BBC Learning Scotland

AROUND SCOTLAND

Autumn 2008

Mondays 11.40–12.00

6 and 13 October

BBC 2

Sustainability: renewable energy

Curriculum for Excellence

These notes relate to re-transmitted programmes, and were conceived within the 5–14 framework. While the 5–14 terminology has been retained, teachers are encouraged to consider the content in terms of its contribution to promoting successful learners, confident individuals, responsible citizens and effective contributors.

Around Scotland

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Sustainability: renewable energy

Sustainability — renewable energy

Introduction

The programmes

The two programmes in this unit, presented by Grant O'Rourke, are designed to provide a stimulus for the study of renewable and non-renewable energy sources.

Grant visits both renewable and non-renewable power stations and is introduced to renewable and non-renewable fuel sources by viewing examples of each and listening to those working in the field explaining how they work.

During the course of both programmes pupils are encouraged to weigh up the pros and cons of each area explored, to allow them to make informed judgements for themselves.

The teacher's notes

The teacher's notes accompanying this programme include a summary of each programme, and suggestions for preliminary and follow-up activities.

Worksheets are also provided, and these can be printed out in multiple copies or photocopied for class use.

The forward plan outlines strands and attainment targets for the material.

Learning outcomes

After working through the material, pupils will understand that:

Energy

— energy is the ability to 'work'.

— energy comes in different forms – electrical, heat, light, sound, chemical, kinetic etc.

— we use electrical energy to help us with a variety of tasks e.g. heating, lighting etc.

Electricity Generation

— electrical energy is generated at power stations.

— power stations use a range of energy sources to generate energy.

— energy sources can be divided into renewable and non-renewable sources.

— renewable sources of energy can be replaced and are clean sources of energy e.g. water, solar, wind.

— non-renewable sources cannot be replaced and cause pollution, which in turn causes global warming e.g. fossil fuels such as coal, oil and gas.

— the burning of fossil fuels emits huge amounts of carbon dioxide and other harmful gases into the environment. These are called greenhouse gases which cause the greenhouse effect. The greenhouse effect is the rise in temperature that the Earth experiences because these gases trap energy from the sun.

— fossil fuels are coal, oil and gas. They have been produced over millions of years as plant and animal matter, have decayed and have been compressed in layers.

— everyone needs to work together to save energy to prevent global warming.

Demand for Energy

— our need for energy (e.g. cars, electricity, heating etc.) is having a serious impact on the world around us through the harmful gases produced. These gases have a negative effect on the balance of Earth's atmosphere.

— we need to reduce emissions of greenhouse gases, be more energy efficient and use alternative sources of energy if we are to reduce the impact of global warming.

What is Being Done

— everyone has a responsibility to try to save energy and try to prevent the effects of global warming.

Programme One **The energy gap**

— Transmission date 6 October 2008

Programme content

This programme introduces pupils to the concept of the 'energy gap' and its impact in relation to our everyday lives with specific reference to electricity generation. It encourages thinking about energy consumption, and how energy is produced and supplied in a range of ways, to meet our demands.

A range of non-renewable energy sources (nuclear and coal-fired power) and renewable energy sources (wind, solar, hydro and wave/tidal power) are explored, detailing advantages and disadvantages of each.

Key vocabulary

Words in bold type are used in the programme itself.
The other words are useful for explaining the concepts being taught.

energy	**power stations**	**energy shortage**
electricity generation	supply and demand	**nuclear energy**
fossil fuels	**turbines**	**pollution**
greenhouse gases	**global warming**	**renewable energy sources**
wind power	**wind turbine**	**non-renewable energy sources**
solar power	**hydro power**	**wave power**
tidal power	**sustainable**	**advantages**
disadvantages		

Before the programme

Energy discussion

— Discuss with pupils what they think 'energy' means and establish that energy gives us the ability to do work.

— Talk about how people get the energy they need to carry out tasks. (We get it from our food.)

— Discuss how in the past the sources of energy that people drew on were usually mechanical but that today electrical energy is mainly used.

— Discuss how electrical energy, once it has been generated, can be converted into other forms of energy such as heat, light, sound and mechanical energy, to help us do the work we need to do.

The Electricity Game

Note: that you may wish to split this activity over two sessions, completing 'electricity use' in session one and 'reducing consumption' in session two.

