

## Lesson 9: Global warming – is it real?

### Teachers' Notes

**This is not intended to be a lesson about global warming. It is assumed that students are already aware of what the Greenhouse Effect and the causes of global warming.**

#### **Starter**

The PowerPoint presentation on 'A journey to Venus' When you have finished with the first slide, click the mouse for the next slide and then leave, it will continue on its own until the first information page (after the space probe has crashed). Then click for the next page until 'The Greenhouse Effect – a quick recap'. This slide is timed. When the last bullet point appears, click for the next slide which once again is timed, needing no teacher computer input.

**(OPTIONAL ICT ACTIVITY – DATALOGGING)** – Fill 3 round bottomed flasks, one with methane (from the gas taps), one with air and one with carbon dioxide. Place a temperature probe into each round bottomed flask and a light bulb next to each flask. Then during the lesson leave the experiment running, students may then use this information to support their argument.

### Main Activity

It is suggested that the material (the graphs/tables and diagrams) are not provided to the students in one go as this may be overwhelming. Rather, present the materials bit by bit to allow the groups time to decide to dismiss this as evidence for their argument.

Guidance notes are provided for the teacher with suggested evidence the students may use. These may not be the only interpretations from the graphs, but it's a start!

If students finish before the 25 minutes, then they could consider what evidence does not support their argument and whether there is any other evidence that they can gather to contradict this (eg. graph 17 implies that the temperature change is opposite to what scientists would expect, so proving global warming, but graph 7 indicates the opposite since 2000) and graph 10 shows that if we look at millions of years then the GMST is decreasing.

### Plenary

Each group presents their three statements (and certainly no more than 6). This means that the students should be encouraged to decide which are their most convincing pieces of evidence and use only these. This is only intended to be a 15 minute activity but you may decide to set this up for a debate in the following lesson for which you might ask students to consider also what evidence there is that does not support their argument, and how this may be discredited, or why they have ignored it.

### **Group 1: - ENVIRONMENTAL GROUP (GREENPEACE)**

You believe that the Kyoto agreement is essential for the future of this planet and the threat that Earth could be the next Venus is a reality. You believe that the government need to find ways to reduce CO<sub>2</sub> emissions as this is the major cause of climate change. You must use the data available to argue (make a conclusion) that you are correct and that there is no other explanation for the climate changes: that the government must be held accountable for this very 'real' problem.

#### ***Possible evidence:***

- **Table 1** – the concentration of greenhouse gases in the atmosphere has risen dramatically
- **Table 2** – the man-made additions of CO<sub>2</sub> was approximately a 1/6<sup>th</sup> of the naturally occurring CO<sub>2</sub> levels. With very high atmospheric lifetime.
- **Table 3** – The greenhouse effect is caused by CO<sub>2</sub> as this is the gas that is clearly present in the greatest concentration on Venus and the greenhouse effect definitely occurs on Venus.
- **Graph 1** – the projected increase in sea level is 0.9m by 2100 – demonstrating that global warming does have an effect on the climate. **Graph 19** confirms an increase in sea levels (but not as dramatic?)
- **Graph 2-6** – shows a general increase in global temperature during last century, this is confirmed **graph 9 and graph 7**, as although there are fluctuations and seems to show a decrease beginning just before 2000 there is has yet to decrease to a 0°C change in temperature.
- **Graph 11** – shows a direct correlation between CO<sub>2</sub> levels and global temperature, the fluctuations are the same (the two lines mirror each other)
- **Graphs 12-14** - shows a dramatic increase in the concentrations of the greenhouse gases.
- **Graph 15** – confirms the increase of CO<sub>2</sub> in the atmosphere from 1958.
- **Graph 16** – the world is getting warmer.
- **Graph 17** – that, if there was no human impact upon the Earth, scientists would be predicting that global temperatures would be decreasing but the opposite is occurring.
- **Diagram 1** – The amount of sea ice has reduced since 1979.

