BIOFUELS

TEACHER / FACILITATOR PACK

Materials developed on behalf of the Royal Air Force to support Glasgow Science Centre Learning Lab.

Materials appropriate for P5 - P7 pupils.

Lesson objective	To learn about the development of biofuels and how they can be used as alternatives to traditional fuels (such as coal and gas).
Duration	Approximate **total** duration of all activities in this resource pack: 1.5 hours. Indicative timings provided for each component.
Context to set the scene for the session	Biofuel is fuel from recently lifeless or living biological material. Biofuel can be solid, liquid or gas. They are renewable and good substitutes to fossil fuels which are from long dead biological material. Some biofuels are produced from plants, from waste processes and recycled material. There are a few ways to produce biofuels from plants. One way is to convert them into gas and liquid fuels. Another way is to grow plants that contain high amounts of oil, and many materials such as wood and grasses can be dried and burnt. These biofuels are used to produce power and are used to power cars, heat buildings and for cooking. Most biofuel companies are from Europe, Asia, and America.

English curriculum links

This activity provides links to experience and outcomes in a number of subject areas covered by the National Curriculum for England *Science programmes of study: key stages 1 and 2*. Specifically, these include:

Purpose of study The national curriculum for science aims to ensure that all pupils: develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics, develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them, are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future. **Aims (page 3).**

Plants Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other. **Year 2 programme of study (page 10)**

Everyday Materials Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. **Year 5 programme of study (page 28)**

Pupil resources

- Introductory explainer
- RAF Marham and biogas
- Biofuels Factsheet
- Worksheet: Which fuel?
- Worksheet: The future and biofuels!
- Worksheet: Biofuels word search
- Worksheet: The biofuels bus
- Worksheet: The biofuels quiz

Hook into the lesson (10 mins)

Play **INTRODUCTORY EXPLAINER**.

Additional context

Stocks of fossil fuels are getting smaller and smaller. Fossil fuels like coal and gas are formed from dead animals and plants that have been buried for millions of years. Burning coal and gas is bad for the environment because they have a high carbon content. The carbon dioxide causes pollution and has led to climate change. We need to find alternative sources of power if we want to keep using the same amount of energy and the same transport system. Biofuels may be part of the solution to these problems! They can be used to provide energy by harvesting crops, trees, agricultural waste and animal waste. We can use all of these things to generate heat and electricity or to fuel transport."

- Biofuel energy was slow to develop in Scotland compared to some countries even though there is a mass of biofuel sources, such as land. But exciting projects are now underway and Scotland's aim is to supply the nation with cheap and clean heat and power in the near future. (info taken from Biomass Action Plan for Scotland)

- Provide pupils with a copy of **Biofuels FACTSHEET.**
- Discuss examples of biofuels including RAF **RAF MARHAM AND BIOGAS.**

Activity (10 mins)

Ask pupils to identify why biofuels are good for the environment.
Ask if pupils think some biofuels will be easier to produce than others.

Lead a discussion with pupils that explores the various fuel sources used in **Worksheet: WHICH FUEL?** (fuel sources include coal, petrol/diesel/aviation fuel/wind energy/electricity).

Activity (20 mins)

Ask pupils what are the challenges about the future and fuels?

Provide pupils with a copy of **Worksheet: THE FUTURE AND BIOFUELS.**

Activity (10 mins)

Ask pupils: 'What does the word Biodiversity mean?' This word appears in the wordsearch.

Provide pupils with a copy of **Worksheet: WORDSEARCH.**

Activity (20 mins)

Ask pupils who has been on a bus and how many people do they think use the bus on a regular basis? Is using public transport better or worse for the environment?

Provide pupils with a copy of **Worksheet: MY BIOFUELS BUS.**

Activity
(20 mins)

Ask pupils who can name one of the three main biofuels? And who can say how they are made?

Provide pupils with a copy of **Worksheet: QUIZ.**

ANSWERS:
Q1: What does the word biofuel mean?
A fuel made from living or recently living biological matter.

