



# Climate4Classrooms

Education Pack

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## Introduction

Our changing climate will impact at the global, national and local scales.

Through some of the latest scientific data and projections, C4C provides ideas and resources to deepen your pupils' understanding of climate change and to help them to see this complex topic in a global context. It aims to support schools around the world to teach, think and talk about the global and intercultural dimensions of climate change.

The Education Pack contains learning activity ideas, sample lesson plans, tips and further resources to use with pupils aged 7 – 16 years. Learning activities are grouped around the following three themes

weather and climate

climate change: causes, evidence and future predictions

making a difference and finding solutions.

The resources include interactive data sets showing the latest global and national climate predictions, climate science brought to life by the experts, case studies investigating global, national and local impacts and solutions. Guidance for teachers on using the resources is provided.

**Theme 1: Weather and Climate** The aim of this theme is to spark an interest in weather conditions and enable pupils to explore variations in weather around the world and the difference between weather and climate.

**Theme 2: Climate change: causes, evidence and future predictions** Activities in this theme will develop knowledge and understanding of climate change and by looking at the evidence, understand its causes and how it is impacting on the present and may impact on the future.

**Theme 3: Making a difference and finding solutions.** This section will consider what we can do to adapt to climate change that is already happening and try to prevent it reaching a point where it seriously damages life on planet earth. The possibilities are endless, the choices are yours!

## Key Features

### Curriculum-based learning

The activities in each theme can be used as starting points for individual lessons or across- curriculum activities forming part of a longer joint project.

### Leading to community action

Schools are encouraged to take their pupils on a journey of understanding from learning about weather and climate to engaging with issues surrounding climate change and then developing community action plans to find solutions and make a difference to their environment and community.

### School partnerships

Working internationally will help students to come to understand that climate is a global issue that is affecting people in different locations and cultures and that there may be different approaches to climate issues around the world. It also allows teachers to share best practice with colleagues in other countries and can help to build and sustain long term global partnerships with other schools.

The pack provides you with joint project ideas on Climate Change based on which you could collaborate with international partners over a number of thematic areas.

The possibilities are endless, the choices are yours

## Project Ideas

Each theme contains some background information and cross curricular ideas for teachers that cover key objectives for both subjects and skills. Units are colour coded blue or green to indicate whether the content is primarily aimed at primary or secondary schools, although teachers may find it useful to 'dip into' the material from both sections. There is also a list of relevant objectives and resources for each theme.

# Theme 1 - Weather and Climate Ideas for Teachers

## Background information

A simple way to think about the difference between weather and climate is climate is what we expect at any given time of year (e.g. cold winters, hot summers) and weather is what we get day-to-day (e.g. rain, sunshine, snow etc). Climate is the long-term average of daily weather conditions allowing for seasonal variations and viewed on a regional scale. The climate of a location is often illustrated by climate graphs showing temperature as a line graph and precipitation as columns throughout the year.

The climate of a location is affected by both global factors, such as proximity to the equator or the poles as well as local factors. In a mountainous region for example the climate will vary from the top of a mountain to the bottom, as locations at a higher altitude have colder temperatures. In Britain a warm ocean current called the North Atlantic Drift keeps Britain warmer and wetter than other places in Europe.

### Cross curricular activities relevant to this theme:

Today's weather forecast

### Pupils aged 7-12

**Subjects covered:** Geography, Science, English, Maths, Art and design, Music

**Key Skills:** Enquiry, research, creativity

**Learning Outcomes:** to encourage pupils to ask and respond to geographical questions, use geographical vocabulary and develop interest and knowledge about weather conditions around the world and the difference between weather and climate

British people are renowned for discussing the weather! Investigate what the weather is like in your locality by going outside with your pupils and discussing the following questions. What is the weather like today? What is the temperature? What other elements of the weather could we measure? How could we do that? Is the weather always like this? What was the weather like yesterday and last week? How can we find out what the weather is like at your partner school today? What would you like to find out about weather around the world?

Ask your students to take interesting photographs of different weather conditions, challenge them to find as many different words to describe weather as they can and 5 interesting weather related facts such as how big was the largest snowflake or hailstone ever recorded? Produce a Did you know display showing their findings. Can they research any examples of extreme weather conditions that have featured recently in the news at home or abroad and find out what caused them?

Set up a school weather station to monitor the weather over a period of time. The Met Office website at <http://www.metoffice.gov.uk/>

[metoffice.gov.uk/](http://metoffice.gov.uk/) shows how to make your own rain gauge, wind vane and Stevenson screen (a special box to protect a thermometer from sunshine, wind and its surroundings.) This website also has a series of other exciting cross curricular weather related activities for children to carry out including measuring puddles, making a sundial or creating a tornado in a jar.

Ask your students to watch televised weather forecasts and note the style and language used by the weather presenters. Make props such as large maps and weather symbols and create short filmed weather broadcasts using appropriate vocabulary and information gathered from their weather station. These can be put on the school website and swapped with their partner school.

Over the years, the topic of weather has proved an inspiration to artists in different media from Dickens' vivid descriptions of fog at the opening of Bleak House, paintings such as Henri Rousseau's Surprised and Turner's Snowstorm at Sea and Vivaldi's Four Seasons. Show your pupils dramatic pictures of a variety of weather conditions and ask them to produce their own pieces of creative writing, paintings and musical compositions to portray different weather conditions. Mount paintings in frames and share with parents at an exhibition and send examples to your partner school.

Discuss with your students the difference between weather and climate. What is the climate like where you live and where pupils from your partner school live? How is the climate different in other parts of the world? Try this activity from the Met Office website <http://www.metoffice.gov.uk> where pupils match photographs with corresponding climate descriptions, tourist activity cards and average weather graphs.

Discuss how the climate affects aspects of life where you live including the types of buildings, school hours, crops grown etc. If the weather is very hot or cold during the day how does this affect your lifestyle? What would happen if the weather changed dramatically where you live?

Two partner schools in the UK and Japan grew Japanese daikon radish seeds at the same time in their school grounds. The resulting Japanese radishes were enormous but the UK results were much smaller. Why were the results so different? Arrange with your partner school to carry out a similar experiment simultaneously growing seeds. Keep a diary of how the plants grow in the different climates and compare the results. After harvesting the crops perhaps swap recipes of different ways to use the plants in cookery.

Useful Vocabulary: weather, climate, temperature, precipitation, humidity, cloud cover, wind direction, wind speed, rain gauge,

## Comparing climates

**Pupils aged:** 11-14

**Subjects covered:** Geography, Science, Maths, Citizenship

**Key Skills:** Data handling using climate graphs, Problem solving

**Learning Outcomes:** To define the elements of weather and climate, extract information from climate graphs, enhance knowledge of weather and climate and learn relevant geographic and scientific terms.

Ask your students to keep a diary of temperatures, weather conditions and cloud types that they see above their school over the course of a week. Are these typical for the location at this time of year? How do they know?

Show your students the climate graphs for cities in appendix 1 or use the following link: Can they describe to a partner what the climate will be like in two of the cities from the given data and answer the following questions:

- Which of the climate graphs is most like the place where you live?
- What is the maximum and minimum temperature for the year?
- What is the temperature range (the difference between the warmest and the coldest month)?
- What is the total rainfall?
- Which is the wettest month?
- Which is the driest month?
- Which months have the most rainfall?
- What season is this?

Ask them to challenge their partner with questions of their own and then write a paragraph comparing similarities and differences between the climates of two of the cities.

Explain the global and local influences that can affect climate such as hemisphere and location and use topographical maps and atlases to identify some reasons for the weather patterns in the graphs. Discuss which influences they think are more important in explaining the climate where they and their partners live - global or local?

In recent years large areas of countries such as Thailand, Pakistan and India have been severely affected by floods caused by sudden extreme weather conditions. Ask your students to research one of these catastrophic events and find out how this has affected the local population. People may have been made homeless or had wells contaminated by polluted water from the floods. Perhaps your students could organise campaigns to make people aware of these issues and plan and hold a fundraising event for organisations such as UNICEF and Save the Children who are helping families who have been affected by these

natural disasters. Share the results with your partner school.

## Theme 2 - Activities to encourage knowledge and understanding of climate change

### Background information:

We owe most of our understanding of climate change to scientists and their methods. It is important to have a basic understanding of the science to have an informed opinion. It is also important to realise that the vast majority of climate scientists understand that the evidence shows climate change is happening and that this is mainly due to human actions.

Teachers may feel that they do not know enough about the issue themselves to engage young people in learning and discussion. There are a lot of very accessible resources to help teachers to improve their own understanding as well as helping young people to develop their own (see the Tips and Resources for Teachers section for some examples).

