Tomorrow's Engineers

Heat Exchange

Solar Water Heater

nationalgrid

For details of all routes into engineering go to www.tomorrowsengineers.org.uk

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Organisers Notes

Heat Exchange

Tomorrow's Engineers

What do you need to know?

Organisers' notes

This activity will help pupils to understand the principles of heat exchange as well as give them an appreciation of using different materials to increase the success of harnessing the power of the sun.

Guidance

- Read through the instructions and familiarise yourself with the procedure
- Do a test run yourself, so you know how to help others make their own model
- Use the discussion topics below to introduce, summarise and provide context to the activity
- Make sure that students have had sufficient time to read and understand the directions

Discussion topics

- Why do we need to look at alternative methods of producing hot water?
- Where do you think this process could be used in today's society?
- Could you use recycled materials to produce a solar water heater?
- What do you think the future of energy production will look like?

Curriculum links

KS4	(Transfer of energy)
KS3 SC3.2	(Materials and their properties)
KS3 SC 3.1	(Energy, electricity and forces)
KS3 SC 1.1	(Scientific thinking)
KS3 SC 1.2	(Application and implication of science)
KS3 SC 2.1	(Practical enquiry)
KS3 SC 2.2 a, b	(Cenritical understanding of evidence)
KS3 Ma 2.3 a-e	(Interpret and evaluate)
KS3 D&T 1.1b	(Apply knowledge to design products)

Get involved

More engineering challenges…

For more great energy related activities check out National Grid's engineering our energy future activity pack. The pack includes 12 fun activities showcase the exciting possibilities of engineering in finding solutions for our future energy needs.

Find out more about careers in engineering

Tomorrow's Engineers provides engineering careers materials for young people aged 11-14, and other resources for teachers.
For more information visit the Tomorrow's Engineers website.

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What do you need to know?

Get involved

Further reading and resources…
National Geographic has lots of information about the energy challenge and how people across the world are saving energy. Take a look at this video of how some Egyptian people are harnessing the power of the sun with solar-power rooftop heaters made out of recycled rubbish.

Also check out the future, Masda City, Masda is Arabic for 'the source', a fuel efficient city where scientists and engineers are developing new approaches to the way we live and not just how we use energy!

Tomorrow's Engineers
Take the Whose crew Are You? quiz to find out which crew you are in!

There are many different types of engineers that are locating and developing new sources of energy and protecting the planet in the process. For example, electrical engineers – part of our power crew –design, develop and maintain electrical systems. They also ensure even production and distribution of power and electricity to the home or workplace.

Energy engineers are focused on finding efficient clean and innovative ways of supplying energy. This work is essential if we are going to find greener and more sustainable ways of producing energy for a world that is too dependent on fossil fuels.

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Student Section

Heat Exchange

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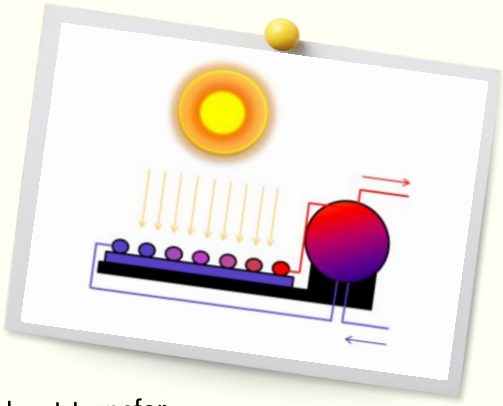
Are you ready for an engineering challenge?

Heat Exchange

Solar water heaters can be a cost-effective way to generate hot water for the home. They can be used in any climate using solar energy (sunshine) as fuel – which is free!

Your task is to design and make a model of a solar water heater – as a member of the design team for a cutting-edge energy company. You are tasked with producing the most efficient heater using the materials provided for a flat roofed house or flat that could be used in warm climates.

Get involved



Solar water heating systems include storage tanks and solar collectors. There are two types of solar water heating systems: active, which have circulating pumps and controls, and passive, which don't.

All systems are also defined as direct or indirect:

- Direct circulation systems pumps household water through the collectors and into the home. They work well in climates where it rarely freezes.
- Indirect circulation systems pump a non-freezing, heat-transfer fluid through the collectors and a heat exchanger. This heats the water which then flows into the home. Indirect circulation heating systems are popular in climates prone to freezing temperatures.

http://en.wikipedia.org/wiki/Solar_water_heater

Find out how you can become an engineer

If you have enjoyed this activity and would like to find out more about careers in engineering, Tomorrow's Engineers can help. To learn more visit the Tomorrow's Engineers website.

For lots more hands-on science and engineering activities visit the National Science & Engineering Week website.

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Heat Exchange

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Get engineering...

Activity materials list

30cm of aquarium tubing or similar
Cardboard tubes (toilet or paper towel rolls)
Tin foil
Sticky tack
Glue or double sided sticky tape
Black paint or black insulating tape
Modelling clay
Styrofoam cups
Measuring cylinder
Thermometer
100w desk lamp

Instructions

Paint the aquarium tubing black or wrap with insulating tape.

Cut the cardboard tube in half to make two u-shaped halves.

Line one half with tinfoil, shiny side showing, glue or double sided sticky tape the two halves back to back, to make a parabolic collector.

Secure the tubing along the length of the tinfoil-lined reflector.

Put a pencil hole in the Styrofoam cup 6mm up from the bottom.

Insert the black tube and seal if necessary with modeling clay.

Raise the cup so it is slightly above the level of the collector.

Place the lamp 3cm over the collector and another cup at the other end of the tube to collect the water that will flow through it.

Measure out 100ml of water, and check its temperature.

Pour it into the Styrofoam cup and let it pass slowly through the heater, and collect it.

Pour it back into the first cup and repeat process until you are happy with the result.

Record the temperature of the water every 30 seconds.

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