The History of Engineering Sciences

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Generation of Electricity

Introduction

- Electricity is produced at an electric power plant.
- Some fuel source, such as coal, oil, natural gas, or nuclear energy produces heat.
- The heat is used to boil water to create steam.
- The steam under high pressure is used to spin a turbine.
- The spinning turbine interacts with a system of magnets to produce electricity.
- •The electricity is transmitted as moving electrons through a series of wires to homes and business.

How dependable electricity reaches you

Figure (2.1) shows diagram for generation, transmission and distribution of electrical energy.



Fig.(1) Diagram for generation, transmission and distribution of electrical energy.

(a) <u>Power source</u>

•At a steam generating plant, the fuel (coal, nuclear or biomass) heats water to make steam and drive a turbine.

- In a combustion turbine, the fuel (gas or oil) is burned and the hot gas drives a turbine.
- •Wind hydro and solar are other forms of energy producers.



(b) High voltage transmission lines

•Transformers at the generating plant increase the voltage up to a transmission voltage (69 kV, 115 kV, 220 kV, 500 kV, 765 kV), so it can travel long distances over high voltage transmission lines.



Fig.(3) Transmission Towers.

(c) Step down auto-transformers

•Transformers reduce the electric energy down to a lower voltage making it suitable for high volume delivery over short distances.



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How electricity is generated through coal



Fig.(4) A coal power station.

How electricity is generated through gas



Fig.(5) A gas power station.

How electricity is generated through hydropower



Fig.(6) A hydroelectric power station.

How electricity is generated through nuclear power



Fig.(7) A nuclear power station.

(power lines)

How electricity is generated through nuclear power



Fig.(7) A nuclear power station.

(power lines)

Nuclear power unit

The main nuclear fuels are uranium and plutonium. In a nuclear power station nuclear fuel undergoes a controlled chain reaction in the reactor to produce heat.

- Nuclear to heat energy.
- Heat is used to change water into steam in the boiler.
- The steam drives the turbine (heat to kinetic energy).
- This drives the generator to produce electricity kinetic to electrical energy.



Fig.(8) A nuclear power unit.

Nuclear power unit

Advantages:-

Unlike fossil fuels, nuclear fuels do not produce carbon dioxide or sulphur dioxide. 1 kg of nuclear fuel produces millions of times more energy than 1 kg of coal.

Disadvantages:-

-Like fossil fuels, nuclear fuels are nonrenewable energy resources if there is an accident, large amounts of radioactive material could be released into the environment. Although modern reactor designs are extremely safe.

-Nuclear waste remains radioactive and is hazardous to health for thousands of years. It must be stored safely.

- This waste material can never be used to make a 'nuclear bomb' which is sometimes mooted as a negative aspect of nuclear power stations. It is the fission fragments from a nuclear chain reaction and not fissionable itself.

How electricity is generated through wind





2 Substation

3 Electricity transmission (power lines)



Consumer homes and businesses

