SOLAR ENERGY

Equipment:

Activity 1:
2 butter cartons, scissors, cling film, thermometer, water, a sunny spot and a shady spot.

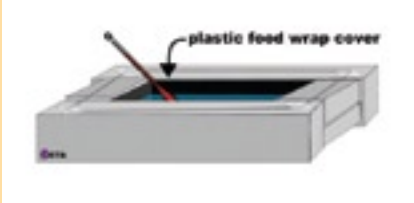
Activity 2:
3 thermometers, black paper, white paper

Suggested Class Level:

3rd – 6th

Preparation:

Activity 1: Cut large rectangles out of the lids of the butter cartons. Put a layer of cling film over the rectangular holes in the lids of the cartons – this reduces the 'wind chill' factor (wind has a cooling effect - that is why people use fans in hot weather).



Activity 2: None

Background information:

Without the sun there would be no life on Earth.

Plants need the sun in order to make their food (photosynthesis) and we need the plants for our food, which gives us energy.

Most cars and many machines which we use are run on petrol, oil or gas and their energy originally came from the sun millions of years ago That's when the plants became compressed into turf, coal, oil and gas. These are called fossil fuels.

Many other machines run on electricity, but much electricity is got from burning fossil fuels. So energy from the sun gives us, either directly or indirectly, almost all of the energy which we use in the world.

One day the world's supply of fossil fuels will run out. So what will take their place?

One possibility is energy from the sun, which we call SOLAR ENERGY.

The sun gives us light and heat; it can also produce electricity.

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People make gadgets to capture the sun's energy.
These gadgets are called solar panels.

There are two kinds of solar panel:

1) Solar panels that capture the heat from the sun and transfer it to heat buildings and give them hot water.

2) Solar panels that convert the sun's energy into electricity: these are called photovoltaic (PV) cells, or sometimes solar cells. (The science behind these photovoltaic cells is based on the electronics of the diode and is too advanced for primary level; but it is appropriate to talk about them and/or use them).

Black surfaces absorb heat and light better than light shiny surfaces (which reflect heat and light better). That is why people in hot countries often wear white clothes to keep cooler.

Energy cannot be created (or destroyed), so in order to 'make' energy – such as electricity, or heat for buildings – you have to use some other energy; you can change one kind of energy to another.

Trigger questions:

What gives you your energy? *(Food - it is the human 'fuel' – which comes from plants or animals, but animals eat plants; talk about the food chain).*

Where do plants get their energy from? *(The sun – photosynthesis).*

Where do cars, buses, rains and planes get their energy from? *(Petrol, oil – i.e. fossil fuels).*

Where did these fossil fuels get their energy from? *(The sun! Millions of years ago plants absorbed the sun's energy – remember photosynthesis – and then they rotted and were compressed into turf, coal, oil, etc. beneath the ground).*

Burning fossil fuels also produces energy to make electricity. Can you think of any other kinds of energy that are used to make electricity? *(Wind, falling water, nuclear).*

What will we do for energy when these fossil fuels run out?

What do we mean by renewable energy?

Do you know any wind farms or hydro-electric power station? What do you think about them?

Apart from the fact that they will run out some day, are there any other problems with burning fossil fuels? *(They produce carbon dioxide and other 'greenhouse gases'. ...global warming, climate change, etc.)*

How is your house/ the school heated?

SOLAR ENERGY

Content Strand:

Energy
Living Things –Plants and Animals/Myself
Environmental Awareness and Care

Skills:

Experimenting
Investigating – fair testing
Recording
Analysing

Cross - curricular links:

Geography- Air, Water, Impact of human activity on the environment.
History – fossils
Mathematics – drawing a time-line

Science Activities:

1) Absorbing the sun's energy in water

Put one of the cartons in a sunny spot and one in a shaded spot. (You can do this indoors with one on a window sill and one in a press, away from a heater). Put the same amount of water in each e.g. 250 mls. (Remember: FAIR TESTING!).

Dip your finger in each and feel how hot or cold the water is. Leave the cartons standing for 30 minutes and then take the temperature of the water in each carton (you may need to check more frequently if indoors). Record your results: Dip your finger into both cartons again. What do you notice?

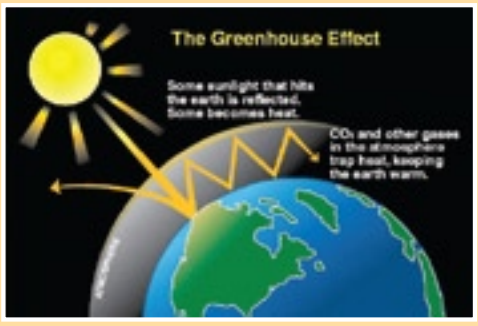
Repeat the readings after one hour, and again after another 30 minutes.

