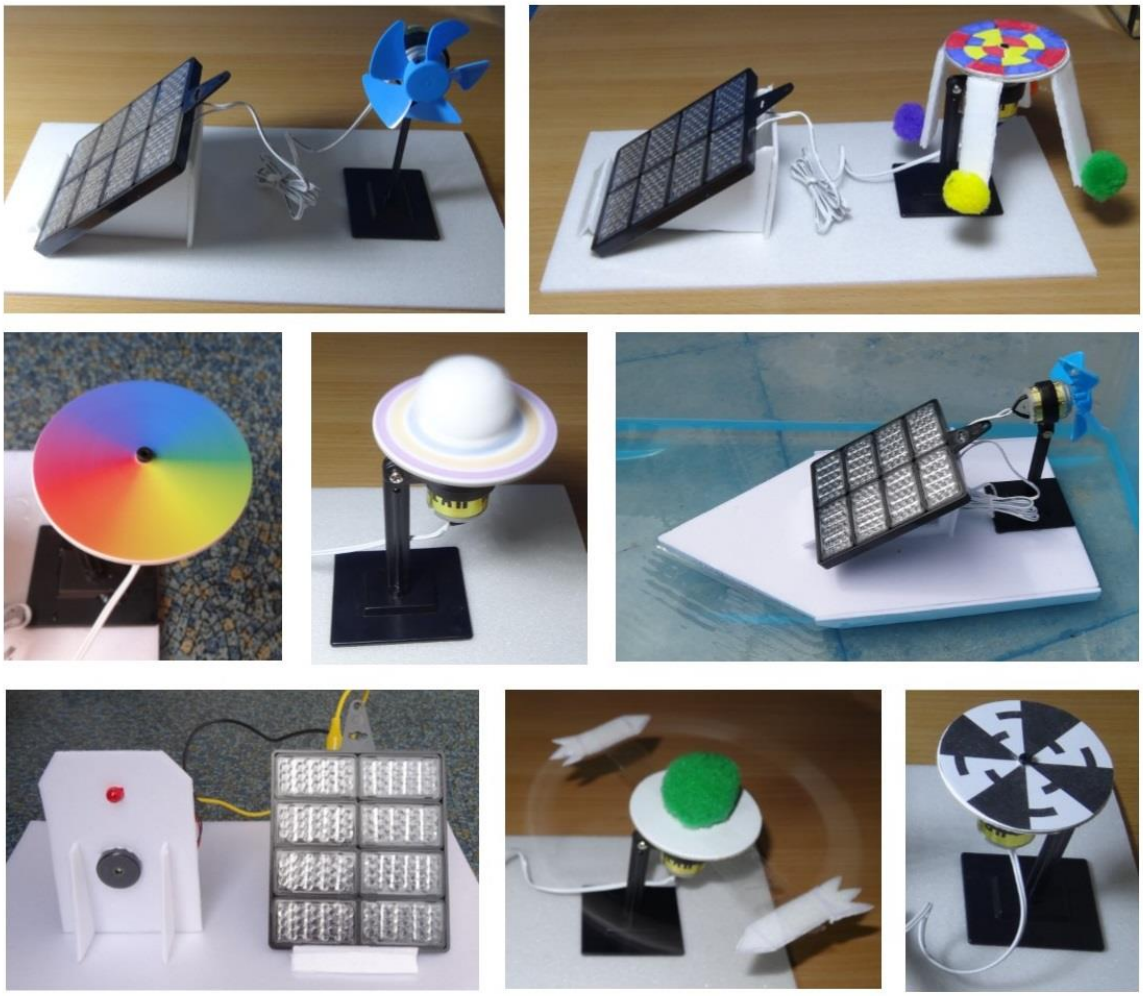

Renewable Energy

Lesson Plan

www.tts-shopping.com

Product Code: TE10030

Renewable Energy Summary

Recommended level – Years 3-6
Time taken – 3-4 hours for modules 1 and 3
2-3 hours for modules 2, 4 and 5
Expectation – to complete 5 solar-powered working models
It is recommended that the 5 modules are completed in order. Module 1 includes assembling the solar panel, so this must be completed first.
The activity needs to take place on a sunny day. The solar panels will perform best in the summer term when the sun's rays are most intense (although the motor will still turn in the middle of winter).

