

MODULE:

Energy and environment: Solar cells and wind turbine

DESCRIPTION OF EXERCISE:

Renewable energy sources are sources that are captured from permanent natural processes, whereby the capture does not exhaust the source. Furthermore, renewable energy sources are environmentally more acceptable, as they produce very few adverse effects on the environment and cause no harmful emissions in electricity generation.

Solar energy comes from the Sun in the form of solar radiation. Using photovoltaics or solar cells, solar energy may be transformed into electricity. In wind energy, electricity is generated with the help of wind and a wind turbine.

A solar cell converts solar energy into electricity. The sunlight falling on a solar cell causes the movement of electrons in the cell, thus generating direct current.

In wind energy, electricity is generated by wind, which turns a wind turbine, which in turn powers a generator that produces electricity. Windmills, however, have a few negative impacts, one of which is the noise they produce, which may also be disturbing for people, and they also pose a danger for birds.

The shear extraction of solar and wind energy is very cheap, as the force of the wind and the Sun's energy are free of charge. However, a relatively high initial investment is required to erect a solar or wind farm, while some costs should also be foreseen for maintenance. Both energy sources also have a few other weaknesses, particularly a relatively low utilisation rate and uncertainty (dependence on the Sun and wind or, rather, weather conditions).

Within the scope of the exercise, you will learn about solar cells and how to make a wind turbine using recycled computer parts.

MATERIAL:

- 1x solar cell
- dupont cables
- 1x buzzer
- a multimeter (for measuring voltage and current)

- 1x electric motor or recycled computer fan
- 1x diode
- a hair dryer to power the fan

The solar cell, electric motor and buzzer must have compliant voltage (e.g. 6V).

METHODS OF WORK:

1. SOLAR CELLS

The piezo buzzer is connected to the solar cell, which is exposed to bright or weak light. This changes the generated voltage and, consequently, the volume of buzzing. Voltage and current may also be measured with a multimeter.



Figure 1: Solar cell- front

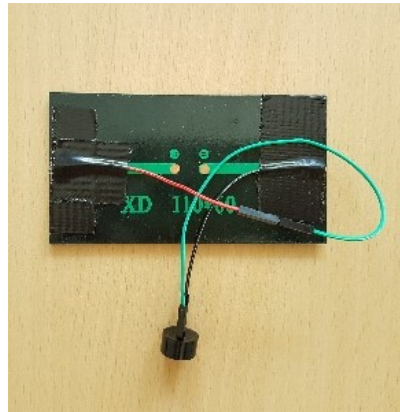


Figure 2: Solar cell- back

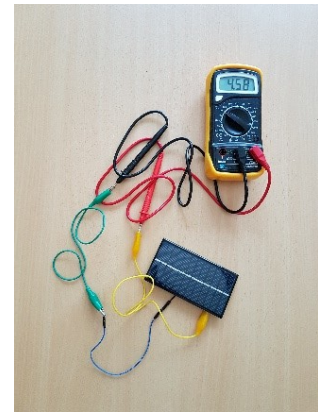


Figure 3: Voltage measurements with a multimeter

2. WIND TURBINE

In step 2, a generator is made from a recycled computer fan. When the fan rotates, it generates electric current that can be measured. The wind turbine is powered by a hair dryer, as it needs to rotate with sufficient speed to generate enough current.



Figure 4: Wind turbine



Figure 5: Voltage measurements with a multimeter

The generator can also be connected to a bulb or LED (LED should be properly connected - connect it to the voltage in the conductive direction, that means connecting the anode (the longest LED diode) to the positive pole, the cathode (marked on the edge of the diode with a notch) to a negative pole). In case the generator generates too high voltage, it is necessary to use the appropriate resistor.

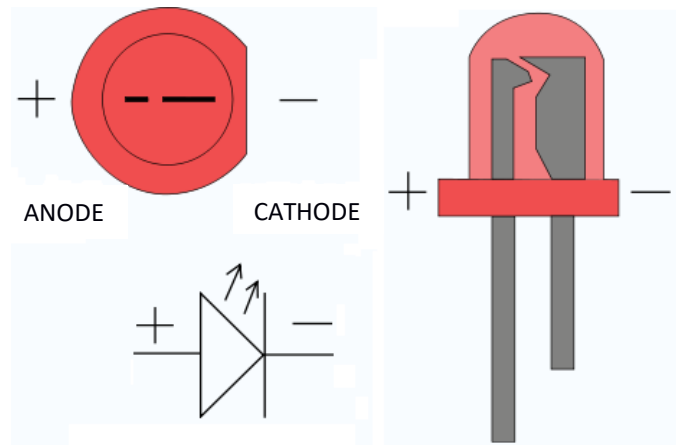


Figure 6: Wiring up LED

RESULTS:

You have learned about two new electricity sources, i.e. a solar cell and windmill, and about two new methods to generate electricity, i.e. electromagnetic induction and photovoltaics.

Please record the test results in the table.

Electricity source	Solar cell	Windmill
Methods to generate electricity		
Voltage (higher/lower)		

In photovoltaics, the more light that is received by a solar cell the more electricity is generated, which can be measured with a multimeter or is reflected in electricity users (louder buzzing, faster rotation of electric motor). During the conversion of the mechanical part into electricity, the electricity generated depends on the rotating speed of the windmill, which can be measured with a multimeter or is reflected in electricity users (louder buzzing).

REPORT:

Prepare a report on the use of renewable energy sources and their strengths and weaknesses.

TEST:

Additional exercises: using a solar cell, you may build a wind turbine for cooling with wind – the more sun there is the faster the wind turbine will cool.

EVALUATION OF THE PRACTICAL:

Knowledge for practical:			
Experimental exercise:			
Results and answers:			
Compliance with security rules:			
Review date:		Supervisor signature:	