SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

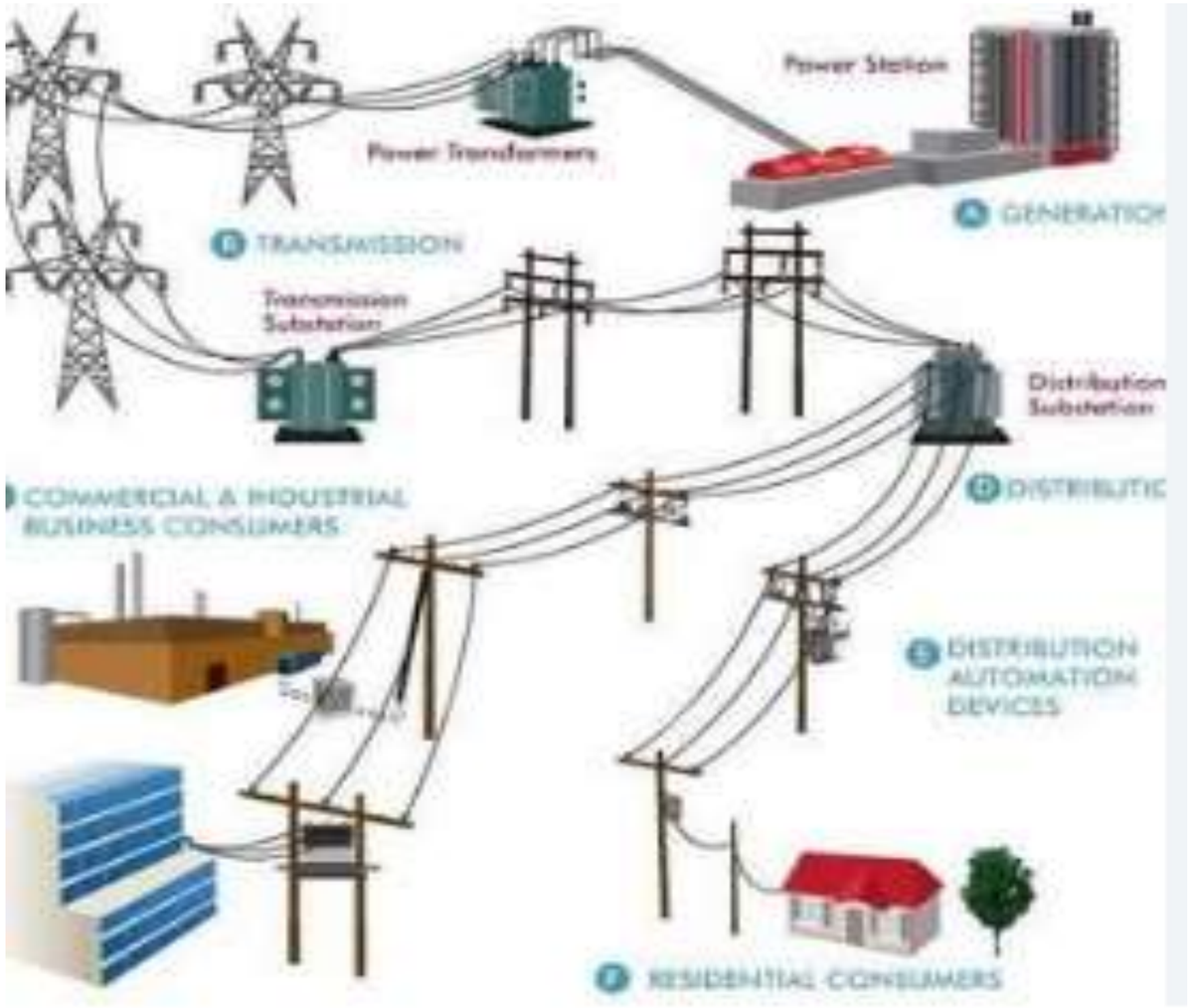
TRANSMISSION & DISTRIBUTION
UNIT 1 – STRUCTURE OF POWER SYSTEM

Applications

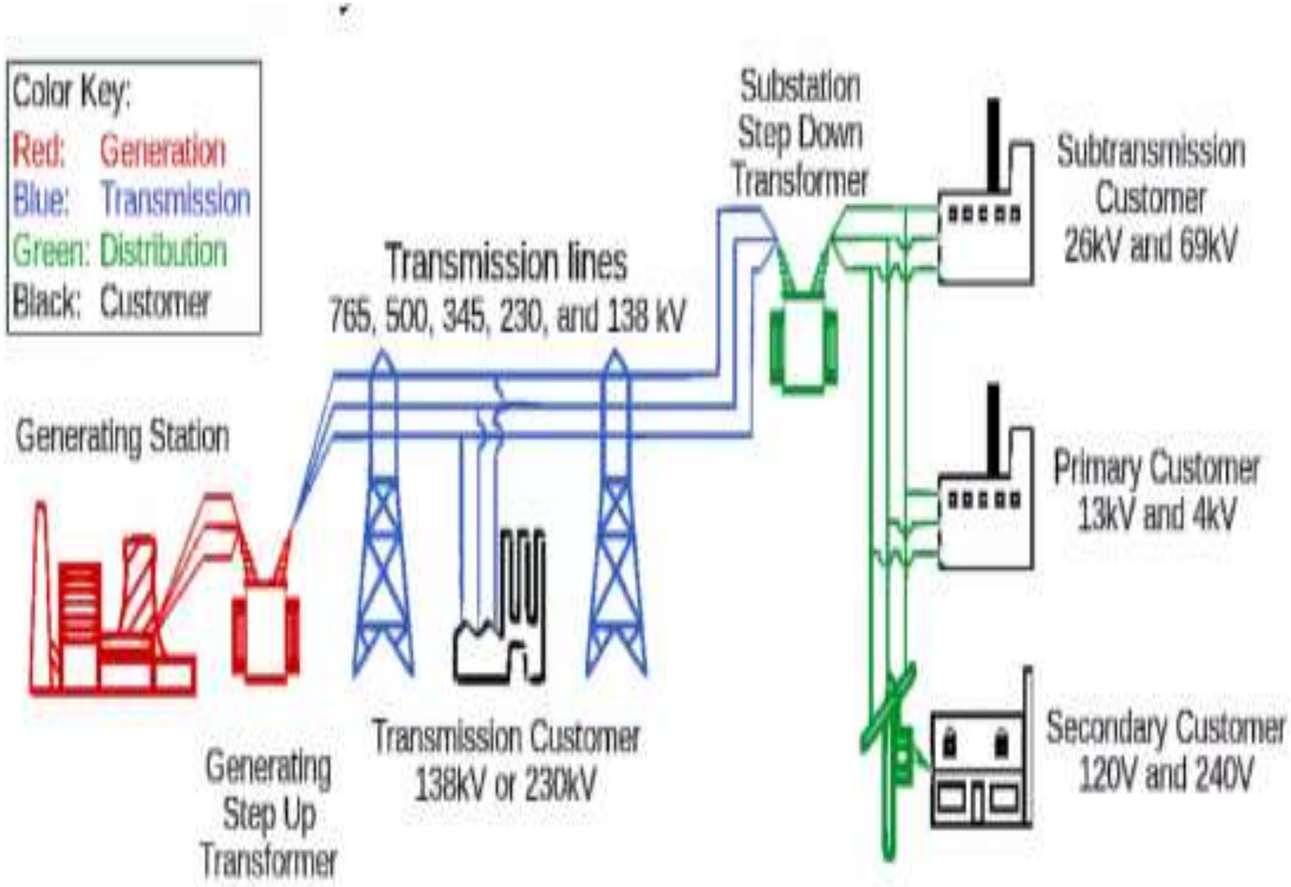
•Power transmission is the large scale movement of electricity at high voltage levels from a power plant to a substation.

•Whereas power distribution is the conversion of high voltage electricity at substations to lower voltages that can be distributed and used by private, public, and industrial customers.