	CARTON IN SUN	CARTON IN SHADE
STARTING TEMPERATURE		
TEMP. (°C) AFTER 1/2 HOUR		
TEMP. (°C) AFTER 1 HOUR		
TEMP. (°C) AFTER 1 1/2 HOURS		

What did you learn from this activity?

Try this without the cling film and see if there is a difference.

The cling film helps to trap the sun's heat in the carton. This is similar to how the earth's atmosphere traps the heat of the sun. This is the greenhouse effect; we could not live on Earth without the greenhouse effect as it would be too cold.



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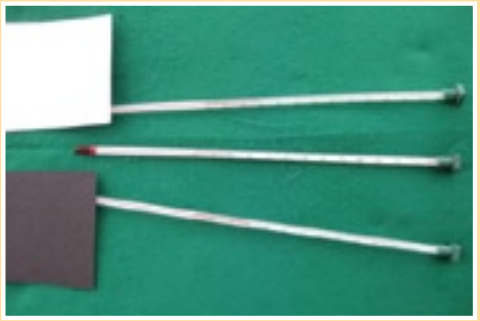
2) Black and White and Thermometers



Put three thermometers in a sunny place.

Cover the bulb of one with black paper.

Cover the bulb of another with white paper.

Leave the third one uncovered.

Predict: Which thermometer do you think will get the hottest?

Wait for a few minutes.

Record the temperatures of the three thermometers.

Were you right?

Can you explain the result?

Maths Activity:

1) GRAPHS (5th/6th classes)

Record the temperatures of the water in the two butter cartons at regular intervals, and make a chart for each:

CARTON IN SUN	
Time	Temp (°C)

CARTON IN SHADE	
Time	Temp (°C)

Draw a graph for each (on either squared paper or graph paper) with 'Time' on the horizontal scale, and 'Temperature' on the vertical scale. What can they say about the shapes of the graphs?

2). MAKE A TIME-LINE (DRAWING TO SCALE)

Make a time-line of the times required to produce energy from different sources, from the following chart:

SOURCES OF ENERGY	PRODUCTION TIME	POSITION ON TIME LINE
Direct solar heat	Minutes	2 cm
Wind	Hours	3 cm
Water	Days and weeks	4 cm
Biomass	Months, years, or decades	5 cm
Coal, oil, natural gas	Millions of years	200 cm

In order to understand this more clearly you can make a time-line as follows:

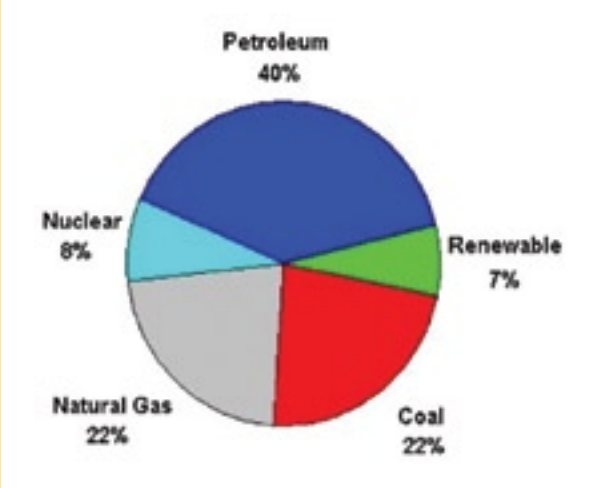
(Draw the first four distances to scale. It would be impossible to get a tape long enough to represent fossil fuels! but making it 200 cm. gives the idea.)

Get a 2 metre length of tape (the sort from cash registers if you can get some) and using a metre stick, begin at one end of the tape and measure the distances mentioned in the third column, and label these lines.. Place a heavy mark to indicate the division between the renewable and non-renewable sources of energy.

Which sources of energy, on your time line, are most commonly used?

3) MAKE A PIE CHART (5th/6th classes)

This pie chart of sources of energy in the USA is taken from figures in 2006:



Can you make a pie chart like this for Ireland in 2007 from the following chart?
(figures taken from Sustainable Energy Ireland Report 2008)

SOURCE	% OF TOTAL
Coal	9
Peat (turf)	4
Oil/Petroleum	56
Natural Gas	27
Renewable	3

Do these figures add up to 100%? If not, the small amount left (how much?) is because we import a small amount of electricity.

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Looking at the 2 pie charts, can you say:

1. What kind of energy do they have in America that we do not have in Ireland? *(Nuclear)*
2. What kind of energy source do we have in Ireland that they do not have in America? *(Turf)*

What do you think about the amount of renewable energy we use in Ireland?

Safety:

Never look directly at the sun – it can damage your eyes.

Be careful with the thermometers.

Follow-up activity:

Solar cooking:

For ideas about solar cooking have a look at:

http://pbskids.org/zoom/activities/sci/solarcookers.html

www.solarcooking.org

Using ideas from these websites, can you design and make your own solar cooker?