



**GANDAKI COLLEGE OF
ENGINEERING AND SCIENCE**



Bachelor of Engineering in Computer Engineering

By: Asst. Prof. Menaka Karki



1. Introduction

- 1.1 Role of electricity in modern society
- 1.2 Energy sources and production
- 1.3 Generation, transmission and distribution of electrical energy
- 1.4 Consumption of electricity

1.1 Role of electricity in modern society

Electricity as a **commodity**

Indicator of living standard→ higher the per capita energy consumption better is the living standard indicating good human development index

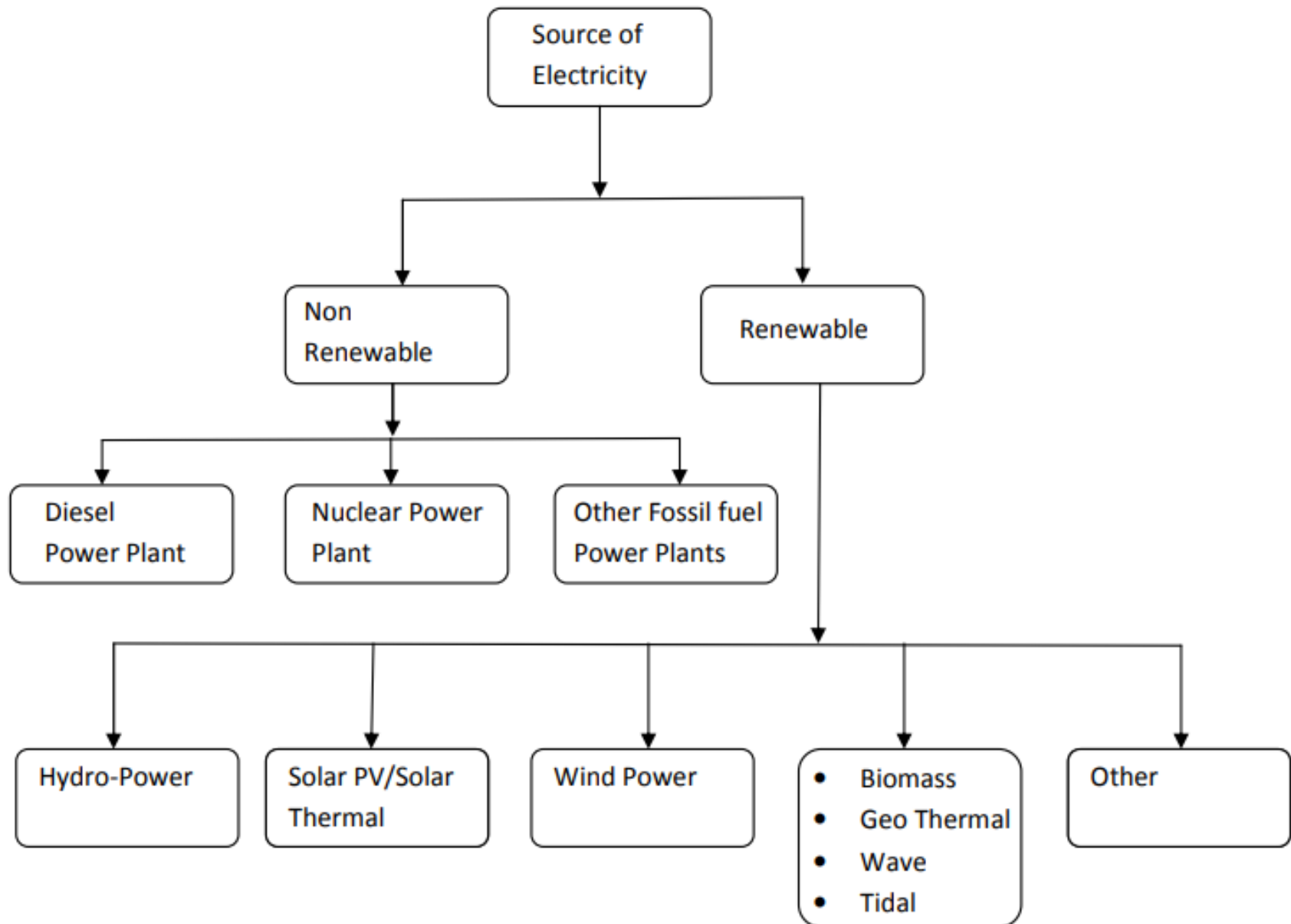
Less dependence on non – renewable sources of energy like; petroleum products, coal, natural gas

Simplified our daily activities with the use of different electrical appliances (heating- ACs, cooking- rice cookers, washing machines, boilers etc), devices (computers, laptops, electronic gadgets), equipment (grass cutter, boilers)