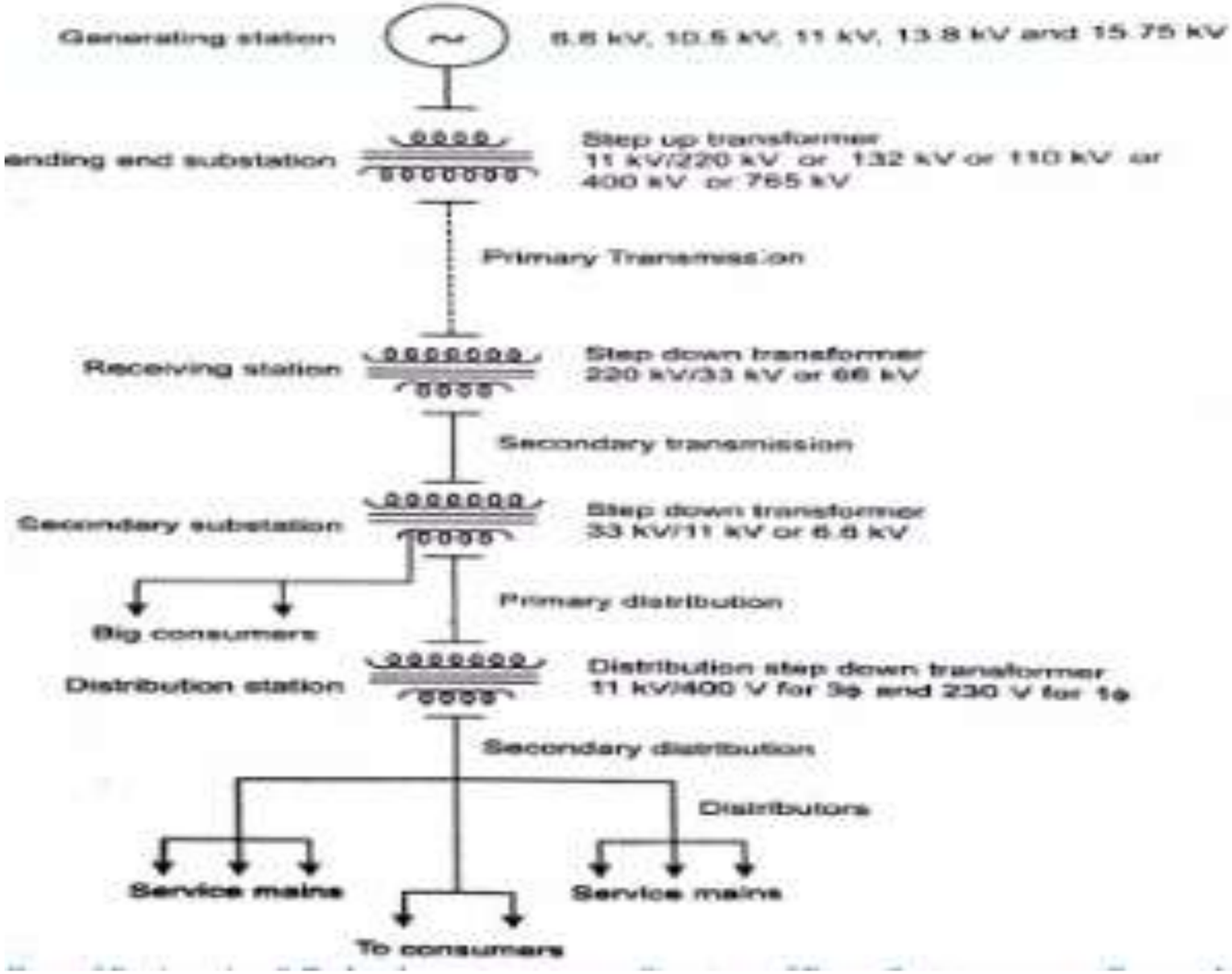
Structure of Power system



Structure of Power system



Single line diagram – Structure of Power System



Voltage Levels

Extra low voltage – below 70 V

Low voltage – upto 1000V

Medium Voltage – 1000V to 35 kV

High Voltage – 35 kV to 230 kV

Extra high voltage – above 230 kV

Ultra high voltage – above 800 kV

Types of Power System

- Two types of power transmission.