— Tell the pupils that they are going to play the *Electricity Game*. This game will show them the extent to which we use electricity nowadays in our every day life and how we can reduce our electricity consumption.

— The class should be split into groups of four. Using Worksheet One, they will try to list 10 ways in which they use electrical energy in their daily lives and 10 ways of saving electrical energy in their daily lives

— Explain that for each appropriate suggestion they can gain points for their team. Award no points for an inappropriate answer, and five points for an answer that more than one group has suggested. Award ten points if a group has a unique answer that no-one else has thought of

— Once completed, ask pupils to add up their team scores. Which team will be the winner?

Electricity generation discussion

— Ask pupils if they can name some of the different types of power stations that generate our electricity, such as coal, gas, wind, water or nuclear powered.

— Introduce the terms 'renewable' and 'non-renewable' in relation to energy and power stations and discuss their meanings.

— Introduce the concept of pollution and global warming from burning fossil fuels.

— Discuss the meaning of green energy / clean energy in relation to renewable energy sources and how this is being greatly exploited because of the problems of burning fossil fuels

After the programme

Words, words, words

Copy Worksheet Two for the pupils and ask them to complete the cloze procedure using the information gained in the discussion and from the programme. This worksheet can be completed either individually, in pairs, in groups or as a class.

'Save Electricity' poster design

Ask pupils to design posters to place around the school prompting pupils, teachers and visitors to save energy. What catchy slogans can they come up with? What colours will they use to catch people's eyes? Encourage pupils to think about as many ways as possible of saving electricity and encourage the use of the three B's of poster design – *big*, *bright* and *bold*.

Invent it

Can the pupils follow the example of the inventors they saw in Erskine, and come up with an invention that focuses on 'clean' energy from renewable sources? First, they should try to come up with as many ideas as possible, no matter how unlikely or imaginative (you could do this as a class session). Next, they should design the invention on paper and make a detailed list of the materials needed (this could be done either as a class, in groups or individually). The pupils could then build prototype models (this could be done in small groups or individually). Lastly, they could test their inventions.

Name

The Electricity Game

In the first column, make a list of 10 things you do in your daily lives that use electricity.
In the second column, make a list of 10 ways of reducing the amount of electricity you use.

We use electricity for		We can save electricity by	
	Score		*Score*
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Total for this column		**Total for this column**	

uranium	Renewable	
energy	fossil	TV
nuclear	electricity	
work	generated	wind
coal	gone	water

Name

Words, words, words

All about energy

Energy is the ability to do _ _ _ _. Energy gives us the power to do things we want to do, like making a fire or watching _ _.

Some sources of _ _ _ _ _ _ we heard about in the programme were nuclear energy, coal fired energy, solar energy, wind energy and energy from water power (hydro electric energy).

Grant told us we could split energy sources into two main groups:

1: _ _ _ _ _ _ _ _ _ energy sources. These are things that are replaced by nature, like wind, water and sunshine. They don't pollute air or water and are described as 'clean'.

2: Non-renewable energy sources. These are things that can't be replaced. Once we use them up, they're _ _ _ _ forever. They also cause pollution.

Both types can be used to produce _ _ _ _ _ _ _ _ _ _ _ to meet our demands.

Fossil fuels

We learned that electrical energy can be _ _ _ _ _ _ _ _ _ from burning non-renewable energy sources, which include the _ _ _ _ _ _ fuels oil, natural gas and coal. Longannet Power station was an example of a _ _ _ _ fired power station in the programme.

Nuclear Power

At Torness Power Station we saw how a metal called _ _ _ _ _ _ _ is used to create electricity by splitting its atoms. This is called _ _ _ _ _ _ _ energy.

Renewable Energy

The school we saw had decided to generate electricity using the energy from the _ _ _ _ and the wave powered station in Islay generated electricity from the power of _ _ _ _ _.

We use all these energy sources to generate the electricity we need for our homes, schools and workplaces.

BUT THE BIG QUESTION IS

Which types of power station would you choose for the future?

Why?

Programme Two **On the horizon**

— Transmission date 13 October 2008

Programme content

This programme further explores the concept of the 'energy gap' and its impact in relation to our everyday lives, but this time, with specific reference to fuels. It encourages pupils to think about the fuels used in the past to generate heat and electricity and to power our vehicles, and also to consider why alternative fuels are being developed to meet our demands.

