

Lecture Notes

(Energy)

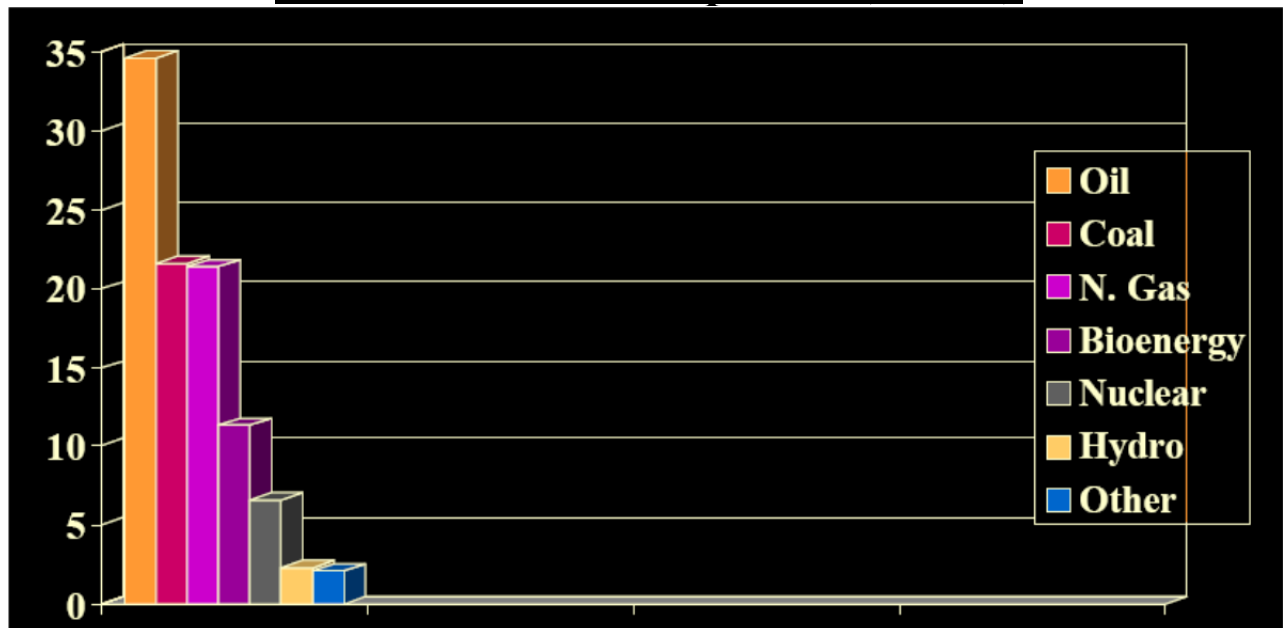
Intro:

- leaders of all nations understand that one of the greatest challenges facing humanity during the twenty-first century is giving everyone on the planet access to safe, clean & sustainable energy supplies
- it is hypothesized that by 2050 we will have run out of economically recoverable fossil fuels
- the modern sense of energy appeared in the 1800's; it described transfer of heat, motion of planets, operation of machinery, and flow of electricity
- today energy is defined as the capacity to do work; that is, to move an object against a resisting force
- the unit of energy is the joule
- power is the rate of doing work or the rate at which energy is converted from one form to of energy to another
- the unit of power is the watt
- much discussion is centered on developing sustainable energy (renewable energy) sources; sustainable means development that meets the needs of the present without compromising the ability of future generations to meet their own needs
- sustainable energy sources:
 - 1) are not substantially depleted by continues use
 - 2) do not emit pollutants or other hazards to the environment on a substantial scale
 - 3) do not perpetuate substantial health hazards

Energy Sources:

