EASY SCIENCE

# Biofuel

## - is this the solution to our power problems?

**Most of the fuel we use today to run our cars and to generate power such as electricity comes from fossil fuels. This is the name given to coal, petroleum (or crude oil) and natural gas which are extracted from the rocks of the Earth's crust.**

Fossil fuels come from animal and plant remains from many millions of years ago that formed fossils. Natural gas and oil are well-known fossil fuels that are often found together. Fossil fuels are natural resources that are only found in certain places and countries. South Africa is rich in coal, but poor in crude oil and natural gas.

### Running out?

For the past 150 years, oil and coal have been the main energy sources used in industrialised countries. There is much more energy stored in fossil fuels than in any other currently available energy source. No other source of energy is as cheap and powerful.

Fossil fuels have been providing a very "easy" energy source for man, but there is a limited amount of fossil fuel on Earth. It is not "renewable" and there is no known way to make more.

### Dirty fuels

Apart from the fact that fossil fuels may run out in time, they are also very "dirty" fuels. When we burn them, a lot of greenhouse gases (GHGs), especially carbon dioxide, are released into the atmosphere. These gases trap the Sun's heat in the atmosphere close to the Earth's surface, with the result that the Earth's temperature keeps rising. This is called global warming, which will make the world hotter, air and water dirtier and cause floods and droughts among other things.

All over the world there is agreement that we need to reduce the levels GHGs in the atmosphere. One way to do this is by reducing the amount of fossil fuel we use.

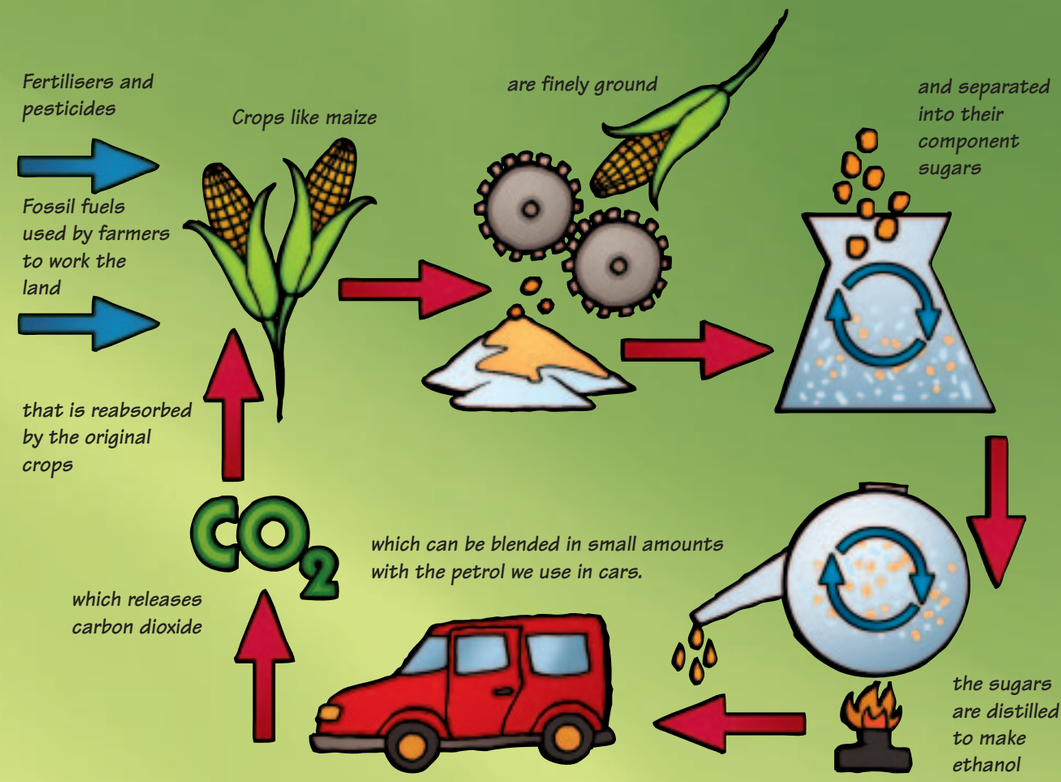
But then we will need alternate sources of energy. Alternate forms of energy are nuclear energy, solar power, wind power, hydrogen, and biomass.

Governments all over the world, including South Africa, are looking into producing more biofuel from biomass.

### What is biomass?

Biomass is organic material from living plants or organic waste. Biomass contains stored energy from the Sun.

Some examples of biomass fuels are wood, plants such as agricultural crops, manure, and even some garbage.




