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# Internal Assessment: 1

# Brief Report

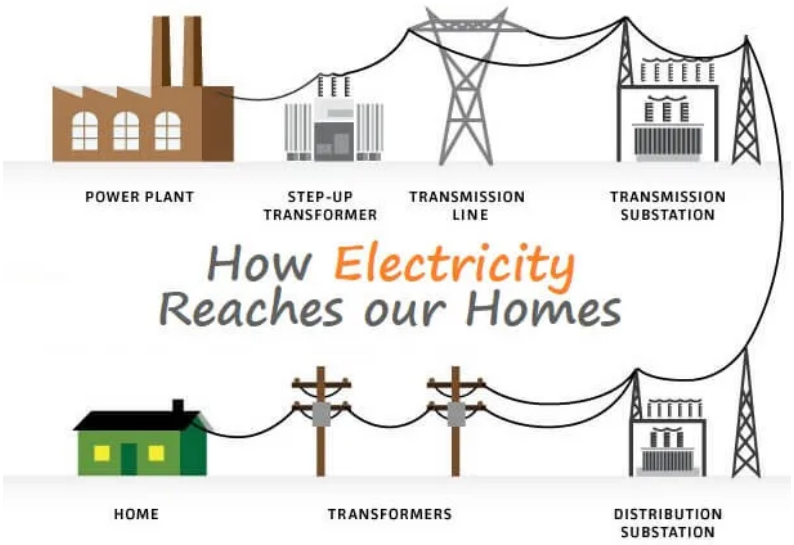
## 1. Electrical power Generation and distribution systems: List the Electrical power generation methods in India. Explain using block diagram how electricity reaches at your home from generating station. Explain in brief the stages of conversion of Voltages and role of transformer.

**The Electrical power generation methods in India are:-**

a. **Thermal power :-** Thermal power is derived from fossil fuels like coal . Coal is evidently one of the abundant fossil fuels in our country and is cheap source of energy.
b. **Hydro power:-** Hydropower uses turbines to derive power from free flowing water and water being a renewable source of energy is more easily available and thus this system is used in places at higher altitudes.
c. **Nuclear power:-** Nuclear power is one of the largest source of power generation and uses a series of nuclear reactions such as fission and fusion to produce power and energy.
d. **Biofuel:-** Biofuel is used in village areas where it is derived from biomass.
e. **Wind Power**;- It is an environmental friendly source of power which uses turbines to convert the wind energy to power and energy.
f. **Solar Power** ;- Solar Power is harnessed using photoelectric cells to convert radiant light and heat into clean power source of energy.
g. **GeoThermal Power** ;- It is derived from the heat generated in the core of the earth that is below the surface of the earth and is a clean source of energy.

**Electricity reaches our home by the following process:-** *[REFERENCE NO.1]* ***(refer fig1.)***

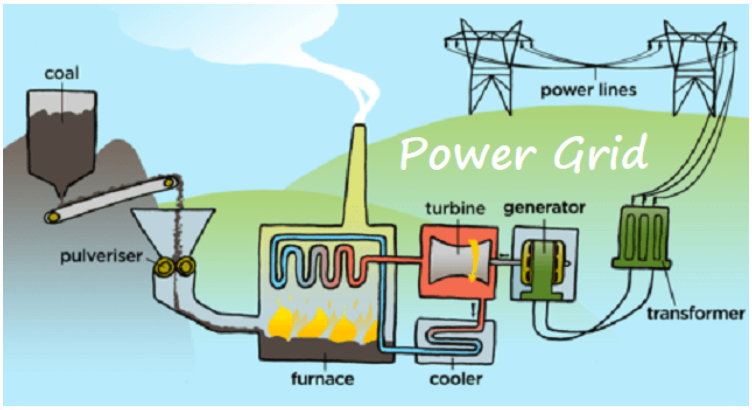
- Power Grid Station
- Transmitting Substation
- Transmission Network
- Receiver Substation
- Distribution Network
- Consumer (our home)




*(fig1. How electricity reaches our home)*

**1. Power Grid Station :-** ***(refer fig2)***

It starts life in a grid station, which is a huge plant located mostly near energy producing sources such as hydroelectricity dams, wind or solar farms and natural gas plants. Power plants use fuel as sources of energy from wind, coal, sun or even nuclear energy.This energy is then converted into electricity using equipment including boiler, furnace, turbine, cooling tower and generators. This electricity is then converted into high voltage and transferred to large substations with the help of overhead lines. This voltage can be as high as 25000 Volts or more.