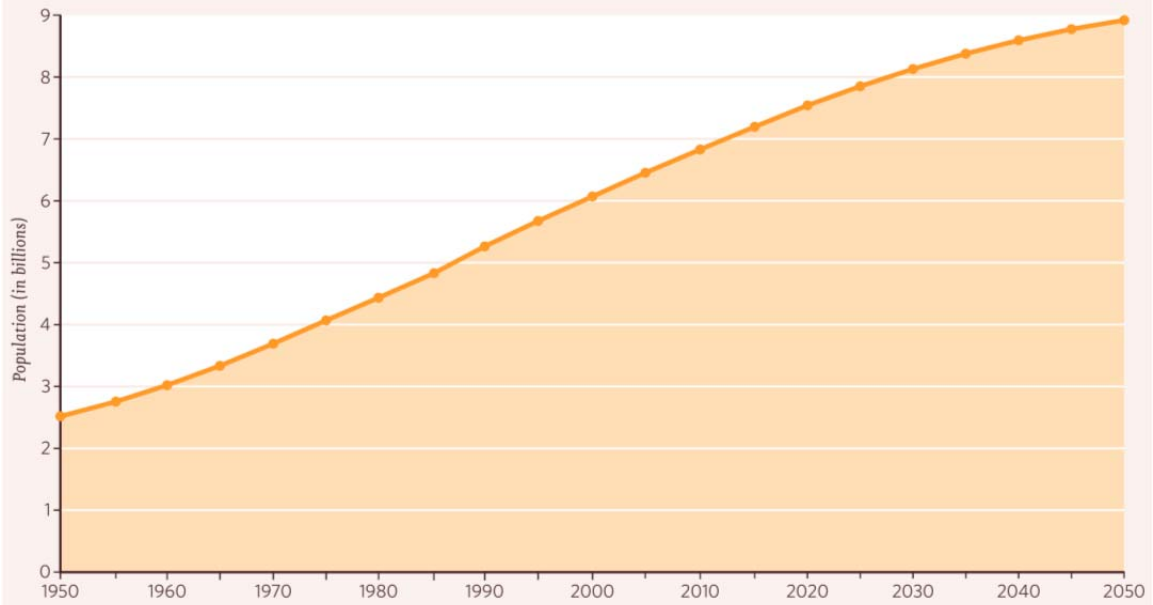
- Fossil Fuels
 - Coal
 - Oil
 - Natural gas
- Nuclear energy
 - Fission
 - Fusion
- Bioenergy
 - Burning wood
 - Animal dung
 - Wastes
 - Alcohol (ethanol)
- Gasohol
- Hydroelectric
- Solar energy
- Wind energy
- Wave power
- Tidal energy
- Geothermal
 - Earth internal heat originates mainly from the decay of long lived radioactive elements

Percent Contributions of Energy Sources to World's Consumption (2000)



