

Lesson Plan 2

Maths

Using lots of electricity puts more greenhouse gases into the air from fuel burning power stations. The less electricity we all use the more we can reduce our Carbon Footprint and help the planet. Electrical appliances use energy in the form of watts.

1000 watts = 1 kilowatt

WOW! factor...

If there are 20 million homes in the UK, how much energy is wasted each year if each home had 3 appliances on standby?

Question 1

Leaving your TV on standby uses 5 watts of energy per hour.

How many watts of energy would this be for:

- 1a. one day?
- 1b. one week?
- 1c. one month?
- 1d. one year? (based on 365 days)

Question 2

If a home had 3 appliances that were left on standby, how many watts of energy would this be for:

- 2a. one day?
- 2b. one week?
- 2c. one month? (30 days)
- 2d. one year?

Question 4

One standard light bulb consumes energy at 60watts or 0.06 kilowatts per hour.

- 4a. How many watts would this be if it was left on for a whole day?
- 4b. How many watts would it be if it was left on for seven days?
- 4c. If you had 4 bulbs lit, each for 8 hours, how many kilowatts would they use?
- 4d. The average house has 20 standard 60 watt bulbs. If they were all used for 5 hours a day, how many kilowatts would that be in a day?

Question 3

Energy saving light bulbs use 60% less energy than normal light bulbs. The numbers below show how many watts were used with normal light bulbs. Work out how much energy you would save if you changed to energy saving bulbs.

- 3a. 240 watts
- 3b. 670 watts
- 3c. 980 watts
- 3d. 1.7 kilowatts
- 3e. 2.36 kilowatts
- 3f. 5.49 kilowatts

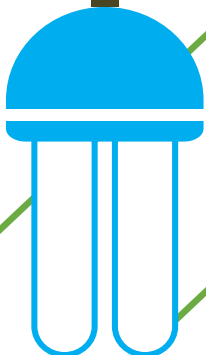
WOW! factor...

4d multiplied by 20 Million is CO² for all the homes in the UK. If every body used energy saving light bulbs, how much would be saved? (4d x 20M x 60%) WOW factor

Question 5

Did you know that a kettle uses a 1000 watts or 1 kilowatt of energy per hour. If you fill it up to make one drink, it will take 3 minutes to boil. If you put just enough water in for one cup, it would probably only take 30 seconds to boil.

- 5. Can you work out what fraction of the 3 minutes you use when only filling it for one cup?



1a. 120 watt hours, 1b. 840 watt hours, 1c. 3,600 watt hours or 3.6 kilowatt hours, 1d. 43,800 watts or 43.8 kilowatts
 2a. 360 watts, 2b. 2,520 watts or 2.52 kilowatts, 2c. 10,800 watts or 10.8 kilowatts, 2d. 131,400 watts or 131.4 kilowatts
 3a. 144 watts, 3b. 402 watts, 3c. 588 watts, 3d. 1,020 watts or 1.02 kilowatts, 3e. 1,416 watts or 1.416 kilowatts, 3f. 3,294 watts or 3.294 kilowatts
 4a. 1,440 watts or 1.44 kilowatts, 4b. 10,080 watts or 10.08 kilowatts, 4c. 1,920 watts or 1.92 kilowatts, 4d. 6,000 watts or 6.0 kilowatts, 5. 1/6th

Maths Answers

Lesson Plan 2

Schools Audit

As you have already found out, we all need to reduce our carbon footprints to reduce global warming and climate change. Using electricity unnecessarily will add to global warming.

Be a detective and find out where electricity is being wasted in your school. For some of the questions you will need permission to talk to the canteen staff and caretaker.

