Sumedh

- **Electrical Supply System**

Generating stations are installed in areas, where power generation are availab.

The transmission of power done at hight voltages

The power received at load center distributed to constomers

The network divided in major parts

1. Power Generation :-

Elec power gen normally at 11 - 6.6 kV by generators in parallel.

Power generated at 11kV is stepped upto 110kV, 230kV 765kV or still higher with power transformer

2. Transmission system - AC

Power Generated is transmitted to higher V to main level centres

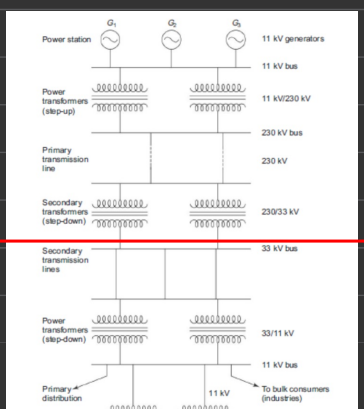
Divided into - primary and secondary transmission

11kV step ups to 230 kV

230kV step downed to 33

advantages :-

i) volume of conductor material req. low
ii) Power Trans ↑ curr ↓, volt ↓ ∴ line regulatin improved



3. Distributing System

Primary : 33KV stepped ↓ to 11KV
used by industries
distribution lines run along town / city / villages

Secondary : 11KV stepped ↓ to 416V
used by small consumers
distributed via service lins

Main Components of Transmission and distributing systems

i) Conductor → carry elec P tron one ploc to another

ii) Supports → Rcc / MS poles, keep conductors at height

iii) Cross arms → support conductors

iv) Insulator → insulate cond at high potential

- Overhead (OH) & Underground (UG)

Overhead	Underground
i) Hazardous as over ground	i) Better public safety
ii) Initial cost low	ii) 10 times more than OH
iii) Can be modified easily	iii) less flexible
iv) More chances in fault as in the atmosphere	iv) less fault chance
v) less life time	v) 2 times more lifetime
vi) More maintaince cost	vi) less
vii) More interference	vii) less compared

- **Transformation - AC**

Compared to AC

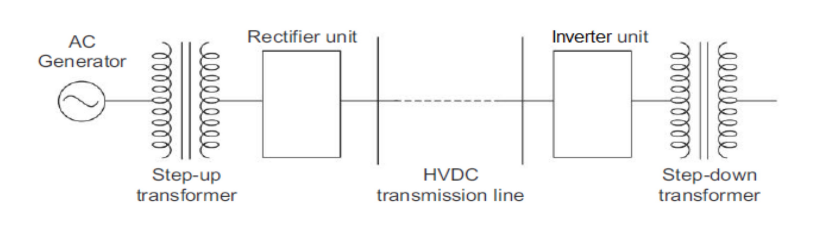
Advantages :-

i) less insulation req.
ii) tower size small
iii) stability improved
iv) Power factor = 1
v) skin effect, inc efficiency

disadvantages :-

i) No transformer for step ↑ ↓
ii) No power gen at high v

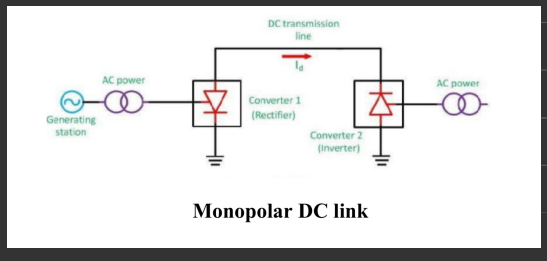
More economical for OH 600km line



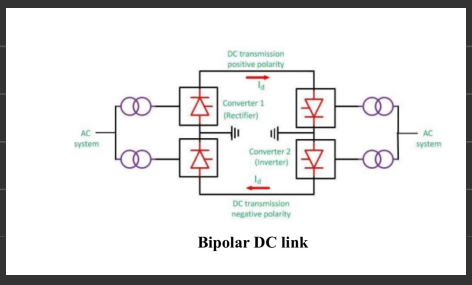
Types of DC links :-

1) Monopolar link : single conductor (-ve)
uses earth / sea path
2 convertors (1 rectify, 1 invert)
earthing electrodes abt 15 to 55km away

2) Bipolar link : 2 cond (+ve, -ve)
2 convertors
midpt of convo earthed
$V_{earth} = \frac{1}{2} V_{convo}$

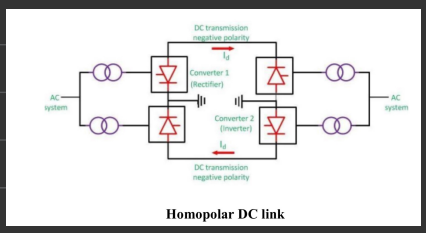


Monopolar DC link



Bipolar DC link

3) Homopolar link : 2 cond (same polarity, -ve)
metallic earth path return
2 convos
poles operated in ||
less insulation cost



