

Conventional and Non conventional Sources of Energy

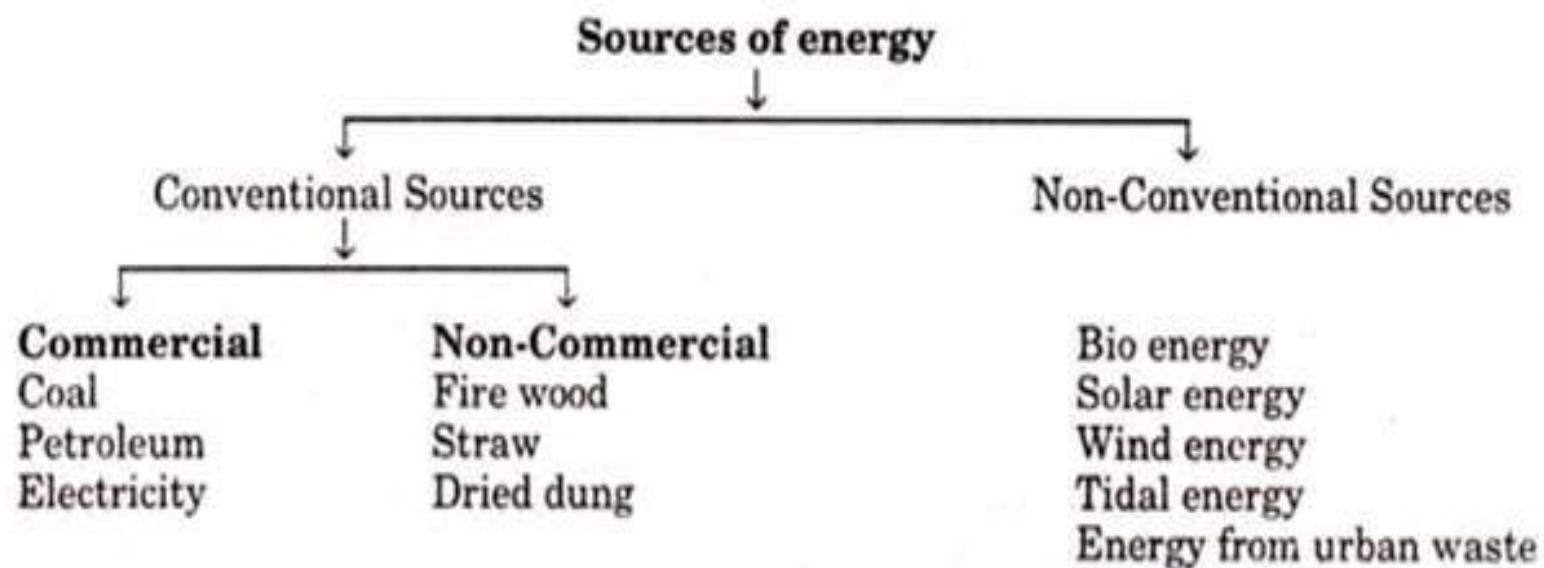
Energy is one of the major parts of the economic infrastructure, being the basic input needed to sustain the economic growth. There exists a strong relationship between economic development and energy consumption.

The more developed is a country, higher is the per capita of energy consumption and vice- versa. Human civilization relies on different sources of energy.

The two major sources of energy can be classified under:

1. Conventional Sources

2. Non-Conventional Sources



What are Conventional Sources of Energy?

These sources of energy are also known as non-renewable sources of energy and are available in limited quantity apart from hydro-electric power. Further it can be classified under commercial and non-commercial energy.

Commercial Energy Sources

The coal, electricity and petroleum are known as commercial energy since the consumer needs to pay its price to buy them.

a) Coal

Coal is the most important source of energy. the total estimated coal reserve (resource) of India is 378.21 billion tonnes as of 01.04.2023. In 2023-2024, the annual production went up to 997 million tons. India is the second largest coal-producing country and the deposits are mostly found in Jharkhand, Odisha, and Chhattisgarh.

b) Oil and Natural Gas:

In India it is found in upper Assam, Mumbai High and in Gujarat. The resources of oil are small in India. In 1950-51, the total production of oil in India was 0.3 million tonnes. It increased to 32.4 million tonnes in 2000-01.