1. Did you spot any lights that have been left on in empty rooms?

In empty classrooms

Yes No

In the empty hall Yes No

In the cloakrooms Yes No

In the corridors Yes No

2. Did you find any hot water taps left running or dripping?

In classrooms Yes No

In cloakrooms Yes No

In the canteen Yes No

3. Do the staff always load the dishwasher fully in the staffroom before using it?

Yes No

4. Do the canteen staff always load the dishwasher fully before using it?

Yes No

5. Are computers left on during the day when no one is using them?

In the classroom Yes No

In the computer suite

Yes No

6. Are computers turned off over night?

In the classroom Yes No

In the computer suite

Yes No

In the office Yes No

7. Are TV's left on standby?

Yes No

8. Does the school use any energy saving light bulbs? (compact fluorescent lights)

Yes No

9. Is the heating on when it is not needed?

Yes No

10. Does the school use any green energy? (Wind power, solar power, rain water to flush toilets etc.)

Yes No

- Can you find any other ways where electricity is wasted?
- Use the results of your survey to identify where electricity can be saved.
- Can you use the results to estimate how much electricity is being wasted?
- Try to find out how much the school's electricity bill is every year, and the gas and oil bills too if they use it. If the bills can be reduced then it means energy is being saved. Perhaps the school could set itself a target for cutting the bills.
- Hold an assembly to inform the rest of the school what you have discovered. Suggest some ways of reducing the carbon footprint of the school and invite each class to pledge at least one way they will get involved. Try and get the whole school to take part.
- Your own personal Pledge can be class specific and the school accumulates the savings! Email your results to marcia@giantssleepover.com. Monitor on an ongoing basis through school.

Did you know? – Lots of fun with Brain Teasers

Energy Saving Light bulbs

Energy Saving Light bulbs or compact fluorescent lights use 60% less energy than normal (incandescent) bulbs. They are also last 10 times longer than normal bulbs. The average house has 20 standard 60 watt bulbs. If every bulb is used for 5 hours that equals 36,500 hours that would give off 1028kg CO² (as the emission factor for standard UK electricity is 0.476 kg/kWh, 1 tonne CO²). For an energy saver this would be just over 60% less, or 0.4 tonnes, saving of 0.6 tonnes.

Full or Empty?

The simple Kettle. Assume a kettle is 1000W. Using only the water you need rather than filling it to the top saves the amount of time and energy required to heat the water. A cup takes 30 seconds, when an entire kettle takes 3 minutes

to boil. If you made two cups a day for a year (730 cups) you would use 6kWh (2.89kg CO²) If you boiled the entire kettle each time this would be 6 times greater, or 36 kWh (16.8kgCO²)

To Standby or Not – that is the question!

TV and other appliances on Standby. Standby uses energy to keep the little lights etc., lit on the appliance in question. It is also used to light digital displays. That small bulb is only using 5 watts but when this is on ALL DAY and multiplied up for the number of appliances in the house for the whole country, this can amount to a very large amount of energy used.

Example

Assume 60 million TVs, computers, monitors etc., each using 5 watts left on standby for one day (24 hours) : 60,000

x 0.005kW x 24 hours = 7,200,000 kWh = 3,400,000 kg CO² = 3,400 tonnes CO² per day! Per year that's 1.2 million tonnes CO², SCARY!

Assume 20 million homes each using 20 normal 60W light bulbs for 1 hour each per day:

20 x 60w x 1 = 1 kWh per day per home. That's 365 kWh per home = 365 x 0.467kgCO₂/kWh = 0.170 tCO₂ per house = 3.4 million tonnes CO² for all the homes in the UK.

Without thinking about the kettle, if everybody in the UK switched off their TVs and used energy saving bulbs together we could save 1.2 + (3.4 x 60%) = 3.44 million tonnes of CO². This is the same weight as 632,352 elephants, or the same as one car travelling around the world 458,666 times – or 60 return trips by car to the sun – ouch that would be hot!

