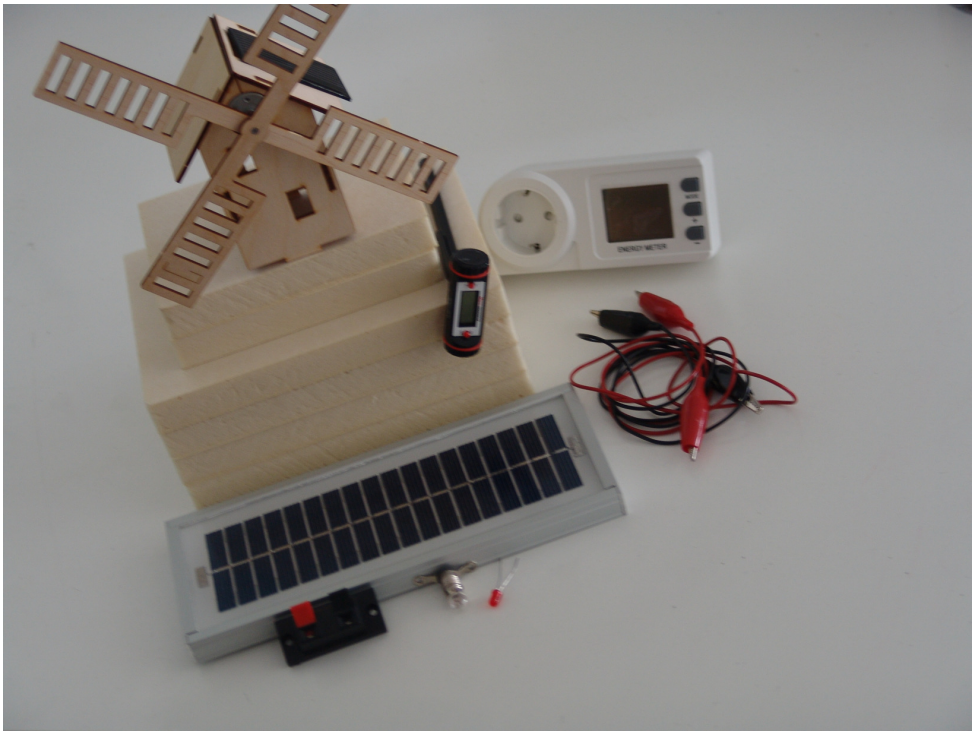
INTELLIGENT USE OF ENERGY AT SCHOOL

IUSES

IUSES Toolkit



Intelligent Energy Europe

Official Partner

Introduction

This is a tool box to support experiments about energy efficiency, energy saving and renewable energy. It was created for teachers and their students to have a direct and interactive experience. Thanks to some tools, animations and handbooks contained in the box, the users can perform a number of experiments on different energy-related themes. The purpose of these exercises is to identify some issues (like thermal energy dispersion or energy consumption) and to associate to them one or two tests in order to fully understand the consequences of some of our daily behaviours. The box consists of several materials and a DVD.

The DVD has the following contents:

- buildings handbook and animation;
- transport handbook and animation;
- industry handbook and animation;
- teachers handbook;
- guideline for the use of the experimental kit;
- an exercise about consumption of energy (excel file)
- an exercise about the energy plan of a building (excel file)

The files can also be downloaded from www.iuses.eu

The materials in the box			
Quantity	**Materials**	**Technical Properties**	**Note**
6	Panels	Thermal insulation material for buildings (**Stiferite**)	Instead of this material you can use polysty-
1	Photovoltaic panel	1,5 W, 6 V	You can buy it on the
1	LED	5 mm, 5 V	Resistance included
1	Light bulb with E10 base	4,8 V; 0,3 A	You can buy it on the
1	Speaker spring clip module	Usually, it is used to connect acoustic cables to speakers or cabinets	You can buy it in electronic shop
4	Crocodile clips cables	For testing circuits making temporary connection	You can buy it on the web
1	Digital thermometer	-40 to +200 °C	You can buy it on the
1	Energy meter	230 V, 50 Hz, 16 A, 3680 W	You can buy it on the
1	Windmill	Solar powered model	You can buy it on the
1	Box	Cardboard box	
1	DVD		Download the files included in the DVD also from the project web site (www.iuses.eu)

List of experiments

The experiences reported below will help you test, describe and understand some of the alternative energy principles:

EXPERIMENT N° 1: BUILDING THE BOX

Necessary materials: the Stiferite panels (6), double-sided tape;

not included in the kit box: scissors (1).