  Overhead transmission
  Underground transmission

Overhead transmission vs Underground transmission

Parameters	Overhead	Underground
System cost	Low	High
Safety	Less safe	More safe
Possibility of expansion	Easy	Difficult
Size of the conductor for the same capacity	Small	Large
Fault detection	Easy	Difficult
Suitability for long distance	Yes	No
Prominent line parameter	Inductance	Capacitance

Assessment

1. By Which of the following systems electric power may be transmitted?

a)Overhead system
b)Underground System
c)Both (a) and (b)
d)None of the above

Assessment

2. Which are the conductors , which connect the consumers terminals to the distribution.

a)Distributors
b)Service mains
c)Feeders
d)None of the above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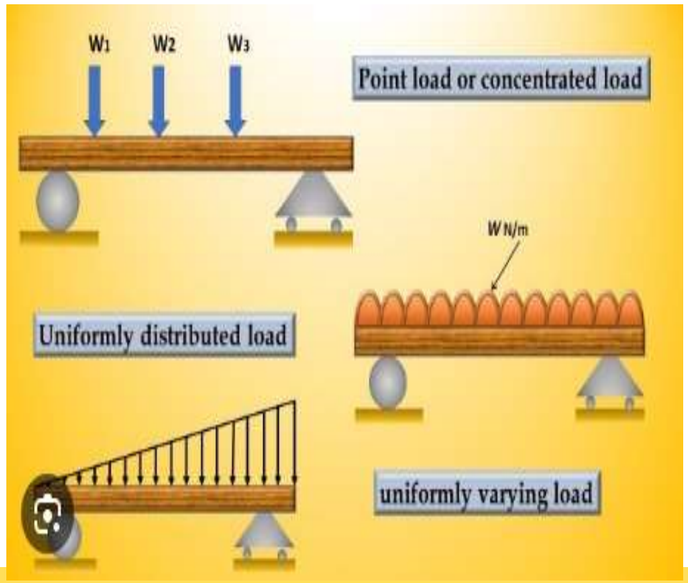
Concentrated and Distributed Loads

- The concentrated loads are those which act on particular points of the distributor.

- A distributed load is modeled when the loads on a line segment are uniformly distributed along the length of the segment.



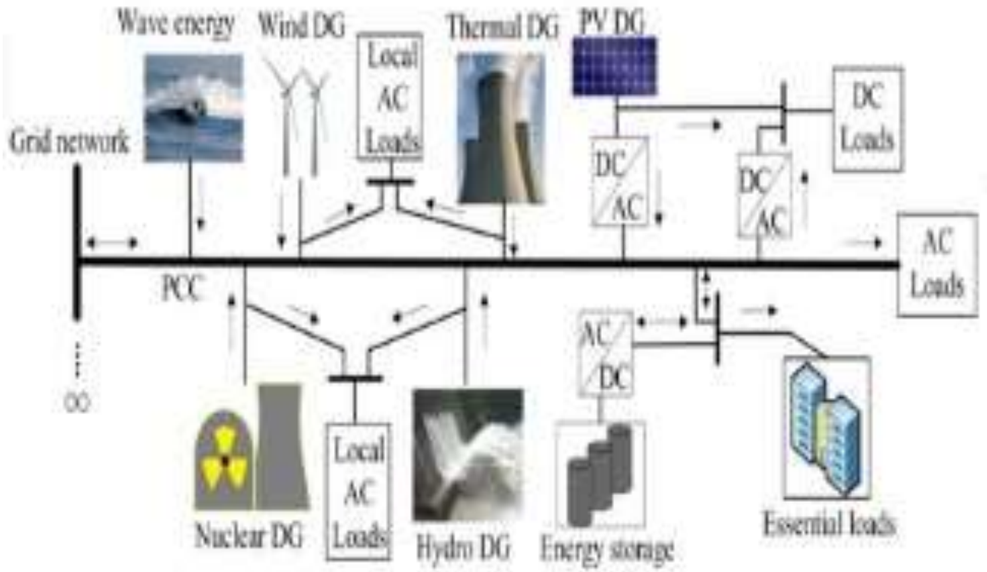
Voltage Tolerances

- As per IE rules the permissible variation of voltage at the consumer end is upto ±6%. In case of low or medium voltage i.e. upto 33 kV , the permissible variation of voltage is ±6% to ±9%.