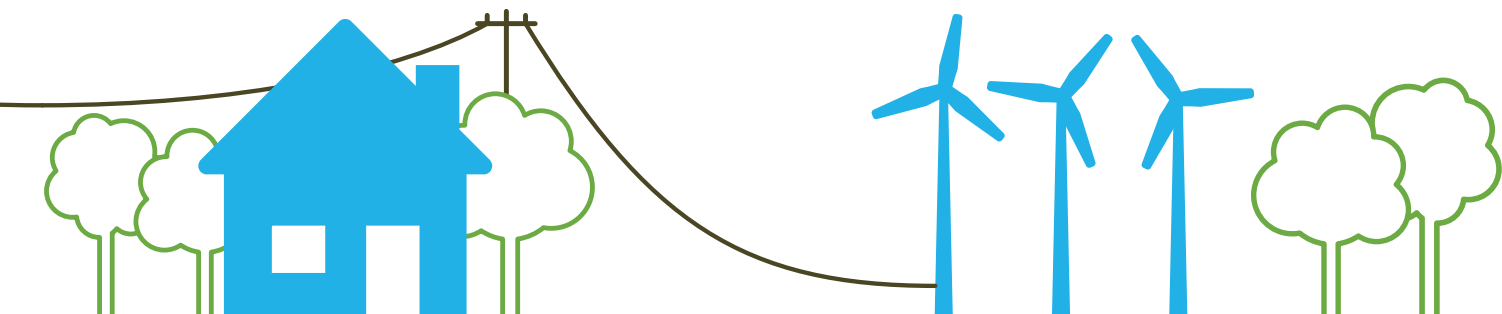
**GREEN
ISSUE**



Cut Your Carbon Emissions With

WOOLWORTHS

Carbon Calculator and Curriculum Resource



PLUS £10,000 of carbon credits
for environmental projects

In association with



Climate Change, Carbon Emissions, Carbon Credits, Carbon Footprint, The Greenhouse Effect, Global Warming, Green Energy, words and more words!

It can all seem a bit overwhelming, sometimes daunting and often confusing. What do they all mean, and more importantly do children understand and relate to them?

In the scheme of things this is a very simple introductory resource sponsored by Woolworths designed to take the first small step towards helping children understand what their 'carbon footprint' is and how they can take responsibility through their own actions to reduce it.

WOOLWORTHS

£10,000 pledge to environmental projects

To support schools and pupils in their quest to measure and then reduce their carbon footprint Woolworths are making a unique commitment by offering £10,000 of carbon credits against the savings made by your pupils to invest in accredited environmental projects.

Cut your carbon with other schools in the BT Giant Sleepover

Running in parallel with this programme children across the UK will be taking part in a fun event – The BT Giant Sleepover. This Guinness World Record breaking event will take place on the night of 16th/17th June.

Prior to and during this event we are asking participants to do their bit to

reduce their own carbon footprint. We invite you to join them in this exercise, indirectly through the activities highlighted in this resource, or directly by running a sleepover through your school. **Sleepover information www.btgiantsleepover.com or telephone the helpline on 0870 240 1640.**

This resource and how to use it:

The focus for this resource is 'simple actions can reduce the effect of climate change'. It has been designed by practising teachers and educational professionals to support a wide range of ability levels within the 7-11 age range.

The core activities are home and school driven. We recommend starting with the Carbon Calculator activity to introduce base level understanding before continuing on with the Home Questionnaire, School Audit and Maths Sheet. You may find the Glossary of Terms helpful during this period to gauge pupils level of understanding.



Focus	KS2/P5/Y5-7
Subject Links:	Science, IT, Geography, Maths plus @home/family activity

Key Aims & Objectives:

- Measure pupils' individual carbon footprint – identify ways of reducing, followed up with a pledge to take them forward.
- Understand the concept of reducing and offering up savings to help others to reduce their own carbon footprint.
- Confirmation of to whom and how they can make their pledges.

