Energy: Background Information

Domestic consumption of energy accounts for almost 25% of the carbon dioxide emissions in the UK, produced by the burning of fossil fuels such as coal, oil and gas. Carbon dioxide contributes to the problem of global warming as it 'traps' energy from the sun (which would normally be dispersed into space) inside the earth's atmosphere. This 'trapped' heat acts like a blanket - or greenhouse - and is believed to be a cause of changes in our climate (called climate change or global warming).

Electricity, gas, oil and coal are being consumed at an ever-increasing rate. If we continue to use non-renewable fuels for energy at the current rate then the supplies could run out during the lifetime of children born in the 1990s.

Currently, renewable forms of energy such as wind, sun and water only supply a small percentage of our requirements. So it makes sense to:

- use as little energy as is necessary,
- get the maximum amount of energy out of every type of fuel that is used and
- ensure a minimum of energy is wasted

Energy is used in schools for lighting, cooking, heating and air conditioning. Lighting uses electricity but cooking and heating may also use gas, oil or solid fuel. All electrical goods should have a plate fixed to them showing the amount of power that they require, measured in watts (W) or Kilowatts (kW). Schools have meters recording the amount of power that is used in kilowatt-hours (kWh). Gas and oil are measured by volume, as cubic metres and litres respectively, and solid fuel is measured by weight (tonnes).

National Curriculum overview

The energy activity involves reading a variety of scales accurately and using a variety of units and so answers requirements for Science and Mathematics.

ICT (optional) common to all activities
Key Stage 2 3a Share and exchange information in a variety of forms.

Citizenship common to all activities
Key Stage 3 1i knowledge of the world as a global community, and the political, economic, environmental and social implications of this

GLOBE Energy Activity

Activity 1. Fuel for Thought

Pupils will measure the total energy use of the school, looking at the different sources of the energy used to work out an 'Energy Profile' of your school for a one-week period.

Preparation: You will need to discover where the various metres are within the school. Is there access for you and some pupils or will the information have to be collected by the caretaker?
Ensure pupils understand the different measurements used.
You will need to measure the various meters twice – at exactly one week apart.

The activity:

1. Discuss the kinds of energy used in the school – can the pupils suggest other energy sources.
2. Introduce the various units used to measure energy in school – show them the data sheet.
3. Pupils will need to meet with the building officer / head teacher and accompany them to take the readings.
4. Enter the totals onto the GLOBE database.

Follow up: You can usefully carry out the activity at different times of the year, to see how climate and the seasons impact on energy use

National Curriculum

Science

Key Stage 2	Sc1.2	Pupils can use all their investigative skills in a practical, real experiment.
Key Stage 3	Sc4.5a	variety of energy resources
	Sc4.5c	electricity is generated by a variety of energy resources
	Sc4.5e	ways of storing and transferring energy
	Sc4.5g	energy may be dissipating, reducing its availability as a resource

Mathematics

Key Stage 2	Ma 3.4b	read scales with increasing accuracy
Key Stage 3	Ma3.4a	interpret scales on a range of instruments

GLOBE Energy Activities

Activity 2. An efficient school

The activity looks for any energy saving measures used by the school such as thermostats on radiators, turning off stand-by switches on TV etc.

Preparation: Get agreement from all staff (their rooms will be checked.
Copy the 'efficient school' data sheet.

The activity

1. Decide how to divide up the work – maybe assign different areas of the school to different pupils.
2. Talk about energy conservation with the pupils and elicit from them a list of actions that would save energy around the school.
3. Discuss the data collection sheet and encourage understanding about why the survey picks up on certain points. Are there any extra actions that could be taken?
4. The activity will take some time and may provide different results at different times of year.

National Curriculum

Science

Key Stage 2	Sc1.2	Pupils can use all their investigative skills in a practical, real experiment.
	Sc3.1b	some materials are better thermal insulators than others.
Key Stage 3	Sc4.5a	variety of energy resources
	Sc4.5c	electricity is generated by a variety of energy resources
	Sc4.5e	ways of storing and transferring energy
	Sc4.5g	energy may be dissipating, reducing its availability as a resource

GLOBE Energy Activities

Activity 3. How Bright is Light?

The activity looks at the energy used by lighting in each room. You could monitor every room at school or just your own classroom. Once the activity has been completed the first time it will be easy to repeat it and so monitor energy use over a school year.