A range of non-renewable fuels (diesel, petrol and coal) and renewable fuels (bio diesel, biomass and hydrogen fuel cells) are explored, and the advantages and disadvantages of each are discussed.

Key vocabulary

Words in bold type are used in the programme itself.
The other words are useful for explaining the concepts being taught.

energy	**energy gap**	**energy shortage**
power stations	**generating**	**fuels**
fossil fuels	**pollution**	**atmosphere**
greenhouse gases	global warming	**renewable energy**
alternative	sustainable	non—renewable energy sources
advantages	**disadvantages**	**bio diesel**
biomass	**sewage**	**hydrogen**

Before the programme

'Alternatives' discussion

— Explain to pupils that the programme they are going to see is about alternative forms of energy.

— Discuss with pupils the meaning of the word 'alternative' (you may wish pupils to look this word up in their dictionaries) and ask them what they think it means.

— Establish that the meaning of this word is 'something used or done in place of something else' and recap on the forms of alternative energy sources explored in Programme One (such as wind power and water power) and how they are being used in place of fossil fuels.

— Discuss the meaning of the word 'fuel' (you may want pupils to look this word up in their dictionaries) and ask pupils what they think it means.

— Establish with pupils that the meaning of this word is 'a material which is consumed to create energy'. Ask the pupils to think of as many fuels as they can (such as petrol, diesel, gas, coal, oil and so on).

— Ask whether pupils have seen, either on TV, in newspapers or in magazines, any articles about vehicles using alternative fuels. You might tell them about electric cars. You can find a story about test driving an electric car, with pictures, at

http://news.bbc.co.uk/1/hi/uk/1535831.stm

After the programme

Match It Up worksheet

Immediately after the programme if possible, carry out the 'Match it Up' activity on Worksheet Three. Pupils will need three coloured pencils (red, blue and yellow) and should match up three statements relating to the fuels discussed in the programme. This activity outlines how the fuels are made and also outlines, in simple terms, some of their advantages and disadvantages.

As an alternative, you may wish pupils to cut out each of the boxes and stick them on to another sheet of paper in columns or rows relating to each fuel source

Ideas Galore

Ask pupils to design a car of the future with a new fuel source. Encourage them to be as creative as they like with both design and fuel source. After designing the car and deciding on the fuel, they should annotate their diagram with details of the car's special parts, and an explanation of how the fuel source will work in practice.

Game Plan

Give pupils in small groups a large piece of paper, a dice and some counters. Can they design a 'snakes and ladders' type board game about the renewable and non-renewable energy sources they have learned about?

For 'renewable' squares on the board, players could move up the ladders (or some alternative method of movement) when they land on squares saying things like, 'You buy a hydrogen powered car' or 'You install a wind turbine'.

For 'non-renewable' squares on the board, players could move down the snakes or some alternative when they land on a square saying things like, ' You buy a gas guzzling jeep' or 'You leave your TV on standby'.

Pupils could think of a good name for their game, make up some rules, then play it with classmates.

Name

Match it up

You will need three coloured pencils (red, blue and yellow) to carry out this activity.
After watching the programme about alternative fuels,
match up three boxes all about bio diesel by colouring them all RED,
match up three boxes all about biomass by colouring them all BLUE,
match up three boxes all about hydrogen by colouring them all YELLOW.
How much have you remembered?

Biomass is a fuel made from poo (sewage to give it its proper name) and wood chips!	Using hydrogen to power cars (and even generate electricity for houses) is very expensive.	The car has a fuel cell inside that carries out a special process to make electricity.
Bio diesel is new fuel. It is an alternative to diesel. It is made from vegetable oil.	The poo and wood chips are made into pellets that can be burned to generate electricity	Our cars and lorries can run on bio diesel. It is cheap to make and doesn't use fossil fuels, but you need a lot of oil to make it!
Hydrogen is a gas with no colour or smell. New cars have been developed to run on this fuel.	The oil is a waste product collected from chip shops, hotels and factories. The vegetable oil is then cleaned and a chemical is added.	This fuel is cheap to make and is renewable but it gives off fumes. The wood chips also use lots of trees which is not so good.