Geography – Programme of Study

Unit 7: Weather around the World

Unit 16: What's in the news

ICT

1a, 3a

Science

Sc1 – 1a, 2a, 2b

Sc3 – 2c

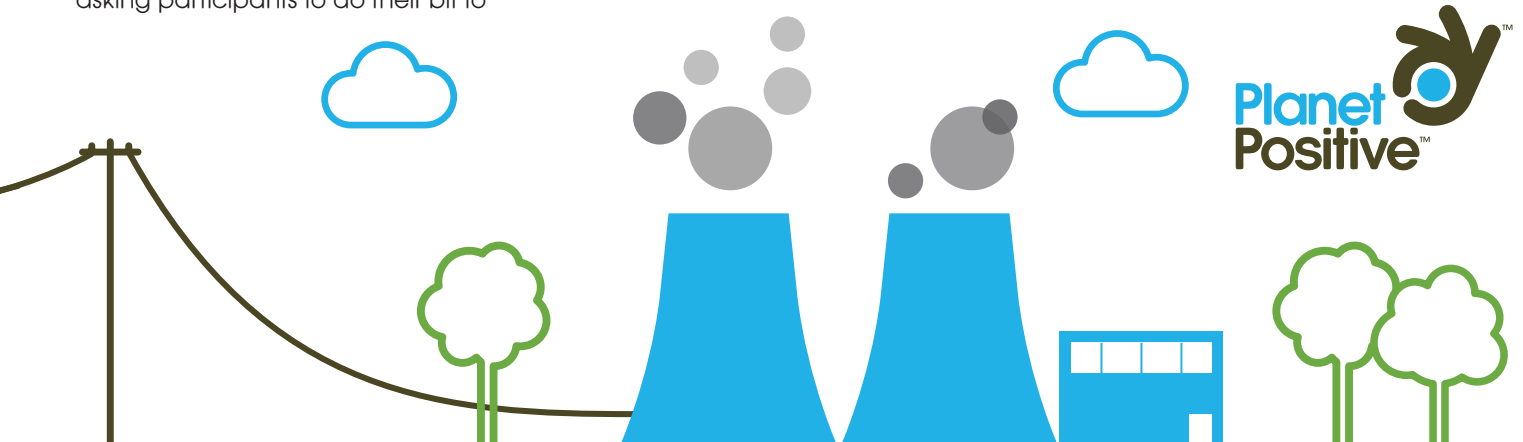
Mathematics

MA2 – 1b, 1d, 2c, 2d, 2i, 3a, 3j, 3k, 4a

Ma3 – 4a

We have included:

1. An option to turn the Maths Sheet into a complete Lesson by adding a suggested mental starter – converting Watts into Kilowatts and Kilowatts back into Watts.
2. The Plenary session – you may want to extend Q5 by working out with the class how much electricity could be saved in a day, week, year.
3. An exemplar is included within this resource with a supporting formula.



Cut Your Carbon Emissions

WOOLWORTHS

Woolworths Working Together

WOOLWORTHS

At Woolworths we aim to ensure that social responsibility is integral to our business, which is why we are excited to be involved with The BT Giant Sleepover. We believe that we all have a role to play in making a safer, greener environment. Even small changes make a big difference. We have been busy exchanging old, inefficient lighting in stores and have even put timers on our in-store drinks fridges so they use less electricity. Our offices also have motion sensors, ensuring that no lights are left on when not required - saving energy. We are working in partnership with the [Carbon Trust](#), to review all energy and carbon use issues in our stores. We have reduced fuel usage in our lorries and recycle over 19,000 tonnes of packaging every year. Our Bedford Distribution Centre has reduced carbon dioxide emissions and six per cent of energy required is now generated from renewable sources. By taking part in The BT Giant Sleepover, you too can help make the environment a better place for future generations.

Woolworths Kids First

Our registered charity, [Woolworths Kids First](#) is at the heart of our community activities. It aims to improve the



quality of children's lives in local communities through fundraising and by offering time and expertise for the benefit of children.

[Woolworths Kids First](#) donated up to £500,000 in 2006/07 to UK primary and special schools through the award-winning Playground Partnerships scheme. The scheme has had another record year with requests for over 6,000 free resource packs that resulted in 569 grant applications. Since the scheme was launched in 2003, over £1,300,000 has been granted to 650 schools in the UK for playground improvements.

For further information, go to www.playgroundpartnerships.org, where you can download resources and activities.

