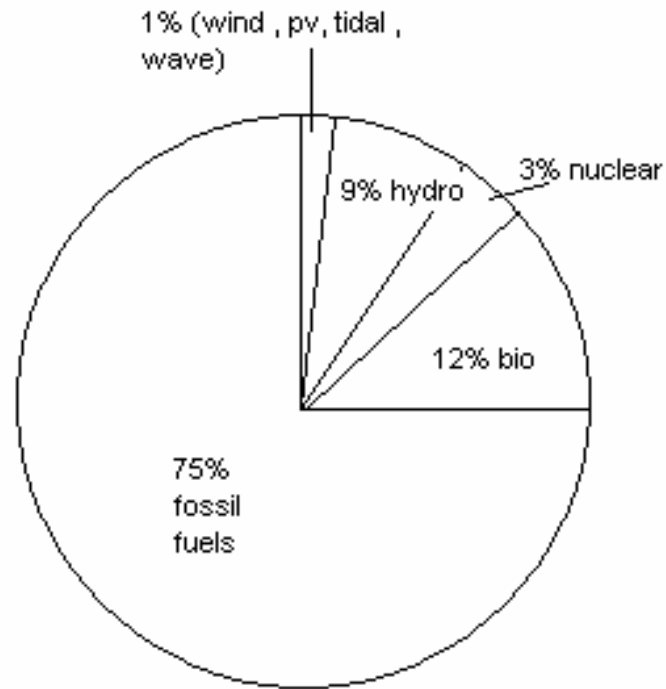


Introduction - 01

Dr.L.Umanand, CEDT
Indian Institute of Science

What is the current energy scenario?



GLOBAL ENERGY SCENARIO

What is the current energy scenario?

- ◆ 75% of energy requirement is met by fossil fuels.
- ◆ Nuclear energy contributes to about 3%.
- ◆ 9% is met by hydel energy.
- ◆ 12% of energy consumption is met by biogas.
- ◆ Renewable sources like wind, tidal, wave, solar, contribute to about 1%.

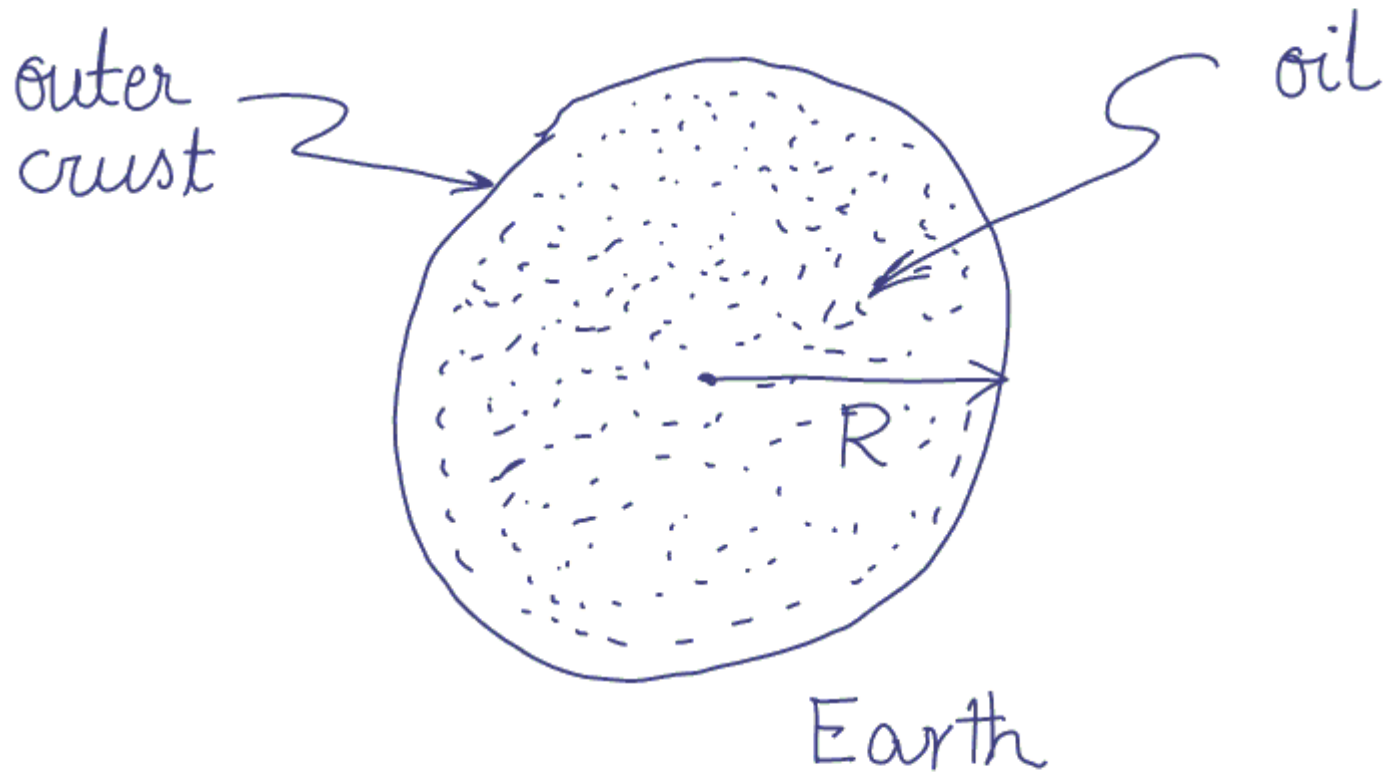
Why should we look for alternate energy sources?