Homopolar DC link

- **Equipment in a transformer Sub-station**

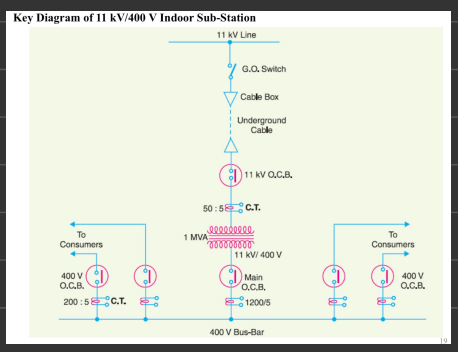
1. **Bus bars** :
   - Cu or Al bars
   - operate at const V
   - electrically connect no of lines operating at same V

2. **Insulators** :
   - Support the conductors
   - Confine the I to conductors
   - usually made of porcelain
   - eg post insulator for bus bar

3. **Isolating Switches** :
   - Used to disconnect a part of the system gen maintainance
   - Operate only when lines carry no current

4. **Circuit breaker** :
   - open / closes circuit under normal & fault conditions
   - operated manually under automatic fault
   - for fault, relay circuit used

5. **Power Transformer** :
   - used to step ↓ & ↑ V
   - Nowadays 3 phase trans used rather than 3-single phase



:
- Used to transfor Vs / Is in the power lines to values which are convinced
- Two types :-

i) Current Trans : Step ↑ trans that Step ↓ Current to known ratio

ii) Potential trans: Step ↓ trans that Step ↓ voltage to known ratio

7. Metering & Indicating instrument : • maintain watch over circuit quantities
• used w instrument trans for satisfactory operation

8. Miscellaneous : fuses - substation auxillary supplies carrier I equipment.

- Earthing

It is used to connect electrical equipment to earth, low R wire, bringin the potential of the body of the equipment to zero (earth's potential)

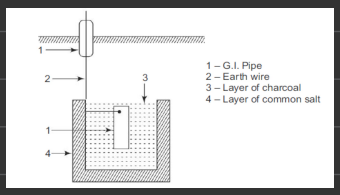
Ensures safe discharge of electrical energy, due to failure of insulation, line coming in contact, etc

Earthing means basically connecting to mass of earth

All metallic parts of every electrical insulation like switches, cables, motors, glares, regulators, etc are earthed using one continuous bus

More than one bus also introduced, no joints are permitted in a earth bus

Types of earthing



i) G.I Pipe Earthing

A Galavanised Iron pipe is used as an earth electrode.

(Size depends upon current to be carried & type of soil

ordinary soil : 2m
dry soil : 2.75m

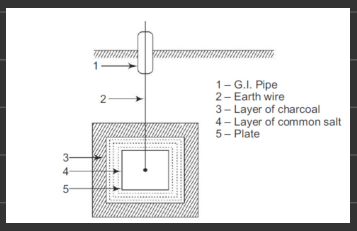
Buried to depth of not less than 2m in a moist plaa
Covered with a layer of charcoal & then common salt (as R↓))

ii) Plate Earthing

A coil / Cu plate is used as an earth electrode

Same dimensions, only 1/2 x thickness that plate

(same)



- **Solar Photovoltaic System**

A Solar cell is an electrical device that converts light energy to electrical energy

absorb solar radiation and convert it to elec. energy called photovoltaic effect.

Working :
i) Sunlight hits
ii) Photons absorbs by semicon mat
iii) releases e^- in same direction
iv) Current produced

* A large no. of solar cells are connected together are called modules / Panels

- **Fuel Cell Technologies**

Electrochemical energy conversion of chemical energy of hydrogen & oxygen into electricity & heat and produces water as byproduct

Working :
- Consists of cathode & anode
- seperated by electrolytic membrane
- organic fuel includes H_2, CH_4, C_2H_6, CH_3CH_2OH
- They combust & release energy in heat
- H_2O, CO_2 by products
- Redox reaction
- e^-s reach cathode by external path
- protons come thru membrane to cathode
- They combine oxygen

Advantages

i) does not req. charging
ii) More efficiency as only H_2 input with water heat elec output
iii) No air pollution
iv) Not Hazardous
v) No much part, ∴ noiseless

disadv

i) expensive
ii) difficult to store
iii) less durable
iv) less lifespan

Applications

i) widely used in transportation vehicles like buses, truck, etc
ii) Employed in material handling equipment
iii) power supply device in hospitals
iv) power rocket & space shuttle, as no toxic waste in envo.

- **Types of EVs**

i) BEVs (Battery electric vehicle)

- run on battery power w/o internal combustion engine assistance.
- run faster on single charge than hybrid vehicles

ii) HEVs (Hybrid Electric Vehicle)

- runs on internal combustion engine & ectronic motor
- Charge batteries via regenerative braking

Stores the KE used to stop the car and help internal combustion engine acc. the vehicle

iii) PHEV (Plug in hybrid EV)

- have both internal combustion engine & elec motor
- stores enough power to feed the elec. motor
- dec gas usage by 60%
- Travel upto 40 miles

EV Charge Station

- It is defined by the power they can produce & what speed they're capable of charge on ev

type

Slow charging : 3kw
Fast 7-22kw
Rapid 43-50kw