BUILDINGS ELECTRICAL SERVICES

2'ND SEMESTER, 3'RD GRADE

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SYLLABUS

0601316 Building Electrical Services:

Electrical works and supply for buildings in general, General principles for electrical shocks protection, Earth system for building in general, Power and Lamps circuits, Protection system in electrical works in general, Conductive material, Insulated material, Electrical wiring, Testing completed installation, Lighting circuit, Two-way lamp-installation for stairs, Practical circuits: Electrical bell-installation, Electrical iron circuit installation, Hair driers circuit installation.

INTRODUCTION

Building services are the essential services provided in the buildings for improving functioning of the buildings in efficient manner for the desired use of the building. The electrical services such as lighting, acoustics and sound insulations, intercommunications, mechanical services such as air conditioning, ventilation, fire protection, elevators, escalators, as well as civil engineering services such as water supply, sanitary services, etc. have become most essential services for residential, industrial, high rise, hotels, motels, monumental buildings.

No building can be put into effective utilization without all these services.

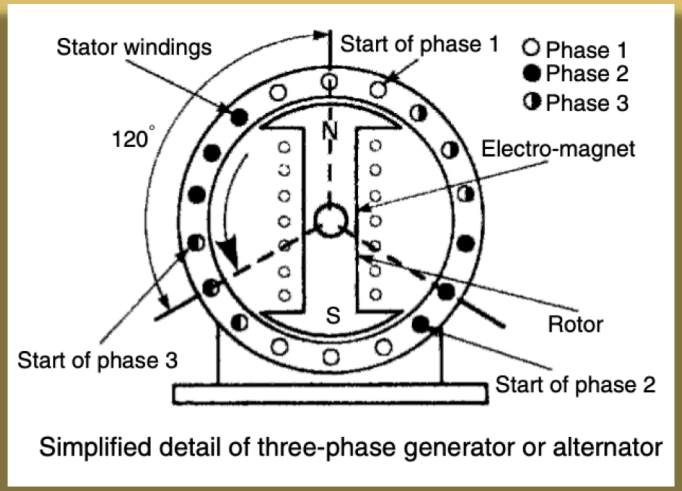
INTRODUCTION

Thomas Edison	Nikola Tesla	 
Direct Current	Alternating Current	 
Incandescent Light Bulb	Fluorescent Light Bulb	 

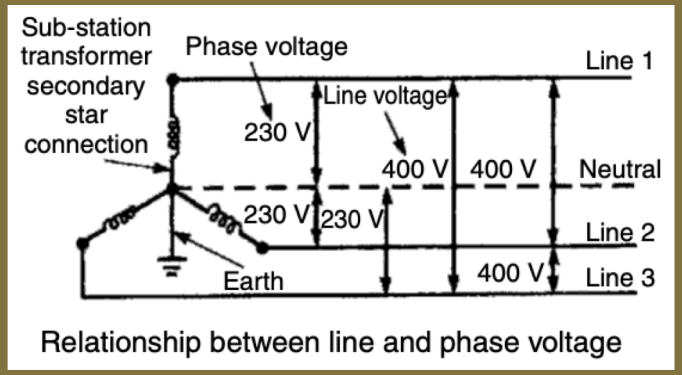
INTRODUCTION

- In 1831 Michael Faraday succeeded in producing electricity by plunging a bar magnet into a coil of wire.
- The first use of electric supply were established in 1882 by Thomas Edison, Thereafter there have been constant effort throughout the world to set-up power stations for more than one purposes.

