

**Date:** 10 January 02  
**Time:** 2.00-4.15pm  
**Venue:** Committee Room 3, National Assembly for Wales, Cardiff Bay.  
**Title:** Global Warming, Climate Change and Energy Policy

## **Global Warming, Climate Change and Energy Policy**

A memorandum to the Energy Policy Review of the Economic Development Committee of the National Assembly for Wales , From Sir John Houghton CBE FRS,Co-chair, Scientific Assessment Working Group, Intergovernmental Panel on Climate Change (IPCC)

1. The IPCC completed its Third Assessment Report in 2001. The Summary documents of the three Working Group Reports and the Synthesis Report, together with the 3000 or so pages of the underlying documents are available on the IPCC web site [www.ipcc.ch](http://www.ipcc.ch).
2. Human activities , in particular the burning of fossil fuels, are contributing to climate change. Over the last 200 years the carbon dioxide concentration in the atmosphere has risen by over 30% and is at its highest value for millions of years. Because of this rise in carbon dioxide and other 'greenhouse gases' (eg methane), the average temperature at the Earth's surface is rising at a higher rate than has occurred for at least 10,000 years. Projections for this century are that the rate of rise will increase substantially to between 0.2 to 0.5°C per decade. Both humans and ecosystems will find it difficult to adapt to this temperature increase.
3. The two most important impacts of climate change are sea level rise and a more intense hydrological cycle.
4. The average sea level rise expected by 2100 is about 0.5 m (range of uncertainty 0.1 to 1 m). The largest contribution to this comes from the expansion of ocean water as it warms. Over a century, only the top levels of the ocean will warm; warming of the lower levels will take much longer. Sea level therefore will continue to rise over many centuries. Since over half the world's population lives in coastal regions , many communities will be affected by a rise in sea level. Worst affected will be those in large delta regions, for instance in Bangladesh (around 10 million people live below the one metre contour) and Southern China (perhaps 25 million people affected), and those in low lying islands in the Indian and Pacific Oceans.
5. The hydrological cycle is affected because, as the Earth's surface warms, more water will be evaporated and enter the atmosphere. Since the main source of energy for the atmospheric circulation is the release of latent heat as water vapour condenses, the circulation will become more energetic and the hydrological cycle more intense. On average, rainfall will increase and periods of heavy rainfall will become more frequent and intense – leading to more frequent and intense flooding in many places. Also,

because of the more intense circulation, air in some drier regions will become drier – leading to more frequent and intense droughts in some places. The regions worst affected are likely to be in the sub tropics where the capacity of human communities to adapt is poor.

6. Models of world agricultural production in a globally warmed world taking into account all the known relevant factors suggest that total production of major food crops might not be greatly affected. In some mid-latitude regions production is likely to increase (partially due to the fertilisation effect of increased carbon dioxide) but in many sub tropical regions, production is likely to decrease. The disparity between rich and poor nations would thereby be seriously exacerbated.
7. Since floods and droughts are some of the worst disasters human communities experience, an increase in their number and intensity will result in additional deaths, misery and economic loss. A study by Norman Myers has estimated that, by 2050, there could be 150 million environmental refugees resulting from the effects of sea level rise and increased disasters.
8. Climate Models do not yet provide reliable detail of the likely changes at the regional level. For the UK, the detail of climate change is particularly uncertain because of the large influence of the oceans on our climate and our lack of knowledge as to what changes in the circulation of the oceans might occur as a result of the increase of greenhouse gases. However, in England and Wales, indications are that winters are likely to be mild, wetter and possibly windier and summers, warmer and drier. Further defences against sea level rise will be required for much of our coasts.
9. Both adaptation and mitigation measures are necessary to combat climate change due to human activities.
10. Adaptation is not an option but a necessity - climate change is already occurring and substantial commitment to further future climate change has already been made. Owing to the long time response of some parts of the climate system, this commitment will only be realised over a period of decades or more.
11. Mitigation measures are necessary to slow the rate of climate change and to limit the damage from climate change so far as is possible. The Framework Convention on Climate Change (FCCC), agreed at the Earth Summit in Rio in 1992, has as its Objective the stabilisation of the concentrations of greenhouse gases in the atmosphere at levels that 'prevent dangerous anthropogenic interference with the climate system' and that are consistent with sustainable development. Since carbon dioxide is the most important of the greenhouse gases, in order to achieve the FCCC Objective, large reductions in the emissions of carbon dioxide from the burning of fossil fuels will have to be made during the 21<sup>st</sup> century.
12. The FCCC clearly recognises the responsibility of the industrialised nations, that have benefited from fossil fuel energy and whose emissions of carbon dioxide still dominate the global total, to take the first action to reduce emissions. The Kyoto Protocol sets out the first binding agreements regarding reductions by industrialised countries (although without the participation of the USA). Although the Kyoto reductions averaging a few per cent below 1990 levels are small compared with what will eventually be required, they

represent an important first step for the international community.