Build a box by using the six Stiferite panels; fix them to each other with some double-sided tape. Keep in mind that one panel has to be removable, while the others can be fixed.

So, just make the top panel the removable one.

EXPERIMENT N° 2: MELTING THE ICE

Necessary material: the Stiferite box, digital thermometer (1);

not included in the kit box: a small dish, ice cubes of similar size (2), timer (1).

Note: remember that for this experiment you need a freezer in your school or in a place very near (restaurant, your home, café, etc).

Take one of the ice cubes and put it in the box using the small dish. Close the box with the removable panel and verify how much time the ice cube takes to melt.

In the meantime, you can make a hole on the lid of the box (removable panel) and measure the temperature inside the box each minute (than make a graph).

Take another ice cube of the same size of the first one and repeat the experiment without closing the box.

Measure the temperature when the box is in the classroom. Then move to a cold area and measure the temperature each minute, make a graph and see how (fast) the temperature drops. Then repeat the experiment with a cardboard box and draw the graph on the same graph paper and see how the two graphs differ.

What do you understand from this experiment?

Note: after these experiments close the hole on the lid with tape.

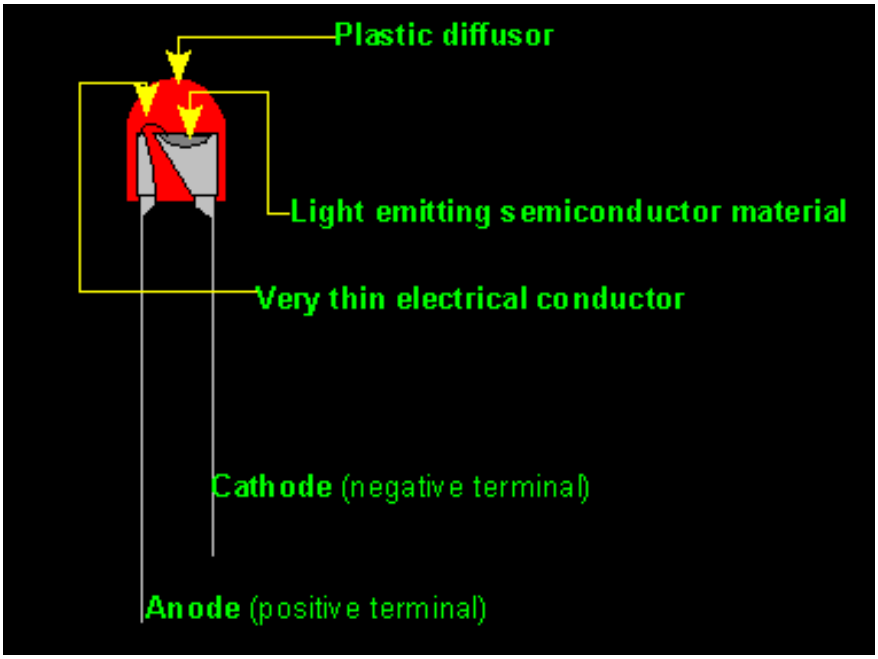
EXPERIMENT N° 3: SWITCHING THE LIGHT ON WITHOUT POWER PLUG

Necessary material: photovoltaic panel (1), light bulb with E10 base (1), LED (1), speaker spring clip module (1), crocodile clips cables (4);

not available in the kit box: a source of artificial light.

Connect the photovoltaic panel to the supplied bulbs (one at a time), by using the electric wires and the crocodile clips at your disposal. Light up the photovoltaic panel through an artificial light source, then try with the natural one (the sun): make sure the bulb connected to the panel switches on. If the bulb does not light, what could be the reasons (a bad connection between wires and bulbs, not enough light reaching the photovoltaic panel, broken bulbs)?

Note: pay attention to connect the LED in the right way because LED has polarity. This means that the positive (longest end) terminal and negative (smallest end) terminal must be connected correctly: on the speaker spring clip module, consider the red clip as positive pole, the black one as the negative. If the polarity is reversed, the LED will not light and it may be damaged.



EXPERIMENT N° 4: THERMAL INSULATION (I)

Necessary material: the Stiferite box, light bulb with E10 base (1), crocodile clips cables (4), digital thermometer (1);

not included in the kit box: 4.5 V flat battery with terminal strips (1), sheet of paper (1), pen (1), timer (1).

