

UE20ME101 MECHANICAL ENGINEERING SCIENCE (4-0-0-4-4)

Notes Unit 1 Class1

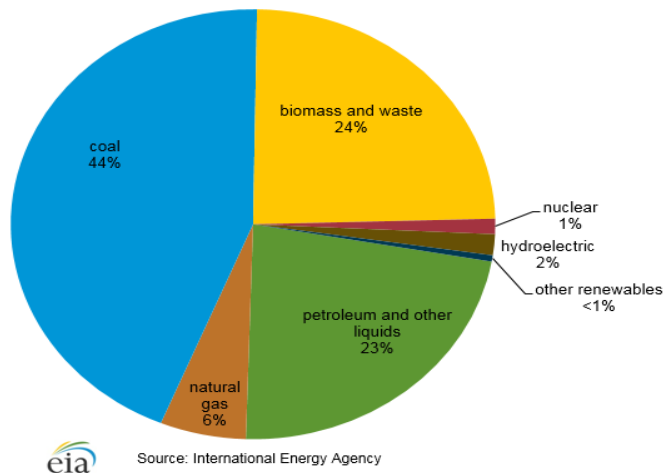
Energy sources

Energy in the form of natural energy from nature can be existing as capital energy that is existing on the earth like fossil fuel, nuclear fuel, bio energy, kinetic energy derived from flowing water, potential energy derived by stored water, wind, nuclear energy, thermal energy by burning coal (peat, lignite, anthracite and bitumeneous coal) and energy derived by celestial energy in the form of solar energy (electromagnetic energy of the earth's sun), gravitational energy and tidal energy.

Energy consumption may be consumed in the form of thermal energy, mechanical energy or electrical energy.

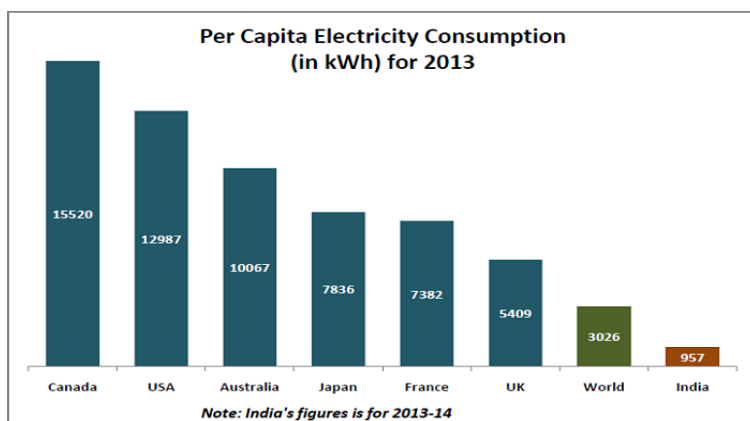
Total energy produced in 2019 is about 371,054.12 MW. out of which the sources is as follows 79.8% is coming from fossil fuel (coal, petroleum and other liquids and natural gas). These are all non renewable sources of energy. 17.3% is from renewable energy. We need to get more towards renewable energy very soon. So we need to grow more in solar, wind, wave, and biomass energy plants.

Figure 2. Total energy consumption in India, 2013



Broad Areas of Energy Consumption:

- Domestic Sector – Thermal energy for cooking food and heating, electrical energy for appliance like washing machine, refrigerators, airconditioners, washing machines and all other domestic machines.
- Transportation Sector – automobile sectors IC engines, batteries, electrical energy for trains and aerospace applications
- Agricultural Sector – tractors IC engine, electrical energy for pumps, and agricultural machinery for cleaning and grinding grains,
- Industry Sector – all kinds of industry like machine tool, automobiles, textile, food processors, defence, etc.,



Standard of Living:

Nearly 25% of total energy is consumed by USA which has about 5% of world's population, while India which has nearly 17% of world's population consumes only nearly 3.5% of world's energy. We need more machines and equipment for better living conditions. Automations improve better living and more accuracy in productions. Average electricity use in 2018-2019 is 1,181kWh per capita. This is below the world average. Efforts to be done to use more machinery and automation to increase the comfort of people.

Energy in physics is the capacity for doing work. It may exist in potential, kinetic, thermal, electrical, chemical and nuclear. Examples: light energy, heat energy, mechanical energy, gravitational energy, electrical energy, sound energy, chemical energy, nuclear or atomic energy and so on.

Kinetic energy is the energy in moving objects or mass. Examples include mechanical energy, electrical energy etc. Potential energy is any form of energy that has stored potential that can be put to future use.

