



SUN and SPACE 2

Using Solar Energy

Registered Charity No. 1005331

Introduction

This issue follows on from the previous one but focuses on solar power but with ideas for older or more able children (it is also closely linked with issue 78). It incorporates both experiments and investigative research ideas. Solar power now has many uses such as water heating and space heating. Our ability to use the sun can relate to where we are on the Earth – due to the Earth's tilt, differing day lengths, and weather and climate, together with many other factors. However even on a cloudy but bright day its power can be harnessed.

The Power of the Sun

This experiment is to demonstrate that the heat from the sun is different depending on its height in the sky.

Equipment required: -

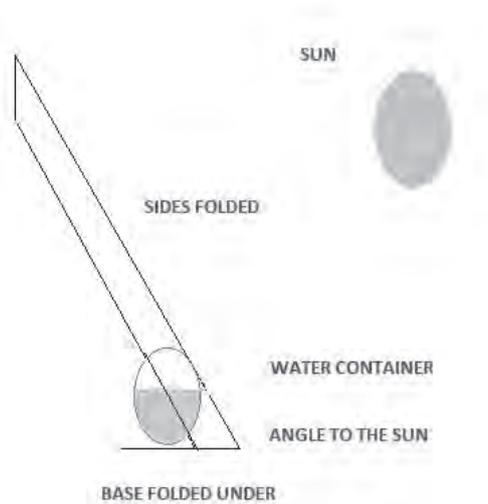
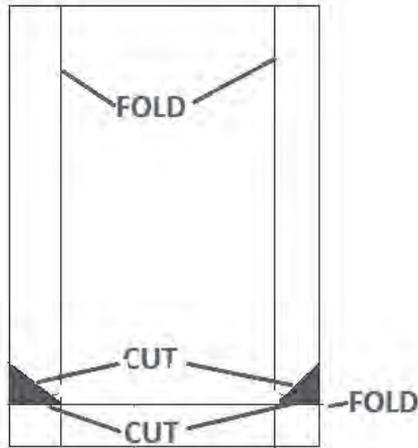
- Black card
- Polystyrene tiles
- Box
- Small polythene bags.
- Thermometer

Construction of equipment:

1. Cut 3 black cards to equal size. (See diagram)
2. Ensure that each card have different angles.
3. The angle to cut out is to make the angle of the card facing the sun (i.e. 10°C will give the card an 80°C angle to the sun.)
4. Fold the sides and the base of the cards and glue then in position.
5. Fix a small plastic bag to the back of the card facing the sun.
6. Part fill the bags with equal amounts of water.

The box is used to hold three cards side by side so that all three are presenting the same face to the sun.

1. Cut one side of the box off.
2. Cut the polystyrene tile and fix to the rear side of the box.
3. Cut four sections of tile to fit between the three cards. (this is to separate the heat intake to each card)
4. Ensure that there is sufficient space behind the cards in the box to enable access for the thermometer to be put into the water in the bags.



When the equipment is ready to carry out the experiment as a fair test.-

1. Measure the temperature of each sample of water.
2. Put the box in a suitable place facing the sun.
3. An ideal time would be noon (1pm in British Summertime)
4. A sunny day would aid the results.
5. Leave the apparatus for one hour and measure the temperature again.
6. Record all the temperature readings
7. The reading and recording can be a group effort
8. It could be done on paper or computers could be used for making of tables etc.
9. Graphs can be constructed to show the differences of temperature (if any)

Extension Activity

Record the temperatures over a full school day and compare them
Repeat this over a longer length of time .e.g. a week and compare
Discuss why there are differences

The Cost of the Sun

These are ideas for a research project, which could be as long or as short as required and aimed at either those children used to this type of investigation or as a short introduction for those who have not done any before.

Suggestions can be used in a pick and mix way to form the type of research and content of the investigation you would like children to do. The basic idea is linked to the cost of solar power, thus incorporating maths with calculations etc: and IT and English (books) for obtaining information. Scenarios can be adapted to suit your own school environment or aims for the project.

The project scenarios suggest investigating the possible installation of either Photovoltaic Panels (for electricity supply) in scenario 1 and/or Solar Panels (for hot water) in scenario 2, at a specific site.

The possible sites for investigation could be the school itself, a local amenity or their own home. This may be dependent on what information is available/obtainable relating to current costs.

