Session 5: Procedure notes

Renewable energy

Activity 25 – Renewable V non-renewable

Time needed: 10 minutes

Write up the definition of renewable and non-renewable on the board and hand out sets of energy source pictures to pairs of students - provided in resource box.

Remind students that making electricity in power stations by burning fossil fuels gives off carbon dioxide that is contributing to climate change. This session is about ways of producing electricity that doesn't give off CO2.
That isn't the only good thing about these ways of producing electricity – they use sources of energy that don't run out, so they are called renewable. Fossil fuels are all going to be used up certainly within the next 100 yrs and cannot be replaced so they are called non renewable.
Ask students to sort the cards into the two groups, guess if they don't know.

Activity 26 – Renewable options

Time needed: 25 minutes

Set up PowerPoint slides "Renewable options" from Session 5 page of the CD Rom and Science Museum animations from:
www.sciencemuseum.org.uk/exhibitions/energy/site/EIZinfogr.asp
Start PP slideshow (There are hyperlinks attached to the relevant slides).

The energy to make the electricity comes from the sun, wind, water and plants.
Slide 1. We will start by taking a more detailed look at wind energy.
Slide 2. This is a wind farm which is a number of large turbines grouped together owned by a company, the electricity produced will go into the national grid. How do they work? *(Hyperlink – wind power)*
Slide 3. Single large turbines can be owned by a community or used to power a specific building for example Manchester City football stadium.
Slide 4. These are huge turbine blades ready to be hoisted in position on to of the wind turbine tower
Slide 5. This is one blade being raised up
Slide 6. A working wind turbine
*Slide 7.*This shows the service hatch, The towers have steps up the inside, to the top.
Slide 8. These are less common vertical ones. (They spin round like the spinning signs you sometimes see at petrol stations)
Slide 9. Small turbines can be fitted to houses but how efficient they are is debateable.

Slide 10 Solar is another word for the sun and it can help us produce electricity and heat.
*Slide 11*hese are Photovoltaic panels. The word “Photovoltaic” splits into two. “Photo” means “light” (also used for words like for photography and photosynthesis). “Voltaic” refers to electricity eg Volts. This is how they work (*Hyperlink – PV*)
Slide 12 You need a lot of these PV panels to make a decent amount of electricity. As they need direct sunlight to work they need to be facing in a particular direction. They also need to be close to the thing they are supplying electricity too, this is why putting them on the roofs of buildings is a good idea.
Slide 13 The roof has to be strong enough to support the panels, this slide shows how the electricity gets into the building through wires.
Slide 14 Some roofs can be covered in Solar PV Panels
Slide 15. Instead of *c*overing your roof in tiles and then putting the panels on top, these roof tiles have been developed where each one is a little PV panel.
Slide 16 More uses for these PV panels are developing because you can have electricity without connecting to a power station, so this is a parking meter powered by the sun.
Slide 17. Marker buoys at sea use them to power lights and foghorns.
Slide 18. This is a bus at Kew gardens in London that ferries people around the site using solar power.
Slide 19. Lights at lonely railway stations.
Slide 20. In countries that have more sun than us typically there are massive areas covered in panels that are able to produce power for whole towns and cities.
Slide 21. The sun can also produce heat – this is a solar hot water panel on a house.
Slide 22. They can produce hot water on a much larger scale these panels could heat a swimming pool.
Slide 23 and Slide 24. If you have a lot of glass on the sunny side of a house you can use the sun’s heat to warm the house like a greenhouse, like these two houses.
Slide 25 and Slide 26. The sun’s heat also penetrates into the ground and can be used to heat homes – These liquid filled pipes absorb heat from the ground and move it into the home by the use of a pump.
Slide 27. Bio energy refers to using living things like plants.
Slide 28. This is a building that houses a wood fuel burner; this is how it makes electricity and heat *(Hyperlink – wood fuel).*
Slide 29. There are fast growing crops like Willow that are grown especially to burn; this is a one-year-old crop.
Slide 30. This is after two years
Slide 31. And it is cut when it is this big at five years.
Slide 32. Low quality timber is also used.
Slides 33, 34, 35, 36. Before it is burnt it will be dried and turned into wood chip or pellets. These pictures show the woodchip warehouse.
Slide 37 This building is heated with biofuel
Slide 38. This is a wood burning boiler. These burners can be automatically fed and used to heat schools factories or a group of houses.
Slide 39. Hydro is another word for water – there are quite a different lot of ways of using water to make electricity.