- In case of high voltage supply i.e. more than 33 kV, the permissible variation of voltage is more than ±9%.

Interconnectors

- Connection between two or more individual systems that normally operates in synchronism.



Benefits of Interconnectors

- During peak loads any area can be fed from the other generating stations.
- Reserve power capacity reduces and efficiency increases.
- Gives continuity in supply
- Better reliability

Assesment

1. Interconnected power system is represented by

a)Electrical Network
b) Electrical Grid
c)Electrical system
d)None of the above

Assesment

2. Advantages of interconnected power system

a) Use of old plants
b)increase diversity factor
c)Reduce capital and operating cost
d)All the above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TRANSMISSION & DISTRIBUTION
UNIT 1 – STRUCTURE OF POWER SYSTEM
EHVAC & HVDC

EHVAC Transmission Lines

- The primary reason that power is transmitted at high voltages is to increase efficiency.
- As electricity is transmitted over long distances, there are inherent energy losses along the way.
- High voltage transmission minimizes the amount of power lost as electricity flows from one location to the next.

Advantages of EHVAC Transmission Lines

- Used to carry large amounts of power across long distances.
- Increase of Surge Impedance Loading.
- Higher voltage levels cause lower losses.
- Transmission efficiency is increased due to lower losses.
- Lesser conductor material is required at high voltages.

EHV AC Systems in India

400KV Line:

- Sultanpur – Lucknow line
- Kanpur – Moradnagar line
- Koradi – Katwa Line
- Srinagar – Jammu kashmir Line
- Obra – Kanpur Line

765 KV Line:

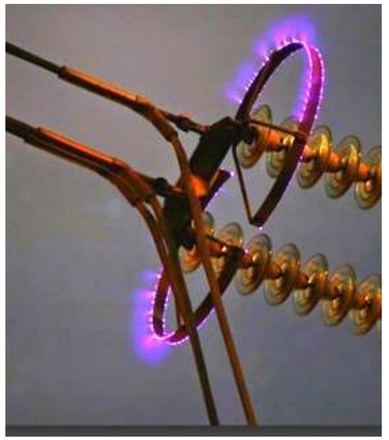
- Agra – Gwalior Line
- Pichor – Malanpur Line
- Vindhayachal – Bina - Nagda

Demerits of EHVAC

Corona loss and radio interference

The phenomenon of ionization of surrounding air around the conductor due to which luminous glow with hissing noise is rise is known as the corona effect.

The corona loss is greatly influenced by choice of transmission voltage. If weather conditions are not proper then this loss further increases. There is also interference in radio and TV which causes disturbance.



Demerits of EHVAC

Line supports

In order to protect the transmission line during storms and cyclones and to make it wind resistant, extra amount of metal is required in the tower which may increase the cost.

Erection difficulties

There are lot of problems that arise during the erection of EHV lines.

It requires high standard of workmanship.

The supporting structures are to be efficiently transported.

Demerits of EHVAC

Insulation needs

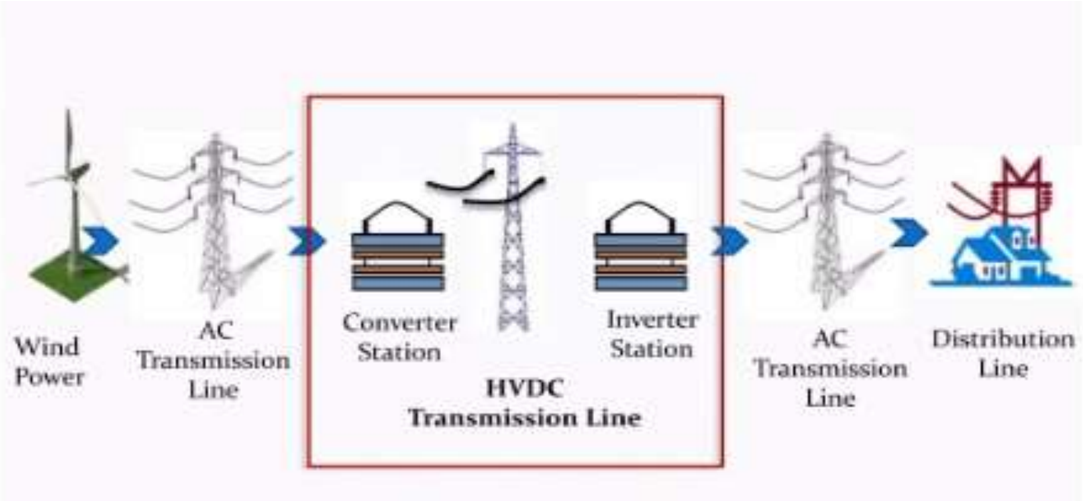
With increase in transmission voltage, insulation required for line conductors also increases which increases its cost.