### Acting out the greenhouse effect

**Pupils aged:** 7-12

**Subjects covered:** Science, Drama, Art and design

**Key skills:** Conceptual understanding through movement, prediction, communication, cooperation

**Learning outcomes:** The aim of this drama activity is to show in a very visual way how the

Greenhouse Effect works and to begin to explore its implications. (From <http://learningtogive.org/lessons/unit372/lesson1.html> Copyright ©

[www.LearningToGive.org](http://www.LearningToGive.org) with kind permission)

Depending on how much the learners know already, you may need to explain about greenhouse gases first. (The Climate Change Briefing Pack is listed in the resources section)

### Step one

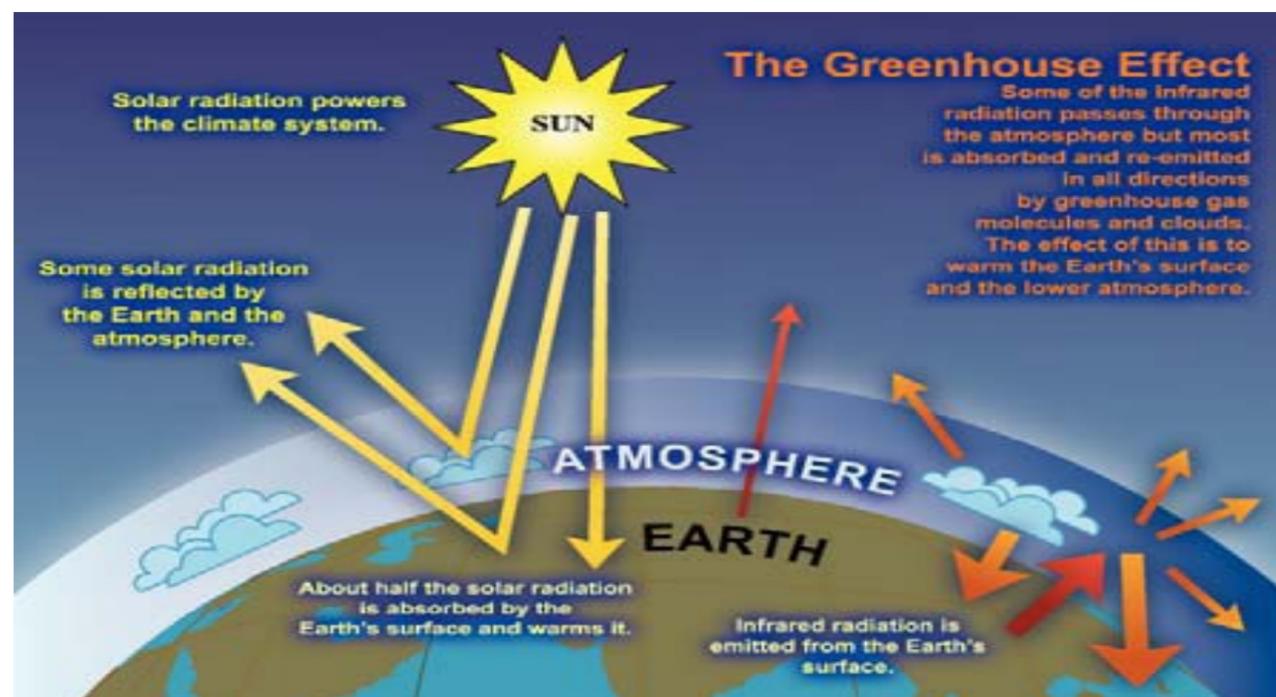
In a large area, such as a gym or classroom, gather the pupils together and give them "roles" to act out the Greenhouse Effect. Have ten pupils be "Heat" and five pupils be "Greenhouse Gases". Hand out Heat/Greenhouse Gases nametags and have pupils put them on. Label one end of the room "Sun" and the other end "Earth." "Heat" pupils should stand at the "Sun" end of the room while the "Greenhouse Gases" pupils stand in the middle of the room. Everyone else sits and watches until their turn.

### Step two

Remind everyone that the Sun produces heat that reaches the Earth's surface. At this time ask the "Heat" pupils to walk from one side of the room to the other, demonstrating heat traveling from the Sun to the Earth.

To demonstrate this have the "Heat" pupils travel back to the "Sun" end of the room, but this time the "Greenhouse Gases" each trap one "Heat" person, keeping them on the "Earth" side of the room, allowing the others to "escape".

Pupils need to be aware that the Greenhouse Effect is a beneficial, natural process and that without it the Earth



### Step Three

Explain that some heat escapes back into space while gases in the atmosphere trap some of the heat. These "greenhouse gases" allow the Earth to stay warm and allows life to flourish.

To demonstrate this have the "Heat" pupils travel back to the "Sun" end of the room, but this time the "Greenhouse Gases" each trap one "Heat" person, keeping them on the "Earth" side of the room, allowing the others to "escape".

Pupils need to be aware that the Greenhouse Effect is a beneficial, natural process and that without it the Earth would be too cold to sustain life.

### Step Four

Now introduce the idea of global warming. Have all the remaining pupils put on "Greenhouse Gases" name tags and have them join the other "Gases" in the middle of the room. Ask the learners to predict what would happen if more Greenhouse Gases were added to the atmosphere

### Step Five

Again, have the original group of "Heat" pupils travel from the "Sun" side to the "Earth" side of the room. Then ask the "Heat" pupils to try to travel back to the other side of the room. The "Greenhouse Gases" pupils should then each trap one "Heat" pupil. Since there are many more Greenhouse Gases, more "Heat" will be trapped on Earth, with very little, if any, "Heat" escaping. This is how global warming happens.

The science that the drama illustrates can be reinforced by using this animation: <http://earthguide.ucsd.edu/earthguide/diagrams/greenhouse/> (click on the text in the slides and scroll down if it does not all appear)

### Conclusion

At the end of the activity, bring the learners back together as a group and discuss what they learned.

Ask: Why should anyone care about Global Warming?

(Because if there is too much global warming plants, animals, and people can't live.)

Ask: Is it everyone's responsibility to care for the Earth?

Since we live on the Earth it is everyone's responsibility to take care of the Earth and the Earth will take care of us!

As a follow-up activity pupils could make power points, posters or other pieces of art work or drama to explain how

the greenhouse effect works to parents and members of the community and share with partner schools.

Comparisons of very recent ice cores with surface measurements show that the ice core acts as a faithful indicator of atmospheric concentrations. Source IPCC 2001(WG1: 2.4 How Rapidly did Climate Change in the Distant Past?)

Ask students what they notice from the first graph about the relationship between the greenhouse gases and temperature and about how the graph changes over time. (You may wish to explain that the low points in the graph correspond to ice ages).

## The greenhouse effect, global warming and climate change

**Pupils aged:** 11-16

**Subjects covered:** Science, Maths

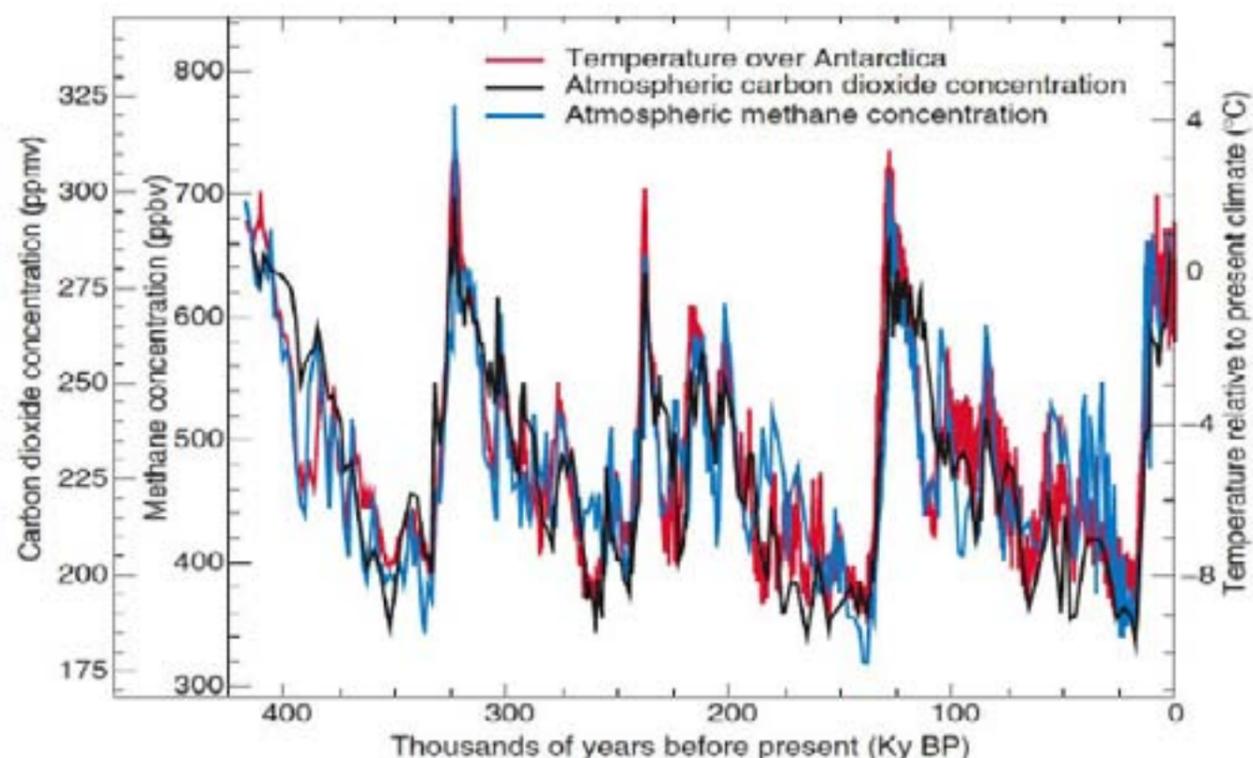
**Key skills:** Interpreting data, making predictions, enquiry

**Learning outcomes:** To understand the concept of the greenhouse effect and how it links to the concepts of global warming and climate change. To examine the evidence for climate change and its causes.