Planet Positive

[Planet Positive](#) is a global environmental mark for business and individuals to demonstrate that they are going beyond carbon neutral. It is a credential to show that they have measured, reduced and offset their carbon footprint by at least 110% by investing in Planet Positive approved environmental projects that make real reductions in carbon dioxide emissions.

www.planet-positive.org



Glossary Of Terms

The following glossary of terms has been collated to aid understanding in preparatory discussions with pupils. Once discussed this glossary can be used to link into your literacy strategy encouraging pupils to investigate and report back in a way that is meaningful to them.

Climate Change

The term climate change refers to the variation in the earth's temperature, in particular the rise in the average surface temperature, known as global warming. Rising carbon dioxide levels in the upper atmosphere, primarily resulting from the burning of fossil fuels, are responsible for accelerating global warming.

Carbon Footprint

It is a measure of the amount of Greenhouse Gases individuals or groups emit into the atmosphere. There are 6 main gases, and since the most abundant is Carbon Dioxide (CO²) we measure our emissions in tonnes of carbon dioxide, hence our carbon footprint. The aim is to try and reduce it.

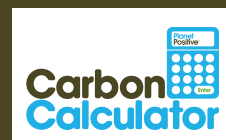
Carbon Dioxide

The gas formed mainly from burning fossil fuels. Carbon Dioxide is a gas that's naturally present in the earth's atmosphere. You may see Carbon Dioxide referred to as CO², or just as carbon. Carbon Dioxide is the gas that is emitted when we burn fossil fuels (like oil, coal and gas) to generate energy. As the world's energy needs have grown, so have our emissions of

Carbon Dioxide. Carbon dioxide levels are now higher than they have been for at least 20 million years. This concentration of gas in the atmosphere has resulted in the Earth's temperature rising. This process is what scientists call the Greenhouse Effect.

Carbon Calculator

A carbon calculator measures the carbon footprint made by individuals based on a number of base calculations. The online carbon calculator referred to and available through this resource is specifically designed for children using pop-ups and flash animation.



Carbon Emissions

The release of gases into the atmosphere due to human activity (carbon dioxide during fuel burning).

Carbon Offsetting

Offsetting schemes allow people or companies to partially neutralise their own carbon dioxide emissions by financially supporting projects that reduce carbon dioxide emissions elsewhere.

Carbon Credits

A carbon credit is a certificate which represents 1 tonne of CO² saved from entering the Earth's atmosphere through a verifiable reduction made somewhere else.

Woolworths have donated £10,000 to buy carbon credits from projects of our choice. By choosing where to invest them we are supporting those projects.

Fossil Fuels

These include coal, oil and gas which are found below the earth and cannot be renewed.

Global Warming

The gradual rise of the Earth's average temperature because of greenhouse gases that come from people burning fossil fuels for industry, transport and power generation.

Green Energy

Energy from zero emission renewable sources like wind, water (hydro) and solar power.

Greenhouse Effect

The trapping of the sun's energy by gases such as carbon dioxide (CO²) causing a warming of the Earth's atmosphere. We need these gases to keep the planet warm so we can live, but nature has to keep them carefully balanced so the Earth does not overheat

The Woolworths Pledge

Encourage pupils to hand in the results of their schools audit & home questionnaire identifying their families and schools current carbon footprint and their pledges to reduce it.

The individual children's pledges should be added together as a class total and submitted for collation to Marcia@giantssleepover.com highlighting in the subject header **WOOLWORTH PLEDGE**. We will also require the name of your school and the year groups involved.

The figures that relate to the schools audit can then be used to compare previous energy bills against future bills to demonstrate savings.

Why not use an element of the financial savings to your school to arrange for an artist to come in to work with the children in communicating key environmental messages through art, music and drama!

Lesson Plan 1

ICT – The Carbon Calculator Introduction

Discuss the items listed in the Glossary of Terms. Do they know what they mean? Pay special attention to carbon dioxide and carbon footprints. Then go on to discuss the carbon calculator and what its purpose is. Explain that when they have finished answering the questions on the calculator, they will be given their carbon footprint score, which will be discussed at the end of the lesson.

Main

Show the children the web site www.giantsleepover.com. Click on 'going green'. Click on the picture of the Carbon Calculator. Click 'enter' on the calculator. Read the explanation together and discuss.

