

Energy scenarios

INTRODUCTION

Any physical activity in this world, whether carried out by human beings or by nature, is caused due to flow of energy in one form or the other. The word 'energy' itself is derived from the Greek word 'en-ergon', which means 'in-work' or 'work content'. The work output depends on the energy input.

Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them.

Energy can be classified into several types based on the following criteria:

- Primary and Secondary energy
- Commercial and Non commercial energy
- Renewable and Non-Renewable energy
- Conventional and Non-conventional energy

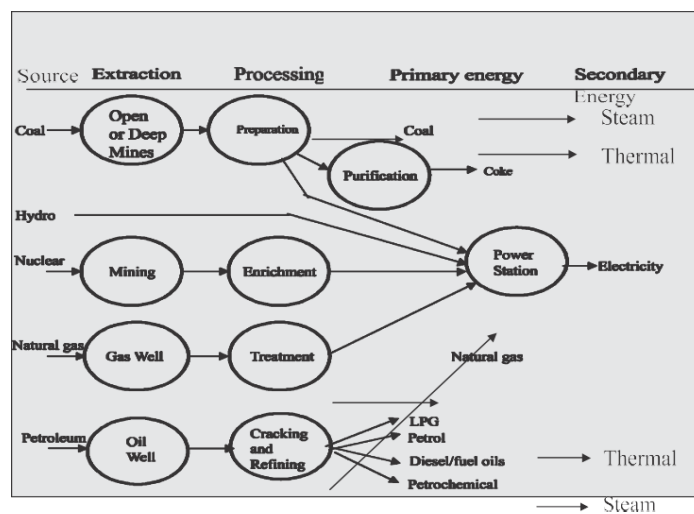


Fig1.1. Major Primary and Secondary sources

1.1 Primary and Secondary Energy

Primary energy sources are those that are either found or stored in nature. Common primary energy sources are coal, oil, natural gas, and biomass (such as wood). Other primary energy sources available include nuclear energy from radioactive substances, thermal energy stored in earth's interior, and potential energy due to earth's gravity. The major primary and secondary energy sources are shown in Figure 1

Primary energy sources are costly converted in industrial utilities into secondary energy sources;

for example coal, oil or gas converted into steam and electricity. Primary energy can also be used directly. Some energy sources have non energy uses, for example coal or natural gas can be used as a feedstock in fertilizer plants.

1.1 Commercial Energy and Non Commercial Energy

Commercial Energy

The energy sources that are available in the market for a definite price are known as commercial energy. By far the most important forms of commercial energy are electricity, coal and refined petroleum products. Commercial energy forms the basis of industrial, agricultural, transport and commercial development in the modern world. In the industrialized countries, commercialized fuels are predominant source not only for economic production, but also for many household tasks of general population. Examples: Electricity, lignite, coal, oil, natural gas etc.

Non-Commercial Energy

The energy sources that are not available in the commercial market for a price are classified as non-commercial energy. Non-commercial energy sources include fuels such as firewood, cattle dung and agricultural wastes, which are traditionally gathered, and not bought at a price used especially in rural households. These are

also called traditional fuels. Non-commercial energy is often ignored in energy accounting.

Example: Firewood, agro waste in rural areas; solar energy for water heating, electricity generation, for drying grain, fish and fruits; animal power for transport, threshing, lifting water for irrigation, crushing sugarcane; wind energy for lifting water and electricity generation.

1.2 Renewable and Non-Renewable Energy

Renewable energy is energy obtained from sources that are essentially inexhaustible. Examples of

renewable resources	include wind power, solar power,	geothermal energy, tidal power and
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hydroelectric power (See Figure 2). The most important feature of renewable energy is that it can be harnessed without the release of harmful pollutants.

Non-renewable energy is the conventional fossil fuels such as coal, oil and gas, which are likely to deplete with time.