Write up the phrases 'greenhouse effect', 'global warming' and 'climate change'. Ask pupils to give a definition of each and to explain how they are connected (use Glossary definitions and diagram for Greenhouse effect from the CC Briefing Pack listed in the resources section). Ask why the phrase 'climate change' is the most commonly used now. Explain that although overall global temperature may be rising, different regions are experiencing warming and / or cooling effects.

Ask pupils what they think the evidence is for climate change (building on work in Section 1) and what they think the causes of climate change are. Are these causes natural or human-induced? Record the pupils' opinions to refer back to later.

Present the two graphs below and explain that they come from reports of the The Intergovernmental Panel on Climate



Change (IPCC), the leading international body for the assessment of climate change set up by the United Nations and supported by thousands of scientists across the world. If you have access to YouTube, you may wish to show this 4 minute video (<http://www.youtube.com/watch?v=Kr02VF3ralc>) or read background information ([http://www.antarctica.ac.uk/bas\\_research/science\\_briefings/icecorebriefing.php](http://www.antarctica.ac.uk/bas_research/science_briefings/icecorebriefing.php)) from the British Antarctic Survey about how the data in graphs like this was collected.

Figure 1 (below) shows Variations of temperature, and the concentrations of the greenhouse gases methane, and atmospheric carbon dioxide derived from air trapped within deep ice cores from Antarctica that date back as far as 420,000 years (based on four separate scientific studies). Comparisons of very recent ice cores with surface measurements show that the ice core acts as a faithful indicator of atmospheric concentrations. Source IPCC 2001 (WG1: 2.4 How Rapidly did Climate Change in the Distant Past?) [http://www.grida.no/publications/other/ipcc\\_tar/](http://www.grida.no/publications/other/ipcc_tar/)

Ask students what they notice from the first graph about the relationship between the greenhouse gases and temperature and about how the graph changes over time. (You may wish to explain that the low points in the graph correspond to ice ages)

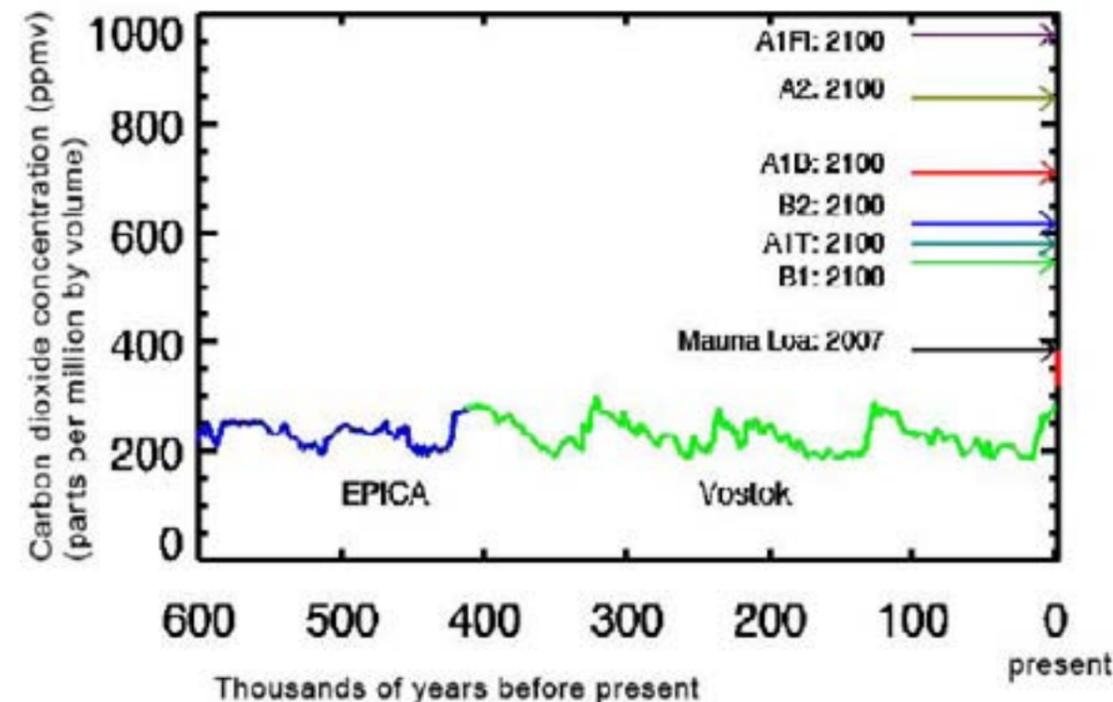


Figure 2 (above) shows CO2 concentrations derived from EPICA and Vostok (Antarctic) ice cores going back 600,000 years. The red bar at the side indicates the increase in the (Mauna Loa, Hawaii) measurements of CO2 in the atmosphere from 1958 to 2007 (In August 2012 the figure was nearly 395 ppmv <http://co2now.org/>) The size and speed of the recent increase in CO2 is unprecedented. The coloured arrows show different predictions of the levels of Carbon dioxide in the atmosphere in the year 2100. Source IPCC, 2007 ([http://www.ipcc-data.org/observ/ddc\\_co2.html](http://www.ipcc-data.org/observ/ddc_co2.html))

Ask students to look at the two graphs together and to suggest what might happen to the earth's temperature if the CO2 levels rise as the predictions show.

In another recent study, ([http://www.nytimes.com/2012/07/30/opinion/the-conversion-of-a-climate-change-skeptic.html?\\_r=4&pagewanted=all&](http://www.nytimes.com/2012/07/30/opinion/the-conversion-of-a-climate-change-skeptic.html?_r=4&pagewanted=all&)) Prof Richard Muller, a physicist and climate skeptic, was funded by a US coal owner's foundation to study earth temperatures going back to 1753 from over 44,000 sites. He said he was surprised to find that the earth has warmed by 1.5C over the past 250 years and "humans are almost entirely the cause". He now considers himself a "converted skeptic". Further information that supports arguments for human causes of climate change (rather than volcanoes or solar activity) can be found in this section of the Climate 4 Classrooms website. <http://uk.climate4classrooms.org/>

module/module-2-what-causes-climate-change

There may also be anecdotal evidence to show that the climate is changing. Ask pupils to interview older members of their community and ask if they think the climate has changed in their lifetime. In what ways? Share this as a group, make a display to complement the scientific information and compare with examples made by your partner school.

## How will climate change impact on us in the future?

**Pupils aged:** 9-15

**Subjects covered:** Geography, Science, Maths, Arts, Literacy

**Key skills:** Enquiry, data handling and interpretation, communication, research, creativity

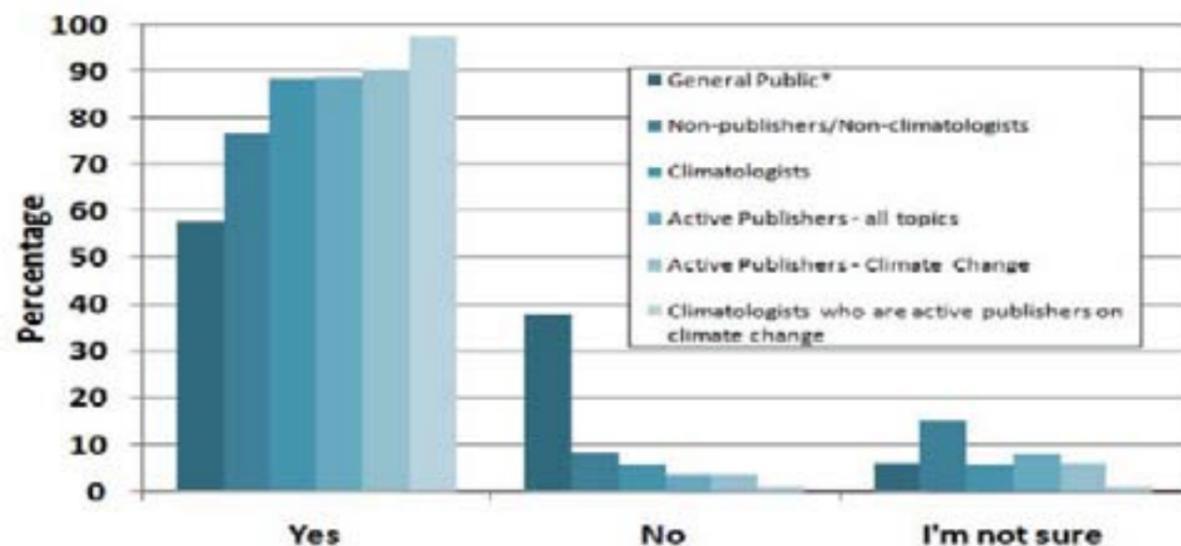
**Learning outcomes:** To investigate the scientific predictions for climate change impacts in different parts of the world.

The Carteret Islands ([http://en.wikipedia.org/wiki/Carteret\\_Islands#cite\\_note-8](http://en.wikipedia.org/wiki/Carteret_Islands#cite_note-8)) in the South Pacific are being swamped by seawater, killing food gardens and forcing the population to migrate to mainland Bougainville. It is widely believed that this is due to sea level rise caused by climate change. This video clip <http://www.oxfam.org.nz/what-we-do/issues/climate-change/take-action/sisters-on-the-planet#Ursula> is the story of Ursula Rakova, who has set up an organisation to help her people relocate with dignity and preserve their culture.

