

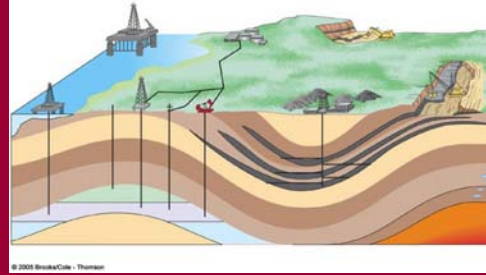
Lecture 12 : Energy as a resource - Fossil fuels

We are addicted to foreign oil
George W.

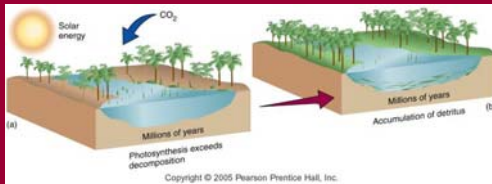


Fossil fuels: Energy sources derived from photosynthetic material, that has died, decomposed and compacted ..

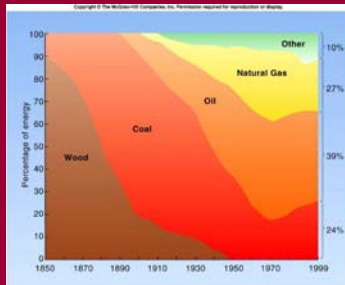
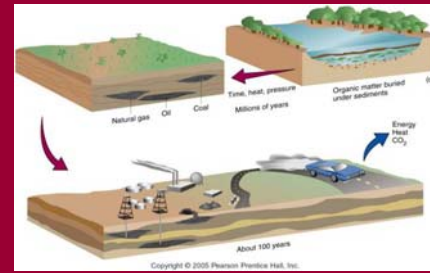
For 2 - 30 million years.....



How Fossil Fuels Are Formed:



How Fossil Fuels Are Formed:



Chronology of fossil fuel use through the ages:

- Wood
- Coal
- Oil
- Natural gas
- Other.....



Major event that impacted use of fossil fuels ..

Industrial revolution
1850's
European - coal driven innovation

US Major oil strikes:

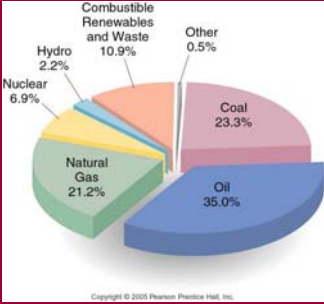


California, from 1890's on...

Initially most of this oil was used for lighting

Signal Hill, California, 1920's

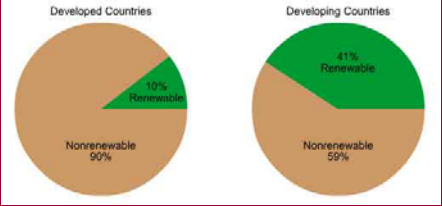
Today - Global Primary Energy Supply



Energy Source	Percentage
Oil	35.0%
Coal	23.3%
Natural Gas	21.2%
Combustible Renewables and Waste	10.9%
Nuclear	6.9%
Hydro	2.2%
Other	0.5%

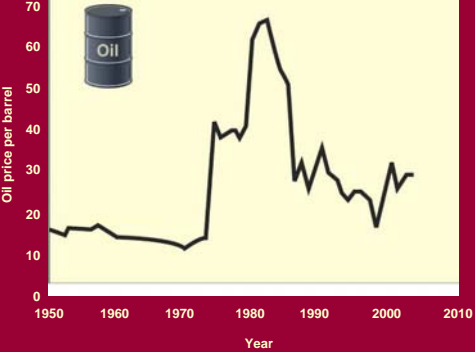
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Variation in energy budgets



Country Type	Renewable	Nonrenewable
Developed Countries	10%	90%
Developing Countries	41%	59%

The importance of price

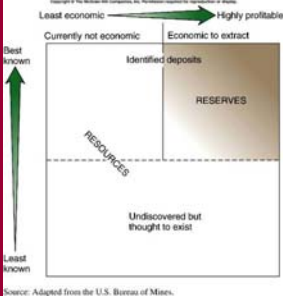


Oil price per barrel

Year

Oil

Reserves vs. Resources ?



Least economic ← Highly profitable

Currently not economic → Economic to extract

Identified deposits

RESERVES

RESOURCES

Undiscovered but thought to exist

Best known

Least known

Source: Adapted from the U.S. Bureau of Mines.

Varies with price.....

Recent headlines -


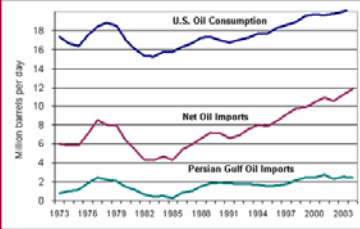
"Oil barrels towards its \$70 record

New all-time high in sight as investors eye threats to supply production, growing global demand.

April 11, 2006: 10:38 AM EDT

Oil:

On best estimates the US currently consumes 20 million barrels of oil per day..