- ◆ Fossil fuels, which are the main source of energy, are getting depleted at a rapid rate. As a consequence the cost of fossil fuels are increasing.
- ◆ Fossil fuel based systems produce detrimental effects on the environments. This in turn will affect our health. This means that indirectly, the medical bills will be rising the world over.

What is the annual world energy consumption?

- ◆ Energy consumption in a year can be calculated by taking the sum of energy generated by different sources in a year. Statistics indicate that the energy consumption in year 2004 was 70×10^{12} KWh. Estimates indicate that the energy consumption is increasing at the rate of 7% pa.

How long will fossil fuel last?



How long will fossil fuel last?

Consider a hypothetical case where in earth contains a thin core filled entirely with oil as shown in the previous slide. It turns out that the volume of the oil present is

$$1.086 \times 10^{21} \text{m}^3 \left(\left(\frac{4}{3} \right) \times \pi \times (6378 \times 10^3)^3 \right).$$

How long will fossil fuel last?

- ◆ The energy density of fuel is in the range of 10000Wh/Lt.
- ◆ The energy content in the fuel within the earth is obtained as 1.1×10^{25} KWh. Assuming that growth rate is maintained at 7% and the entire energy is supplied using fossil fuels. The energy requirement at any time, t can be calculated using $70 \times 10^{12} e^{0.07t}$ KWh
- ◆ t is obtained as 368 years. The fossil fuels will get depleted in about 368 years.

How long will fossil fuel last?

- ◆ If we consider the real situation, the earth is not-completely filled with oil as assumed and further the annual energy consumption rate is continually growing. So the fuel may get exhausted in about 70-100 years.
- ◆ If the reserves of fuels decrease there will be a sharp increase in the price of energy. This will lead to decrease in energy consumption through fossil fuels. If alternative sources are explored and utilized, then the fuel may be actually used for more number of years.

Is nuclear energy really an alternative?

- ❖ Nuclear energy as an alternative source is not a feasible option. To increase the present 3% consumption to say 20% it requires the installation of a 400MW plant every day for the next 10 years!!!.
- ❖ The disposal of nuclear waste also poses a problem.

What about energy densities?

- ◆ The alternative sources considered have energy density in the range of **10Wh/Lt** where as fossil fuel energy density is in the range of **10000Wh/Lt**.

Energy densities of fuels...

	Fuel	Wh/kg	density Kg/m ³	Wh/m ³	Wh/lit.
1	Gasoline	12300	~700	9348000	9348
2	Natural Gas	9350	~800	7480000	7480
3	Methanol	6200	791	4904200	4904
5	Kerosene	12300	870	10701000	10701
6	Coal	8200	1250-1550	10250000	10250
7	Battery (lead- acid)	35	-	-	80
8	Flywheel	15	-	-	-
9	Solar thermal**	-	-	900/day	0.9/day
10	Solar PV*	-	-	500/day	0.5/day

*Efficiency is assumed as 10% and 1m height is required for installation with appropriate inclination.

**Efficiency is assumed as 18% and 1m height is required for installation with appropriate inclination.

What should be the paradigm shift?

- ◆ We should move from a concentrated energy usage pattern to a more diffuse energy usage pattern

What are the alternative energy possibilities?

- ◆ Muscle power
- ◆ Solar photovoltaic
- ◆ Solar thermal
- ◆ Wave
- ◆ Tidal
- ◆ Wind
- ◆ Geothermal
- ◆ Bio