

Greenhouse effect

– looking at the causes

Learners will have/be able to:

- Seen and felt peat and coal, and looked closely at oil & natural gas/camping gaz/plg and describe how they are formed
- Name the most common gases in the atmosphere, and the most important greenhouse gases
- Describe the greenhouse effect in words, and/or a diagram/drawing
- Describe the things they use at home/school that depend on the burning of fossil fuels
- Explain the main steps in making electricity, and how industrial development has increased the proportion of greenhouse gases in the atmosphere

Outdoor/indoor space

Examples for handling in small groups

Leaves (collected & squashed with bricks in a bag for 6 months), small log, peat briquette (broken up) or garden peat, small pieces of coal, small (200ml) sealed plastic bottle with engine oil, small, sealed plastic bottle – empty and labelled *natural gas*

Tables of carbon dioxide emissions

SNH Advances 7 – The heat is up and it's raining (activity 3) (see *Sources & further inspiration*):

- *Concentration of carbon dioxide in the atmosphere from 1960* – table of figures
- *Carbon dioxide emissions per person from ten different countries (1997)* – table of figures

1.2A – Diagram explaining how greenhouse gases contribute towards global warming

– 1 per student/group

Flash cards (optional)

Fossil fuels, non-renewable, carbon dioxide CO₂, methane CH₄, water vapour H₂O, renewable – use as necessary with older students

Internet searches

Formation of fossil fuels, how a power station works, renewable energy sources

Schools Global Footprint resource

Energy & transport

www.itscotland.org.uk/schoolsglobalfootprint

Scottish Natural Heritage

SNH Advances Series 7 – The heat is up and it's raining poster and activities (Curriculum for Excellence Third Level). Available from <http://www.snh.org.uk/pubs/>

Woodland Trust Nature Detectives

Explore the study of phenology and record the first and last sightings of species – see how they are affected by global warming

www.naturedetectives.org.uk

Royal Highland Education Trust

www.rhet.org.uk

Forest Education Initiative

www.foresteducation.org.uk

Introducing the concept of the greenhouse effect, this activity draws on understanding that some gases found in the atmosphere trap heat.

As the sun's rays heat up the earth's surface, it radiates heat back into the atmosphere, which is absorbed by these gases. This is the greenhouse effect, and the gases are called greenhouse gases.

The greenhouse gases most responsible for trapping heat are carbon dioxide, and methane. There are other greenhouse gases – nitrous oxide, ozone, CFCs, and water vapour. The most abundant gases in our atmosphere are still oxygen and nitrogen (see *SNH Advances 7* poster).

50% of Scottish local authority greenhouse emissions originate from schools. 15% of Scotland's public sector greenhouse gas emissions originate from schools.

Preparatory activity

In preparation for a later talk about greenhouse gases, here you can start talking about atoms, molecules and matter in science, including gases, liquids and solids. You could use water as an example: "It's all H₂O."

Use table tennis / polystyrene balls to illustrate blue as a hydrogen atom, white as an oxygen atom and black for a carbon atom. Use self-adhesive Velcro to stick them together. How would they make carbon dioxide (CO₂)? How many of each colour would they use? What about methane, which is CH₄?



Activity 2

01 Pass round the hand samples to each group to touch and/or examine and describe. What is happening to the leaves? Discuss the term **fossil fuel** and ask/explain how peat, coal, oil and natural gas are formed. They are also called **non-renewable fuels** – why is this? Which example doesn't fit – wood – why not? What are fossil fuels used for? Power – heat/steam, fuel and electricity. Which gas/es is/are released when they are burnt? Carbon dioxide especially – what does this mean? Are there other non-renewable sources of energy? Nuclear & geothermal. Did they know that 2.5m thick peat is thought to produce 3 cm of coal? Mark this on the school/classroom wall with metre rules and chalk.

02 What other kinds of fuel/energy sources do they know about? Use a **thought shower**. Collect their responses in a table and then complete the lists with missing examples. Besides fossil fuels, add charcoal for barbecues; waste fuel and biogas/sewage, and renewable/green energy sources such as wind, solar, tidal, wave etc. Which group produces most carbon dioxide/greenhouse gases? Does the use of renewable sources produce any greenhouse gases? Introduce **cradle to grave** concept.

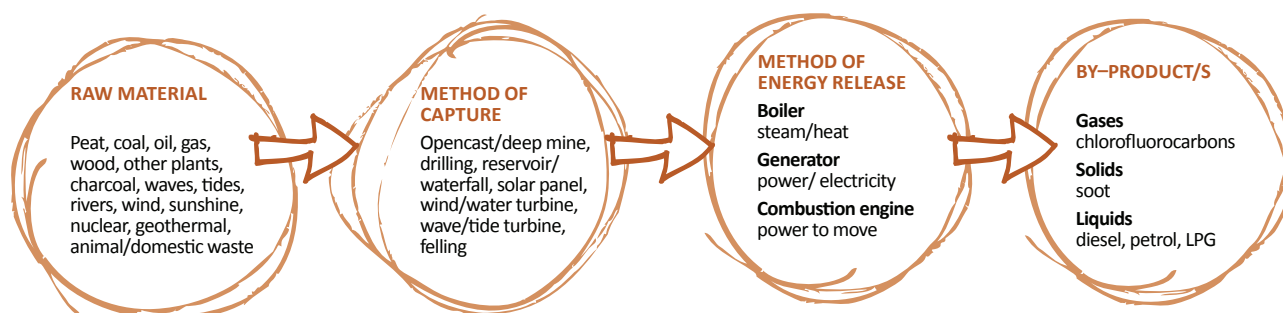
03 Ask each small group to develop a cradle to grave diagram to complete for one of the fuel sources – from its formation and capture through to the place of energy release/ power production, to delivering electricity to houses/industry. Use the library/internet to research. Don't forget to consider the machinery, vehicles and transport required – what fossil fuels have been involved in making/fuelling them?

04 Then discuss which aspects of the children's lives depend on burning fossil/wood fuels. Consider what would happen if there was a serious powercut and their batteries were all exhausted. What things they usually use at home would be affected? In their groups, make a list of what wouldn't work, starting from the front/back door. Gather descriptions illustrating how they would feel about this situation?

05 Find out which are the most important greenhouse gas emissions – use posters/internet – carbon dioxide and methane. Where do they mostly come from. Carbon dioxide from burning fossil fuels and cement production, methane from animals & their waste (cows & sheep 'farts' particularly, and including human waste!) and domestic waste (landfill).

06 How does the greenhouse effect work. In small groups look at the diagram and work out and explain what is happening. If you have it, look at the SNH Advances 7 poster – greenhouse gases before and after industrialization. When did industrialization start in Britain? What has happened to our temperatures since that period?

07 At the end of the session ask everyone to share one thing that they learnt, found surprising, got them thinking about what impact they have as individuals/citizens.



The greenhouse effect