Preparation:
Decide which rooms you want to monitor.
Copy the 'how bright is light' data sheet – one for each room.
Assign a room to each group of students.
Get the help and support of the school premises officer.
Acquire different types of light bulbs to show the class

The activity

1. Discuss the use of lighting in the school. Are there enough lights? Too many?
2. Look at the different type of light bulbs. How are they different?
3. How is electricity measured – what units do we use? (Kilowatt/hours)
4. Pupils will need to find the wattage of each bulb in a room and change W into kW.
   60 W = 0.06 kW 45 W = 0.045 kW
5. Pupils need to find out how long each light is on during a day. They can monitor the lights for themselves – checking in a morning, then at lunch time and again at the end of the day. Alternatively, ask someone in each classroom to monitor the lights.
6. Once they have the numbers for wattage and hours, work out the kWh and then the total for the day.

Follow up
Repeat regularly.
Work out the lighting cost per room.
Present results using line graphs.
Start a 'turn it off' campaign – posters and presentations.

National Curriculum

Science

Key Stage 2	Sc4.1	changing number/type of component in a series can make bulbs brighter or dimmer
	Sc4.3a	that light travels from a source.
	Sc4.3b	that light cannot pass through some materials
	Sc4.3c	that light is reflected from surfaces
Key Stage 3	Sc1	carry out a scientific enquiry

Mathematics

Key Stage 2	Ma3.4a	convert one unit to another eg 60 W = 0.06 kW
Key Stage 3	Ma3.4c	use compound measures eg kWh

GLOBE Energy Activities

Activity 4. Temperature Survey

Students will collect temperature data at fixed times during the day and will look at the heating use in the school in comparison.

Preparation: Decide which rooms you want to monitor.
Copy the 'temperature survey' data sheet – one for each room.
Assign a room to each group of students.
Get the help and support of the school premises officer.
Acquire and calibrate several thermometers.
Check outside thermometers to see that they are in working order and correctly installed– either use you Stevenson Screen (as for weather protocol) or use a digital thermometer with an outside probe.

The activity

1. Discuss the use of heating in the school. Are there enough radiators? Too many? What do thermostats do? Does the school use individual thermostats?
2. Talk about the need for heat to circulate freely from radiators without obstacles such as furniture in the way.
3. How might the temperature in a classroom change during the day – draw graphs to predict what you think will happen to the classroom temperature during a typical winter / summer / weekend day.
4. Make sure all pupils know how to accurately read a thermometer.
5. Calibrate the thermometers by placing the bulb in icy water for 3 minutes. The temperature must drop to 0^{o}C otherwise find a new thermometer.

Follow up Repeat the activity at different times of the year and for different rooms.
Produce graphs / displays to illustrate the findings to the rest of the school.
Find out about thermostats for individual radiators.

National Curriculum

Science

Key Stage 2	Sc4.1a	changing number/type of component in a series can make bulbs brighter or dimmer
	Sc4.3a	that light travels from a source.
	Sc4.3b	that light cannot pass through some materials
Key Stage 3	Sc1	carry out a scientific enquiry

Mathematics

Key Stage 2	Ma 3.4b	read scales with increasing accuracy
Key Stage 3	Ma3.4a	interpret scales on a range of instruments
	Ma4.1a	collect data, progress and represent, interpret and discuss data
	Ma4.4b	calculate means of small data sets

Research links and project ideas

- Discuss what we will do for energy when the oil, coal and gas begin to run out. What will happen to transport? What will we do for heating, cooking, etc. What would be the effects on travel? On sport?
- Make comparisons with other schools of the same size using the GLOBE database.
- Discuss how pupils think improvements in energy use could be made within the school.
- Research alternative sources of energy available. Are any suitable for a school environment?
- Research and discuss the possible effects of burning fossil fuels on the environment

Useful contacts

CREATE
CREATE is a charity promoting the sustainable use of energy, with activities for children in schools as well as the general public.
http://www.create.org.uk

Energy Saving Trust
A government funded trust that runs promotions and discounts on buying energy efficient goods and services.
http://www.est.org.uk

The Centre for Alternative Technology
The Centre for Alternative Technology at Machynlleth in Mid-Wales provides a wide range of alternative options for energy – and other sustainability issues. You can visit them in real life – or on the web at http://www.cat.org.uk

Eco-Schools
Eco-Schools provides a whole-school environmental management and certification system, based upon a simple methodology with energy as one of its components.
http://www.eco-schools.org

Global Action Plan
Global Action Plan is an independent charity that provides practical solutions to environmental and social problems. Schools can choose to tackle water, waste, energy or transport projects over three terms.
http:www.globalactionplan.org.uk

You can also work out your carbon balance using the web-based carbon calculator
http://www.carboncalculator.org