Locomotives: tramways, tempos, electric cars and buses

Advancement in different sectors - sensitive equipment used in hospitals, in military purposes, easy and efficient teaching learning process, more research possibilities with the use of back up power

1.2 Energy sources and production

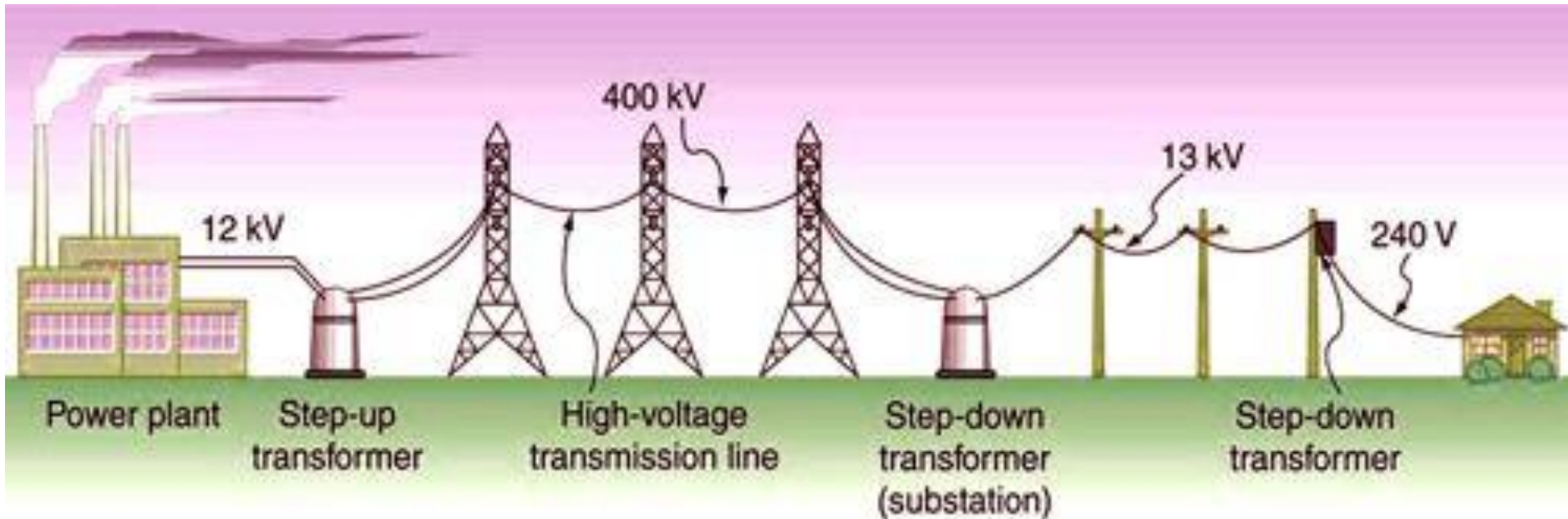


1.2 Energy sources and production

Electricity is energy that has been harnessed and refined from a wide range of sources and is suitable for diverse uses. Here are six common energy sources used to make electricity:

- **Chemical energy.** This is stored, or “potential,” energy. Releasing chemical energy from in carbon-based fuels generally requires combustion – for example the burning of coal, oil, natural gas, or a biomass such as wood.
- **Thermal energy.** Typical sources of thermal energy are heat from underground hot springs, combustion of fossil fuels and biomass (per above) or industrial processes.
- **Kinetic energy.** Kinetic energy is movement, which occurs when water moves with tides or flows downstream, or when air moves wind turbines in the wind.
- **Nuclear energy.** This is the energy stored in the bonds inside atoms and molecules. When nuclear energy is released, it can emit radioactivity and heat (thermal energy) as well.
- **Rotational energy.** This is the energy of spinning, typically produced by mechanical devices such as flywheels.
- **Solar energy.** Energy radiates from the sun and the light rays can be captured with photovoltaic and semiconductors. Mirrors can be used to concentrate the power, and the sun’s heat is also a thermal source.