*(fig2 Power Grid)*

**2. Substation *(refer fig3)***

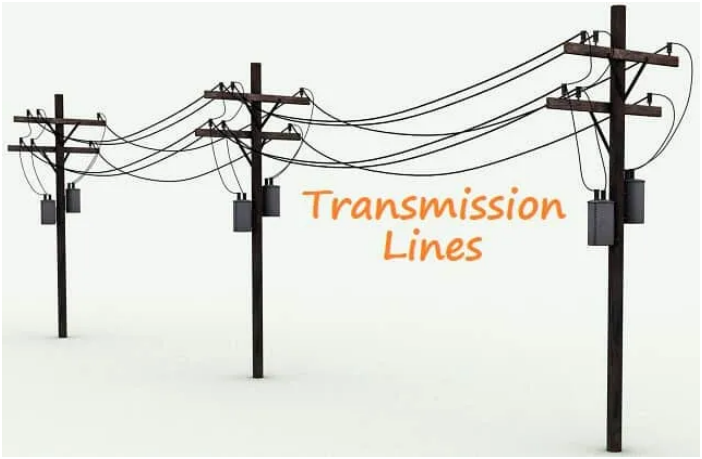
*Substations are an important part of the electricity transmission. Usually located near power grid stations, they increase the voltage even further, thus allowing it to be transmitted to longer distances while retaining power. This is done with the help of step-up transformers which can increase the voltage.When electricity passes through the first substationtransformer, it next goes to transmission network.*


(fig3 Substation)

**3. Transmission Network :- (*refer fig4*)**

A transmission network helps move electricity from power substations to a distribution network. It facilitates delivery of electricity to end users such as houses, offices and commercial areas. The voltage is still very high at this stage because electricity has to cover long distances before it reaches the end user. transmission network is made of overhead lines on metal pylon, or, lines

buried underground. These lines are insulated to keep them safe from giving electric shock in case they come in contact with a human, since they carry ultra-high voltages.




(*fig 4 Transmission lines*)

**4. Receiver Substation :- (*refer fig5*)**

Again, with the help of step-dowm transformer, electricity voltage is reduced to a safe and standard level. Voltage decrease is required during distribution to make it safe and less powerful before electricity enters households. At this stage, electricity leaves the transmission network and reaches the distribution network.Depending upon the location and usage, substation type and voltage can differ. For instance, industrial areas may require the voltage to be reduced to around 33,000 volts whereas urban areas with small factories may require voltage between 11,000 to 33,000 volts. Transformers distributing electricity to houses and buildings on the other hand will deliver voltage as low as 230 volts.

*(fig5 Substation*)

**5. Distribution Network**

From substation transformer, the electricity enters the distribution network lines to reach its final destination. These power lines could be underground or overhead in different areas. Once it reaches a neighborhood, it passes through another small street transformer to further reduce the voltage – thus ensuring its safety of use.

**6. Consumer (Home)**

As a last step, it passes through service drop and your meter records the electricity used by you. It gets divided into circuits for all areas of the house/ offices at the switchboard, and finally transmits through the wires inside your walls to power switches. Here is where you conveniently operate all your electrical appliances and lights.

## 2. List the possible electrical Hazards inside a home?? [*REFERENCE NO.2 ]*

**1.Faulty or Damaged Wiring :-**

Non-functioning wires or cables should be removed at once. Cables which are frayed, loose or have exposed wires should be attended to and replaced. Damaged wires and cables can cause electric shocks and fires.

**2.Overloading Circuits:-**

If too many devices are plugged into a circuit, the current will heat the wires to a very high temperature, which may cause a fire. If the wire insulation melts, arcing may occur and cause a fire in the area where the overload exists or even inside a wall.

**3.Use of Extension Cords :-**

Extension cords tend to develop cracks and other defects that can lead to shocks. And these problems cannot be covered with electrical tape. Better to be safe and position your electrical devices within reach of an electrical outlet rather than to use an extension cord.

***4.Water Spill on Electrical Devices :-***

No electrical equipment should be operated or even switched in case of contact with water. Water greatly increases the risk of electrocution especially if the equipment has damaged insulation. Switch off the main power connection, then unplug all the wet or damp equipment. Make sure you dry them out well. Have a certified electrician check the device to confirm it is no longer a danger and can be switched back on.

