5 Energy Sources

a - Energy from the sun

Purpose

To explore sourcing our energy from the sun

Key concepts

- Solar energy is a natural and renewable resource
- Heat energy from the sun can be used to heat things such as water
- Light from the sun can be used by plants and can also be converted to electricity
- There is a difference between solar heat energy and solar light energy

After exploring the many forms and uses of energy (and the impacts they can have on the environment), consider possible ways to reduce your energy use. Also consider how you could increase your use of energy forms that won't harm the environment.

Consider

- How can you collect solar energy for use in your school?
- What are other alternatives?

Evaluate/Reflect

- To what extent were you able to collect and use solar energy in your school? What were the alternatives and were they more feasible?

Activities

Energy from the Sun – Energy from living plants

Energy from the Sun – Energy from solar panels

Renewable Energy – Solar Hot Water

5a.1 Make a solar cooker

5a.2 Solar Energy – almost all our energy comes from the sun

Little Green Readers (MAC)

- Making Use of Solar Energy
- Making a Solar Water Heater
- Solar Cooker
- Power from the Sun

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- Benefits of solar panels
- What's cooking with solar?
- Harnessing solar energy
- Warming it up using solar energy

Background text

Energy from the sun - Energy from living plants

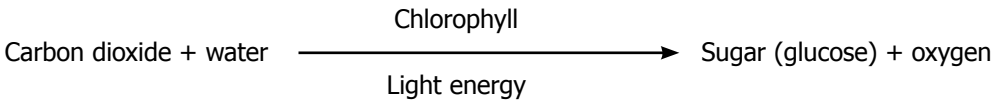
The energy from the sun gives us heat and light. Green plants can directly capture the sun's light energy and change it into stored chemical energy through a process called 'photosynthesis'. Photosynthesis is made up of two words.

Photo = light

Synthesis = putting together

Plants take in carbon dioxide from the air and water from the soil; put them together (in the presence of light energy and chlorophyll) to produce sugar (glucose) and oxygen.

Photosynthesis is very complex. Put simply it is:



Chlorophyll is the green pigment found in plants. Both chlorophyll and light energy need to be present for photosynthesis to take place.

Some of the sugar produced during photosynthesis is used by the plant for growing and reproducing; the excess is converted mainly to starch and stored in various plant parts which may be used as food by animals and humans.

The stored chemical energy in plants is released when the plants are eaten as food by animals and people. A food chain is formed as one living thing feeds on another. At every point on the chain energy is transferred. Animals and people use food to give them energy. The energy is changed to heat and mechanical energy to live, breathe and move.

Look at this interactive website to learn more about the food chains.

http://www.bbc.co.uk/schools/ks2bitesize Science - living things - food chains

Biomass

Fast growing trees are being used as a sustainable energy source called biomass as trees can be grown quickly to replace those that are cut down for fuel.

Biomass energy from wood (woody biomass) is a clean and sustainable energy source. Because fossil fuels are likely to become increasingly expensive, woody biomass can play an important role by providing energy in the form of heat, electricity or transport fuels.

Woody biomass is effectively a store of solar energy. During tree growth, energy from the sun is captured using the process of photosynthesis. The wood stores this energy in the form of cellulose, a form of carbohydrate.

As a renewable energy source that can be grown and used sustainably, burning woody biomass has almost zero net greenhouse effect as the carbon dioxide given off during combustion is absorbed by the growth of the next crop of woody biomass.

Woody biomass can be used to generate heat and electricity, and can also be converted into liquid fuels similar to petrol and diesel. When used as a substitute for fossil fuels (coal, oil and gas) woody biomass reduces the amount of greenhouse gas emissions produced by New Zealand.

Source EECA

Wood pellet fire

Wood pellets

Wood pellets are made from waste wood and sawdust, which is dried and passed through a die at high pressure. Pellets contain 5-10% moisture so they burn longer, hotter and more efficient than firewood which had 25-85% moisture.

Electricity from solar panels

The sun's energy can also be used to produce electricity. The Bay of Plenty is one of the sunniest areas in New Zealand. Photovoltaic cells are able to convert the sun's light energy to electrical energy. Solar panels provide electricity to remote places that are not connected to the electricity grid. Some appliances like torches and calculators have solar cells to provide energy.