Slide 40. The most common way is to use a dam and water turbines; this is how they work *(Hyperlink – hydro power).*
Slide 41. Water turbines can be used on a massive scale like this one where enough electricity is produced to power whole cities.
Slides 42, 43, 44, 45. Or they can be small scale on little rivers like these.
Slide 46. This is a small turbine that could produce electricity for just one building.
Slide 47. Being an island we can make use of the sea for making electricity, and one way is by using the tides. Here is how it works *(Hyperlink – tidal power).*
Slide 48. These tidal turbines are underwater. As the tide flows in and out, it spins the blades, like a propeller – or like a wind turbine.
Slide 49. We can also use waves to make electricity.
Slide 50 This is a diagram of the first wave power machine in the UK on Islay a Scottish Island. Here's how it works *(Hyperlink – wave power).*
Slides 51 and 52. These are pictures of the wave power generator
Slides 53 and 54. These are futuristic wav power plants, which are being developed by engineers and scientists.

Activity 27 – Wind and solar kits

Time needed: 20 mins for each group

Prepare mini wind turbine, solar PV and hot water panel, available to borrow from Harrogate Borough Council.

If possible split class into two groups and take turns looking at renewable energy kits outside and doing worksheets inside.

Outside: Solar hot water kit
Discuss:

- The purpose of the technology
- The components of the box, which are integral to the design
- How it works
- Where it would be installed on a house
- What it replaces (remembering that producing heat with electricity is very costly)

Instruct the students to set up the solar hot water experiment first by recording the temperature of a jug of cold water and pouring it into the copper pipe in the solar water kit. Place it in full sunlight angled towards the sun with the thermometer set up outside the box. Leave for the temperature to adjust.

Solar PV
Set up by allowing the students to plug in the different appliances and move PV panel in and out of the sun.
Discuss:

- The purpose of the technology
- How it works
- Where it would be installed on a house

- Cost
- Storage of electricity

Wind turbine
Set up by allowing the students to construct the turbine and experiment with positioning, amount of sails and angle of sails.
Discuss:

- The purpose of the technology
- The different scale of turbines
- How it works
- Where it would be installed

Return to the solar hot water panel record the temperature, if it is around 60 degrees centigrade allow the students to feel the water as it is poured out but be aware in the right conditions it can get very hot!

Activity 28 – Renewable brainteasers

Time needed: 20 minutes (whilst a group are outside looking at renewable energy kits)

Print the "Renewable brainteaser worksheets" double sided one for each student from the Session 5 page of the CD Rom.
Spread all the renewable fact cards and posters out on tables – provided in the resource box.

Explain there is a choice of 4 worksheets and all the information needed is on the fact cards and posters.

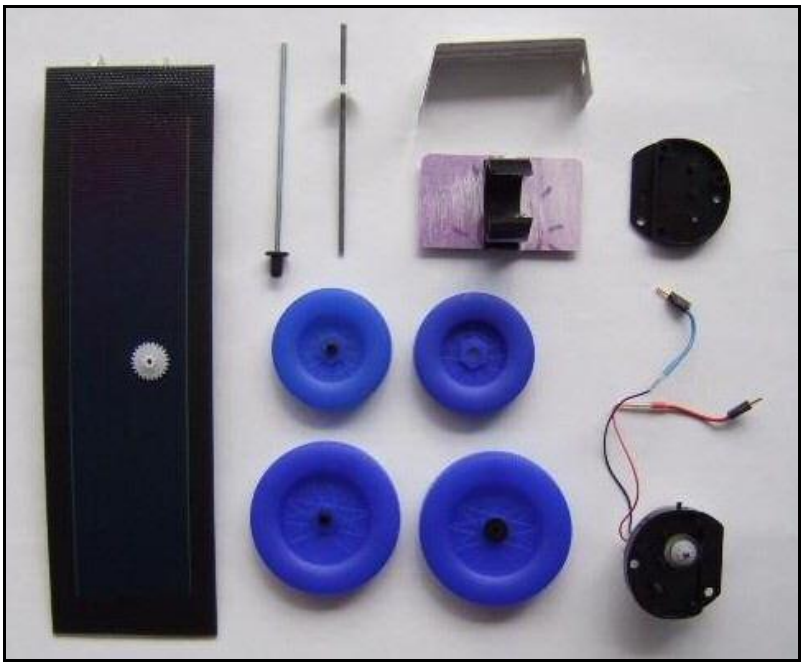
Activity 29 - Solar racers

Time needed: 35 minutes

Set up by dividing the class into pairs and distributing a solar car box - available to borrow from Harrogate Borough Council, to each pair.