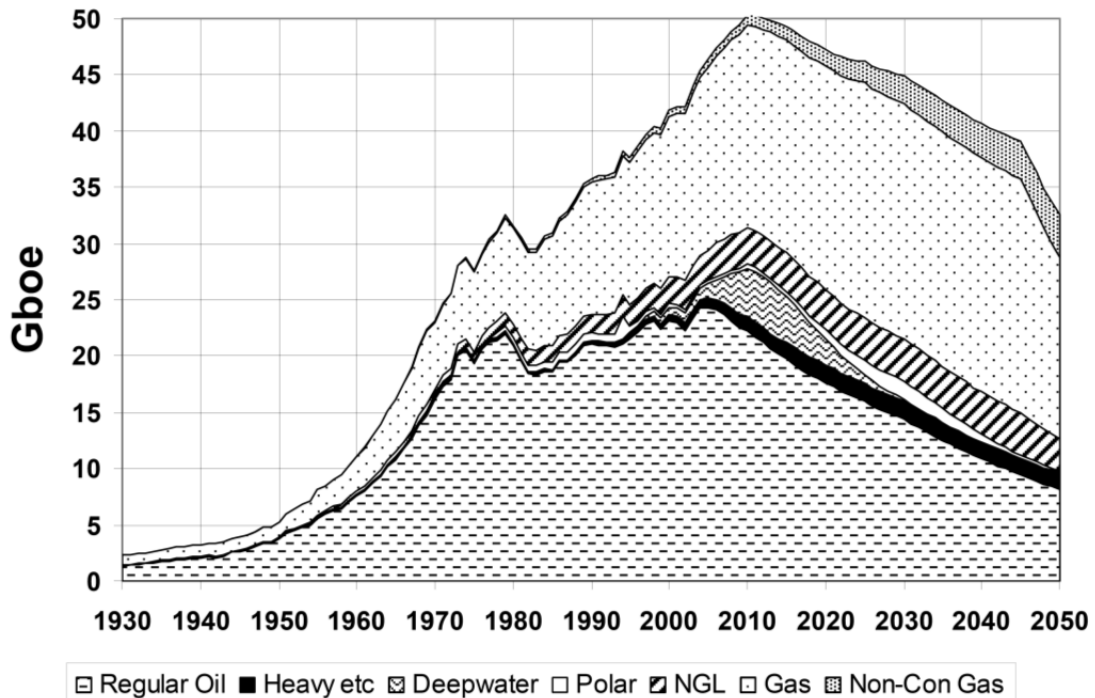
World Population Trends

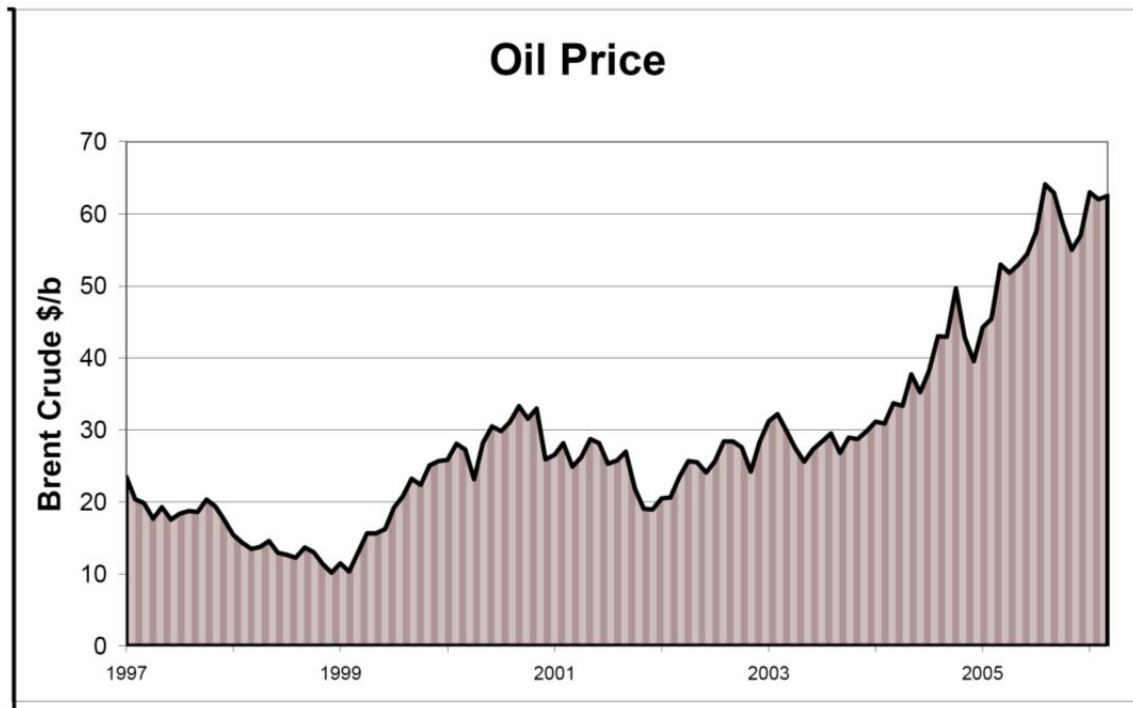
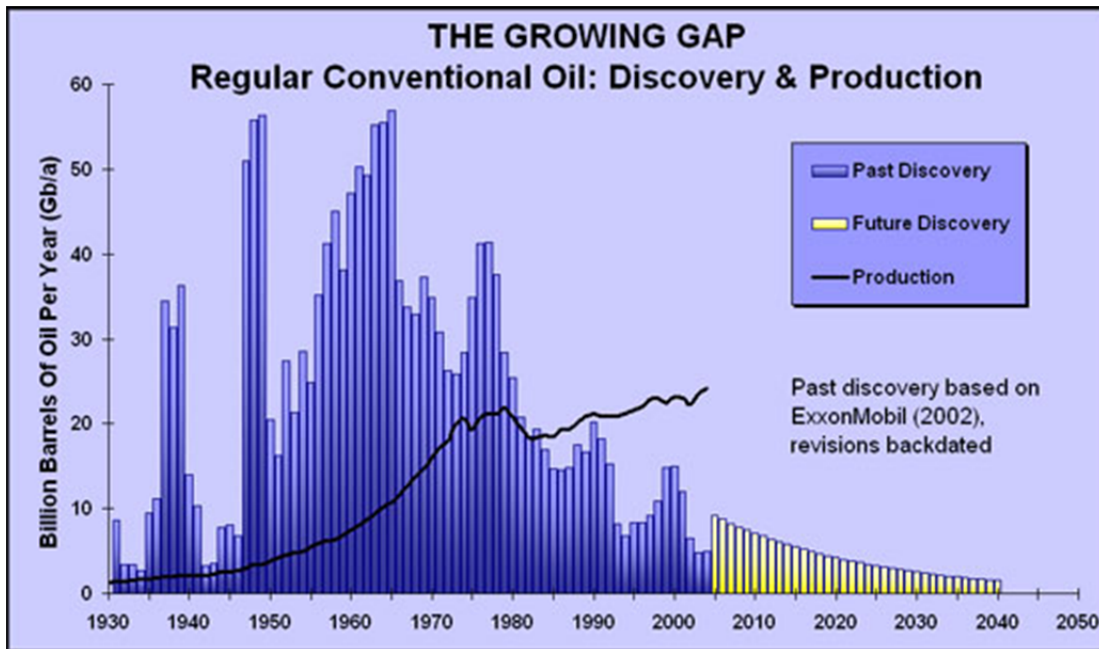
Figure 1: World population, 1950-2050 (projected)