Despite tremendous increase in oil production. India still imports 70% of oil requirements from abroad. In 1951, there was only one oil refinery in Assam. India imported 232.5 Million Metric Tonne (MMT) in 2023-24.

Oil is mostly used in planes, auto mobiles, trains and ships

c) Electricity:

Electricity is a common source of energy and used for domestic and commercial purposes. The electricity is mainly utilized in electrical appliances like Fridge, T.V, washing machine and air conditioning.

The major sources of power generation are mentioned below:

- 1.Nuclear Power
- 2.Thermal Power
- 3.Hydro-electric power

1.Thermal Power:

Thermal power is generated at various power stations by means of coal, oil or natural gas. It is a vital source of electric current and its share in total capacity of the nation in 2004-05 was 70 percent. As on 31 March 2023, this percentage has reduced to 57%.

2.Hydroelectric Power:

The hydroelectric power is produced by constructing dams above flowing rivers like Damodar Valley Project and Bhakra Nangal Project. The installed capacity of hydroelectric power was 587.4 MW in 1950-51 and went up to 46850 MW in 2022-23.

3.Nuclear Power:

The fuel used in nuclear power plants is Uranium, which costs less than coal. Nuclear power plants can be found in Tarapur, Kota(Rajasthan), Naroura (UP) and Kalapakam (Chennai). Its supply accounts for only 3 percent of the total installed capacity.

Non-commercial energy sources

Generally, the energy sources that are freely available are considered as the non-commercial energy sources. The examples of non-commercial energy sources are, Straw, dried dung, firewood.

What are Non-Conventional Sources of Energy?

These non-conventional sources are also known as renewable sources of energy. The examples include solar energy, bioenergy, tidal energy and wind energy.

1. Solar Energy

This is the energy that is produced by the sunlight. The photovoltaic cells are exposed to sunlight based on the form of electricity that needs to be produced. The energy is utilized for cooking and distillation of water.

2.Wind Energy

This kind of energy is generated by harnessing the power of wind and mostly used in operating water pumps for irrigation purposes. India stands as the second largest country in the generation of wind power.