The cost of transformers, switchgear equipment's and protective equipment's increases with increase in transmission line voltage.

The EHV lines generates electrostatic effects which are harmful to human beings and animals.

High Voltage Direct Current Transmission

A high-voltage direct current (HVDC) electric power transmission system uses direct current (DC) for electric power transmission, in contrast with the more common alternating current (AC) transmission systems.



Why DC Transmission?

- Losses are less compared to AC
- Only two conductors are required for DC with positive an negative polarities.
- DC overhead lines cables are less expensive.
- DC line are useful for long distance above 500km

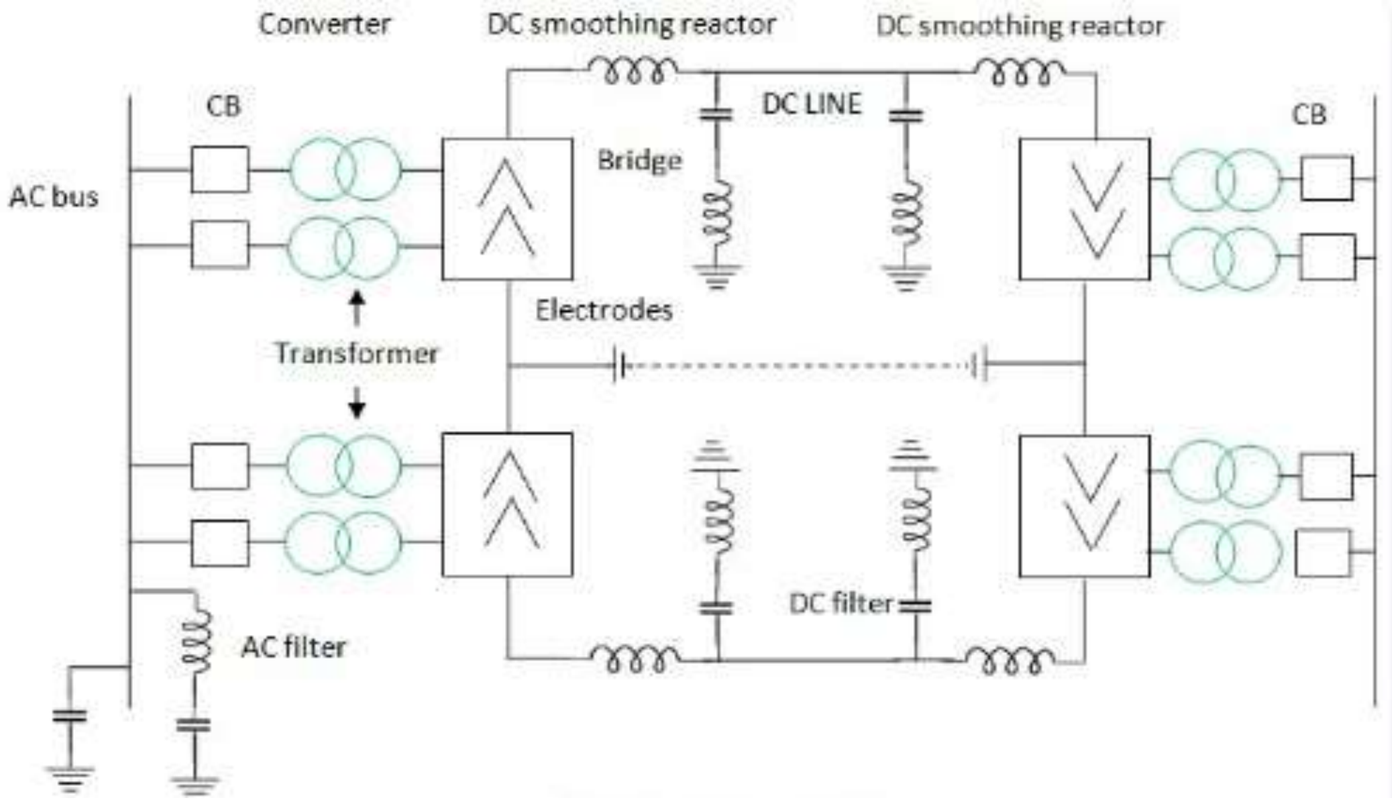
HVAC VS HVDC

HVDC Transmission System	HVAC Transmission System
Low losses.	Losses are high due to skin effect and corona.
Better Voltage regulation and Control ability.	Voltage regulation and Control ability is low.
Transmit more power over longer distance.	Transmit less power compared to HVDC system.
Less insulation is needed.	More insulation is required.