Source: UN Population Division

OIL & GAS PRODUCTION PROFILES 2005 Base Case





[Simmons: global energy war could happen over oil](#)

Karl Hanlon, The Irish Times (21 April 2006)

A global energy war could become a reality unless governments and people make painful adjustments to cope with dwindling oil reserves, an international energy expert has predicted.

Matthew Simmons, a former energy adviser to US president George Bush, warned that global oil production was now close to "peak" level and would decline irreversibly.

Mr Simmons who is chairman of Simmons & Co - a US-based investment bank that specialises in the energy industry - was speaking at the University of Limerick. As crude prices hit a record high of \$74 a barrel yesterday, Mr Simmons claimed that oil was still

selling at a price far below its true value.

In an address entitled "Will 'Twilight in the Desert' mean Economic Eclipse for Europe", Mr Simmons dismissed suggestions that oil prices were rising too fast and said he believed the real price of oil should peak at \$180 a barrel in the next decade.

...Mr Simmons suggested that a global energy conference would be a major first step in addressing dwindling oil supplies allied to increased demand. "Unless we want to have a terrible vicious energy war we better work on a concerted way to actually start using less oil, particularly in the way we transport people and goods," he said.

Mr Simmons outlined a series of conservational approaches and "painful adjustments" which he said needed to be implemented to avoid a global energy war.

He advocated a major shift in the way goods are transported in the marketplace from a dependence on road infrastructure to rail and water transport.

Fossil Fuel & Nuclear Power Facts:

- approx. 80% of our energy comes from fossil fuels and nuclear power; examples of fossil fuels include oil, coal, and natural gas
- nuclear fission is used in nuclear power plants

Coal:

- abundant, burns dirty, causes acid rain and pollution

Oil:

- flexible fuel source, easily transportable, causes pollution

Natural Gas:

- easily transportable, burns cleanly, highly combustible

Nuclear Power:

- clean, no CO₂, safety concerns, waste disposal issues

- fossil fuel and nuclear fuel supplies are finite, which leads to the ultimate problem with sustainable energy sources; how will sustainable energy sources make up for the extra 80% of the world's energy needs when our fossil fuels run out
- the answer may lie in nuclear fusion; let's take a look at nuclear power in more detail