Invite pupils to do their own research on the effects of climate change on their own country or another country. They can use the National Futures section and related teaching resources from the Climate 4 Classrooms website to find out country-specific information. Ask your pupils to prepare a poster, PowerPoint presentation or film to share the results of their research and what they learnt in the previous activities. Encourage them to use powerful images or cartoons, compelling quotes and statistics or gripping animations or interviews. Guidance on PowerPoint

presentations <http://uk.climate4classrooms.org/module/module-2-what-causes-climate-change> (click on For Students tab). Ask them to present their results to an audience of parents and community representatives and share with their partner school, perhaps through a joint online space.

To help motivate the pupils in their task you could share the graph below which indicates how few of the general public, compared to climatologists, actually believe that humans are responsible for climate change. (Participants in the survey were asked the question: "Do you think human activity is a significant contributing factor in changing mean global temperatures?")



From: Doran, P.T. and M. Kendall Zimmerman 2009. Examining the Scientific Consensus on Climate Change. EOS VOLUME 90 NUMBER 3

## The age of oil

**Pupils aged:** 11-16

**Subjects covered:** Science, Geography, History, English

**Key skills:** Research, enquiry, deduction, creativity

**Learning outcomes:** To examine the history and consequences of our dependence on fossil fuels.

Ask pupils to look at the clothes they are wearing, the possessions they have with them, the contents of the classroom, the buildings and transport systems outside. What do they have in common? If there is no clear agreement or commonality, focus on the lighting, computers, cars etc. Try and draw out the idea that so much of what we depend on is a product of fossil fuels like oil, coal and gas. Has this always been the case? Is it true in all parts of the world?

Show pupils the graph below

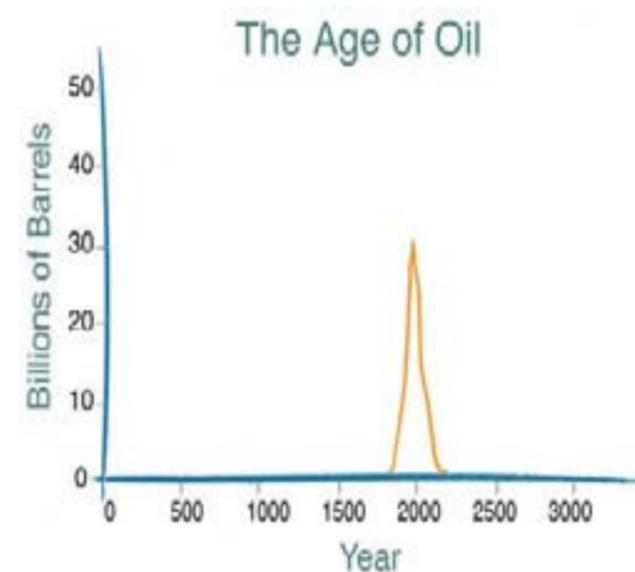


Figure 3 The Age of Oil illustration by Richard Crookes in Sense & Sustainability

Educating for a circular economy Ken Webster & Craig Johnson, Ellen Macarthur Foundation

2008

What does it show? What is the time-scale? What does it tell us about our world today? Introduce the phrase 'peak oil'. What do they think it means? (Peak oil is the point in time when the maximum rate of petroleum extraction is reached, after which the rate of production is expected to enter terminal decline). What does this mean for our lives? What does it mean for the world economy? What are the prospects for continued and future oil exploitation <http://www.peakoil.net/about-peak-oil> (Shale gas /tar sands, Arctic drilling etc? Who benefits? And who loses from this?)

What have been the benefits of the age of oil? What are the drawbacks?

Write a letter to someone your age 200 years into the future. Explain to them what it was like to live in the 'Age of oil'. Describe what the good and bad sides of relying on fossil fuels. What would you hope for the energy systems in 200 years time?

Alternatively prepare a climate exhibit for a museum, with two adjacent displays that show two worlds, one based on the 'Age of oil' and one of a future world without any oil. What would the differences be? What would be better/worse about each of the worlds? Encourage them to use a variety of imaginative display methods including sound boxes, display cases and audio visual displays. Visit local museums for inspiration and exchange ideas for this with your partner school.

To consider some of the issues that might arise in trying to move to a low carbon future for China, download the Energy Debate Activity Plan; Energy Sources Information Pack and the Invitations to Conference PowerPoint. [http://www.carbonpartners.org.uk/sites/default/files/Energy\\_Debate\\_Activity.pdf](http://www.carbonpartners.org.uk/sites/default/files/Energy_Debate_Activity.pdf)

## Theme 3 - Making a difference and finding solutions

### Background information:

Although scientists have helped us to understand climate change and its causes and implications, science cannot tell us how to live our lives. It is easy to feel overwhelmed or paralysed by the scale of the problem and to hope it will go away or someone else will deal with it.

However, even small actions can help to reduce the impact of climate change. China has over one hundred million school students and if they and their partners around the world can be empowered to understand climate change and adopt sustainable practices their engagement could produce positive change on a vast scale. There is also a powerful economic argument for equipping young people with the skills, know-how and capacity to respond to climate change as China adapts to more sustainable practices.

Taking action on climate change is not just about helping others and the planet in the present and future; it could also help us to lead more fulfilling and meaningful lives.

Mahatma Gandhi once said: 'Happiness is when what you think, what you say and what you do are in harmony' and many studies (such as those of Martin Seligman <http://www.authentic happiness.sas.upenn.edu/newsletter.aspx?id=1533>) indicate that a major component of happiness is having meaning in our lives and devoting time to something larger than ourselves.

In order to take informed action to make a difference, it is useful to know which aspects of our behaviour or lifestyles cause the greatest emissions of carbon dioxide. The activities in this section begin to explore the most effective ways of making a difference.

The secondary case study at the end of this pack provides links to on-line tools to help individual pupils and schools to work out in detail their emission levels or 'carbon footprints'. This allows for the measurement of any reduction in carbon emissions following a course of action

### Making a Difference – Where do I start?

**Pupils aged:** 7-14

**Subjects covered:** Maths, English, Science

**Key skills:** estimating, prioritising, collaboration, innovation

**Learning outcomes:** To find out more about the most effective ways of reducing carbon dioxide emissions. (Adapted from an activity found at: [http://www.yourclimateyourlife.org.uk/1\\_footprint.html](http://www.yourclimateyourlife.org.uk/1_footprint.html) with kind permission from the Royal Geographical Society: Your Climate Your Life <http://www.yourclimateyourlife.org.uk/>)

Ask pupils to work in groups to rank the following aspects of life according to which they think causes the greatest carbon dioxide emissions (in the UK):

### Phones

All sources of CO<sub>2</sub> from communications including computers and mobile phone chargers.

### Education

These are emissions relating to schools, travel to and from school, and the production of books and newspapers.

### Aviation

The fastest growing source of CO<sub>2</sub> emissions, thanks in part to the boom in low-cost air travel.

### Commuting

Travelling to and from the workplace on both public and private transport including flying.

### Hygiene

Includes emissions from the health sector and from individuals bathing and washing.

### Clothing

Energy and emissions generated in producing, transporting and cleaning clothes and shoes.

### Household

This covers non-heating emissions generated in the home from electrical appliances, furnishings and from the construction of the building itself.

### Food

Generated by cooking, eating and drinking, including how many miles food has travelled to get to our homes, including driving to supermarkets.

### Heating

Second biggest source of CO<sub>2</sub> resulting from burning of gas, electricity and oil. It is one of the easiest areas to reduce by turning down heating.

### Recreation

The single largest source of emissions. Leisure activities including seaside trips, TV, videos and stereos.

The pupils' estimates can then be compared with the actual figures by using this animation ([http://www.yourclimateyourlife.org.uk/1\\_footprint.html](http://www.yourclimateyourlife.org.uk/1_footprint.html)) or from the figures listed below:

In the UK, each person produces, on average, 11 tonnes of carbon a year, made up of:

Phones: 0.1 tonnes, Education: 0.49 tonnes, Aviation: 0.68 tonnes, Commuting: 0.81 tonnes, Hygiene: 1.34 tonnes, Clothing: 1.00 tonnes, Household: 1.37 tonnes, Food: 1.39 tonnes, Heating: 1.49 tonnes, Recreation: 1.95 tonnes

Then ask your pupils to start to think about practical ways that they and their families could change their behaviour in areas of their lives where carbon emissions are likely to be the highest (this can be checked against more detailed carbon footprint calculations in the secondary case study).

Swap suggestions with partner schools and perhaps award certificates for the most innovative ideas and actions carried out.

This activity could act as a stimulus for action research projects or further activities in the specific areas for which (GAP) teaching resources have been developed.



## Towards solutions: adaptation and mitigation

**Pupils aged:** 11-16

**Subjects covered:** English, Geography, Science

**Key skills:** Problem solving, critical thinking

**Learning outcomes:** To research and present findings on different possible solutions to the mitigation of climate change.

Ask pupils what they feel the difference between a) adaptation to climate change and b) mitigation of climate change mean. (A = accepting it is happening and that we need to make adjustments to how we live; B = preventing the more damaging effects/preventing it getting any worse).

