■ OCEAN THERMAL ENERGY (OTE)

The energy available due to the difference in temperature of water at the surface of the tropical oceans and at deeper levels is called Ocean Thermal Energy. A difference of 20°C or more is required between surface water and deeper water of ocean for operating OTEC (Ocean Thermal Energy Conversion) power plants. The warm surface water of ocean is used to boil a liquid like ammonia. The high pressure vapours of the liquid formed by boiling are then used to turn the turbine of a generator and produce electricity. The colder water from the deeper oceans is pumped to cool and condense the vapours into liquid. Thus the process keeps on going continuously for 24 hours a day.

■ GEOTHERMAL ENERGY

The energy harnessed from the hot rocks present inside the earth is called geothermal energy. High temperature, high pressure steam fields exist below the earth's surface in many places. This heat comes from the fission of radioactive material naturally present in the rocks. In some places, the steam or the hot water comes out of the ground naturally through cracks in the form of **natural geysers** as in Manikaran, Kullu and Sohana, Haryana. Sometimes the steam or boiling water underneath the earth do not find any place to come out. We can artificially drill a hole up to the hot rocks and by putting a pipe in it make the steam or hot water gush out through the pipe at high pressure which turns the turbine of a generator to produce electricty. In USA and New Zealand, there are several geothermal plants working successfully.

■ BIOMASS ENERGY

Biomass is the organic matter produced by the plants or animals which include wood, crop residues, cattle dung, manure, sewage, agricultural

In rural areas these forms of waste biomass are burned in open furnaces called '**Chulhas**' which usually produce smoke and are not so efficient (efficiency is <8 %). Now improved Chulhas with tall chimney have been designed which have high efficiency and are smokeless.

The burning of plant residues or animal wastes cause air pollution and produce a lot of ash as waste residue. The burning of dung destroys essential nutrients like N and P. It is therefore, more useful to convert the biomass into biogas or bio fuels.

■ BIOGAS

Biogas is a mixture of methane, carbon dioxide, hydrogen and hydrogen sulphide, the major constituent being methane. Biogas is produced by anaerobic degradation of animal wastes (sometimes plant wastes) in the presence of water. Anaerobic degradation means break down of organic matter by bacteria in the absence of oxygen.

Biogas is a non-polluting, clean and low cost fuel which is very useful for rural areas where a lot of animal waste and agricultural waste are available. India has the largest cattle population in the world (240 million) and has tremendous potential for biogas production. From