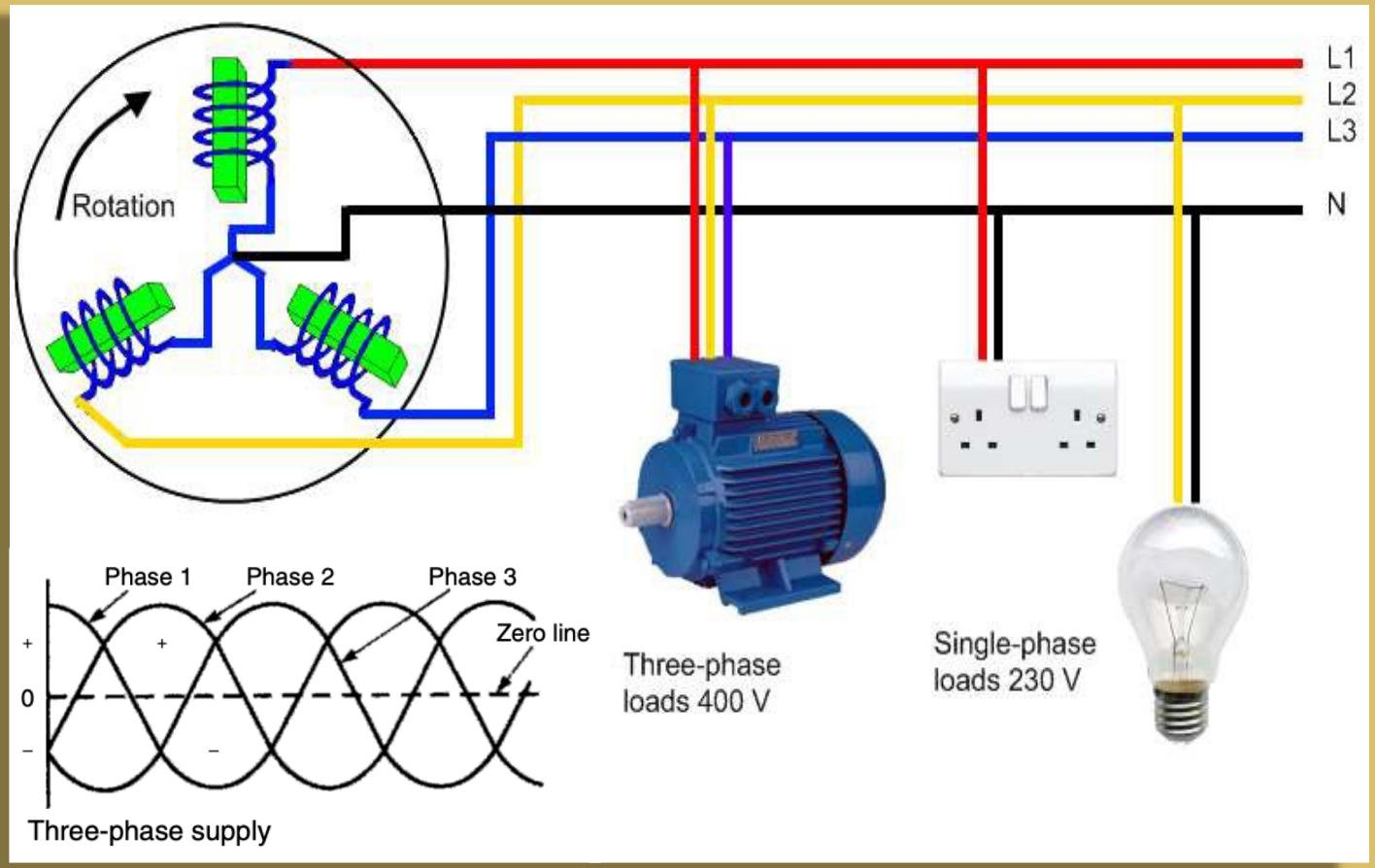
SINGLE AND THREE PHASES



Simplified detail of three-phase generator or alternator



Relationship between line and phase voltage

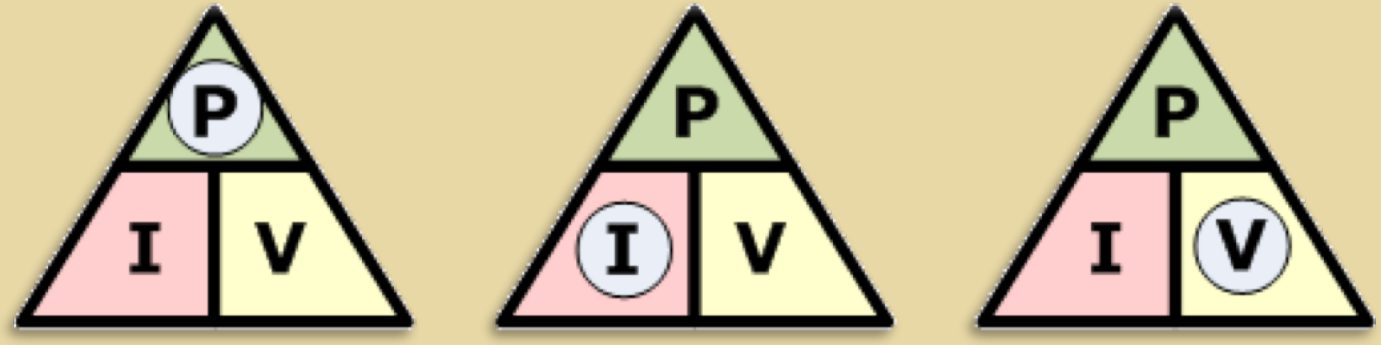


Three-phase supply

DOMESTIC SUPPLY

- Domestic electricity supply usually effected through distribution system and describe as single and three phases. Normally small buildings are supplied with electricity by two wires, one phase wire and the other neutral. This is known as single phase supply and gives a voltage for the premises of 240 volts. The loading of the supply wiring is balanced between the phases by using the phases in rotation so that each one services every third building.
- In three phases, four wire bring 420/ 240 volts, 50 cycle per second. The voltage between any two of the phases wires is 415 Volts. And between any phase wire and the neutral is 240 volts. The balancing of load is then achieved by serving different areas of the building by different phases. Large electric motors are usually designed for three phase operation.