13. Three principles are at the basis of international action to reduce emissions: the precautionary principle (lack of full scientific certainty should not prevent necessary action), the polluter-pays principle (the polluter should bear the economic cost of the damage from his pollution) and the principle of equity, both intergenerational and international.
14. The 22<sup>nd</sup> report of the Royal Commission on Environmental Pollution (RCEP) entitled 'Energy – the Changing Climate' published in 2000, considers in detail the response of the UK to the requirement for the mitigation of climate change through the reduction of carbon dioxide emissions. It supports the proposal called 'Contraction and Convergence' publicised by the Global Commons Institute as an appropriate basis for international agreements on emissions reduction. This proposal squarely addresses the three principles mentioned in para 13. For the UK, the RCEP proposes a target of 60% reduction in carbon dioxide emissions from current levels by 2050 and perhaps 80% by 2100.
15. Reductions in the emissions of carbon dioxide can be achieved mainly by three means, (1) by improvement in the efficiency of energy generation and energy use, (2) by changing to non-fossil-fuel sources of energy generation, and (3) by sequestration. These will be briefly mentioned in turn.
16. Very large potential exists for an increase in the efficiency of energy generation and use. For instance in buildings, where 30% of energy is used, increases of efficiency of 60% are easily achievable. Many such improvements are also associated with cost savings. Incentives, planning and appropriate encouragement are necessary if they are to be achieved.
17. Sources of renewable energy that are not dependent on fossil fuels are now available and many are becoming competitive with fossil fuel sources. Wind power has already become established in Wales. There is also substantial potential in Wales for tidal power (eg Severn Barrage or tidal stream turbines) and for the generation of energy from wastes or from energy crops.
18. Carbon dioxide can be sequestered or prevented from entering into the atmosphere through forestation (that locks up carbon during the growth period of the trees) or through pumping the gas into suitable porous rock strata (eg into the rocks from which oil or gas has been extracted). Both of these can make some contribution towards the reduction of atmospheric carbon dioxide.
19. Important new technologies associated with energy generation (eg renewable energy technologies), energy storage (eg hydrogen storage), energy use (eg fuel cells) and energy supply (eg local rather than via a national grid) are poised for rapid development and growth. More research and development and investment is urgently required in the energy sector. Investment in the UK in this sector, both by government and by industry, has fallen by nearly a factor of ten over the past 15 years, despite the current need for exceptionally rapid development in the energy sector. The world market in the energy sector is huge and there are large opportunities for UK industry. Sadly, however, we are lagging behind many other countries in taking these.

20. Nuclear energy is an energy source that is substantially free from greenhouse gas emissions and can contribute therefore towards carbon dioxide reduction targets, especially perhaps in the medium term while other sources of non-fossil-fuel energy are coming on stream. However, unless satisfactory and low cost solutions to the concerns about nuclear energy (namely the danger of accidents, disposal of nuclear waste and the proliferation of nuclear material) are found, nuclear energy will not be seen as a primary solution to energy needs in the longer term.
21. A number of careful estimates have been made of the likely cost to the world's economies of the mitigation measures necessary to achieve stabilisation of the concentration of carbon dioxide in the atmosphere. Providing the changes necessary are carefully planned and phased appropriately, estimates mostly fall substantially below 1% of global world product (GWP), considerably less than estimates of the cost of the damage that would ensue if no action is taken. Further there are, of course, other human consequences of inaction that cannot be costed.
22. Wales is well placed to make an innovative and effective contribution to the mitigation of the negative impacts of climate change. Could, for instance, by some appropriate date, Wales aim to be a zero net emitter of carbon dioxide? Such an aim could provide a substantial positive benefit to Welsh industry.