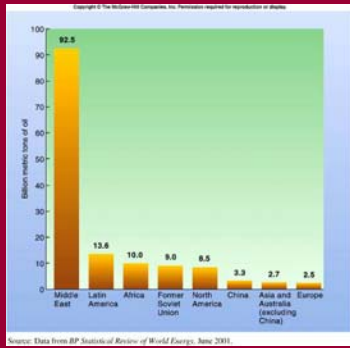
U.S. Oil Consumption

Net Oil Imports

Persian Gulf Oil Imports

Million barrels per day

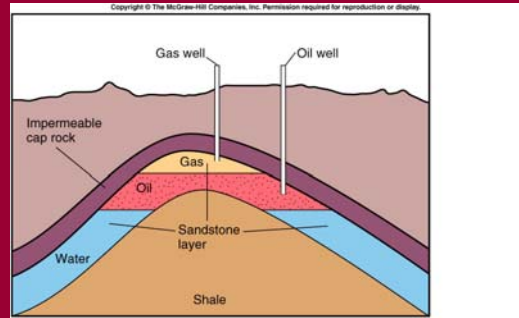
Year



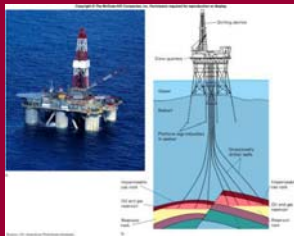
Worldwide location of oil supplies.

Where are most of the oil supplies today ?

Specific geologic formations give rise to extractable oil deposits



Adapted with permission from Arthur N. Strahler, *Planet Earth*, Copyright ©1972 by Arthur N. Strahler

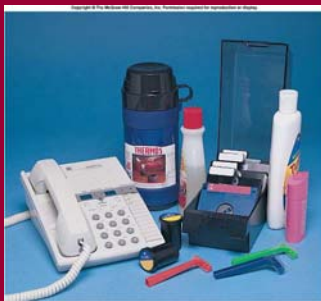
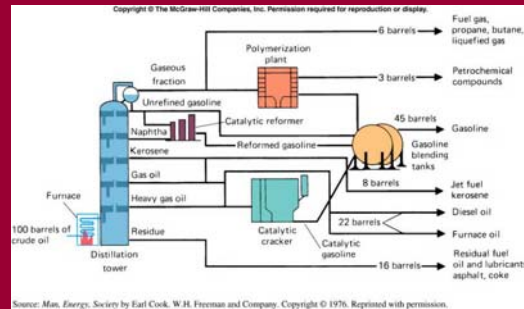


Technology of oil extraction has been well researched..

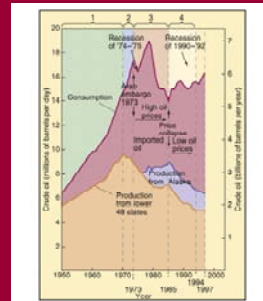
From sea beds - 30,000 feet and counting

Following the "gush" high pressure agents used to enhance levels of extraction

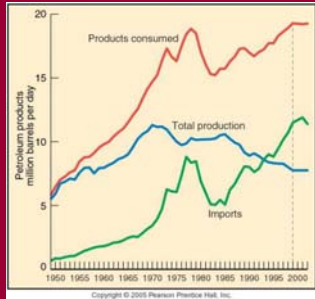
The oil is fractionated to produce a wide range of products



Oil Production and Consumption in the United States

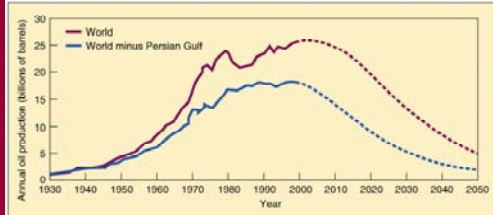


For an interesting overview of the variations in oil price, consumption and supply, see pg 333 in your textbook



Basically, as US supplies dwindle, more oil is imported

Hubbert Curves of Oil Production



Oil production follows a bell-shaped curve and will peak around 2010.

Hubbert Predictions

- U.S. oil production would peak (1970s)
- Dependence on OPEC oil will increase

At current rates of consumption, we have about 42-90 years supply left.....



Alternatives:

- Oil shale
- Oil tars.....

