Climate Change Basics

The aim of this activity is to develop your understanding of the basic processes underlying climate change and determine how people are contributing to climate change through their everyday behaviour. You will identify key greenhouse gases, their sources and their effect on Earth's energy balance and use a carbon calculator to determine the amount of carbon emissions your lifestyle and the people around you directly and indirectly generate.

Time

Three hours

Tools

- Internet access
- Paper and coloured pens / pencils

Background

Greenhouse gases are a tiny fraction of the total composition of the atmosphere that forms a thermal blanket around the earth. Without them the global average temperature would be 30°C cooler than the current average temperature of 15°C. These naturally occurring gases are released into the atmosphere by biogeochemical processes such as the decomposition of organic matter, plant and animal respiration and volcanism. The three main gases are water (H_2O) at less than 1%, carbon dioxide (CO_2) 0.035% and methane (CH_4) at just 0.00018% of the total atmosphere.

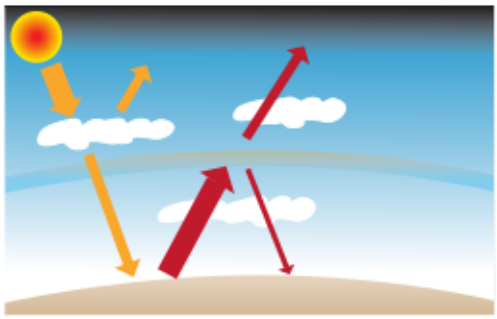
These gases act just like a garden greenhouse. Short wavelength light energy from the sun is absorbed by the components of the climate system (air, water, soil, ice and forests). The excess energy that is absorbed is reradiated back out into the atmosphere and space as long wavelength heat energy. This energy flow keeps the temperature of the Earth's surface in balance. Greenhouse gases prevent a proportion of the reradiated surface heat energy from escaping the Earth's atmosphere and passing out into space. The higher the concentration of greenhouse gases in the atmosphere the greater the amount of surface heat energy is trapped close to the Earth's surface, causing our atmosphere to warm-up.

The various greenhouse gases released into the atmosphere (collectively known as carbon emissions) are the result of activities and processes that support our lifestyle. Individually they form the basis of a carbon footprint. We each contribute to carbon emissions directly from the use of fossil fuels to power and heat our homes, fill up our cars or when we travel and indirectly through energy that is "embedded" in activities we participate in and the items we buy.

Global change depends on each of us reducing our contribution to climate change. To do this we need to first workout just what those contributions are. There are many websites that provide a way of measuring your carbon emissions using a carbon calculator. You can also estimate using averages provided by trusted sources, or you can make a more detailed measurement of your own consumption of fuel, electricity, food and other natural resources and generation of waste.

Classroom Activity 1

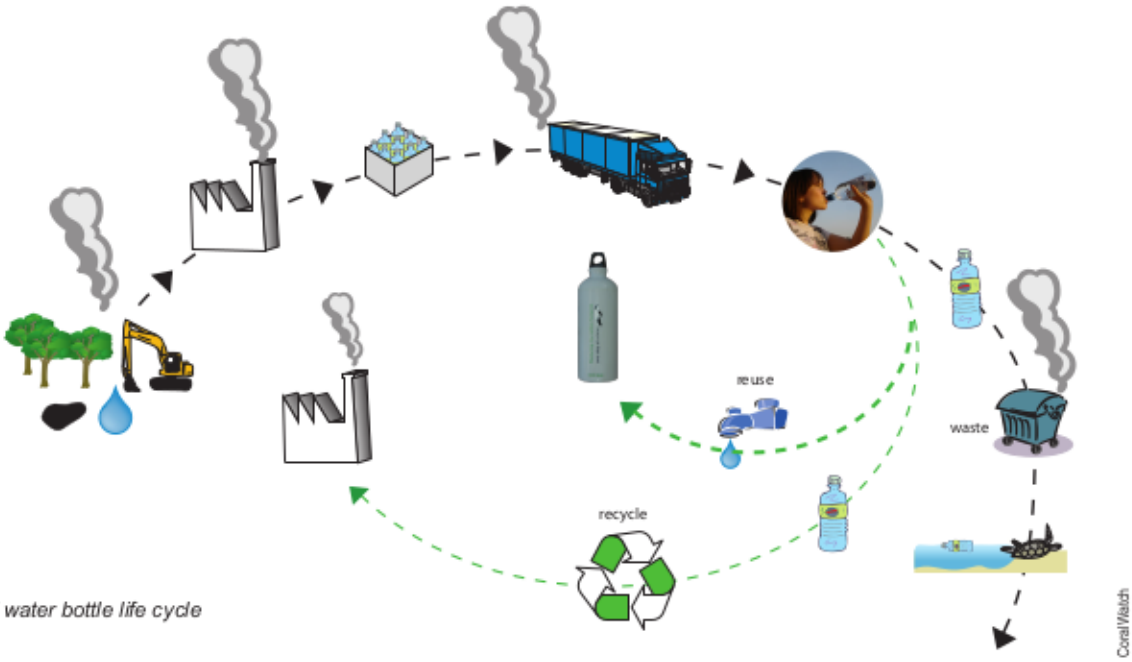
Draw a similar model as shown and explain in your own words the processes taking place.