If you took part in the activity in Section 2: ‘How will climate change impact on us in the future?’ you will have an idea about what impact climate change could have on your country. This knowledge allows us to work back to the present and think about what we need to start doing now to adapt and protect ourselves in the future. Some developments and changes can take many years to implement; for example the Thames Barrier which protects London from flooding was built in response to the severe flooding of 1953, but it did not open officially until 1984. Creating new wetlands to absorb flood water or preventing new buildings on a flood plain

or on a vulnerable coastline means starting to take action now. Think about the area where you live, especially the places that might be most vulnerable to the effects of climate change.

If you were in charge, what sort of plans would you put in place now? How would you persuade people to support you and to make the money available, given that some of the changes might not benefit people living today?

To avoid dramatic climate change, the world must reduce its emissions by about 200 billion tons of carbon, or eight 25 billion ton ‘wedges’, over the next 50 years.

Ask pupils to carry out an action research project into one of these areas:

E.g. Renewable energy; Nuclear energy; Energy efficiency; International climate conventions; Carbon trading; Carbon capture and storage; Carbon off-setting; Carbon quotas; Geoengineering; Transition Towns; Sustainable Cities; Circular economy

These could be based on the Princeton Stabilization Wedges and the ‘Wedges game’ could be played. (<http://cmi.princeton.edu/wedges/intro.php>)

The Wedge Game has been criticised for focusing on

‘technological fixes’ rather than challenging the drive towards an endless growth to the economy and a disconnection from the natural world that is at the heart of global climate change. Older pupils could consider what other approaches could be taken. One film clip that might provoke discussion is ‘The Elder Brother’s Warning’ (<http://www.youtube.com/watch?v=pnLX9pdKuEg>) – a film with a message from the indigenous ‘Kogi’ community living in the mountains of Columbia. The Kogi were invited to give presentations at the Rio+20 summit in 2012

You could also use videos made with the support of the British Council and shown first at the Planet Under Pressure conference 2012. They are the voices of indigenous peoples on their visions of sustainability: <http://bravecollaboration.tumblr.com/>

A useful resource for younger pupils to read about possible renewable energy for the future can be found: [http://www.yourclimateyourlife.org.uk/10\\_tomorrows\\_pros\\_cons.html](http://www.yourclimateyourlife.org.uk/10_tomorrows_pros_cons.html)

Present findings and debate which are most preferable / practical.

## Climate change scenario

**Pupils aged:** 10-14

**Subjects covered:** Drama, Science, English

**Key skills:** Communication skills, collaboration, identifying problems and considering solutions Learning outcomes: To look at potential real life scenarios insituations related to climate change and develop the arguments about the importance of taking into account the possible consequences of ignoring climate change.

These activities recognise that there are some areas of emissions over which individuals have little or no direct control (for example, government energy policy) but can lead to discussion about how to influence decision makers in relation to mitigating climate change.

A series of role play scenarios could be organised where students “stand in the shoes” of people making real life decisions to mitigate climate change or adapt to a changing climate. They could consider the economic and social impacts of proposals to reduce amount of water used by a village in China using the Water Problem Solving Activity, ([http://www.carbonpartners.org.uk/sites/default/files/Water\\_Problem\\_Solving\\_Adaptation.pdf](http://www.carbonpartners.org.uk/sites/default/files/Water_Problem_Solving_Adaptation.pdf)) challenges involved in reducing amount of waste produced at a biscuit factory using the Waste Discussion Activity ([http://www.carbonpartners.org.uk/sites/default/files/Waste\\_Discussion\\_Activity.pdf](http://www.carbonpartners.org.uk/sites/default/files/Waste_Discussion_Activity.pdf)) the challenges of meeting transport needs of a new Eco-City using the Transport Creative Design Activity ([http://www.carbonpartners.org.uk/sites/default/files/Transport\\_Creative\\_Design\\_Activity.pdf](http://www.carbonpartners.org.uk/sites/default/files/Transport_Creative_Design_Activity.pdf)) a series of activities about the importance of Biodiversity, or an International Climate Change Summit simulation. ([http://www.carbonpartners.org.uk/sites/default/files/Climate\\_Change\\_Summit\\_Activity.pdf](http://www.carbonpartners.org.uk/sites/default/files/Climate_Change_Summit_Activity.pdf))

The teacher (or volunteer) could act in role as a Finance/Energy Minister of a major world economy who is pledging that fossil fuels would continue to be the country’s biggest source of energy into the 2020s and beyond in order to provoke pupils into putting forward counter arguments from what they have learned. (See guidance notes in appendix 2 or look at Mantle of the Expert Website (<http://www.mantleoftheexpert.com/wp-content/uploads/2008/03/Teacher-and-Role.pdf>).

## Making it happen

**Pupils aged:** 6-8

**Subjects covered:** Citizenship, English, Maths, Art and design

**Key skills:** Identifying problems and considering solutions, communication, persuasion

**Learning outcomes:** To inspire young children to make a difference to their local community

Ask your pupils if there are things that bother them about their local environment. What would they like to change and how could they go about changing it? The class could agree on one issue that they would like to tackle, or work in groups on different issues. Once they have identified the issue(s), pupils will need to make a plan for making a difference which sets out the different tasks that they need to complete such as writing letters, interviewing local people, raising awareness in the community etc.

For example, a primary school in England worked with their local Council to highlight issues of waste and how it impacts on our environment. The pupils made a presentation to show to the whole school about the problems that plastic bags can cause. They also made posters asking people to reduce their use of plastic bags and asked local businesses and supermarkets to display them.

They commissioned their own “bag for life “ which they sold at the school fair to encourage their families to use instead of plastic bags. At the end of the project, they had a ‘showcase’ event for staff, children, parents and the local Council to share all the work that they had done

## Making it happen 2

**Pupils aged:** 10-13

**Subjects covered:** English, Geography,

**Key skills:** Research, enquiry, collaboration

**Learning outcomes:** To investigate and discuss inspiring examples of people taking action on climate change at a personal / collective, local / global level. What obstacles did they face and how were they overcome. Examples could be taken from the Ashden Awards website <http://www.ashden.org/>.

Ask your pupils to research the work being done by schools around the world to adapt to their changing climates.

The following website shows how a primary school in Mexico is modifying the school building to avoid using fans (in order to save energy) and are working to protect the building during the hurricane season.

They have substituted all electrical installations including the installation of energy saving light bulbs throughout the school. They have managed to convince 25 businesses and 12 homes near the General Juan Carrasco Primary School to install energy efficient light bulbs. Laying ceramic floor tiles, thanks to the material they’re made from, helps to keep the school building cool. This reduces the need for fans, and saves energy.

They are also planning to place material on the roof of the school that will reflect the heat from the sun, again helping keep the building cool. More information can be found on this website. <http://uk.climate4classrooms.org/case-study/general-juan-carrasco-primary-school-mazatlan-sinaloa-mexico>

At a primary school in Worcestershire in the UK it is expected that summers will get hotter and drier, winter rainfall will get heavier and there will be more very hot days and intense rain storms. They have developed plans to use a rainwater harvesting scheme. This will collect water from roofs and use it to flush toilets. Other roof areas will be planted with sedum. This is a small green plant that absorbs water, reducing the amount of rain running into drains.

Further case studies, including short films can be found by visiting the links in the resources section.

Discuss with your pupils what their school might do to mitigate the effects of climate change. Swap ideas with your partner school

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## Sample Project Plans

Project plans come in many shapes and sizes, depending on the needs of schools and teachers. They can be broken down into weekly lessons or take place over an extended period of time. However, they should always be adaptable and flexible and focus on providing compelling learning experiences to increase the knowledge and skills of your students. The following project plans show how a primary and secondary school planned a series of cross curricular lesson plans for their pupils.

the school would produce over a week, a term and a year. They were astonished at the amount.

They then had the rather unpleasant task of going through all the bags, sorting the rubbish. They were surprised at how much could be recycled or reused if sorting and collection was reorganised. This one small action could achieve a huge reduction in the waste produced over the course of a school year.

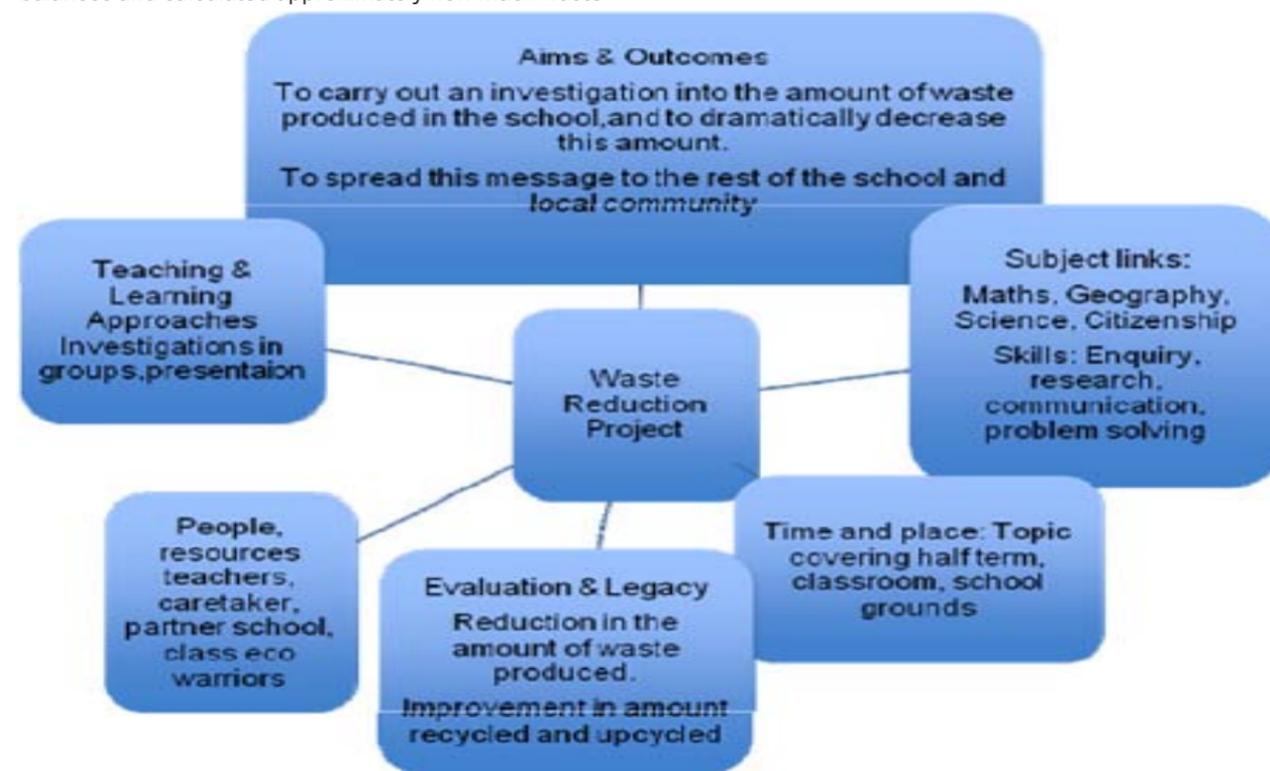
### Sample Project Plan 1 (Primary School): Waste Reduction Project