The Athabasca Tar Sands

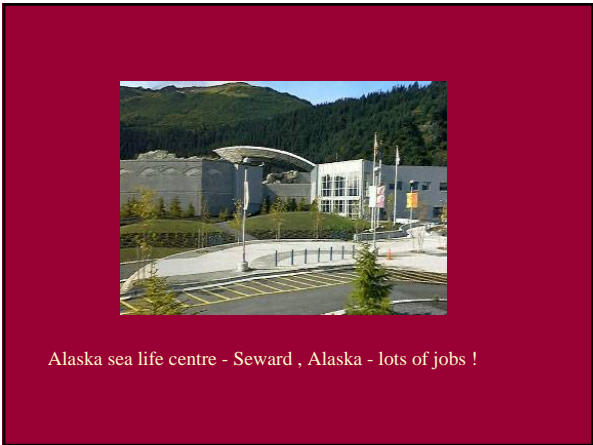
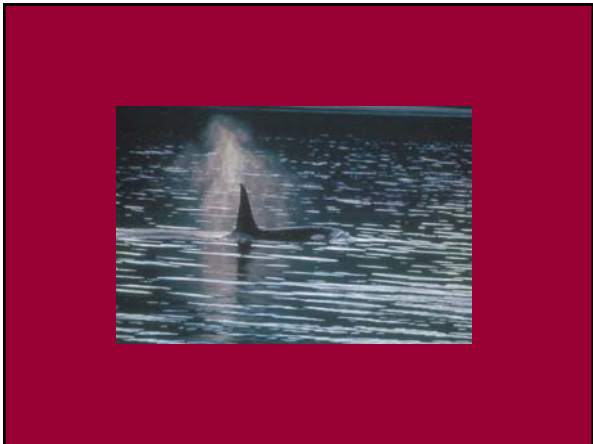
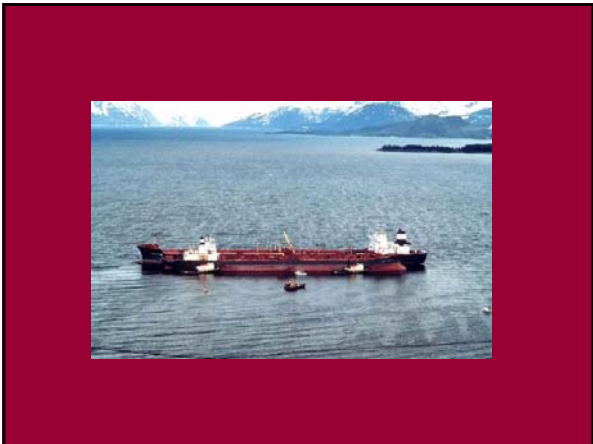


Economically / ecologically feasible ?

Case studies on the environmental impact of fossil fuels:

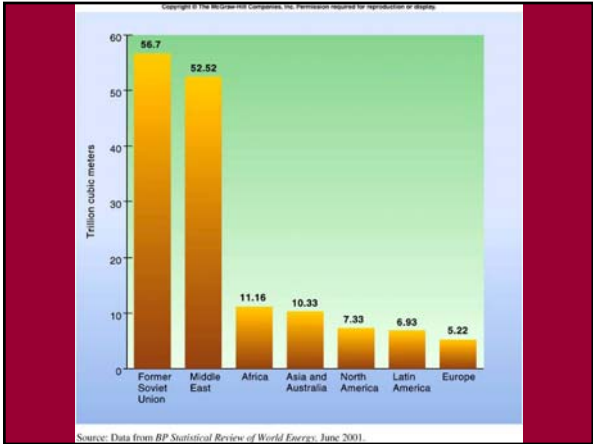
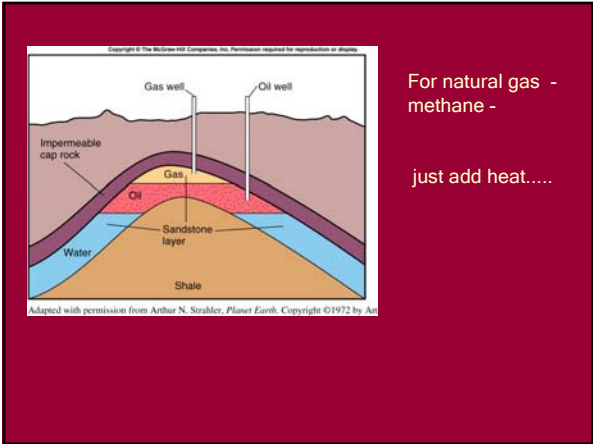
Oil spills and the *Exon Valdez*





The Arctic National Wildlife Refuge.

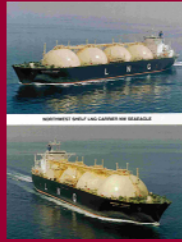
A pristine wilderness, which sits atop potentially large oil deposits....



Used in transportation, industry, home heating

Transported as a liquid at -180 degrees C.

Current best estimates - 125 years supply remaining



The LNG terminal planned for Oxnard.....



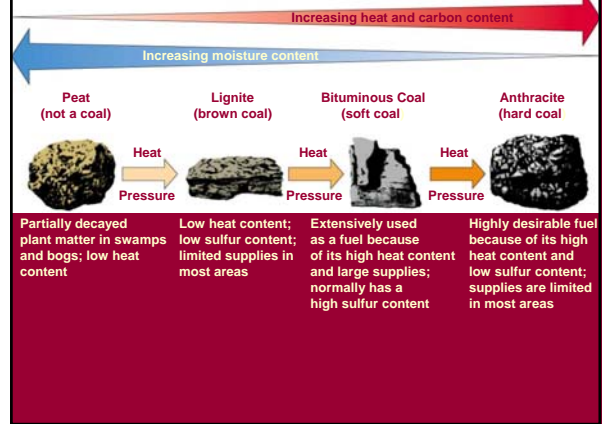
Worldwide distribution of coal

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Source: Data from BP Statistical Review of the World Energy, June 2001.

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Coal mining - a dangerous industry, huge environmental consequences.....