N.B. In order to keep the costs to a minimum the kit contains only 5 solar PV panels, so a class of 30 pupils would need to work in groups of 6. It is difficult to co-ordinate a group of 6 pupils and make sure they are all involved in the activity. If there is the opportunity to work with half the class at a time or to purchase two renewable energy kits (so that there are only 3 pupils to a group) this would be preferable.

Associated resources:

Blogs
These are intended for the teacher to run through the activity in advance of the lesson.
Blog 1 – Pedestal fan
Blog 2 – Fairground ride
Blog 3 – Electric boat
Blog 4 – Spinner
Blog 5 – Sun alarm

PowerPoints
These are for conducting the actual lesson. Teacher notes are included on some slides with hints and tips and other useful information which could help the class with the activities.
PowerPoint 1 – Pedestal fan
PowerPoint 2 – Fairground ride
PowerPoint 3 – Electric boat
PowerPoint 4 – Spinner
PowerPoint 5 – Sun alarm

Worksheets
These are for pupils to complete after the activity to help capture and record what they have learnt.
Renewable energy worksheet – Module 1
Renewable energy worksheet – Module 2
Renewable energy worksheet – Module 3
Renewable energy worksheet – Module 4
Renewable energy worksheet – Module 5

Worksheets with suggested answers
These suggest possible answers to the worksheets to help those unfamiliar with the subject.
Renewable energy worksheet – Module 1 – suggested answers
Renewable energy worksheet – Module 2 – suggested answers
Renewable energy worksheet – Module 3 – suggested answers
Renewable energy worksheet – Module 4 – suggested answers
Renewable energy worksheet – Module 5 – suggested answers

STEM Links

- Science: electrical circuits, light, forces, materials, Earth and space
- Technology: electrical systems, design, make and evaluate a product
- Engineering: optimise performance of equipment, propulsion, drag and streamlining, troubleshooting
- Mathematics: draw 2-D shapes, measure angles, measure distance and time, calculate average speed

Curriculum Learning Objectives – it is recommended to cover these topics prior to the exercise so that the pupils are reinforcing their knowledge and understanding, rather than meeting the topics for the first time.

Science: Light (Year 3)

Pupils should be taught to:

- recognise that dark is the absence of light
- recognise that light from the sun can be dangerous and that there are ways to protect their eyes
- recognise that shadows are formed when the light from a light source is blocked by an opaque object

Science: Electricity (Year 4)

Pupils should be taught to:

- construct simple electrical circuits
- recognise some common conductors and insulators, and associate metals with being good conductors.

Science: Forces (Year 5)

Pupils should be taught to:

- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- identify the effects of air resistance and friction, that act between moving surfaces

Pupils should explore the effects of friction on movement and find out how it slows or stops moving objects.

Science: Materials (Year 5)

Pupils should be taught to:

- identify and compare the suitability of a variety of everyday materials for particular uses

Pupils should be encouraged to think about unusual and creative uses for everyday materials.

Science: Earth and Space (Year 5)

Pupils should be taught to:

- describe the movement of the Earth and planets relative to the sun in the solar system

Pupils should find out about the way that ideas about the solar system have developed, understanding how the geocentric model of the solar system gave way to the heliocentric model.

Science: Electricity (Year 6)

Pupils should be taught to:

- compare and give reasons for variations in how components function

Science: Light (Year 6)

- Pupils should explore the way that light behaves including light sources and shadows
- They could extend their experience by looking at a range of phenomena

Design and Technology (Key Stage 2)

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. When designing and making, pupils should be taught to:

Design and Technology: Design

- design innovative, functional, appealing products that are fit for purpose
- generate, develop, model and communicate their ideas

Design and Technology: Make

- select from and use a wide range of tools and equipment to perform practical tasks
- select from and use a wide range of materials and components according to their functional properties and aesthetic qualities

Design and Technology: Evaluate

- evaluate their ideas and products and consider the views of others to improve their work

Design and Technology: Technical knowledge

- apply their understanding of how to strengthen, stiffen and reinforce more complex structures
- understand and use electrical systems in their products

Mathematics: Measurement (Year 3)

Pupils should be taught to:

- measure lengths (cm/mm)
- record and compare time
- draw 2-D shapes

Mathematics: Measurement (Year 5)