When burned, the chemical energy in biomass (the stored energy from the Sun) is released as heat. If you make a fire for a braai, the wood you burn is a biomass fuel. Wood waste (or garbage) can be burned to produce steam for making electricity, or to provide heat to industries and homes.

### Biofuels

Biofuels are energy sources that are produced from biomass. These fuels are usually blended with the petroleum fuels - petrol and diesel - but they can also be used on their own.

**The two main types of biofuels that are in use today are:**

- Plant sugars or starches that come from biofuel crops such as sugar cane, rice, wheat and maize. These crops are fermented to produce ethanol. Ethanol, an alcohol fuel, can be blended in small amounts with the petrol we currently use in our cars.
- Biodiesel that comes from vegetable oils, such as rapeseed or soybean. Even fats, or greases - such as recycled restaurant grease can be used to produce biodiesel.

**New sources of biofuels that are still being researched and developed include:**

- Non-edible plants and plant parts. Scientists are working on cheaper ways to make ethanol by using all parts of plants and trees. Farmers are experimenting with other sources like small trees and grass, to see if they can grow them cheaply and abundantly. Scientists and farmers are doing research on new biodiesel crops such as jatropha, a non-edible plant with oil rich seeds that grows on land where nothing else will.
- Algae, that are easy to grow and that can carry up to 50% oil content and is a good candidate for making biodiesel.

### Why consider using biofuels?

Biomass is a renewable energy source because we can always grow more trees and crops, and waste will always exist.

Using biofuels means we don't burn quite as much fossil fuel. Ethanol and biodiesel are still more expensive than fossil fuels but they are cleaner burning fuels, producing fewer air pollutants.

Biodiesel fuels can be used in diesel engines without changing them. Biodiesel, a renewable fuel, is safe, biodegradable, and reduces the emissions of most air pollutants.

Biofuel crops recycle carbon dioxide by absorbing it when they grow and then releasing it back into the atmosphere when they are burned. So, in theory, crops grown fo biofuels should not add to the total amount of carbon dioxide in the atmosphere.

Most farmers, however, use fossil fuels to work the land and for many other purposes. This amount varies from crop to crop. So in practice one cannot say that the production of biofuels do not add to GHG emissions at all.

**EasyScience is produced by the South African Agency for Science and Technology Advancement (SAASTA), an operational unit of the National Research Foundation. SAASTA's mission is to promote the public understanding, appreciation and engagement with science and technology among all South Africans. Visit the website: www.saasta.ac.za for more information.**

SAASTA

## What are the issues around biofuels?

We need new technology and better farming practices before biomass can replace fossil fuels. These technologies should increase the production of biofuels, minimize the negative impact on the environment or food supply, and use less energy to grow, extract and burn the fuels than the total energy they supply.

**● Food supply**

Countries are currently using the crops they grow best (because of factors such as climate and agricultural practices) to produce biofuels. This means they use mostly food crops, which can drive up food prices. Farmers will rather plant biofuel crops than food crops if they can get a better price for the former. This also puts pressure on the limited land available for agriculture and on water supplies.

Fortunately it seems that new crops, such as inedible plants that can thrive under harsh conditions, such as jatropha, can be developed to replace food crops as sources of biofuels.

**● Energy balance**

The production of ethanol from maize now consumes about the same amount of fossil fuel as the ethanol itself replaces.

**● Environment**

Some biofuel crops harm the environment. They need lots of fertiliser, pesticides and water to grow and can cause soil erosion.

## If not biofuels, then what is the solution?

Biofuels are one tool of many. The production of biofuels is only one of a number of energy options that can eventually replace fossil fuels. These include nuclear energy, solar energy, and wind power. Fossil fuels, especially coal, will however remain an important part of the energy mix for the foreseeable future.