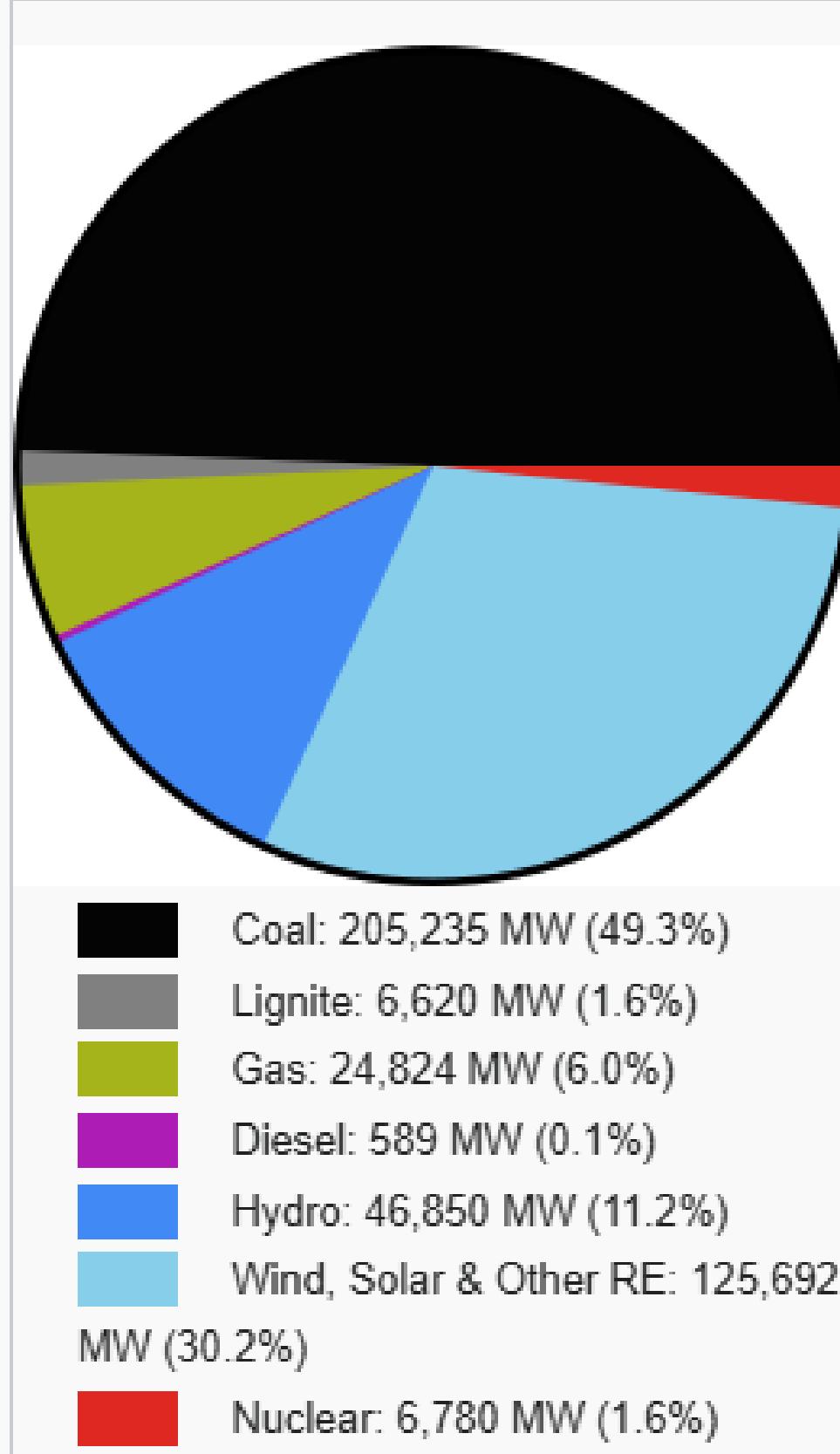
3.Tidal Energy

The energy that is generated by exploiting the tidal waves of the sea is known as tidal energy. This source is yet to be tapped due to the lack of cost-effective technology.

Breakdown of Installed Generation Capacity as on 31/03/2023

Source	Installed Capacity (MW)	% of Share in Total
Fossil Fuels (Total)	237,269	57%
Coal	205,235	49.3%
Lignite	6,620	1.6%
Gas	24,824	6.0%
Diesel	589	0.1%
Non-Fossil Fuels (Total)	178,790	43%
Hydro	46,850	11.3%
Wind	42,633	10.2%
Solar	66,780	16.1%
Bio Mass Power/Cogen	10,248	2.5%
Waste to Energy	554	0.1%
Small Hydro	4,944	1.2%
Nuclear	6,780	1.6%
Total Installed Capacity	416,059	100%

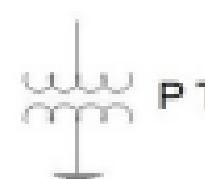
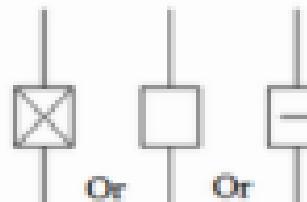
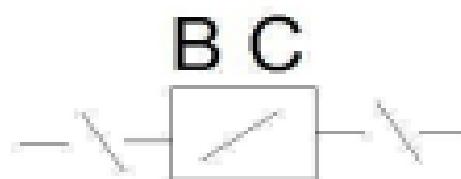
Installed capacity by source in the utility sector as on 12 June 2023^[48]



Symbols for Equipment in Sub-Stations

It is a usual practice to show the various elements (e.g. transformer, circuit breaker, isolator, instrument transformers etc.) of a sub-station by their graphic symbols in the connection schemes. Symbols of important equipment in sub-station are given below.

