

## Sun & Heat – Teacher Notes

Sun heat (infra red radiation) can be used passively (solar cooker) or be transformed into wind power or waterpower, which themselves can be further transformed to movement and electricity. Apart from heat derived from the natural breakdown of radioactivity in our rocks and from wave turbines, the Sun is the source of most of our energy

### Wind energy

Land heats and cools faster than water/sea. Heat from the Sun in the day warms the atmosphere above land. The air expands and this creates upward moving air currents or wind as the cooler denser air over the sea rushes in to take its place. At night air cools down faster above land and the reverse happens. People who live near the coast enjoy this effect as the breeze coming in from the sea cools them in summer. It is often called “The Fremantle Doctor”. Darker land heats faster than lighter land.

These activities only take about 15 minutes. The class can be split with half doing one activity and the other half doing the other.

### Student Activity - To demonstrate that heating air causes it to expand

#### Materials per group

- Empty cool drink bottle
- A Balloon
- A sunny spot, radiant heater or hairdryer
- Option – access to a fridge

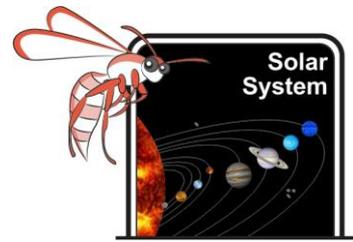
#### Method

1. Inflate the balloon several times to soften the latex
2. Place the balloon over the mouth of the bottle. I have placed the balloon and bottle in the fridge or in a cold-water bath to keep it cool.
3. Draw and describe the balloon (Before)
4. Place the bottle with balloon attached in a sunny area (preferably away from the wind as it will take longer to heat and may blow over)
5. Leave for 10 minutes
6. Draw and describe the balloon (After)

**Warning - Some of the students may find watching the balloon inflate overly funny.**

#### Observations

	
Before (cold) The balloon was deflated	After (hotter) The balloon was inflated by expanding heated air in the bottle



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### Conclusion

What do you think caused the change to the balloon?

Heat made the air in the bottle expand and the balloon was inflated

### Discussion

Was this a fair test? Did the Cow Moo Softly? Explain your answer.

It was not a fair test because although we changed only one thing and kept everything else the same, we did not measure the expansion of the air.



### Student Activity - To demonstrate that land heats faster than water



### Materials per group

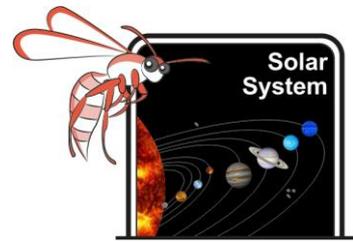
- Two small beakers, glasses, jam jars or containers of the same size. I have used the washed and pre-cut bottoms of cool drink bottles so there was enough equipment for the whole class. I found that a bread knife cuts them easily.
- Water and soil (preferably dark)
- A laboratory thermometer

### Method

1. Fill one container with water and the other with the same volume of soil
2. Take the temperature of the soil and of the water before placing in sunlight. Enter this data in the table provided
3. Place in sunlight and leave for 10 minutes
4. Take the temperature of each again and enter the data in the table provided

### Observations On a 26°C day

	Temperature of water °C	Temperature of soil °C
Inside	24	24
Outside after 10 minutes	26	32



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Differential heating and cooling at the surface of the Earth can be due to:

Time of day

Season/tilt of the axis

Land or sea

Colour of surface light or dark



These variations cause a difference in air pressure to occur and wind is generated. This wind can be used to turn the blades of turbines to generate electricity from wind farms.

What else can wind energy be used for?

Drying wet clothes

Wind turbines

Sailing ships. Interestingly long haul tankers and large modern cargo ships often use additional sails when out from port to cut fuel costs

Corn mills

Winnowing grain in third world countries.



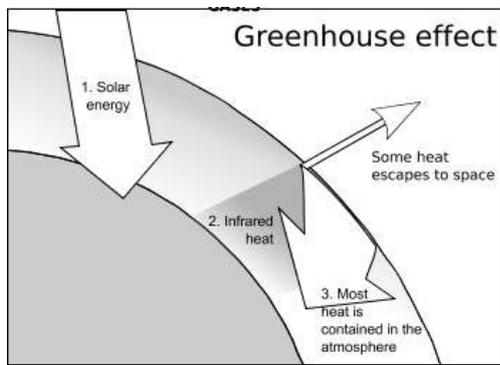
An old Australian bush trick was to leave a black plastic jerry can out in the sun during the day. When you came back from work dirty, the water would have warmed and made an excellent shower. Black plastic hose was also draped over bush roofs and beach shacks to provide hot water.

### Extension at home

Students may try using three or four different soil types to find which heats up fastest. Suggestions would be black potting mix, grey limy soil, yellow building sand and white coastal sand. The darker the soil the faster it heats up.

### Student misconception

A common student misconception is that atmospheric carbon dioxide and its greenhouse effect is



dangerous. Low levels of carbon dioxide are necessary to retain heat in the atmosphere. Without some atmospheric carbon dioxide to retain heat, life could not have evolved, as the planet surface would be frozen. If the carbon dioxide levels rise too high however, an enhanced greenhouse effect occurs and temperatures increase. All life depends on enzymes that make changes in cellular behaviour. They only work within a narrow range of temperatures. Increased and decreased levels of carbon dioxide in our geological past have been linked to extinction events.

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