#### Overview

This project arose when a UK primary school asked its pupils what they would like to find out as part of a topic on the environment. One pupil asked if they could research how much waste the school produces and how much was recycled

**Learning objectives:** To carry out an enquiry based investigation into the amount of waste produced in school as a response to child initiated questions.

**Activities:** The pupils put on plastic gloves and helped the school caretaker collect the bags of waste that the school produced in one day. They weighed them with spring balances and calculated approximately how much waste



## Lesson 2

**Learning objectives:** To investigate methods of waste disposal

**Activities:** The teacher helped the pupils investigate where the school waste ended up and how it can contribute to greenhouse gases. They visited a local landfill site and planned how the school could reduce its contribution by increasing recycling and up cycling.

## Lesson 3

**Learning objectives** To encourage speaking, listening and persuasive writing skills for a purpose.

**Activities** The teacher encouraged the pupils to put their ideas on paper, talk to the Headteacher and write to Governors about their suggestions. They suggested that the school introduced a series of different coloured bins to enable them to recycle efficiently. When sorting the rubbish they noticed that there was a large amount of fruit peelings being thrown away so set up a compost bin in the school grounds. They suggested that each class could have a team of eco warriors who helped to collect the sorted waste and empty the peelings into the compost bin each week. The compost could then be used in the school grounds where produce was grown by the pupils and used in cookery.

## Lesson 4-6

**Learning objectives** To spread the message of waste reduction and recycling across the school and local community

**Activities:** To capitalise on the children's enthusiasm the school organised a zero waste week where each class included elements of waste reduction into the curriculum. One year group created bags and mobile phone holders from old clothes, another jewellery from recycled materials which they sold and another produced a greenhouse from old drinks bottles.

The new eco friendly green house

They also created posters and board games on this theme which they played with the younger children and their families. The oldest year group were challenged to create costumes and instruments from recycled materials for the school production.

During the week the eco warriors also became eco spies! They made cards and films to remind teachers to turn off lap tops and lights when not in use, and awarded certificates to the classes doing the most to achieve waste reduction.

At the end of the week they also had a day where they tried to use no electricity. The children were astonished at how

much they depended on it, and how their school had very little natural light which made it very dark without electric lighting even in the daytime.



## Lesson 7

**Learning objectives:** To complete research into their waste reduction activities and share the results with others

**Activities:** At the end of term they repeated the weighing exercise and carried out questionnaires amongst staff and pupils to see that their campaign to raise awareness and change behaviours had been successful.

They were pleased to see that they had made a real difference. The amount of rubbish going to the landfill sites was dramatically reduced and both staff and pupils said they had changed their behaviour and recycled or reused materials much more frequently.

They shared the results of this project with the school governors and community and with their partner school who is planning to undertake a similar project in their school.

Four of the children were also invited to London University's Institute of Education to spread their message further by speaking at an international conference called Young People: Doing and Using Research to Change Schools and Communities.

They gave a confident presentation about their role as Eco Warriors and the research they had carried out. The audience included teachers and pupils from schools in the UK, India and Turkey and a number of professors from universities. One Headteacher then brought a group of children from her school to spend the day with the children to swap ideas about ways to continue to reduce waste and improve the environment at both schools.

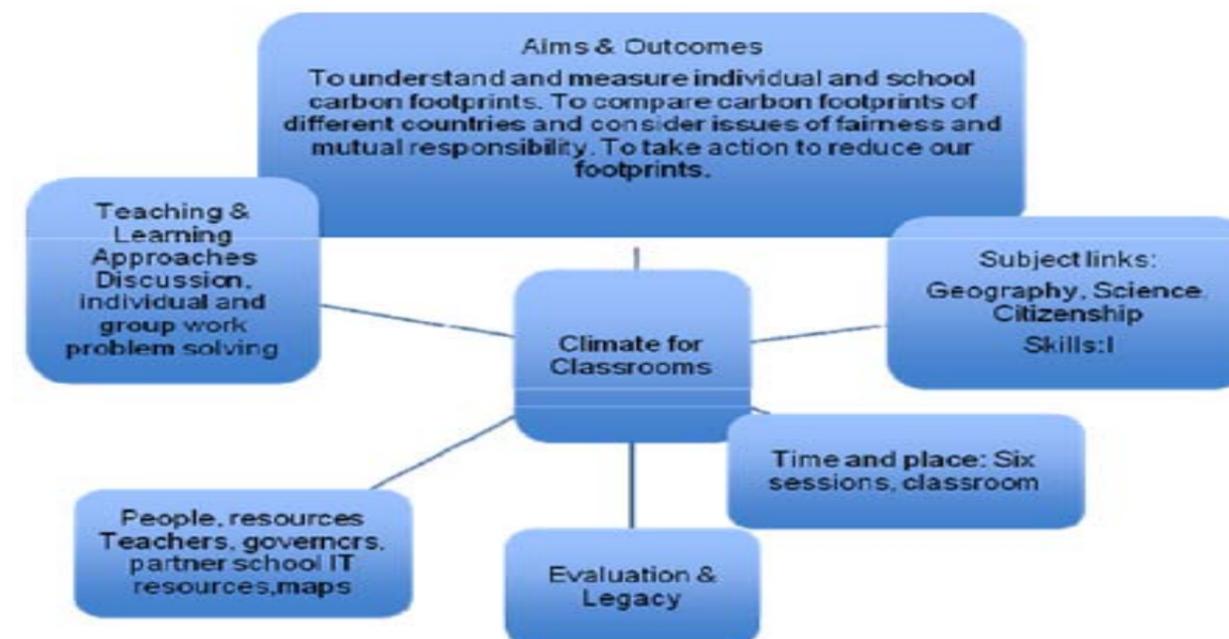
# Sample Project Plan 2 (Secondary School): Climate for Classrooms

## Overview

The following project plan give ideas for cross curricular activities that you could do with your partner school to share learning about carbon footprints

It can be hard to visualize tonnes of gases, but to help you think about it, one tonne would fill a hot air balloon or use [www.carbonvisuals.com](http://www.carbonvisuals.com) to get a variety of ideas.

Students could submit their individual figures to the teacher



## Lesson 1

**Learning Objective:** To understand the concept of a carbon footprint and measure their own.

**Activities:** What is a carbon footprint?

Write the phrase on the board and ask students individually, and then in pairs, to try to come up with a definition.

Compare the class definition with this one:

"A carbon footprint is a measure of how much carbon dioxide and other greenhouse gases (Carbon Dioxide, Methane, Nitrous Oxide, and Methane) are produced by one person. It is normally measured in kilogrammes or tonnes of CO<sub>2</sub>. People, who use lots of electricity, eat meat, and drive everywhere in their car will have a large carbon footprint."

Ask students to think of all the activities they do that produce carbon emissions and list these on the board. You can give them prompts such as thinking about what they do after school or when they first get up in the morning.

Students calculate their own personal carbon footprint. To do this they will need to consider their daily routine and all the activities they do that use energy. We recommend using one of these calculators: [www.cooltheworld.com/kidscarboncalculator.php](http://www.cooltheworld.com/kidscarboncalculator.php) (For younger pupils) <http://footprint.wwf.org.uk> (For older pupils)

anonymously and then work out the total and average carbon footprint for the class.

Ask students if they ever think about the environmental impact of their actions. Which activities have the greatest impact? Which activities do students have the power to change directly and which ones could / would they need to persuade someone else to take action on?

Students could make a photo-story or short video of their day highlighting all the times they use energy to share with their partner school.

## Lesson 2

**Learning Objective:** To calculate the school's carbon footprint.

**Activities:** Use an online school / organizational carbon footprint calculator and produce a pie chart or graph showing which factors contribute to the school carbon footprint e.g. Travel to school, electricity use, purchasing. Discuss what they could do differently to reduce the school footprint? Which changes do they think would have the biggest impact?

