

EFFECTS OF ELECTRIC CURRENT

Electric circuits are used to carry energy from a power supply (e.g. a battery) to a consumer device (e.g. a light bulb). Depending on the consumer device, a variety of different energy conversions can take place. On the other hand, there are physical effects which allow converting most energy forms into electric energy.

The following list gives an overview of typical applications.

HEAT

The efficiency for the conversion electric – heat energy is almost 100 %.

Applications:

- Household appliances such as hot plate, oven, iron, ...
- Blow fuse
- Hot wire ammeter
- Peltier element

The *thermoelectric effect* can be used to directly convert a temperature difference into an electric potential difference. Thermal (e.g. nuclear, gas, geothermal, ...) power stations are indirect ways for the same transformation.

LIGHT

Types of electric light sources:

- Incandescent lamp ("light bulb"): efficiency 5 %
- Fluorescent lamp: efficiency 25 %
- Light emitting diode (LED): efficiency > 25 %

Light can be converted to electric energy with *photovoltaic cells* (efficiency 10 – 15 %).

MAGNETISM AND MOTION

The only efficient way to convert electric to mechanical energy is by using the current to produce a magnetic field (electromagnetism).

Applications:

- Relay
- Electric motor (efficiency > 90 %)

Mechanical energy can be used to produce electric energy in a *generator*, which is again based on magnetic effects.

CHEMICAL EFFECTS

In electrochemical processes, an electric current is used to cause a chemical reaction.

Examples:

- Hydrolysis
- Galvanisation

A *battery* is often used to convert chemical energy into electric potential energy.

PHYSIOLOGICAL EFFECTS

Our nerves use electric impulses to transfer signals to the muscles. As a consequence, a current flowing through our body can cause (unwanted) physiological effects. We can feel currents from about 1 mA (*sensing threshold*). Currents over some 20 mA can be very dangerous and lead to apnoea within minutes. Currents over 50 mA cause a sudden death.