Non-commercial Sources of Energy

All materials which originate from photosynthesis form the **biomass**. It includes all new plant growth, residues and wastes (wood, short rotational trees) ; herbaceous plants, freshwater and marine algae, aquatic plants; agricultural and forest residues (straw husks, bagasse, corn cobs, bark, sawdust, wood shavings, roots, animal droppings); wastes (garbage, dung, night soil or faeces), industrial refuse, etc. Biodegradable organic effluents from industries such as cannaries, sugar mills, slaughter house, meat packing plants, breweries, distillaries, etc., are also included in this category. Biomass-based energy can be obtained by the following sources :

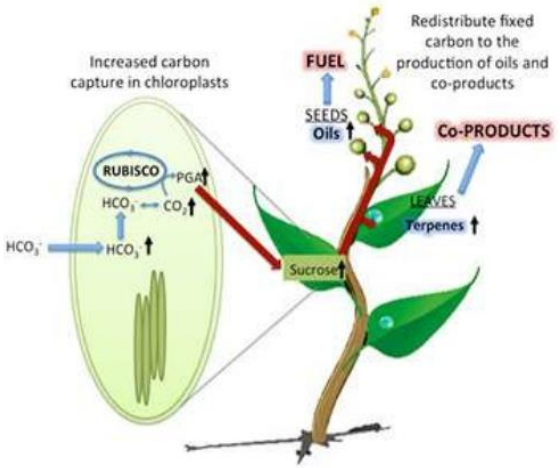
1. **Fire wood.** According to Advisory Board on Energy or ABE the demand for firewood is going to go up in order of 300 – 330 Mt in the year 2004/ 2005 against the present level of 120 – 130 Mt. Recently, efforts are going on to improve the firewood utilisation to get more and more energy. Some new techniques are the following :

(i) Briquetting. The Indian Institute of Technology, New Delhi has developed the technology of briquetting saw dust into smokeless fuel.

(ii) Gasification. Gasification of biomass is an important means of harvest energy through thermo-chemical conversion. It yields **biogas**, **producer gas** and **pyrogas.**

(iii) Improved chullahs. Present day chullahs (which are about 112 million in number) have a very low, 2–10% efficiency. This results into wastage of wood, deforestation, air pollution and health problems. Department of Non-conventional Energy Sources (DNES) have designed certain improved stoves which contain thermal efficiency up to 15 to 20%.

2. **Petroplants.** There are attempts to identify potential plant species as sources of liquid hydrocarbons, a substitute for liquid fuels. In this respect, 15 species hold promise and they belong to families Euphorbiaceae, Asclepiadaceae, Apocynanceae, Urticaceae, Convolvulaceae and Sapotaceae. There is a need to increase the biomass of these plants, and conversion of their hydrocarbons into petroleum fractions. The Indian Institute of Petroleum, Dehra Dun done a remarkable job in this area, particularly on hydrocracking of the crude products. The products, thus, obtained are gases, naphtha, kerosene, gas oil, coke, etc.



Petroplants

3. **Biogas.** Biogas provides a significant solution to present energy crisis, especially in rural areas. This is an environmentally clean technology. The generation of biogas involves decomposition of animal dung (even human faecal matter), leafy and agricultural residues, under anaerobic conditions by bacterial action, in a suitable capacity digester. This results in the production of methane gas which is used for cooking and even for lighting purpose. Biogas is composed of methane, CO2, H2 and N2. At 40% methane content, calorific value of biogas is 3,214 kcal/m^3, at 50% is 4,429 k cal/m^3 and at 55% is 4,713 k cal/m^3.

Dung of domestic herbivore is used in biogas production. According to **Dr. Archana Sharma** (1987), India annually produces about 1000 million tonnes of dung, from which about 22,425 million m3 gas can be produced. Besides the cooking gas, slurry (i.e., residual organic matter obtained from the digester) can produce 206 million tonnes of organic manure (or bio-fertilizer) every year that can replace 1.4 million tones of N2, 1.3 million tonnes of P2O5 (phosphate) and 0.9 million tonnes of K2O (potash). However, this source of bioenergy is not being fully tapped in India, though China has fully exploited this biotechnology.

Biogas can also be generated from sludge obtained from primary treatment of raw sewage and one such plant is in operation at Okhla. Water hyacinth, Hydrilla, duck weeds and algae can act as supplements for production of biogas. At present, in India, there are about 6.1 lakh biogas plants. It is estimated that 1.5 lakh biogas plants will save 6 lakh tonnes of wood equivalent every year.