**5.Improper Grounding:-**

Every electrical equipment, appliance or device must be Earthed or grounded to obtain a low resistance path for dissipation of current into the earth. Ground fault current directly has an impact on human safety, can cause fires and electrical shock. Additionally, ungrounded electrical systems can be potentially hazardous to your electronics. This important safety feature takes the extra electricity away from your device, which can save your electronics from damages.

**6.Loose Fitting Plugs:-**

Plug for all electrical equipment's should be firmly fitted in its socket. Be aware that loose-fitting plugs can potentially cause equipment to overheat and catch fire. It may require periodic physical checks to ensure that the plug has not loosened. Be wary when cleaning of work location takes place and equipment is moved during cleaning, causing the plug to get loosen from the socket.

## 3. Electrical safety essentials: List and brief about Products for a safer home such as Circuit barkers, MCBs, Switch Fuse Unit (SFU, ELCB, MCCB).

**1.Circuit Breaker:-** *[REFERENCE NON 3]*

**(Refer fig 6)** A circuit breaker is a switching device that interrupts the abnormal or fault current. It is a mechanical device that disturbs the flow of high magnitude (fault) current and in additions performs the function of a switch. The circuit breaker is mainly designed for closing or opening of an electrical circuit, thus protects the electrical system from damage.


*(fig 6. Circuit Breaker)*

**2.MCB(Miniature circuit Breaker) :-** *[REFERENCE NO. 4]*

***(refer fig7)***

A **Miniature Circuit Breaker** (**MCB**) is an automatically operated electrical switch used to protect low voltage electrical circuits from damage caused by excess current from an overload or short circuit. MCBs are typically rated up to a current up to 125 A, do not have adjustable trip characteristics, and can be thermal or thermal-magnetic in operation.he operating mechanism of a miniature circuit breaker provides the means of manual opening and closing operation

miniature circuit breaker. It has three-positions “ON,” “OFF,” and “TRIPPED”. The external switching latch can be in the “TRIPPED” position if the MCB is tripped due to over-current.

When manually switch off the MCB, the switching latch will be in the “OFF” position. In the closed condition of an MCB, the switch is positioned at “ON”. By observing the positions of the switching latch one can determine the condition of MCB whether it is closed, tripped or manually switched off.


*(fig 7. MCB)*

**3. Switch Fuse Unit (SFU):-***[REFERENCE NO.5]*

Switch fuse unit is compact combination, generally metal enclosed of a switch and a fuse.It is very widely used for low and medium voltages.The ratings of switch fuse units are in the range of 30,60,100,200, 400, 600 and 800 amperes.Switch fuse units are available as 3 pole and 4 pole units.They are developed for making capacities upto 46 kA.They can safely break, depending upon ratings, currents of the order of 3 times the load current.Switch fuse units can be installed on metal-clad switchgear.

**4. ELCB(Earth Leakage Circuit breaker):-** *[REFERENCE NO. 6]*

**(refer fig 8)**

An Earth-leakage circuit breaker (ELCB) is a safety device used in electrical installations with high earth impedance to prevent shock. It detects small stray voltages on the metal enclosures of electrical equipment and interrupts the circuit if the voltage level exceeds danger threshold.An ELCB is a specialised type of latching relay that has a building's incoming mains power connected through its switching contacts so that the ELCB disconnects the power in an earth leakage (unsafe) condition. The ELCB detects fault currents from live (hot) to the earth (ground) wire within the installation it protects. If high voltage appears across the ELCB's sense coil, it will switch off the power, and remain off until manually reset. Thus, protecting the electrical system in the buildinG.

*(fig 8. ELCB)*

**5.MCCB(Moulded Case Circuit Breaker):-***[REFERENCE NO.7]*

**(refer fig 9)**

A moulded case circuit breaker (MCCB) is a type of electrical protection device that is used to protect the electrical circuit from excessive current, which can cause overload or short circuit. With a current rating of up to 2500A, MCCBs can be used for a wide range of voltages and

frequencies with adjustable trip settings. These breakers are used instead of miniature circuit breakers (MCBs) in large scale PV systems for system isolation and protection purposes.


*(fig 9 MCCB)*

## 4. What are Types of Wires and Cables used for electricity distribution?

*[REFERENCE NO.8]*

An electrical wire is a type of conductor, which is a material that conducts electricity. In the case of household wiring, the conductor itself is usually copper or aluminum and is either a solid metal conductor or stranded wire. Most wires in a home are insulated, meaning they are wrapped in a nonconductive plastic coating. One notable exception is ground wires, which are typically solid copper and are either insulated with green sheathing or uninsulated (bare).