Depending on the age, ability and previous research experience of the children this can be done on their own, in small groups or as a whole class. Scenario 1 will be more complex than scenario 2.

Introducing the Project

Where possible take the children to visit a site/ house with appropriate panels and talk to them about the issues.

Ask a local solar energy firm to come into school and give them a talk, they may also be willing to supply information and statistics.

Alternatively (or as well) before starting, look at web sites that relate to solar energy.

Running the Project

Decide which type of panels, and the building to be used. Decide how much or how little information you will provide for them and how much they have to research themselves. Decide how much support they will get. Provide the children with an appropriate scenario that includes those areas you have already decided on as fixed (e.g. the site to be used).

Sample Scenarios which can be adjusted to suit your situation and requirements:

Scenario 1 The local community centre is considering installing photovoltaic panels to supply their electricity. Their use of electricity is very erratic, so they would want to sell any excess to the national grid, whilst in times of heavy usage might need to use electricity from the grid. You will need to visit the site to assess its potential and talk to the centres manager in order to obtain current information.

The chart below can be used as a basis for structuring the work for Scenario 1 and again, children can be given as much or as little of this information as required.

Progressive decisions	Issues	Information needed	Sources
Visit the site and assess its basic potential.	There may be various possibilities.	Is any part of the roof not permitted?	Centre manager.
Choosing a site – find the best available roof.	Which way is it facing? Is it shaded by anything – buildings, trees?	Average hours of possible sunlight? Calculate seasonal figures and find an average.	Own observations.
Deciding how many panels are needed.	Is there space for this many?	How much electricity can panels supply? How much is needed?	Web search for information. Centre manager.
Investigating costs – purchase and installation.	Where is the best place to purchase them?	Obtain a variety of costings.	Local suppliers and web searches.
Investigating running costs	Cost of maintenance and repairs?	Obtain a variety of contract costs	Local suppliers and web search
Investigating Financial Viability, Costs and Payback	How long will it take for the costs to be recouped?	Use the previous two sets of information and the current cost per year to calculate pay back time.	Centre manager.
Investigate purchase and payback agreements and arrangements.	Arranging the payout/payback, any special metering installations etc.	Cost of electricity, amount paid by electricity company to purchase excess.	Web sites, local electricity supplier

Scenario 2 Our school has decided it might like to invest in solar panels to supply our hot water. This class have been given the task of investigating whether the case for doing so would be cost effective for the school. The potential site for the panels is fixed, as no other is available, and is ... (insert an appropriate site). The school secretary has provided us with figures that we will need relating to the school.

The chart below can be used as a basis for structuring the work for Scenario 2 and again, children can be given as much or as little of this information as required.

Progressive decisions	Issues	Information needed	Sources
Visit the site that has been designated.	Which way is it facing? Is it shaded by anything – buildings, trees?	Average hours of possible sunlight? – calculate seasonal figures and find an average.	Own observations.
Deciding how many panels are needed.	Is there space for this many?	How much hot water the panels can supply? How much do we need?	Web search for information. Research current usage.
Investigating costs – purchase and installation	Where is the best place to purchase them?	Obtain a variety of costings.	Local suppliers and web searches.
Investigating running costs.	Cost of maintenance and repairs?	Obtain a variety of contract costs.	Local suppliers and web search.
Investigating Financial Viability Costs and Payback.	How long will it take for the costs to be recouped?	Use the previous two sets of information and the current cost per year to calculate payback time.	Research current costs and payback tariffs.

Useful web sites

<http://www.energysavingtrust.org.uk/> main site address – good general info.
<http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-water-heating>
<http://info.cat.org.uk/solar-water-heating> good info and information sheet to download
<http://info.cat.org.uk/pv> good info and information sheet to download
<http://www.solar-facts.com/panels/panel-efficiency.php>
<http://greenreview.blogspot.co.uk/2012/06/uk-leading-solar-energy-website.html>
<http://sroeco.com/solar/most-efficient-solar-panels>
www.whichsolarpanels.co.uk/default.aspx
<http://greenreview.blogspot.co.uk/2012/06/uk-leading-solar-energy-website.html>
<http://www.reuk.co.uk/Introduction-to-Solar-Water-Heating.htm>

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