#### **Suggested Conclusions (Students must choose the graphs to support this argument):**

- The graphs clearly demonstrate an increase in CO<sub>2</sub> levels and a corresponding alteration in global temperatures.
- Global warming does exist; there is a projected increase in sea levels based on observations, including the decrease in sea ice.
- The world is getting warmer but it is predicted that the Earth should be decreasing.

**These arguments may also be used for Group 4**

### **Group 2: MEMBER OF PUBLIC**

You are concerned by rising petrol prices and increased household energy bills. You don't truly understand the reasons behind the Kyoto agreement. You must use the data to present a balanced argument as to whether Earth is really going to become the next Venus and whether these increases are justified.

This Group can choose to use any argument provided in any of these answer sheets.

### **Group 3 – MEMBER OF PARLIAMENT**

You are a member of the current Western government and believe that you are being unfairly penalised for your growing industrial economy. You have no problem with looking at alternative energy sources (reducing fossil fuel emissions) but believe that you are not a major contributor to climate change and in fact would argue that global warming does not exist and that the current and projected climate changes are a natural cycle of the Earth. You believe that the threat that Earth is the next Venus is unjustified. You must use the data available to argue (make a conclusion) that the Kyoto agreement is unfair to the industrialised Western world, especially when the Eastern world economy relies on its production of rice in paddy fields and is not necessarily being penalised equally for this.

#### ***Possible evidence:***

- **Table 1** – the % change in methane is a lot greater than the increase in manmade carbon dioxide, so you are being unfairly penalised as paddy fields produce the methane, not you.
- **Table 3** – the concentration of CO<sub>2</sub> in Venus' atmosphere is 213333 times greater than Earth, so Earth will never reach this level, it can't be a Venus.
- **Graph 7** – shows that the global temperature is beginning to decrease.
- **Graph 10** – That on a larger time range the global temperature is following a pattern and actually decreasing and that maybe we could expect a dramatic decrease in GMST and therefore regardless of human activity earth has a natural cycle in temperatures.
- **Graph 11** – That the temperature change in the Earth may not be related to CO<sub>2</sub> concentration but that it also mimics the change in methane concentrations.

#### **Possible conclusions (must be supported by graphs/table no's) see brief;**

- That methane is the major contributor to global warming not CO<sub>2</sub>
- That fluctuations in Earth's temperature are a naturally occurring phenomena and that the Kyoto agreement will not have any effect.
- That the concentration of CO<sub>2</sub> is nothing like Venus, so there is no evidence that the concentration on Earth can produce global warming.

**These arguments may also be used for Group 5**

### References

#### Tables

- Table 1 taken from <http://zebu.uoregon.edu/~soper/Venus/atmosphere.html>
- Table 2 taken from U.S Department of Energy  
[http://www.clearlight.com/~mhieb/WVFossils/greenhouse\\_data.html](http://www.clearlight.com/~mhieb/WVFossils/greenhouse_data.html)
- Table 3 taken from <http://zebu.uoregon.edu/~sober/Venus/atmosphere.html>

#### Graphs

- Graph 1 taken from  
<http://yosemite.epa.gov/oar/globalwarming.nsf/content/ClimateFutureClimateSeaLevel.html>
- Graph 2- 14 taken from RSC Climate Change Book
- Graph 15-17 taken from 12 February 2005 NewScientist.com

Graph 18 - ACIA, *Impacts of a Warming Arctic*, Arctic Climate Impact Assessment, 2004 ([http://www.ucsusa.org/global\\_warming/science/arctic-climate-impact-assessment.html](http://www.ucsusa.org/global_warming/science/arctic-climate-impact-assessment.html))

#### Diagrams

**Diagram 1** ACIA, *Impacts of a Warming Arctic*, Arctic Climate Impact Assessment, 2004

[http://www.ucsusa.org/global\\_warming/science/arctic-climate-impact-assessment.html](http://www.ucsusa.org/global_warming/science/arctic-climate-impact-assessment.html)