Explain that there are very small parts that will roll around; also some parts are delicate so to be gentle with them.

Solar Racer parts

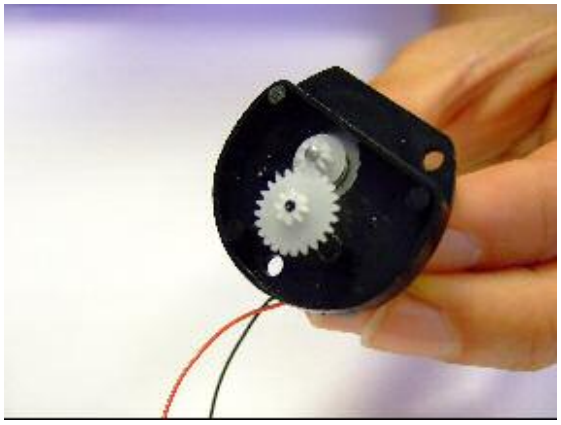


Each kit contains:

1 x Flexible solar panel with two clips
1 x Black plastic motor casing
2 x front wheels (diameter 40mm)
2 x axels (75mm)
1 x Black clip, mounted on plastic card
1 x Motor with blue and red wires
2 x rear wheels (diameter 50mm)
4 x black plastic hubs
2 x 13mm cogs
1 x Front axel support

Give instructions to construct the cars following the directions below.

Step one



Take the motor with the two wires attached. You will see that there are three pegs sticking up: one has a hole down the middle; the others do not.

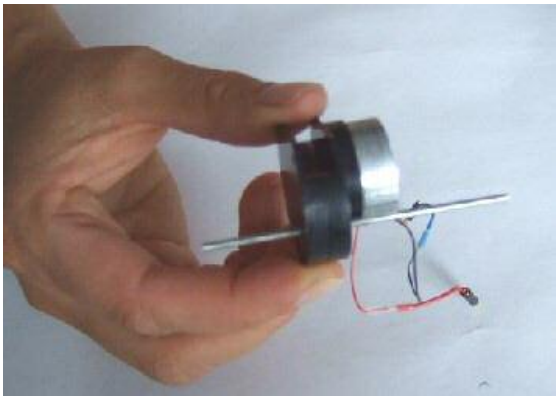
Place the double-layered cog, teeth up, on the middle peg, so that the teeth engage with the cog attached to the motor.

Step two

Take the metal axel with the cog attached. Insert this into the peg with the hole, and push it through until the cogs engage.

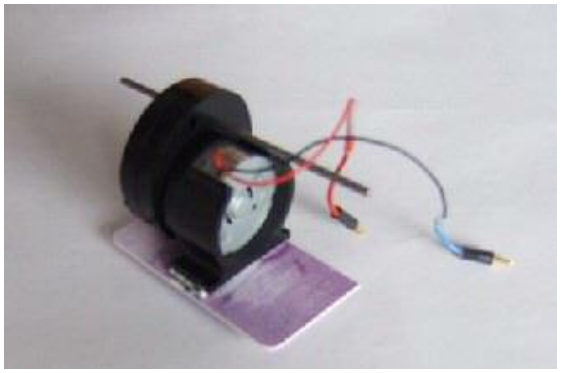
Step three

Take the black cover, and slide it along the axel.



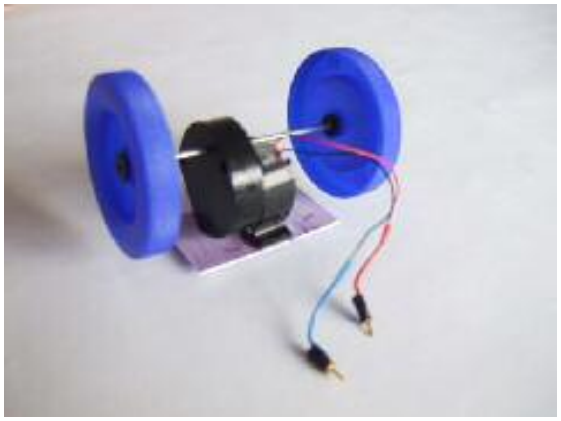
Line the pegs up, and push the two black plastic halves together until they clip shut.