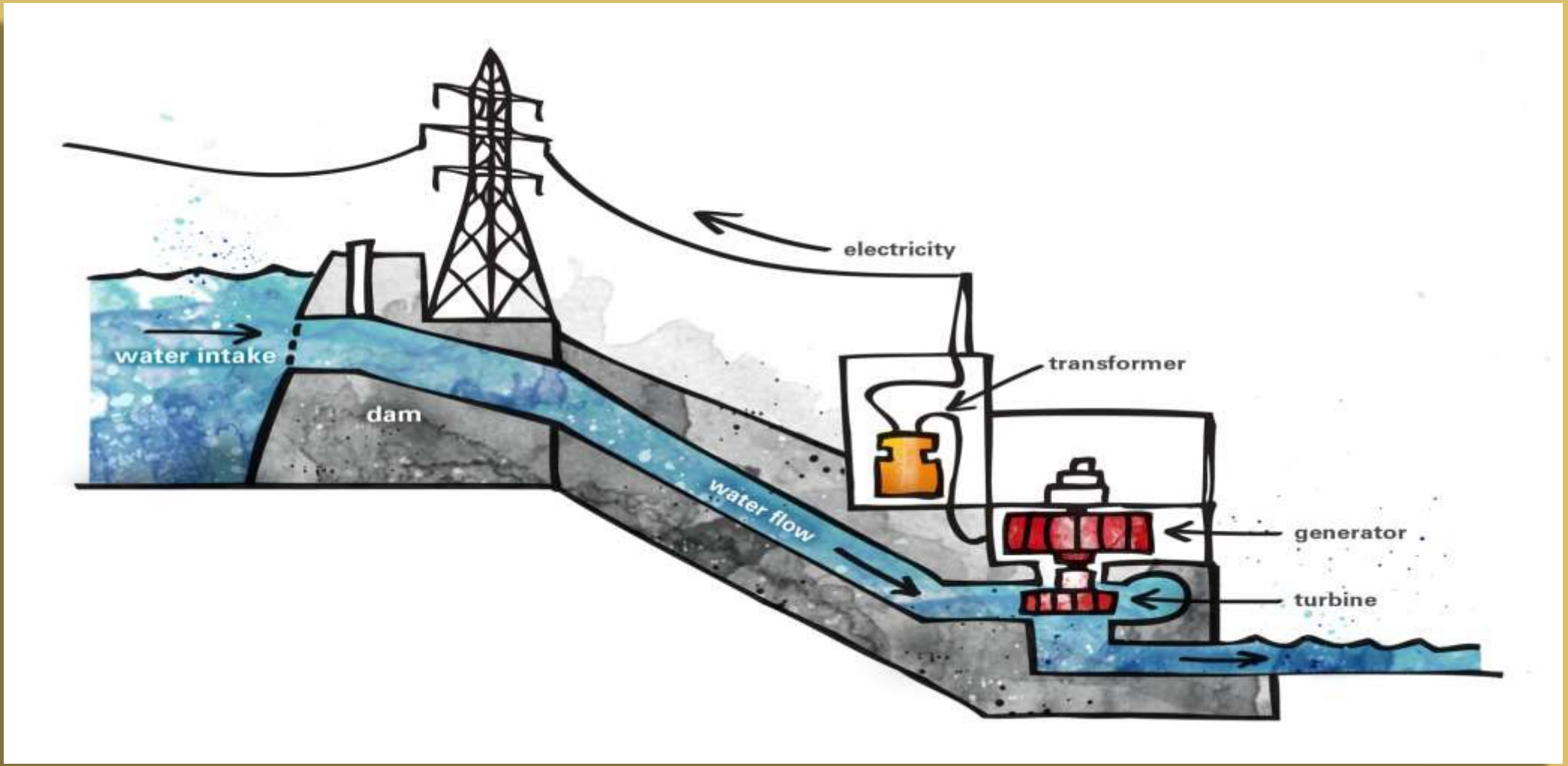
ELECTRICITY



$$P = I \times V \qquad I = \frac{P}{V} \qquad V = \frac{P}{I}$$

$$Losses = R \cdot I^2$$

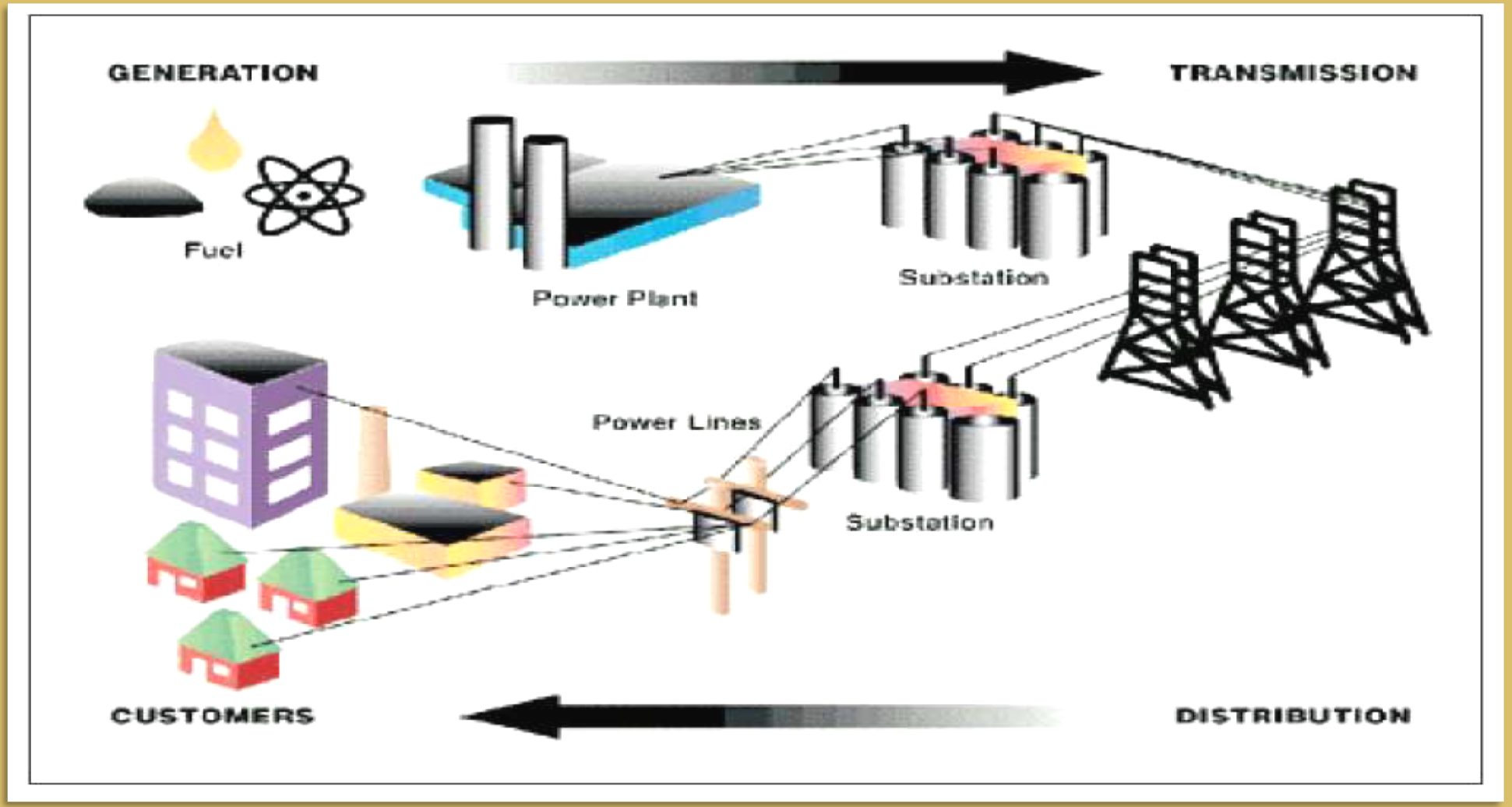
ELECTRIC GENERATOR



ELECTRIC GENERATOR

- Electricity is generated from the stored energy of water that makes turbine run and generate electricity. The other method includes fuels (Coal, diesel or gas) to fire boilers and pass stream and generate electricity through generators.
- Transformer step up several thousands or even hundreds of thousands of volts before it is supplied to the transmission lines or cables. By transmitting electricity at high voltages less power is lost in the cables. The voltage is stepped down by transforms at the receiving end in local sub-stations to consumers at 240 volts.