1.3 Generation, transmission and distribution of electrical energy



Generation

Transmission

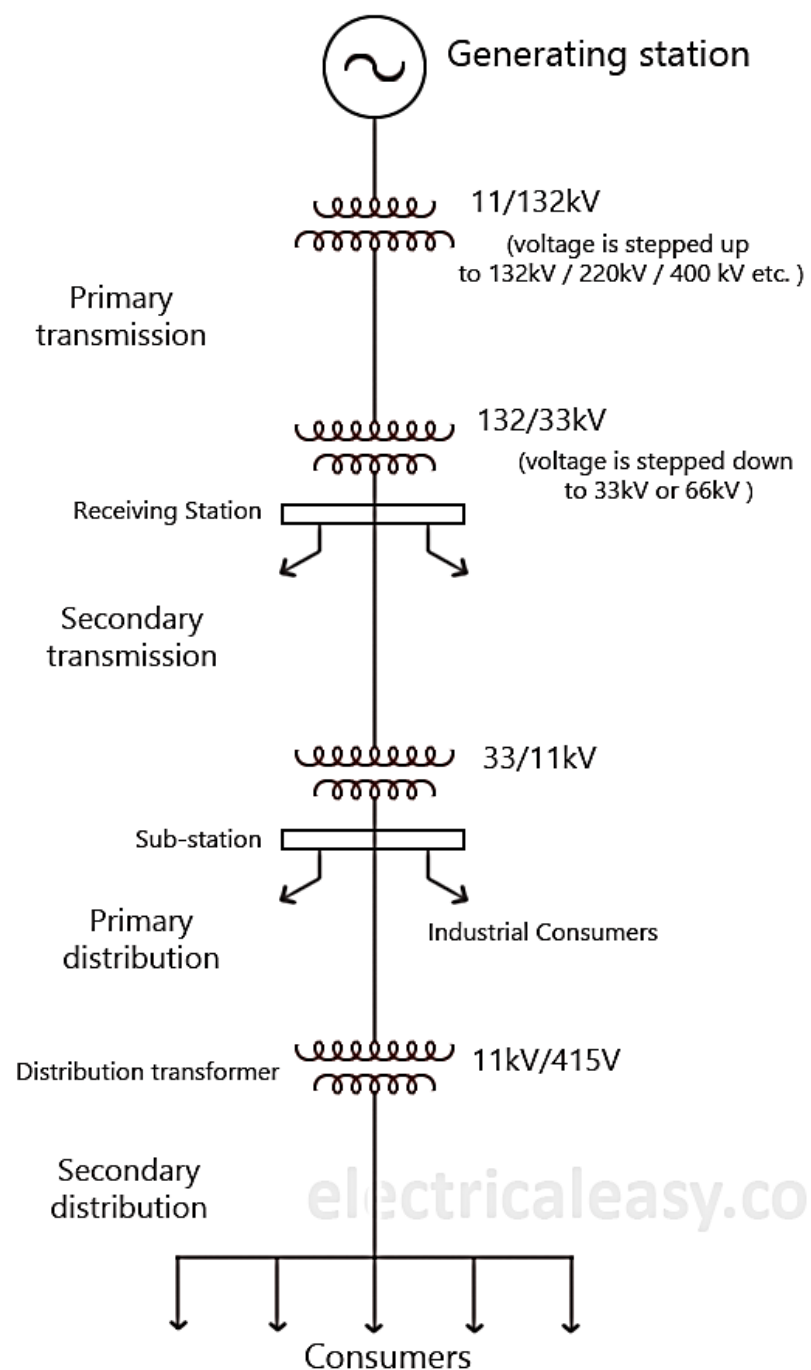
Distribution

Utilization

Generation

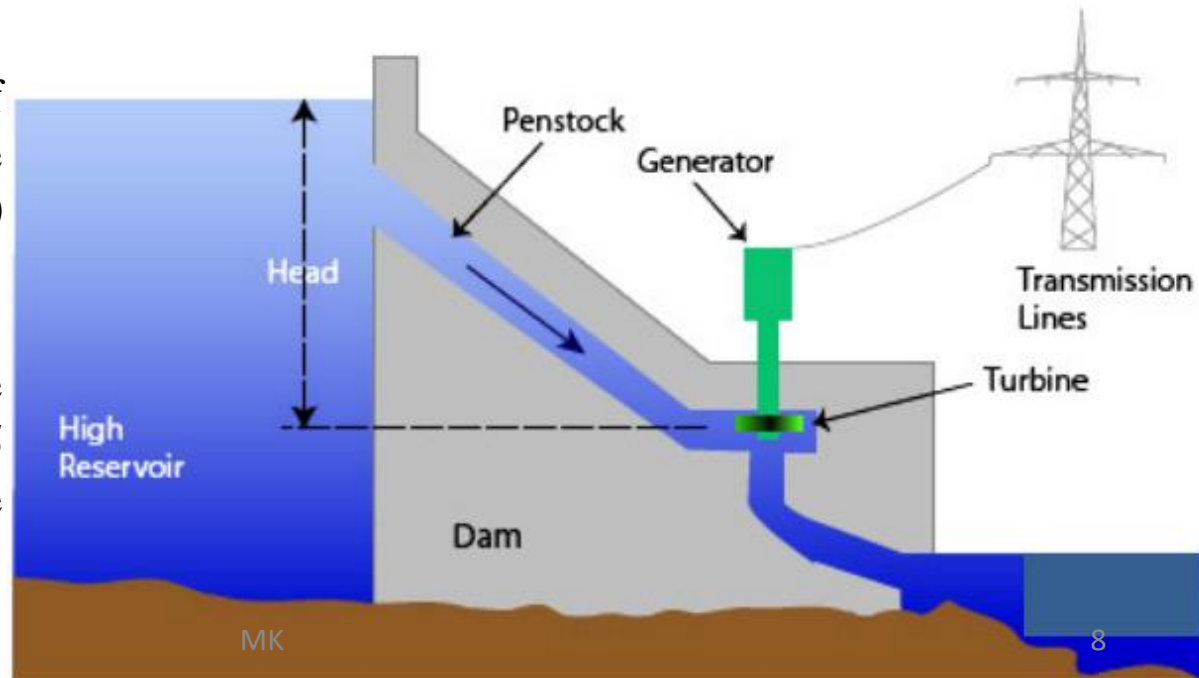
Transmission

Distribution



Generation

- Electricity is generated by different methods:
 - Hydropower
 - Solar
 - Wind
 - other sources: diesel generator
- Generally, generated far away from the load center where there is enough of energy available.
- Generation normally occurs at large quantity.
- Generation is normally one time investment project, that receives revenue on long run, lifetime is many years.
- Frequency:** The standard of the frequency shall be maintained as 50 cycles per second (50 hertz).
- The fluctuation shall not be allowed more than **2.5 percent** in the frequency standard.



Transmission

- Generally power station are very long distance from load center or consumer so electricity generated is required to transferred from generation station to different load centers via Transmission line.
- To reduce the transmission line loss voltage of transmission line is kept very high which may be 132kV, 320kV or more.
- Generated voltage is raised up to transmission voltage level by using step-up transformer at generation substation.
- Then it is transmitted to different parts of the country via transmission towers and lines.
- There are also some substations which interconnects different transmission lines .
- Interconnected network of transmission line is also known as grid.
- **High Voltage Transmission System:** The standard of the voltage in the high voltage transmission system shall be transmitted as follows:-
 - 33,000 V,
 - 66,000 V,
 - 1,32,000 V,
 - 2,20,000 V,
 - 4,00,000 V.
- The fluctuation shall not be allowed for **more than ten percent** in standard volt.

Distribution

- Near the load center, at distribution substation the transmitted voltage is reduced to Primary Distribution voltages 11kV, 33kV or 66kV via step down transformer from which electricity for large industrial consumer can be supplied.
- A number branches of primary distribution supply starts from distribution substation and which is known as feeders.