Classification of resources

1. Based on Usability of Energy
 - a) Primary Resources
 - b) Intermediate Resources
 - c) Secondary Resources
2. Based on Traditional Use
 - a) Conventional Energy
 - b) Non-conventional Energy
3. Based on Long time Availability
 - a) Non-renewable Resources
 - b) Renewable Resources

4. Based on Commercial Application
 - a) Commercial Energy Resources
 - b) Non-commercial Energy Sources
5. Based on Origin

Based on Utilization of Energy

- (a) Primary Resources: These are resources embodied in nature prior to undergoing any human made conversions (raw energy sources). Ex: sunlight, wood, wind.
- (b) Secondary Resources: The form of energy which is finally supplied to a consumer for utilization is known as Secondary Resource. Ex: Electrical Energy, thermal energy (in the form of steam or water)

Conventional Energy and Non-Conventional Energy

Conventional energy means the energy source which is obtained from fixed reserves in nature like oil, gas and coal. In other words conventional energy is also termed as non-renewable energy sources, or fossil fuels.

Examples: Fossil Fuels, Coal, Gas, Oil Nuclear (Fission): Uranium, wood, geothermal Hydro.

Non-Conventional Energy - Energy generated by using wind, tides, solar geothermal heat and biomass including farm and animal waste as well as human excreta is known as non-conventional energy. All these sources are renewable or inexhaustible and do not cause environment pollution. More over they do not require heavy expenditure.

Example Wind, Solar: Thermal, Photovoltaic, Tidal, wave, Bio energy

Renewable energy and Non Renewable energy

Renewable energy is any energy source that is naturally replenished, like that derived from solar, wind, geothermal or hydroelectric action. The oil crisis of 1973 began when the members of the Organization of Arab Petroleum Exporting Countries proclaimed an oil embargo. Because of this the price of oil went up sharply. Importing oil was very expensive. This was the time the emphasis on developing renewable energy resources began. MNRE- Ministry of New and Renewable Energy (MNRE) is the nodal ministry of the government of India for all matters relating to new and renewable energy. The five major renewable energy resources are, solar, wind, water (hydro), biomass and geothermal.

Non-renewable resources represent the resources which do not revive itself at a substantial scale, for enduring economic extraction in the specified period. These natural resources are available in finite quantity, which is once used, cannot be replenished. Examples of non-renewable resources are coal, fossil fuel, crude oil, nuclear energy, etc.

Environmental aspect of energy

1. Trade off between energy and environment.
2. Ecology.
3. Greenhouse Effect, Burning of fossil fuel causes green house effect. Consequences of global warming
4. Pollution: burning of fossil fuel causes pollution. Various pollutants like CO₂, SO₂, nitrogen dioxide, ozone, and fine particulate matter and their Harmful effects like lung and skin disease.
5. Green power : to be used as far as possible to avoid these harmful effects.

Energy scenario in India

| Sector | MW | % of Total |
|-------------------|----------|------------|
| Central Sector | 93,477 | 25.2% |
| State Sector | 103,322 | 27.9% |
| Private Sector | 173,549 | 46.9% |
| Total | 3,70,348 | |
| Fuel | MW | % of Total |
| Total Thermal | 2,30,600 | 62.8% |
| Coal | 1,98,525 | 54.2% |
| Lignite | 6,610 | 1.7% |
| Gas | 24,955 | 6.7% |
| Diesel | 510 | 0.1% |
| Hydro (Renewable) | 45,699 | 12.4% |

| | | |
|--|---------|-------|
| Nuclear | 6,780 | 1.9% |
| RES* (MNRE) | 87,269 | 23.6% |
| Total | 370,348 | |
| As on 23-05-2020 Source: OM SECTION | | |
| 1.Total Installed Capacity (As on 30.04.2020) - Source : Central Electricity Authority (CEA) | | |

Principles of Energy Conservation

- Recycling of Waste.
Examples: recycle metals, plastics, papers etc.
- Modernization of technology: modern machines are energy efficient.
- Waste heat utilisation: waste heat in thermal power plant is used for reheating incoming air and steam to super heated steam.
- Judicial use of Proper Type of Fuel.
- Cogeneration or combined heat and power (CHP) is the use of a heat or power station to generate electricity and useful heat at the same time.
- Adopting Daylight Saving Time: used in western country like Europe and USA to save daylight during winter.
- Proper Operation and Maintenance: Better regular maintained machine use less power.