Emphasize the importance of answering the questions truthfully. If they are unsure of how to answer - ask for help. The children will now answer the questions and find their Carbon Footprint score, which they will print. They will then be shown what their score means.

Plenary

Discuss their scores. Why do some people think their score is higher than others? Which answers do they think gave the highest scores? Looking at the questions, what could they change to bring their scores down? What have they learnt from the questions? Is there anything they could change to reduce their scores? Perhaps they could pledge to walk to school or turn lights and TV's off when they are not using them.

An Exemplar and Supporting Formula

The power of the appliance is measured in Kilo Watts and one kilo watt is equal to 1000 watts. The amount of electrical energy an appliance uses is measured in kWh and is the number of watts used to power the appliance for 1 hour. This energy used is measured over a period of time, which is what comes in your electricity bill. This is measured in KILOWATT HOUR (kWh) and this is the standard way for people to know HOW MUCH energy (as electricity) they've used.

e.g. one standard incandescent bulb consumes energy at 60 watts (or 0.06 kilowatts) if you use the bulb for one hour you have consumed 0.06 kWh of electricity.

Once you know HOW MUCH energy you've used, converting this into carbon dioxide is easy!

This is because the UK national grid produces energy from various sources (coal, gas, nuclear, renewable etc.,) and on average, emits a given amount of carbon dioxide for all the burning of fossils fuels required for the electricity it produces. This means you can calculate your electrical energy consumption (total kWh) and electricity it produces and allows you to express your electrical energy consumption (total kWh) and reference it in terms of number of tonnes of carbon dioxide emitted to create this electrical energy. Phew!

Your Carbon Footprint – @ Home Questionnaire

Did you know that your family's carbon footprint is the impact your way of living has on the environment? Just by changing several simple things in your home or leisure activities you can reduce your carbon footprint and help

reduce global warming and climate change. Electricity is one of the biggest producers of carbon emissions, so every time you use it you add to global warming.

Have fun with your family and find out which one of you has the lowest carbon footprint. The questionnaire below will allow you to work out your family's carbon footprint or that of each individual member.

How many people live in the house?

Question	Yes	No	Sometimes
1. Do you use any green energy in the home?(wind power, solar power etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you turn off lights when not in the room?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Do you turn off the T.V. when not in the room?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Do you turn off the computer when not using it?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Do you turn off the Play Station when not using it?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Is the dishwasher full before turning it on?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Is the washing machine full before using?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Do you only put as much water in the kettle as you need before boiling it?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question	Yes	No	Sometimes
9. Do you unplug the mobile phone charger after it has charged the phone?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Do you hang out the washing instead of tumble drying?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Do you take more showers than baths?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Do you use any energy saving light bulbs in the house?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Do you turn off electrical appliances instead of leaving them on standby?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. If feeling chilly, do you put a jumper on instead of turning the heating up?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Do you recycle as much as you can?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Do you walk to the shops or school if it is possible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results

If you have ticked mostly YES or SOMETIMES you are well on your way to doing your bit.

If you ticked a mixture of YES, NO and SOMETIMES, you are doing quite well, but might want to decide as a family which areas you will change to help reduce your carbon footprint.

If you ticked mainly NO or SOMETIMES, then perhaps your family could look at ways to reduce its carbon footprint. Once you have decided which things you can alter easily, then perhaps you will make a pledge to work as a family to reduce. Can you think of some other interesting ways to save energy and reduce your carbon footprint? e.g. put a hippo (no not a real one!) in your toilet cistern. Its like a brick and sits in the toilet cistern to save water each time you flush. Also think about taking a shower rather than a bath.

The Formula

Assume the average emissions of CO² in the UK is 0.467kg CO² per kWh
So, to get the CO² emissions for our 60W (or 0.06 kW) light bulb being used for one hour, you simply do the following sum:

$$0.06\text{kW} \times 1 \text{ hour} \times 0.467\text{kg/kWh} = 0.028 \text{ kg CO}_2, \text{ or } 28 \text{ grams of CO}_2$$