Ask your students to produce a collage with their ideas for their ideal low-carbon school. This could be done by each student or pair drawing or writing one thing that they would like to see in the low-carbon school and collating all the ideas on a large piece of paper. Compare the results with your partner school.

(A UK school could use the calculator on [www.carbondetectives.org.uk](http://www.carbondetectives.org.uk), schools from other countries could try one of the following sites: <http://www.epa.vic.gov.au/ecologicalfootprint/calculators/school/introduction.asp> <http://www.carbonpartners.org.uk/calculate-partners-footprint>

Examples of schools who have calculated their carbon footprints as part of the Carbon Partners

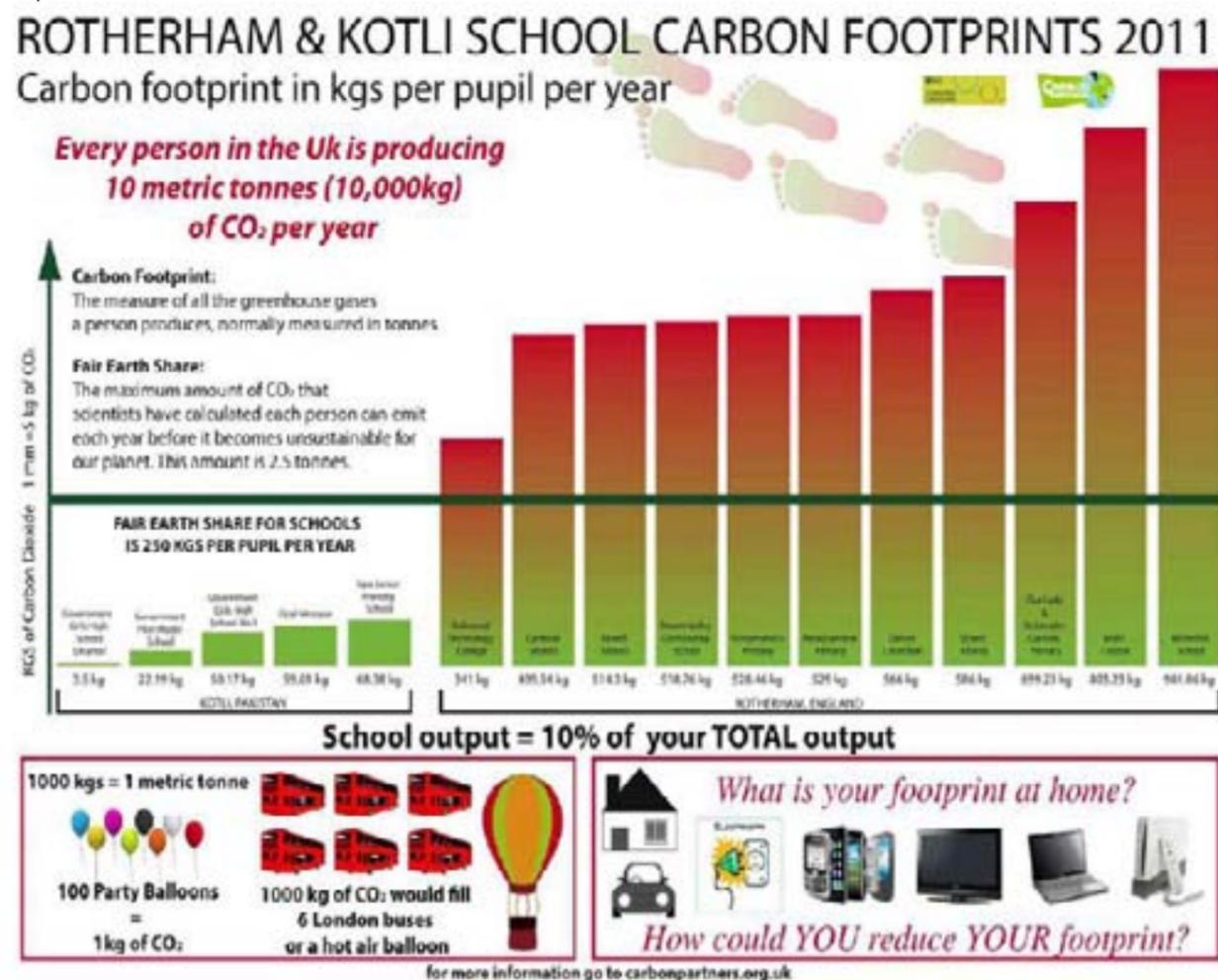
Project can be found at:

<http://www.carbonpartners.org.uk/participating-schools>

As part of the Carbon Partners Project, partner schools have each worked out their school carbon footprints and then made comparisons. A comparison of the footprints of a cluster of schools in the UK and Pakistan is given below. If you have a partnership with a school that is likely to have very different levels of carbon dioxide emissions to yours, then you might wish to consider the project's model of working towards every school producing only its 'fair earth share\*' of emissions. You can register with the Carbon Partners Project to access their free tools.

source: Carbon Partners

(\*A 'Fair Earth Share' is the maximum amount of CO2 it is calculated that each person can emit before it becomes unsustainable for the planet. It's around 2.5 tonnes of CO2 per person (per year) and 10% of this figure per pupil in school.)



## Lesson 3

**Learning Objectives:** The Bigger Picture: To compare carbon footprints of countries around the world and understand the different ways they can be measured (total emissions, per capita, historical)

**Activities:** Using <http://www.theguardian.com/environment/interactive/2011/dec/08/carbon-emissions-global-climate-talks> you could compare the total, per capita and historic emissions of key countries.

You could make to-scale footprints for different countries and ask students to match them up with countries marked on a large map. Which countries have the largest/smallest footprints? Think about climate change as a global issue. The impact of a large footprint in one country is felt in other countries. Often the countries with the smallest footprints are suffering most from the impacts of climate change through flooding, drought, extreme weather events etc. Is that fair? What will happen as poorer countries develop further?

**Resource:** <http://www.worldmapper.org/display.php?selected=322>

This website shows world maps that have been redrawn, basing the country sizes on different factors, including one based on ecological footprints.

Students could do some research into how climate change is affecting different countries around the world, perhaps focussing on the country of their partner school.

The Central Foundation Girls School in Tower Hamlets, London, worked with their partner school in Sunamganj, Bangladesh, on an innovative climate change project.

The UK students realised that they could use their links with Bangladesh to collect first-hand testimonies, opinions and experiences about the impact of climate change, started a blog to store all this information, which the Bangladeshi students could access and add to.

Check out the Sumanjblog <http://sunamganjth.primaryblogger.co.uk>

The campaign really got going when five students and three teachers from Bangladesh came to visit the school in London. It was really inspiring to see how much work they had been doing on this project, and see the films they had created on their experiences of climate change. They shared these on the blog, and used them in lessons as well.

A group of UK students then arranged a meeting with their local MP and used the testimonies to call for her to put pressure on the UK government to do more to tackle climate change. She promised that she would support their campaign and challenged them to get even more people in the community involved!

The blog is proving to be a real success. The school uses it in lessons, for homework and have lots of groups of students who are now busy making films and writing articles to post on it.

They look forward to using it to launch other campaigns in the future too.

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## Lesson 4

**Learning Objective:** To understand the concept of 'Hidden / embedded footprints' and the concept of a 'fair earth share'

**Activities:** When we measured our carbon footprints in lesson 3, we looked mainly at the activities that we do that directly produce carbon emissions. But what about all the things that we buy? They have carbon footprints too. If the UK imports products that are manufactured in China, the emissions count towards China's carbon footprint, but the goods are used in the UK. If the UK then exports the waste from those products to China, they also add to China's carbon footprint.

'What's the footprint?' worksheet [http://www.carbonpartners.org.uk/sites/default/files/Whats\\_the\\_carbon\\_footprint\\_of....pdf](http://www.carbonpartners.org.uk/sites/default/files/Whats_the_carbon_footprint_of....pdf) Introduce the concept of a 'fair earth share'. This is the maximum amount of CO2 that scientists have calculated each person can emit before it becomes unsustainable for our planet. It's around 2.5 tonnes per person (per year). Which countries are using more than theirs / which less? What do students feel about this? How might this change in the next 10 / 20 / 30 years? What do they think should be done about it?

You could consider running the GAP Food Poster Presentation Activity ([http://www.carbonpartners.org.uk/sites/default/files/Food\\_Poster\\_Presentation\\_Activity.pdf](http://www.carbonpartners.org.uk/sites/default/files/Food_Poster_Presentation_Activity.pdf)) which examines the food eaten in eight different countries and compares how much greenhouse gas is emitted in their production.

## Lesson 5

**Learning Objective:** To look at how we can reduce our individual and collective carbon footprints.

**Activities:** Students can make individual or class pledges about actions they will take to reduce their carbon footprints. They could display these in school and review them regularly so that they are not forgotten. They could calculate the amount of carbon emissions the agreed actions would save and use this to set a challenging but achievable target for reducing their carbon footprints. For example if the school heating was turned off an hour earlier each day, or 50% more pupils walked to school, how much energy would this save? Students should be encouraged to work collectively to increase momentum and the potential for emissions reduction.

Students should be encouraged to consider embedded emissions as well as direct emissions. For example could they reduce the amount of clothes they buy, buy second-hand or share objects such as books with friends? Could they eat less meat, buy locally-produced food or food with less packaging?

