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Climate Change Quick Start Guide

What's it all about then?

This experiment aims to increase awareness of climate change with a particular focus on renewable energy sources and energy efficiency. Students are introduced to the concepts of Work and Power, investigate ways of increasing efficiency in the home and how renewable energy sources can help us reduce CO2 emmissions.

The Kit

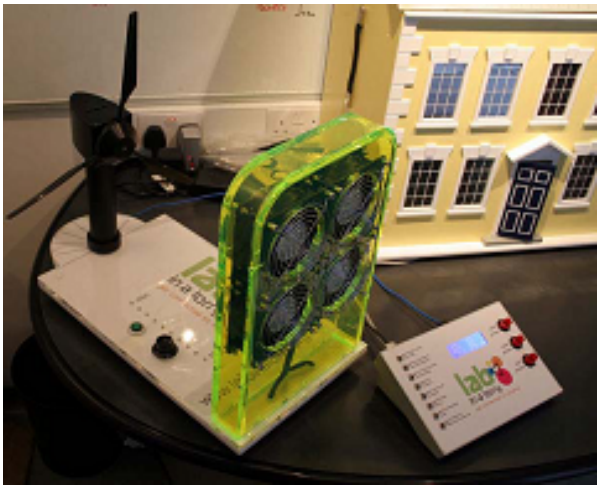
Light board & wind-up power supply.

Control panel connected to dolls house and wind turbine, with power consumption display and energy saving options.

Wind generator.

Two wind turbine hubs, 6 turbine blades per hub, 2 types of blade.

Anemometer.



How to present it

This is a guideline of how to present the experiment to the students. You do not have to follow it exactly, just as long as you allow the students to explore the concepts outlined below. You can expand or shorten this experiment as necessary to fill the time allocated.

Remember - the emphasis here is to ensure the students interact with the equipment, try things out for themselves and above all - have 'fun'. Ask plenty of questions and encourage suggestions and ideas that can be tested. Challenge the students to come up with feasible explanations rather than you just telling them what's going on.

There is a more detailed version of this doucument, providing background information on the experiment, available from the Operations Coordinator on the Lab or you can download a copy from the Lab in a Lorry wesbite:

http://www.labinalorry.org.uk/volunteer_information/downloads.cfm

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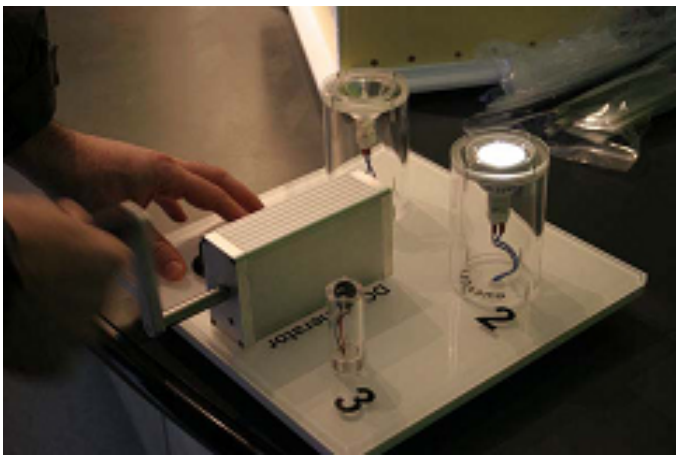
Introduction

Start by asking the students how we get power into our homes and the various methods we use to generate electricity. This can lead to asking what they know about Climate Change and renewable energy sources. There is a presentation on the DVD, but don't linger for too long on this as you want to get the students working on the kit as soon as possible.

Energy Efficiency in the Home - 8 minutes

Introduce the students to the house and ask someone to power it up using the "Grid Power" switch on the control panel. The display gives you a read out of the power consumption. Ask the students to read the number from the display. *What units does the "W" stand for?*

The house is using 11125 Watts from the National Grid. We want to reduce this as much as possible. What measures could be made to the house to make it more efficient?



One answer is the use of energy efficient light bulbs, which you can then demonstrate using the light board. *Do they think the Halogen or LED is the energy efficient light bulb?* Show the students how the generator works and get them all to light up both bulbs. *What happens to the LED bulb? The faster the handle is turned, the brighter it is. Why? Which is the Energy Efficient bulb?*

The more work the students put into turning the handle, the more current is forced around the circuit, which in turn causes more electrical work to be done in the LED bulb, making it give out more light. Less energy is required to illuminate the LED than the Halogen bulb.

You can demonstrate this effect on the house by using the array of eight switches on the control panel. Explain that each switch reflects a different energy saving measure for the home and has a value ranging from 100-1000 Watts.

For example, when the "Use energy saving light bulbs" option is chosen, the students observe a reduction of 445 Watts from the power consumption.

Challenge each student to pick 1-3 options (depending on time) and see who can make the highest saving. The aim here is to highlight those options that make the biggest difference. By saving energy, the load required from the grid will reduce.

Flick all the switches on before moving to the next experiments.

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When the "Solar Power" and/or "Wind Power" switches are turned on, the power consumption from the Grid is reduced, depending how much power is being generated from the renewable methods.

Solar Cells - 4 minutes

Ask a student to switch on the "Solar Power" supply and observe the power generated by the photovoltaic cells on the roof of the house, 319W. *The display will now also show the percentages provided by each power supply option, i.e. Solar 5%, Grid 95%.*

Do we have enough power to supply the house? *Turn the Grid Power off to see how much of the house remains powered, typically a few lights and appliances.* Explain how the cells work and ask the students if they can think of any problems which stop the cells working? Cloud cover or darkness reduce the power generated by the cells. Get the students to simulate this using their hands as passing clouds or switching off the lights and observe the changes on the display and in the house.

Wind Turbine Engineering - 8 minutes

Switch on the "Wind Power" and demonstrate how the wind generator works. *How do we harness this wind?*

Explain that the students must design a wind turbine for the house and make it as efficient as possible. Split them into 2 teams and distribute the kit with the only rule initially being that the turbine must turn clockwise to generate power.

Give the teams a few minutes to come up with an initial hub design and allow them to test it. Give them a further tip, e.g. that all blades must be angled the same way. Allow the teams to keep testing and swapping over to improve their design, each time giving them further hints, angle of blades, amount of blades etc. When both teams are happy with their designs, pitch them against each other to see which design generates the greatest power output.

Ask the students to observe the power output on the display gives, see how many appliances in the house will switch on and the percentage of power provided to the house. Finish by discussing which design is best and why.

Keywords: climate change, greenhouse gases, global warming, carbon dioxide, fossil fuels, renewables, non-renewables, work , power, Watts, generator, wind turbine, Carbon Capture and Storage (CCS), anemometer, grid network, base load, microgeneration, energy efficiency, solar/photovoltaic cells.