Q2: How is biogas made?
By collecting gas from rotting animal waste.

Q3: What chemical is contributing to climate change?
Carbon dioxide.

Q4: What daily activities require fuel?
All of the above.

Q5: A fuel formed naturally in the ground from the remains of living organisms is?
Fossil Fuel.

Q6: Which of these is NOT a FOSSIL FUEL?
Ethanol.

Q7: Resources that can be produced over and over are called?
Renewable resources.

Q8: Which of these is NOT an example of a BIOFUEL?
Natural gas AND/OR Petrol.

Q9: Which of these is NOT an example of a RENEWABLE RESOURCE?
Coal.

Q10: Resources that can only be used once are called?
Non-renewable resources.

BIOFUELS

TEACHER / FACILITATOR PACK

CONTEXT AND EXAMPLES

USE OF BIOFUELS IN SCOTLAND

It gives a whole new meaning to the phrase "one for the road". Whisky, the spirit that powers the Scottish economy, is being used to develop a new biofuel which could be available at petrol pumps in a few years.

Researchers at Edinburgh Napier University have been working with Glenkinchie Distillery in East Lothian and have developed a way of producing biofuel from some of the waste produced when making whisky!

BIOFUELS TO FLY AIRCRAFT!

The RAF is using biofuels in a big way. By 2050 aircraft such as F-35s, Typhoons and Wildcat helicopters will replace up to half of their traditional aviation fuel with sustainable sources – these include the use of biofuels. Sustainable sources of fuel are also known as 'drop-ins,' and these include hydrogenated fats and oils, wood waste, alcohols, sugars, household waste, biomass and algae.

SCOTLAND DRIVES FOR GREENER CARS

Scotland has set tough targets to reduce the problem of harmful gas emissions. GreenFleet is a Scottish biofuels programme aiming to replace combustion-engine vehicles with greener ones.

This fleet would consist of electric cars and vans and new engine types that use biofuel. To reach these goals there are a number of things that need to be addressed, such as plant feedstock availability, land availability, government policy and money to support the programme.

More information on GreenFleet's website.

Rudolf Diesel
(inventor of the diesel engine)

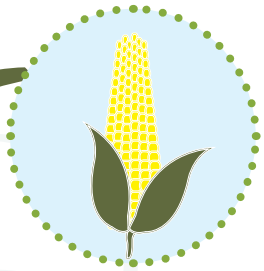
Biofuel is not a new invention. It has a long history in the motor industry, going back to the 1800's. Rudolf Diesel designed car engines to run on peanut oil. And the first Model T Ford cars ran on bioethanol.

BIOGAS AT RAF MARHAM

RAF Marham in Norfolk is one of the RAFs most important bases. It is where the new F-35 aircraft are based.

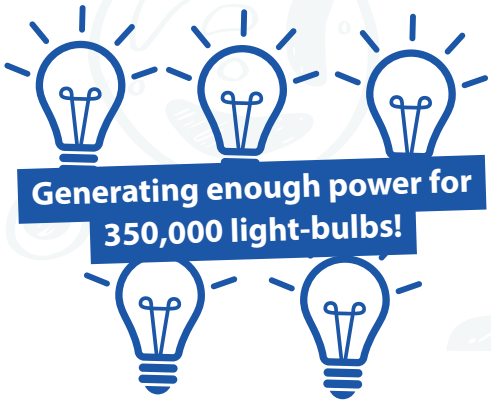
Biogas will be produced by fermenting locally grown crops. This process will provide up to 95% of RAF Marham's energy needs. That's not all, the waste from the process is then going to be used by local farmers as a fertilizer for other crops!

Biogas facilities being built at RAF Marham

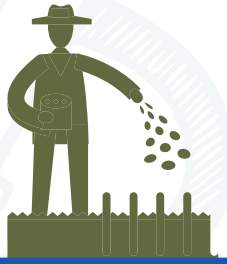


Crops fermented

Biogas produced from crops



Generating enough power for 350,000 light-bulbs!



Waste product used to fertilise local crops