Reliability is high.	Low Reliability.
Asynchronous interconnection is possible.	Asynchronous interconnection is not possible.
Reduced line cost due to fewer conductors.	Line cost is high.
Towers are cheaper, simple and narrow.	Towers are bigger compared to HVDC.

Components of HVAC

1. Converters
2. Smoothening Reactors
3. Harmonic filters
4. DC Lines
5. Electrodes
6. AC Circuit Breakers

Components of HVDC

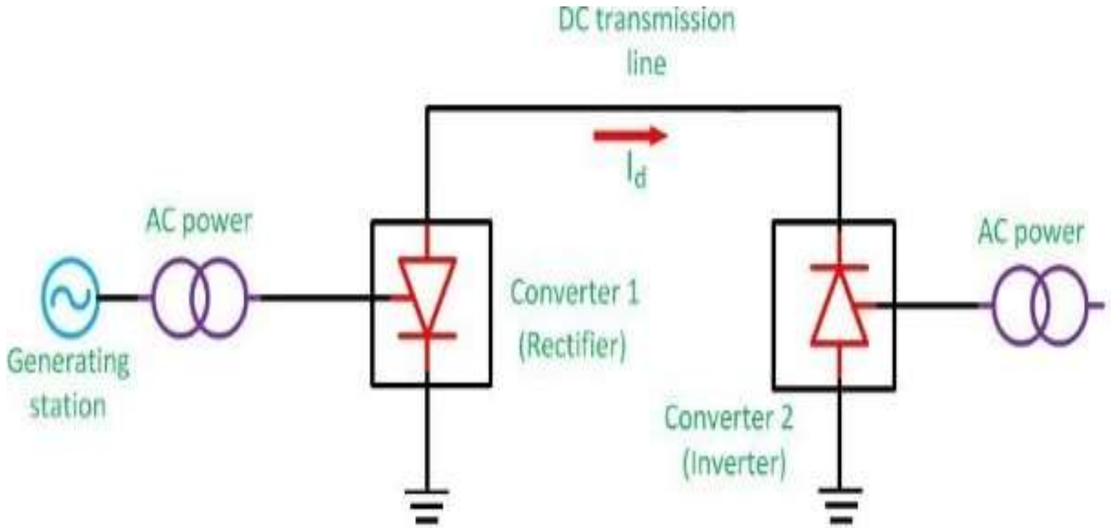


Types of HVDC systems

1. Monopolar Link
2. Bipolar Link
3. Homopolar Link
4. Two Terminal DC Link
5. Back –Back DC Link
6. Parallel connection of AC and DC Links
7. Multiterminal DC Link

Monopolar Link

- It uses only one conductor
- The return path is provided by ground
- Use of this system due to cost considerations
- Earth resistivity is to high



Bipolar Link

- Each terminal has two converters of equal rated voltage connected in series on DC side.
- The junction between converters are grounded.
- If one pole is isolated due to fault, the other pole can operate with ground and carry half of the rated load.