Pupils should be taught to:

- draw given angles and measure them in degrees (°)

Mathematics: Measurement (Year 6)

Pupils could be introduced to compound units for speed and apply their knowledge as appropriate

Mathematics: Geometry – properties of shapes (Year 6)

Pupils should be taught to:

- draw 2-D shapes using given dimensions and angles
- illustrate and name parts of circles including radius and diameter, and know that the diameter is twice the radius

Equipment needed

Parts included in class kit:

- 5 solar power educational kits
- 20 crocodile leads
- 5 buzzers
- 10 battery holders
- 100 card discs
- 10 motor pulleys
- 25 foam sheets 30 cm x 30 cm
- 100 assorted pompoms

Check you have received the correct contents in your class kit. Please let TTS know if there are any problems as soon as possible.

Tools and consumables (not included in class kit):

- 10 AA cells (these are often called batteries). It is very important to use **zinc chloride** type of cells, **not** alkaline or re-chargeable ones. If the pupils accidentally short circuit their battery (which often happens) then alkaline or re-chargeable cells get extremely hot and can cause burns. Zinc chloride type cells are cheap and easily available (e.g. from discount stores).
- Small bowl per group to put small components in during the activity so they don't get lost (for example the nuts and washers from the solar panel and the motor pulley)
- Rulers
- Pencils
- Felt tip pens
- Protractors
- Large scissors
- Transparent sticky tape in dispensers
- Sheets of card roughly A4, e.g. old cereal box
- Pairs of compasses (if you don't have compasses you can draw round bottle lids or wheels)
- Cool melt glue guns and glue sticks (several needed, e.g. 3-4, as there could be a queue to use them!). **Note: High melt temperature glue guns should not be used, as they can cause nasty burns.**
- A small container with lid (such as a labelled plastic food container), to store the smaller components safely after use so they don't get lost. For example, the motor pulleys and propellers, and the plastic spanners and spare contacting strips for the solar panels.

For module 3 – electric boat

- Water tray or paddling pool
- Cylindrical pencils to balance the boat on (or 20 cm lengths of circular wooden rod)
- Stopwatch
- Measuring tape

Risk Assessment

Conduct a risk assessment before undertaking the activity. A sample risk assessment is given below; you can use this as a starting point when writing your own. (L=low, M=medium, H=high)

Activity	Identified Hazard	Initial Risk Rating L/M/H	Control Measures	Controlled Risk Rating L/M/H
Use of glue guns	Burns	H	Children should be supervised by a responsible adult at all times when using the glue guns. Explain to children how to use the glue guns. Warn them that the ends are very hot. Use only cool melt glue guns. If burned hold under running water for ten minutes. Don't switch on the glue guns until after the safety briefing. In some schools children wear safety goggles when using glue guns.	M
Accidentally short circuiting battery	Burns, smoke inhalation	M	Explain how to avoid short circuits. Use only zinc chloride cells, not alkaline or re-chargeable ones as these can get very hot if short circuited.	L
Use of scissors & Sellotape dispensers	Injury e.g. to fingers	M	Make the children aware of the dangers. Do not give out the scissors until after the safety briefing.	L
Looking directly at the sun	Damage to eyes	M	Explain to the children why they must not look directly at the sun	L
Damaging eyes with rotating parts	Bruising or damage to eyes	M	Explain to the children that they should not put rotating parts such as propellers or model fairground rides near their eyes.	L
Running extension leads along floor for glue guns	Trip hazard	M	Avoid using extension leads if possible. Otherwise make sure extension leads are run where they cannot be tripped over.	L
Damaged extension leads or glue gun leads	Electrocution hazard	H	PAT test electrical items regularly Conduct a visual check of all electrical items before session to ensure the leads are undamaged.	L

Preparation needed

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- Select a **sunny day** on which to run the activity!
- Build sample models to explore any pitfalls following the instructions given in the blogs. As there are only 5 renewable energy kits you will then need to disassemble your models so that the pupils can re-use the solar energy kits.
- Print out a copy of the relevant worksheet for each group. Print it double sided to save paper.
- It is recommended to test the models outside in the sunshine, although the solar panels will also work with the sun passing through a window.
- To run module 3 (electric boats) you will need access to a water tray or paddling pool with about 3 cm of water in it.