You may like to look at the resources produced by the Ellen MacArthur Foundation about the benefits of a circular (rather than linear) economy. This advocates the need for more fundamental changes in western society to move away from the culture of “take, make and dump” where resources are being used up in an unsustainable way.

<http://www.ellenmacarthurfoundation.org/education/secondary>

Students at Darrick Wood Secondary School, UK, have been involved in a project to raise their awareness about the environmental impact of the fashion industry, and to get them thinking about the effects of their ‘throwaway’ fashion culture.

A Campaigner from Oxfam came into school and taught a lesson on the human impact of the fashion industry. The pupils were visibly shocked at some of the statistics involved.

The pupils started with the simple idea of recycling fabric- looking at ways to make new products out of ones that were no longer needed. The local Oxfam charity shop supplied old clothes for fabric and the pupils started designing and making their range of cushions.

They also took on other aspects of the whole project, such as designing the window displays and writing the press release that was supplied to the local papers.

They produced two lovely window displays in Oxfam, and came away with a much greater awareness of their impact on the environment.

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## Lesson 6

**Learning Objective:** To explore how to take action to involve the school and wider community in reducing carbon footprints

**Activities:**

Students could work in small groups to take action to reduce the carbon footprint of the school or individuals in the community/school. This might include:

- Giving a presentation to the whole school, governors or community representatives about carbon footprints and the changes that could be made.
- Creating a poster, presentation or film to inspire other students.
- Writing letters, e.g. to suppliers of goods to the school, to ask about their environmental policies.
- Writing to the Council to ask for support to become more sustainable, e.g. to provide better energy monitoring information or recycling facilities.
- Organising a student Environment Group that meets regularly and takes action on environmental issues.
- Developing a community growing project to grow vegetables and thus reduce food miles. Share all pledges and examples with your partner school.

## Tips and resources for teachers

### A teacher's checklist for the design of learning

Focus	Action
<p><b>Aims and outcomes</b></p> <p>Have you clearly identified what you are trying to achieve for your pupils through this project?</p> <p>Have you clearly identified what the outcomes will be?</p>	
<p><b>Pitch and challenge</b></p> <p>Are there sufficient opportunities for pupils to exercise choice and autonomy and express their own creativity and imagination?</p>	
<p><b>Teaching and learning approaches</b></p> <p>What approaches will be most effective to achieve your aims? Will they encourage creativity and critical thinking?</p> <p>Will they include enquiry, and independent research?</p>	
<p><b>Time and place</b></p> <p>Where and when will the activities take place?</p> <p>Will the activities take place weekly, over a term, or in a condensed period of time?</p> <p>How will the timetable be organised?</p> <p>How will time differences with partner schools be accommodated? What will be done outside of the school day?</p>	
<p><b>People</b></p> <p>Who will need to be involved?</p> <p>Will this include other teachers, parents, teaching assistants, supporting organisations, partner school staff and pupils and members of the local community?</p> <p>Will subject faculties in secondary schools need to plan and work together? Will the learning experience be most effective if the work is organised for one class, year group or mixed ages?</p>	
<p><b>Resources</b></p> <p>What resources will be needed?</p> <p>How will you ensure they are available when required?</p>	
<p><b>Curriculum links</b></p> <p>What themes or subjects will be involved?</p> <p>What knowledge and skills will you are looking to develop?</p> <p>How will the project encourage your pupils to ask 'big' questions about the world around them and explore key issues such as identity and culture? Will the activities encourage innovation, optimism, purposeful enquiry?</p>	

Focus	Action
<p><b>Evaluation</b></p> <p>How will you evaluate the project? How could you involve learners, colleagues, parents, members of the local community in this?</p> <p>Who are you going to share the information with and how will this be done?</p>	
<p><b>Legacy</b></p> <p>How will you build on this experience to further develop the knowledge, skills and understanding of your pupils?</p> <p>How can the experience be extended across the school to other pupils and staff?</p>	

## Resources

10:10 Schools Practical tips and tools to help schools cut carbon. <http://www.1010global.org/uk/education/schools>

Ashden Awards Sustainable Energy Solutions for Schools <http://www.ashden.org/schools>

Association for the Study of Peak Oil and Gas An international network of scientists concerned about oil depletion. <http://www.peakoil.net/>

Carbon Partners Website for schools wishing to measure their carbon footprints and consider partnership collaborations to bring their footprints closer to a fair earth share. <http://www.carbonpartners.org.uk/>

Climate 4 Classrooms A comprehensive global website supporting the teaching and learning of climate change in different languages using recognized scientific research. <http://uk.climate4classrooms.org/>

Design for Change has case studies of ways to engage and empower children to lead change in their communities. <http://www.designforchange.org/>

Doran, P.T. and M. Kendall Zimmerman. 2009. Direct Examination of the Scientific Consensus on Climate Change. EOS 90(3):22 Original Scientific Paper on a survey that indicates that over

97% of published climate scientists believe that human activity is a significant contributing factor in changing mean global temperatures.

Eco-Schools An international programme for environmental education and management, which aims to raise students' awareness of sustainable development issues through classroom study as well as school and community action. <http://www.eco-schools.org/>

Everything you need to know about climate change – interactive one-stop guide to the facts of global warming, from the science and politics to economics and technology. <http://www.theguardian.com/environment/interactive/2011/aug/15/everything-know-climate-change>

Green Schools has examples of ways that schools can reduce their effects on the environment <http://www.greenschools.net/>

Ice Cores and Climate Change A briefing paper on how slices of ice core, drilled from the depths of the Earth's ice sheets reveal details of the planet's past climate. [http://www.antarctica.ac.uk/bas\\_research/science\\_briefings/icecorebriefing.php](http://www.antarctica.ac.uk/bas_research/science_briefings/icecorebriefing.php)

Muller, R. (2012) The Conversion of a Climate Change Sceptic The New York Times, July 28th

2012 An opinion piece by Prof Richard Muller, a physicist and climate sceptic who now believes that the rising global

temperature over the past 250 years result from the human emission of greenhouse gases.

Petit, J.R. et al (1999) Climate and Atmospheric History of the Past 420,000 years from the

Vostok Ice Core, Antarctica. Nature Vol 399 429–436. Original Scientific Paper that indicates that current levels of Carbon Dioxide and Methane in the atmosphere are unprecedented during the past 420,000 years.

Power down Multimedia resources for schools on mitigating climate change. [http://www.antarctica.ac.uk/bas\\_research/science\\_briefings/icecorebriefing.php](http://www.antarctica.ac.uk/bas_research/science_briefings/icecorebriefing.php)

<http://www.guardian.co.uk/environment/interactive/2011/aug/15/everything-know-climate-change>

Action Aid's Power Down toolkit includes a video about reducing carbon emissions in school and the impact of climate change in different countries. <http://powerdown.actionaid.org.uk/index.php/component/resources/search?limit=0&lastlimit=10&keystage=62&lessonid=301&groupname=PowerDown>

## Appendix 1 Role Play Debate

A debate is a verbal and logical argument that is conducted within a set framework. In a role play debate students take on specific roles in order to take part in the argument.

The benefits of carrying out a role play debate include:

To increase understanding: By having to argue a point students will gain a more rigorous understanding of the topic being covered. If the students are in a role which may have a different view point to their own it may help them to sympathise with alternative view points. Debates can help students to understand that there is not always a right and wrong answer to every question, but many view points.

To develop skills: a number of important skills are utilised and developed through taking part in a debate. These include; processing information, formulating a persuasive argument, public speaking, note taking, questioning and decision making.

Managing a role play debate in class:

Preparation: Familiarise yourself with the debate topic and materials. Decide how you are going to divide the class into groups using Teaching Technique 1: Group Work and your knowledge of the students. Think about how you might be able to position students in the room.. If possible each of the groups should sit around the edge of the room all facing inwards to a central point. This way they do not have to move when speaking to the rest of the room. If this is not possible think about the best way groups can speak to the rest of the class, perhaps the groups may need to come to the front of the class to present.

Introduction: Explain to the students that they are going to take part in a debate. You may wish to discuss with the class what a debate is and ask them if they have any experience of debates. Once the students are in groups ensure that they understand their role. Emphasise that everyone in the group should contribute equally. Remind the class that everyone has different skills and they should take this into account when dividing tasks.

Preparation for facilitating the debate: Circulate and offer help where appropriate. Ensure

that all members of the groups are engaged in the activity. Check that all the groups understand their role and are happy using the resources provided. If you are using the Energy Debate Resource from this series then draw the students' attention to the advice given on the front of the Energy Sources Information Pack. You may wish to set a time limit for each part of the task to give the group a structure to work to.

Facilitating the debate: Ensure the class sit in the positions that you have decided on for the debate. You may wish to act in role yourself as the chair of the debate. You can do this by greeting the students and introducing the debate in a formal way, 'in character'. Add as much drama to the debate as you are comfortable with and encourage the

students to act in role as well to really engage them in the occasion. You may wish to use a timer and a bell (or even nominate a student who is not speaking to be a timekeeper) to keep each group on time and to control the debate. Let the students know that when the bell sounds they should stop speaking. Use the bell to keep time while the students are presenting their argument. If you are under a tight time limit you can use it while they are asking questions too. Allow any interesting debate to develop between groups when they are asking one another questions, using the bell to stay in control of the group. At the end of the debate, ask the students to come out of role and vote for the group who presented the most persuasive argument.