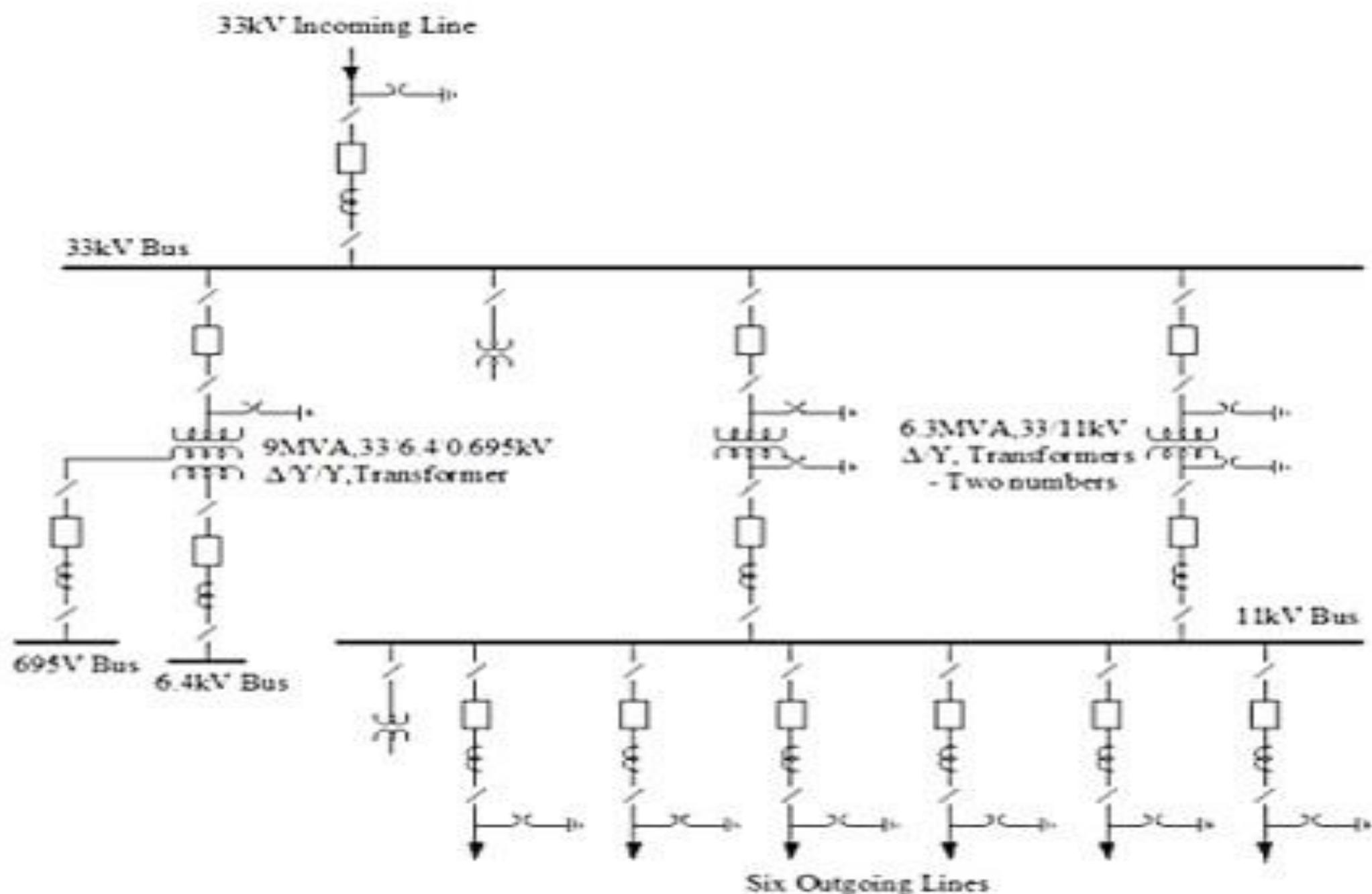
SI No.	Circuit Element	Symbol
1.	Bus-bar	
2.	Isolator	 ISO
3.	AC Generator or Alternator	
4.	Power Transformer –Step Up	 STEP UP TRF.
5.	Power Transformer –Step Down	 STEP DOWN TRF.
6.	Three Winding Transformer	 or
7.	Current Transformer (CT)	

8.	Potential or Voltage Transformer(PT)	
9.	Circuit Breaker(CB)	
10.	Circuit breaker with isolator	
11.	Oil Circuit Breaker (OCB)	
12.	Lightning Arrestor (LA)	
13.	Bus Coupler	
14.	Earthing Switch	

Q4. Draw the single line diagram of a 33/11kV substation having the following equipments

- Incoming line: One, 33kV
- Outgoing lines: Six, 11kV
- Transformers-
 - One, 9MVA, 33/6.4/0.695kV, Δ/Y/Y
 - Two, 6.3MVA, 33/11kV, Δ/Y

Show the positions of CTs, PTs, isolators, lightning arresters, circuit breakers.



Q7. Draw the single line diagram of a Pole Mounted Substation.