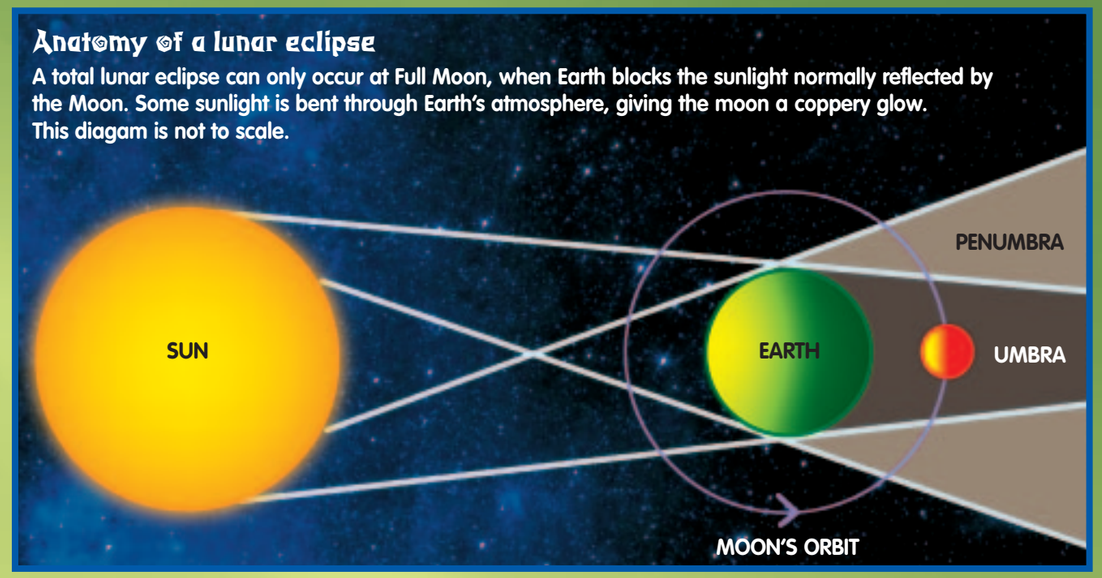
# The Moon went missing!

**A total eclipse of the Moon (also called a lunar eclipse) occurred on the evening of 20 February and the morning of 21 February. It was visible in the predawn western sky from most of Africa and Europe on February 21.**

The South African Astronomical Observatory (SAAO) joined forces with Lynedoch Primary School in Stellenbosch, Victor Scott primary school in Bermuda and the Universe Awareness Programme in the Netherlands, to participate in a global event where learners from various countries were linked up via a Skypecast (an Internet-based conferencing tool) while they were looking at the eclipse.

*The Moon as seen from Stellenbosch during the lunar eclipse.*






On the afternoon of the 20th SAAO staff explained to the learners at school what they could expect to see that night and the next morning. Twenty learners then slept over at the school and got up very early on the morning of 21 February to watch the eclipse near moonset and to share their experiences with learners from other countries.

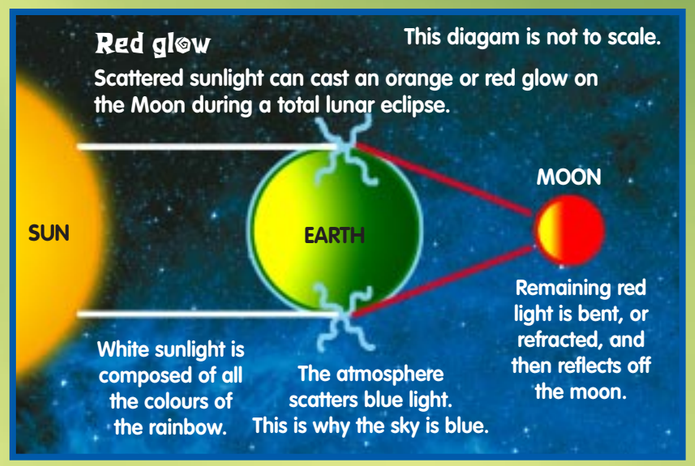
SAAO took telescopes and a solar filter for both day and night viewing to the school, which made this a really special experience.

## What is a lunar eclipse?

A lunar eclipse occurs whenever the Moon passes through some portion of the Earth's shadow. This happens only when the Sun, Earth and Moon are aligned exactly, or very closely so, with the Earth in the middle. There is always a full moon the night of a lunar eclipse.

The Earth's shadow is made up of two parts, one nested inside the other. The outer shadow, called the penumbra, is a zone where the Earth blocks only parts of the Sun's rays from reaching the Moon. The inner shadow, or umbra, is a region where the Earth blocks all direct sunlight from reaching the Moon.

Why does the Moon look red during a lunar eclipse? Some of the sunlight striking the Earth is diffused and scattered by our atmosphere, so the Earth's shadow is not completely dark. The sunlight refracted from the atmosphere around the edge of the Earth makes the Moon glow with a reddish tint.




*Learners from Lynedoch Primary line up to catch a glimpse of the sky through a telescope. The telescope has been fitted with a filter, which makes it safe to look at the Sun. DO NOT TRY THIS WITHOUT THE PROPER EQUIPMENT. YOU CAN GO BLIND IF YOU DO!*