**Types of Wires and Cables are as follows :-**

**NM Cable :-**

Often called “Romex” after one popular brand name, NM cable is a type of circuit wiring designed for interior use in dry locations. Most NM cables have a flattened tubular shape and run

invisibly through the walls and floor cavities of your home. Almost all of the wiring in outlets and light fixtures a modern home is NM cable

**UF C able :-**

Underground Feeder (UF) is a type of nonmetallic cable designed for wet locations and direct burial in the ground. It is commonly used for supplying outdoor fixtures, such as lampposts.UF contains insulated hot and neutral wires, plus a bare ground wire.UF cable is also used for major circuit wiring, and it carries a dangerous amount of voltage as long as the circuits are turned on.

**THHN/THWN Wires :-**

T: Thermoplastic

H: Heat-resistant; HH means highly heat-resistant

W: Rated for wet locations

N: Nylon-coated, for added protection

THHN and THWN are codes for the two most common types of insulated wire used inside the conduit, these wires are single conductors, each with its color-coded insulation. Instead of being protected by NM cable sheathing, these wires are protected by tubular metal or plastic conduit.

**Low Voltage wires :-**

Low-voltage wiring is used for circuits typically requiring 50 volts or less. Several common types are landscape lighting wire, sprinkler system connections, bell wire,speaker system wires, and thermostat wires. Wire sizes range from about 22 gauge to 12 gauge. Low-voltage wires typically are insulated and may be contained in cable sheathing or combined in twisted pairs, similar to lamp cord wire.

## 5. Importance of Earthing :-*[REFERENCE NO. 9]*

*(Refer fig 10)*

Earthing is defined as the discharge of electric current in the earth with the help of the wires or cables having low resistance.

Importance of Earthing are as follows :-

- Earthing keeps the humans safe from getting electric shock.
- Earthing protects the equipment form getting damage from the excessive flow of the current in the circuit.
- Earthing prevents the risk of the damage of the equipment from leakage current.
- in case of the electrical faults high voltage can pass through the circuit which can damage the electrical installation. If earthing is installed in the circuit the excessive voltage passes through the cables to the earth.
- The earthing provides the easiest path to the flow of the shortcircuit current even after the failure of the insulation.

(fig no. 10. earthing)

## 6. Explain in brief fluorescent, CFL, LED operations and typical power ratings. (refer figure 11)

**Fluorescent lights :-** *[REFERENCE NO. 10]*

Fluorescent lighting is a highly versatile type of lighting that you most likely encounter at various different places. It's known for energy efficiency compared to incandescent and halogen light bulbs, and a lower price compared to LEDs.Fluorescent lighting depends on a chemical reaction inside of a glass tube to create light. This chemical reaction involves gases and mercury vapor interacting, which produces an invisible UV light. That invisible UV light illuminates the phosphor powder coating the inside of the glass tube, emitting white "fluorescent" light.

*(fig 11 fluorescent light)*

**CFL(The compact fluorescent light):-** *[REFERENCE NO. 11]*

The compact fluorescent light bulb or lamp is a type of fluorescent lamp generally designed as a replacement for incandescent or halogen lamps. There are two major types of compact fluorescent lamp, screw-in and plug-in.

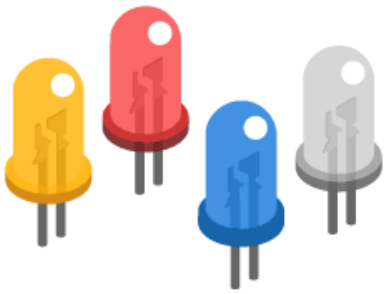
Screw in lamps are self-ballasted and can generally be placed in an existing screw socket without any additional equipment, plug-in bulbs require a ballast and a socket that corresponds to their

specific base configuration. These are also sometimes referred to as integrated (screw base) and non-integrated (plug base).

## LED (Light Emitting Diode):-*[REFERENCE NO.12]*

**(refer fig 12)**

**A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction When the diode is forward biased, the minority electrons are sent from p → n while the minority holes are sent from n → p. At the junction boundary, the concentration of minority carriers increases. The excess minority carriers at the junction recombine with the majority charges carriers.The energy is released in the form of photons on recombination. In standard diodes, the energy is released in the form of heat. But in light-emitting diodes, the energy is released in the form of photons**



*(fig 12 LED)*

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