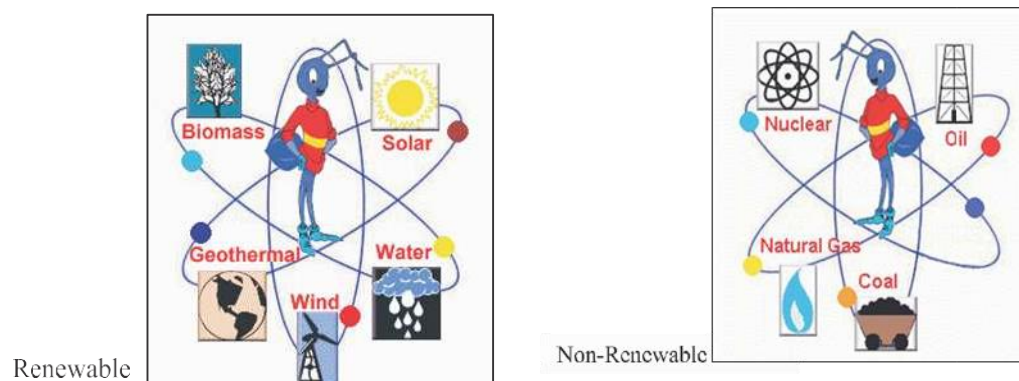


Figure 2: Renewable and Non-Renewable Energy

1.3 Conventional and Non-conventional energy resources:

Conventional Energy

Conventional energy resources which are being traditionally used for many decades and were in common use around oil crisis of 1973 are called conventional energy resources, e.g., fossil fuel, nuclear and hydro resources.

Non-conventional energy

Non-conventional energy resources which are considered for large – scale use after oil crisis of 1973, are called non-conventional energy sources, e.g., solar, wind, biomass, etc.

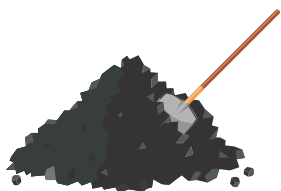
Energy Consumption and Standard Of Living:

The energy consumption of a nation can be broadly divided into the following areas or sectors depending on energy-related activities. These can be further subdivided into subsectors:

- Domestic sector (houses and offices including commercial buildings)
- Transportation sector
- Agriculture sector
- Industry sector

Consumption of a large amount of energy in a country indicates increased activities in these sectors. This may imply better comforts at home due to use of various appliances, better transport facilities and more agricultural and industrial production. All of this amount to a better quality of life. Therefore, the per capita energy consumption of a country is an index of the standard of living or prosperity (i.e. income) of the people of the country.

1.4 Global Primary Energy Reserves*



Coal

The proven global coal reserve was estimated to be 9,84,453 million tonnes by end of 2003. The USA had the largest share of the global reserve (25.4%) followed by Russia (15.9%), China (11.6%). India was 4th in the list with 8.6%.

Oil

The global proven oil reserve was estimated to be 1147 billion barrels by the end of 2003. Saudi Arabia had the largest share of the reserve with almost 23%. (One barrel of oil is approximately 160 liters)



Gas

The global proven gas reserve was estimated to be 176 trillion cubic metres by the end of 2003. The Russian Federation had the largest share of the reserve with almost 27%.

(*Source: BP Statistical Review of World Energy, June 2004)

Global Primary Energy Consumption

The global primary energy consumption at the end of 2003 was equivalent to 9741 million tons of oil equivalent (MTones). The Figure 1.3 shows in what proportions the sources mentioned above contributed to this global figure.

Energy distribution between developed and developing Countries

Although 80 percent of the world's population lies in the developing countries (a four-fold population increase in the past 25 years), their energy consumption amounts to only 40 percent of the world total energy consumption. The high

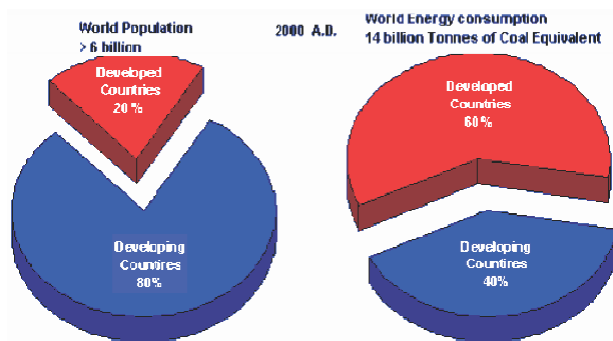


Fig. 1.4: Energy Distribution Between Developed and Developing Countries

standards of living in the developed countries are attributable to high energy consumption levels.

Also the rapid population growth in the developing countries has kept the per capita energy consumption low compared with that of highly industrialized developed countries. The world average energy consumption per person is equivalent to 2.2 tones of coal. In industrialized countries, people use four to five times more than the world average and nine times more than the average for the developing countries.