Put the light bulb connected to a 4.5 V battery (using the crocodile clips cables) into the Stiferite box. Close the box with the removable panel (lid) and put the thermometer into the hole already done during the experiment number 2, leaving the display outside. On a sheet of paper note the initial temperature inside the box and then measure it after a certain time interval (at least 15 minutes). Repeat this experiment with the box open and with the box closed. What do you notice? What do

you have to do in order to obtain a more evident temperature change? Make a graph "temperature against time" for each experiment.

EXPERIMENT N° 5: THERMAL INSULATION (II)

Necessary material: the Stiferite box, LED (1), crocodile clips cables (4), digital thermometer (1);

not included in the kit box: 4.5 V flat battery with terminal strips (1), sheet of paper (1), pen (1), timer (1).

Repeat the same experiment replacing the light bulb with the LED. Take note of the temperature variation at the same time intervals, and compare the results with the ones from the previous experiment. What are the differences and why?

EXPERIMENT N° 6: PHOTOVOLTAIC PANEL AND HEATING (I)

Necessary material: photovoltaic panel (1), LED (1), crocodile clips cables (4);

not included in the kit box: desk lamp (at least 60 W light bulb).

As you can see in the experiment number 4, the light bulb warms up the environment. Is the thermal energy it releases able to turn a LED on? Test this by using a light bulb as a light source: put it close to the photovoltaic panel connected to the LED and verify whether it switches on or not.

EXPERIMENT N° 7: PHOTOVOLTAIC PANEL AND HEATING (II)

Necessary material: photovoltaic panel (1), LED (1), crocodile clips cables(4);

not included in the kit box: desk lamp (energy saving light bulb, at least 11 W, equivalent to

60 W light bulb).

Repeat experiment 6 replacing the light bulb with an equivalent energy saving light bulb. Does the LED connected to the photovoltaic panel switch on? Is there more or less thermal dispersion in the environment?

EXPERIMENT N° 8: PHOTOVOLTAIC PANEL AND HEATING (III)

Necessary material: photovoltaic panel (1), LED (1), crocodile clips cables (4);

not included in the kit box: desk lamp (LED bulb at least 7 W, equivalent to 60 W light bulb).

Repeat experiment 6 replacing the light bulb with a LED bulb. Does the LED connected to the photovoltaic panel switch on? With this kind of light, is there more or less thermal dispersion in the environment?

EXPERIMENT N° 9: PHOTOVOLTAIC PANEL AND SUNLIGHT

Necessary material: photovoltaic panel (1), light bulb with E10 base (1), crocodile clips cables (4).

During one of the previous experiments you have noticed that the photovoltaic panel receiving light from the sun transforms it into electrical energy; now go outside and put the photovoltaic panel in front of the sun, then rotate it; does the incandescent light bulb connected to the panel still switch on? What do you understand from this experiment?

EXPERIMENT N° 10: DIFFERENT MATERIALS, SAME TEMPERATURE?

Necessary material: the Stiferite box, double-sided tape;

not included in the kit box: panels made of paperboard, nylon or other material.

Use the panels to build at least two different kit boxes (for example out of paperboard or nylon). Then repeat all the previous experiments. What are the differences in the results you obtain?

EXPERIMENT N° 11: THERMAL INSULATION (III)

Necessary material: the Stiferite box, objects and tools used in previous experiments;

not included in the kit box: cutter (1).

Cut a window and a door on the two opposite sides of the box, so as to make it look like a house. What results do you obtain if you repeat some of the previous experiments with the door or the window (or both of them) open?

Note: cutter is a dangerous disposable that can be used only by the teacher or adults.

To reuse the box, please cut it accurately so you will be able to close it again by sealing with tape or glue.

EXPERIMENT N° 12: MEASURING ENERGY CONSUMPTION

Necessary material: energy meter (1), file with exercises included in the DVD;

not included in the kit box: appliances.

Using the energy meter, measure the energy consumption of different appliances. Try to define the total consumption of energy in different environments, situations, habits of your life (at school, at home, etc), using as template the tables reported in

the excel file included in the DVD.

EXPERIMENT N° 13: SOLAR AND WIND POWER

Necessary material: solar-powered windmill component.

Follow the instructions to build the windmill, verify its functioning and discuss with your friends about energy transformations and energy saving.

Note: brushless electric motor and small photovoltaic panel provided can be used also for other applications (solar propeller fan car, ceiling fan for your Stiferite house/ box, etc).