Step four



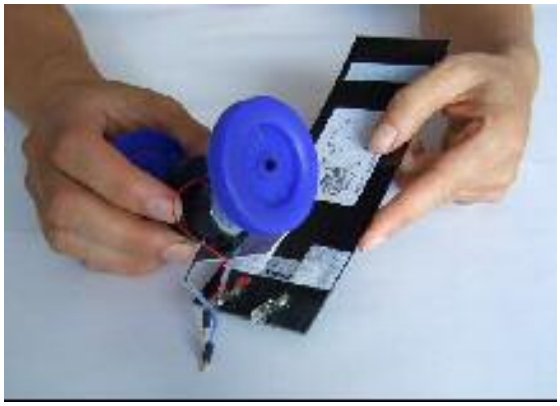
Fix the round part of the motor into the plastic clip.

Step five



Attach the two large wheels to the axel, by pushing them on.

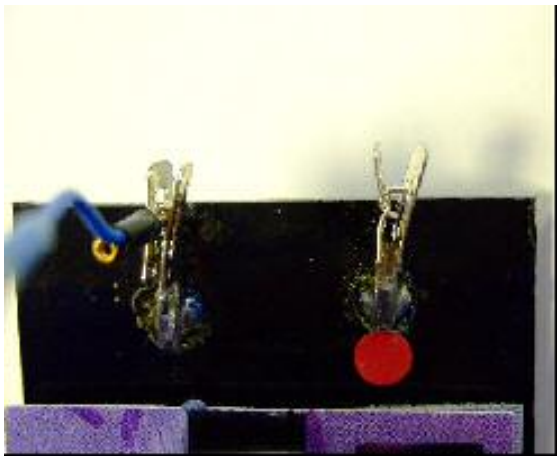
Step six



Attach the motor, axel and wheels to the back of the solar panel with the Velcro pads.

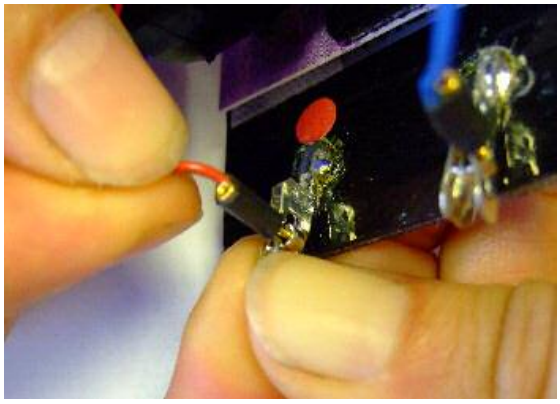
Step seven

The motor now needs to be connected to the panel.



There are two clips on the panel, one is marked with a red dot – this is for the red wire.

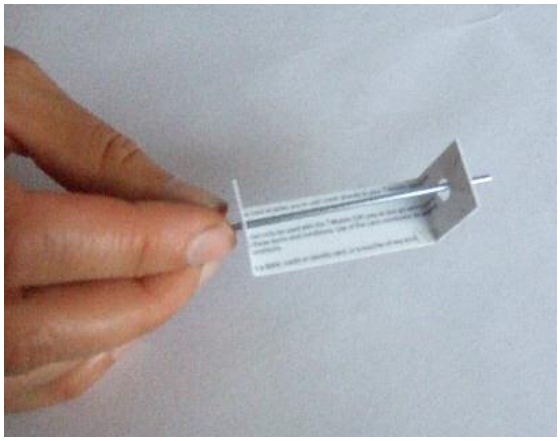
Squeeze the clip closed. A small loop will poke through, forming a "D" shape.



Keep the clip squeezed together, whilst you push the metal end of the wire into the "D". When you release the clip, the wire will be held in place, attached to the panel.

Repeat for the other wire.

Step eight



Put together the front axel, by threading it through the plastic holder

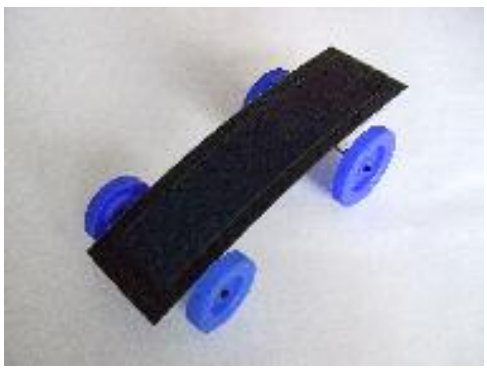
Step nine

Attach the two front wheels to the axel, by pushing them on

Step ten

Attach the front axel and wheels to the panel with the Velcro pads

The finished car



Take the cars outside and give them a test run; if they go backwards swap the motor wires around.

The Grand Prix can be straightforward or involved. Having only 4/5 cars racing at a time in heats with the winners competing together at the end builds the excitement. Check that the students don't put each other's cars in the shade with their shadows.