Coal	3500	2.4
Oil	670	2.7
Natural Gas	500	1.3

SOURCE: <http://www.eia.doe.gov/emeu/international/enviroinm.html#IntlCarbon>

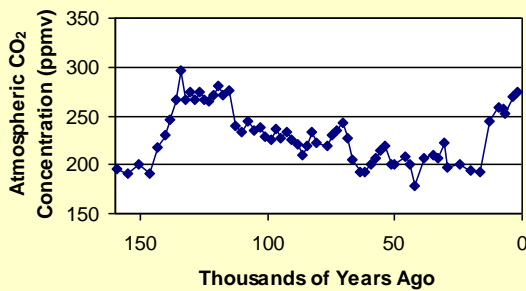
Schematic Diagram of Coal Burning Power Plant



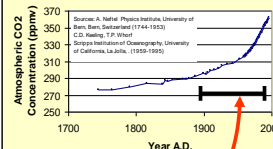
Global Atmospheric CO₂ Concentrations 1744-1995



Historical CO₂ Record from the Vostok Ice Core (September 1994)



Global Atmospheric CO₂ Concentrations 1744-1995



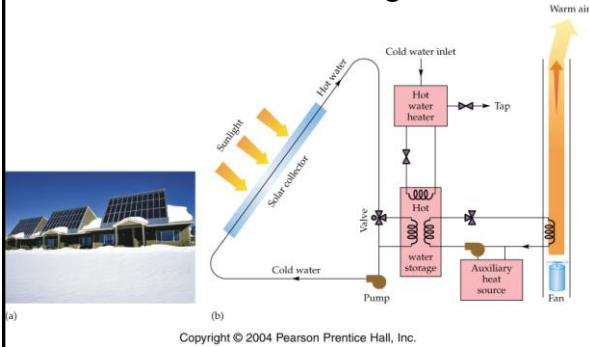
Historical CO₂ Record from the Vostok Ice Core (September 1994)



~ 100 years

~ 10,000 years

Solar Heating



Biomass

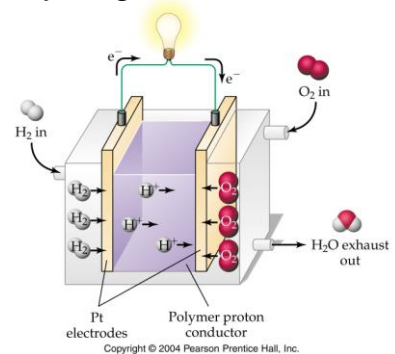
- Use plant material as energy source
- Can use directly
 - Burn
- Can convert to another form
 - Make alcohol from grains (ethanol)



Hydrogen

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

Hydrogen Fuel Cell

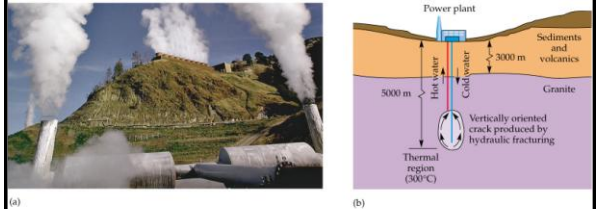


Wind and Water Power

- 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



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