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WHAT IS ELECTRICITY?

Electricity is a form of energy. Electricity is the flow of electrons. All matter is made up of atoms, and an atom has a centre, called a nucleus. The nucleus contains positively charged particles called protons and uncharged particles called neutrons. The nucleus of an atom is surrounded by negatively charged particles called electrons. The negative charge of an electron is equal to the positive charge of a proton, and the number of electrons in an atom is usually equal to the number of protons. When the balancing force between protons and electrons is upset by an outside force, an atom may gain or lose an electron. When electrons are "lost" from an atom, the free movement of these electrons constitutes an electric current.

HOW IS ELECTRICITY GENERATED?

Electricity generation is the process of generating electric power from sources of energy. The fundamental principles of electricity generation were discovered by the British scientist Michael Faraday. His basic method is still used today: electricity is generated by the movement of a loop of wire, or disc of copper between the poles of a magnet.

Electricity is most often generated at a power station by electromechanical generators, primarily driven by heat engines fueled by chemical combustion or nuclear fission but also by other means such as the kinetic energy of flowing water and wind. Other energy sources include solar photovoltaic and geothermal power.

Methods of generating electricity

- 1- **Steam turbines:** A turbine converts the kinetic energy of a moving fluid (liquid or gas) to mechanical energy. Steam turbines have a series of blades mounted on a shaft against which steam is forced, thus rotating the shaft connected to the generator. In a fossil-fuelled steam turbine, the fuel is burned in a furnace to heat water in a boiler to produce steam.
- 2- **Coal, petroleum (oil), and natural gas** are burned in large furnaces to heat water to make steam that in turn pushes on the blades of a turbine.
- 3- **Natural gas**, in addition to being burned to heat water for steam, can also be burned to produce hot combustion gases that pass directly through a turbine, spinning the blades of the turbine to generate electricity. Gas turbines are commonly used when electricity utility usage is in high demand.
- 4- **Petroleum** can also be used to make steam to turn a turbine. Residual fuel oil, a

product refined from crude oil, is often the petroleum product used in electric plants that use petroleum to make steam.

- 5- **Nuclear power** is a method in which steam is produced by heating water through a process called nuclear fission. In a nuclear power plant, a reactor contains a core of nuclear fuel, primarily enriched uranium. When atoms of uranium fuel are hit by neutrons they fission (split), releasing heat and more neutrons. Under controlled conditions, these other neutrons can strike more uranium atoms, splitting more atoms, and so on. Thereby, continuous fission can take place, forming a chain reaction releasing heat. The heat is used to turn water into steam that, in turn, spins a turbine that generates electricity.

OTHER GENERATING SOURCES

Solar power is derived from the energy of the sun. However, the sun's energy is not available full-time and it is widely scattered. The processes used to produce electricity using the sun's energy have historically been more expensive than using conventional fossil fuels.

Photovoltaic conversion generates electric power directly from the light of the sun in a photovoltaic (solar) cell. Solar-thermal electric generators use the radiant energy from the sun to produce steam to drive turbines. Less than 1% of the nation's electricity is based on solar power.

Wind power is derived from the conversion of the energy contained in wind into electricity. Wind power like the sun, is usually an expensive source of producing electricity, and is used for less than 1% of the nation's electricity. A wind turbine is similar to a typical wind mill.

Biomass (wood, municipal solid waste (garbage), and agricultural waste, such as corn cobs and wheat straw, are some other energy sources for producing electricity. These sources replace fossil fuels in the boiler. The combustion of wood and waste creates steam that is typically used in conventional steam-electric plants.

Transporting electricity

The electricity produced by a generator travels along cables to a transformer, which changes electricity from low voltage to high voltage. Electricity can be moved long distances more efficiently using high voltage. Transmission lines are used to carry the electricity to a substation. Substations have transformers that change the high voltage electricity into lower voltage electricity. From the substation, distribution lines carry the electricity to homes, offices and factories, which require low voltage electricity.