Look at the www.schoolgen.co.nz website to see how schools in New Zealand are using solar photovoltaic cells to produce electricity.

In some countries individual houses sell the excess electricity they produce back to the national grid. At night when they are not producing electricity from solar cells, they buy back electricity from the national grid. This system means that the houses do not need banks of batteries to store the electricity they produce during the day to use at night.

There is plenty of solar energy in New Zealand that can be harnessed in many areas. On average, New Zealand has about 2000 hours of bright sunshine each year. In energy terms, New Zealand's solar energy resource is about 4 kWh/m2 per day.

If every New Zealand home had its roof covered in photovoltaic panels, they would collectively generate enough power in a year to satisfy over a quarter of New Zealand's annual electricity needs.

Source EECA

Electricity is only generated during the day when the sun shines on the photovoltaic cell. This solar electricity must be stored in batteries so it can be used when the sun isn't shining.

The sun and other types of renewable energy

The sun also drives the weather systems and the water cycle so the sun is the cause of the winds, the waves and the rain patterns.

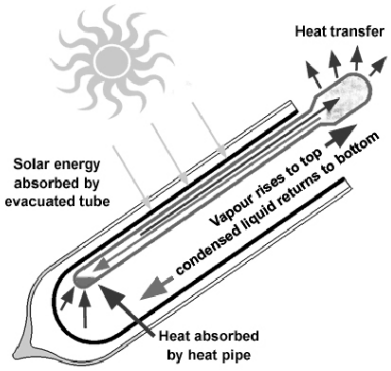
Wind can be used to generate electricity by turning huge wind turbines.

Moving water turns turbines and generators in hydro electric power stations. Wave power and tidal power are also harnessed to generate electricity in some parts of the world.

Solar Hot Water

In sunny places sunlight is an important source of energy. The heat from the sun can be used directly to heat water. Some houses have solar hot water systems on their roofs. The solar hot water systems are black because this is the best colour for absorbing the sun's heat. The sun heats the water during the day. Even on cloudy days there is some solar gain.

There are different types of solar water heating systems. The one below is called an evacuated tube system; the heat is transferred to the pipe containing cold water and the warm water flows back to the hot water cylinder. Other types of solar water heating use a flat panel and have the water cylinder on the roof. Have you seen a house with solar water heating on its roof?



Heat is transferred from the evacuated tube to the water in the hot water cylinder.

5a.1 Make A Solar Cooker

See www.schoolgen.co.nz "What's cooking with solar"

Or make a solar hot box using the instructions below.

You will need

- A pizza box (a 12" square box works well)
- Tape
- Aluminium foil
- A pair of scissors
- An ice-block stick (popsicle stick)
- A piece of transparent plastic
- A piece of black paper the same size as the base of the pizza box.
- Plain biscuit and piece of chocolate

1 Cut a flap in the lid of the pizza box. Cut three sides about 3cms in from the edge and fold back the 4th side at the back to form the flap.

2 Cut a piece of aluminium foil to cover the inside of the flap and fold over or tape in place.

3 Place the black paper inside on the base of the pizza box.

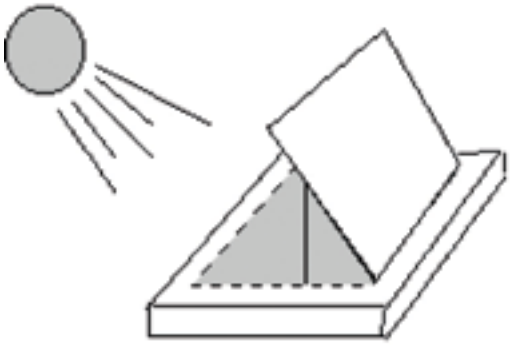
4 Cut a piece of transparent plastic to fit the hole under the flap in the lid. Tape the plastic in place on the inside of the lid.

5 Place the biscuit with the chocolate on top of it inside the solar cooker.

6 Find a sunny spot and angle the foil of the lid flap to best concentrate the solar heat energy. Use the stick to keep the flap at the best angle.

7 Spread the melted chocolate over the biscuit.

8 Try insulating the solar cooker by rolling up newspaper and taping it around the outside of the box. Stand the cooker on a few pieces of folded newspaper. Does it make a difference?



5a.2 Solar Energy
– almost all our energy comes from the sun

The pictures show how the sun's energy is changed into electrical energy.