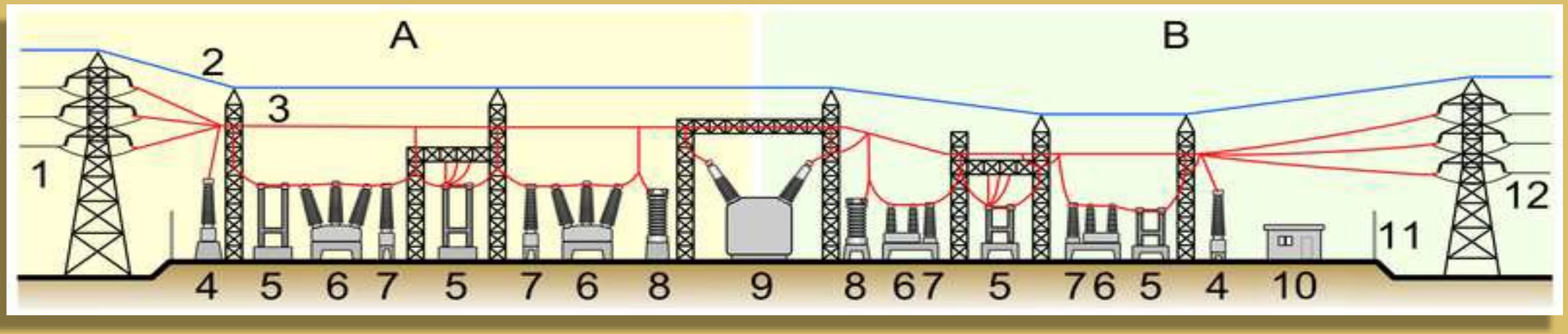
ELECTRIC DISTRIBUTION



SUB-STATION

- Substation is a part of an electrical generation, transmission, and distribution system, where voltage is transformed from high to low, or low to high, or many other important functions.
- Electric power may flow through several substations between generating plant and consumer, and may be changed in voltage in several steps.
- The requirements for a sub-station depend upon the number and size of transformers and switchgear.

SUB-STATION LAYOUT



A:Primary power lines' side

1. Primary power lines
2. Ground wire
3. Overhead lines
4. Transformer for voltage measurement
5. Disconnect switch
6. Circuit breaker
7. Current transformer
8. Lightning arrester

B: Secondary power lines' side

7. Current transformer
8. Lightning arrester
9. Main transformer
10. Control building
11. Security fence
12. Secondary power lines

TRANSFORMERS

- A transformer can accept energy at one voltage and deliver it at another voltage. This permits electrical energy to be generated at relatively low voltages and transmitted at high voltages and low currents, thus reducing line losses and voltage drop.

- A transformer is basically two electric windings, magnetically inter- linked by an iron core. An alternating electromotive force applied to one of the windings produces an electromagnetic induction corresponding to an electromotive force in the other winding.

TRANSFORMERS

LOCATION OF TRANSFORMER

- Location of the transformer is very important as far as distribution loss is concerned. Transformer receives HT voltage from the grid and steps it down to the required voltage.
- Transformers should be placed close to the load centre, considering other features like optimization needs for centralized control, operational flexibility etc. This will bring down the distribution loss in cables.

TYPES OF TRANSFORMERS

- Transformers are classified as two categories: power transformers and distribution transformers.
- Power transformers are used in transmission network of higher voltages, deployed for step-up and step down transformer application (400 kV, 200 kV, 110 kV, 66 kV, 33kV)
- Distribution transformers are used for lower voltage distribution networks as a means to end user connectivity. (11kV, 6.6 kV,3.3 kV, 440V, 230V)

ENTRY IN THE BUILDINGS

- In Urban areas electrical cables are usually underground and are brought up to entry point at ground level or into basement service. Cables cannot be bent to small radiee and this should be borne in mind when considering point of entry. In small buildings the cable run is kept as short as possible, terminating in a distribution board at the first convenient position. In these buildings the distribution board will be fitted with a seal box to prevent moisture from entering the insulation of the service cable, a main fuse for the premises in a box sealed by the supply authority and the consumer unit or other switch and fuse gear belonging to the building. The position chosen for the distribution board should be readily accessible both for meter reading and for replacing fuses. In some cases special glasses are provided so that meter can be read without entering the premises.

ENTRY IN THE BUILDINGS