- From feeders, voltage is further reduced to 220V/380V via pole mounted distribution transformer to supply small industrial, commercial as well as domestic Consumer.
- **High Voltage Distribution System:** The standard of the voltage in the high voltage distribution system, the standard of distribution system shall be maintained as follows:
 - 3,300 V,
 - 6,600 V,
 - 11,000 V,
 - 22,000 V,
 - 33,000 V.
- The fluctuation shall not be allowed for more than **five percent** in standard volt.

Utilization

- Electricity is supplied to different consumers via connection lines through an Energy meter which is used to determine monthly electricity consumption of that consumer.
- **Utilization Voltage level:**
 - **230 volt in A.C. single phase** for general consumers.
 - **400 volt in three - phases** for general consumers.
 - For those who want a **supply of electricity from four wires**, the electric service shall be made available in **230/ 400 V from AC three phases**.
 - The **fluctuation shall not be allowed for more than five percent** in standard volt.
- **Standard of the power factor:** The level of power factor of the electricity supplied to the consumer shall not be allowed **not less than 0.8 lagging & not more than one unit leadings**.
- **Domestic:** Electricity is used for mainly lighting, cooking, heating and cooling , cleaning, personal caring, computer and entertainment.
- **Commercial:** Lights, office equipment, computer and entertainment, heating and cooling, cooking, personal caring, lift, elevator etc.
- **Industrial Load:** Motors, lights, HVAC etc.

1.4 Consumption of electricity

- **Industrial sector:** to run different industries, factories
- **Commercial sector:** entertainment purpose, to supply the major events, to run hospitals, academic institutions, different banks, offices
- **Agricultural and irrigation sector:** for pumping, for food drying, refrigeration's of food, for irrigating lands.
- **Domestic sector:** lighting, cooking, supplying power to electrical appliances, space heating, to run electrical appliances etc.
- **Electric traction:** Electric vehicles, tramways, railways etc.
- **Street Lighting:** to light up the streets