Classroom Activity 2

Using the lifecycle of the water bottle as an example, draw and label the lifecycle of an everyday item in your life (e.g. your mobile phone, pen, shoe, can of drink).

1. Draw or paste an image of the item in the middle of your page.
2. Draw labels to each component (e.g. for a biro pen; plastic lid, ink, plastic casing, metal nib).
3. Now draw and label the process that has created that item from extraction of raw materials ► processing ► manufacture ► packaging ► distribution ► sale ► use ► disposal / recycling.
4. For each step, also draw or list the sources of greenhouse gas emissions (these could include direct emissions from vehicles and manufacturing machines, use of electricity from a powerplant, clearing of land and burning of trees and wood, etc).



Example of water bottle life cycle

Classroom Activity 3

1. Make a list of 10 activities you enjoy doing every day.
2. Next to each, identify if you believe it releases none, few or lots of carbon emissions.

Hint: If you don't know the answer to this, it helps to think about the bigger picture. For each item on the list, think about how it was manufactured, what are the raw materials needed to make it, what is the energy used in the process.

3. Write one way you could reduce the emissions from the activity.

Reducing daily emissions		
Activities I enjoy doing every day	Carbon emissions (none, few, lots)	Way I could reduce emissions

Before Class

Find out the following facts:

- How far is it from your home to school?
- What type of fuel does your car use?
- What do you use to heat water at home? (gas, electricity, solar)
- How much electricity did you use on your last electricity bill? Over what amount of time?

Carbon Calculator

1. Complete a carbon calculator online to determine your carbon emissions.
2. Compare this to the rest of your group and find the average carbon footprint of your group.

Questions

1. What is the greenhouse effect?
2. What are the main greenhouses gases that are found in our atmosphere?
3. What are the sources of those gases?
4. How is climate change different from the greenhouse effect?
5. Using examples describe the differences between natural and anthropogenic forcings.
6. Explain how recycling helps to reduce greenhouse gas emissions.
7. List at least three things you could do while shopping to help reduce greenhouse gas emissions.

Research projects

1. Evaluate the factors that limit the implementation of clean coal technology today.
2. Outline the case for the development of new zero emissions technologies.
3. What industry would be the largest source of GHGs in your area? List five actions that you could participate in that could reduce these emissions.
4. Methane is a GHG that has a greenhouse effect 24 times more powerful than carbon dioxide. Investigate the main sources of methane production and how climate change may be increasing the rate of release of methane into our atmosphere.
5. What are methane clathrates and how have they been implicated in climate change in the past?
6. Why is the stability of clathrates so important?
7. Investigate whether nuclear power is the solution to climate change.
8. What is carbon trading and how does it work?
9. Debate the argument: "Australia only produces 1.5% of the total greenhouse gas emission on a global basis and cannot justify the economics of mitigating for climate change."
10. Evaluate the role of renewable energy into the future.

References

Reid et al. (2009) Coral Reefs and Climate Change: The guide for education and awareness. CoralWatch, The University of Queensland, Brisbane. (See Climate Change sections pages 152-158)

Gore A (2006) An Inconvenient Truth. Bloomsbury Publishing, London

Intergovernmental Panel on Climate Change (IPCC); www.ipcc.ch

CO2CRC Cooperative Research Centre for Greenhouse Gas Technologies; http://www.ga.gov.au/oceans

United Nations Framework Convention on Climate Change; www.unfccc.int

RealClimate; www.realclimate.org

Global Carbon Project (GCP); www.globalcarbonproject.org

The Pew Center on Global Climate Change; www.pewclimate.org

The Australia Institute; www.teachingclimatechange.com.au

1degree; www.1degree.com.au

Act on CO2; actonco2.direct.gov.uk/actonco2/home.html

Australian Government; Department of Climate Change, www.climatechange.gov.au/en/community/carbon-footprint.aspx

Climate Crisis; www.climatecrisis.net/takeaction/carboncalculator/