

## Generators

You flip a switch and there will be light. Flipping another switch, you then enjoy the cool breeze from the air-conditioner in a hot summer day. Do you know how the electricity for your lamps and air-conditioners is produced?

Electricity is usually produced by a machine called generator which converts mechanical energy into electrical energy. It works in the reverse of an electric motor which converts electrical energy into mechanical energy. The principle of both generator and motor operations is based on 'electro-magnetic induction' discovered by Michael Faraday in 1831. When an electrical conductor is moved in a magnetic field (e.g. the space between two poles of a magnet), a force will be produced to move the electric charges (the electric current) if the conductor forms a loop. In smaller generators, the magnetic field is from permanent magnets. For large generators, the permanent magnets are replaced by electro-magnets, that is, magnets produced by passing current through a coil called the 'field winding'.

The mechanical energy for moving the conductor can come from various sources such as by burning fossil fuels like coal, oil, gas, biomass or municipal waste; from a nuclear reactor; or renewable sources like water flow in river, wind, waves and tidal currents.

Generator is a very efficient machine. The efficiency of large generators in power stations is over 99%. However, even with this high efficiency, adequate cooling is essential to keep the generators running reliably. Small generators are cooled by air while large generators are cooled by hydrogen gas or water.

Generators are not only installed in power stations. Actually, there are many small generators around you. For example, most high-rise buildings, commercial or residential, have diesel generators for back up and fire services. Also, there is a small generator in every vehicle to charge up the battery.

[The Electrical Blog is contributed by the Electrical Division. If you would like to know more about this topic, please contact the Division Hon Secretary, Ir Geoffery L Chan at \[glchan@hec.com.hk\]\(mailto:glchan@hec.com.hk\)](#)