Electricity generation and electrical power engineering essay

Introduction

Electricity is the flow of electrical power or charge. It is a secondary energy source that can be produced from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources. The energy sources we use to make electricity can be renewable or non-renewable, but electricity itself is neither renewable nor non-renewable.

Electricity is a basic part of nature and it is one of our most widely used forms of energy. Many cities and towns were built alongside waterfalls (a primary source of mechanical energy) that turned water wheels to perform work. Before electricity generation began over 100 years ago, houses were lit with kerosene lamps, food was cooled in iceboxes, and rooms were warmed by wood-burning or coal-burning stoves. Beginning with Benjamin Franklin’s experiment with a kite one stormy night in Philadelphia, the principles of electricity gradually became understood. Thomas Edison helped change everyone’s life he perfected his invention the electric light bulb. Prior to 1879, direct current (DC) electricity had been used in arc lights for outdoor lighting. In the late-1800s, Nikola Tesla pioneered the generation, transmission, and use of alternating current (AC) electricity, which can be transmitted over much greater distances than direct current. Tesla’s inventions used electricity to bring indoor lighting to our homes and to power industrial machines. (Msn Encarta, http://encarta. msn. com/encyclopedia_761566543_9/Electricity. html#p93)

1- 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 center, 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. Electricity is a basic part of nature and it is one of our most widely used forms of energy. (Electric energy conversion and transmission).

2-Electric current

Electricity by definition is an electric current that is used as a power source . This electric current is generated in a power plant, and then sent out over a power grid to homes, and ultimately to the power outlets. An easier way to think of electric current is to picture cars going Through a Turnpike or Parkway Toll. The cars could represent electrons or charge, and the toll booth could represent the cross sectional area of the wire at a certain point. If you counted the number of cars or electrons, that passed through the toll booth or a certain cross sectional area of the wire, and divided that number by the time it took for those cars or charges to pass, you would get the current. (Msn, http://encarta. msn. com/encyclopedia_761587966/Current. html), (Electrical Wiring and Repair, 4)

a-The generation of electric current

An electric generator is a device for converting mechanical energy into electrical energy. The process is based on the relationship between magnetism and electricity. When a wire or any other electrically conductive material moves across a magnetic field, an electric current occurs in the wire. The large generators used by the electric utility industry have a stationary conductor. A magnet attached to the end of a rotating shaft is positioned inside a stationary conducting ring that is wrapped with a long, continuous piece of wire. When the magnet rotates, it induces a small electric current in each section of wire as it passes. Each section of wire constitutes a small, separate electric conductor. All the small currents of individual sections add up to one current of considerable size. This current is what is used for electric power. See figure (1). If a magnet and a conductor (copper wire) are placed, in a room together there will be no electric current generated. This is because motion, from our equation for electricity, is missing An electric current is not generated unless the magnetic field is moving relative to the copper wire, or the copper wire is moving relative to the magnetic field which is called motion. See figure (2). In September of 1831, Michael Faraday made the discovery of Electromagnetic Induction. Faraday attached two wires to a disc and rotated the disc between the opposing poles of a horseshoe magnet creating an electric current. See figure (3). (Msn Encarta, http://encarta. msn. com/encyclopedia_761589785/Alternator. html)

b-HOW TURBINES USED TO GENERATE ELECTRICITY

An electric utility power station uses a turbine, engine, water wheel, or other similar machine to drive an electric generator or a device that converts mechanical or chemical energy to electricity. Steam turbines, internal-combustion engines, gas combustion turbines, water turbines, and wind turbines are the most common methods to generate electricity.

Most of the electricity in the United States is produced in 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-fueled steam turbine, the fuel is burned in a furnace to heat water in a boiler to produce steam. Here is some example of fuel which is used in turbines:

A-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. Did you know that coal is the largest single primary source of energy used to generate electricity in the United States? In 1998, more than half (52%) of the county’s 3. 62 trillion kilowatt-hours of electricity used coal as its source of energy.

B-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. In 1998, 15% of the nation’s electricity was fueled by natural gas.

C-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. Petroleum was used to generate less than three percent (3%) of all electricity generated in U. S. electricity plants in 1998.

D-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. Nuclear power is used to generate 19% of all the country’s electricity.

E-Hydropower, the source for 9% of U. S. electricity generation, is a process in which flowing water is used to spin a turbine connected to a generator. There are two basic types of hydroelectric systems that produce electricity. In the first system, flowing water accumulates in reservoirs created by the use of dams. The water falls through a pipe called a penstock and applies pressure against the turbine blades to drive the generator to produce electricity. In the second system, called run-of-river, the force of the river current (rather than falling water) applies pressure to the turbine blades to

produce electricity. See figure (4). (Msn Encarta, http://encarta. msn. com/encyclopedia_761566999/Electric_Power_Systems. html#p4)

3- Simple electric generator

So simple electric generators found in power plants contain, magnets and copper wire that when put into motion relative to one another create the electric current that is sent out to homes. The major electricity generation problem in Is where does the Motion come from that keeps the copper wire and magnets moving relative to one another. In this case, wind power applies a force to the blades that turns them. The spinning blades spin an armature that turns the copper wire relative to the magnetic field. As long as the blades spin, electricity will be generated. See figure (5). (Msn Encarta, http://encarta. msn. com/encyclopedia_761574329/Electric_Motors_and_Generators. html)

4- How electricity is transmitted to houses and other places

Once the energy is generated, high-voltage transmission lines carry it to the ultimate consumer. To accomplish this, the energy’s voltage is raised to a level that is most efficient to transport large amounts of energy over long distances. Transmission lines are most often supported on poles (wood, cement or steel) along city streets. Together, the transmission lines and their support structures form a cross-country grid that serves as a superhighway for electrical energy.

“ Step-down” transformers located in distribution substations, and smaller distribution pole-type transformers reduce the high-voltage energy to a level at which it is safe and practical to connect the energy to homes and

businesses. Distribution lines carry lower-voltage electricity from substations to customer areas.

Near each customer’s home or business, the voltage is again reduced by means of a transformer located on a pole or, in the case of an underground area, a pad next to a street. This provides the customer with the right voltage to operate a given piece of equipment such as an air conditioner, an electric range or an electric light. Higher voltage is required for factories using a lot of power and/or high-tech equipment; lower voltage for homes using less power. Voltage is carefully measured to meet the customer’s needs.

Priority lines also connect directly to emergency services like hospitals, fire stations and police stations. See figure (5) At home, electric current that was generated by generators in the power plant is used to power the electric current, running through the copper wire causes the armature to spin which is how most motors generate motion electric appliances. (Electric power systems, 36)

Conclusion

Electricity has a great importance in our daily lives; most of us rarely stop to think what life would be like without electricity. Yet like air and water, we tend to take electricity for granted. Every day, we use electricity to do many jobs for us from lighting and heating/cooling our homes, to powering our televisions and computers. Electricity is a controllable and convenient form of energy used in the applications of heat, light and power