Climate Change: a Christian Challenge and Opportunity

Presentation by Sir John Houghton to the National Association of Evangelicals Washington DC, March 2005

Twenty years or so ago was the era of leaders like Ronald Reagan and Margaret Thatcher. They were both strong leaders and good friends with a great respect for each other. Margaret Thatcher was a scientist and proud of her links with the science community. In 1988, when speaking at the annual dinner of the Royal Society in London, the British equivalent of your National Academy of Science, she spoke of the possible threat posed by Global Warming and the urgency for scientists to address it and understand it.

She later spoke of our need as humans to care for the Earth. She explained that "We have a full repairing lease on the Earth," meaning that we must pass it on to the next generation in a better state than we found it. In saying that she is echoing the Christian doctrine of creation that 'The Earth is the Lord's' and to be good stewards of it is fundamental to our Christian obedience.

Soon after that Margaret Thatcher speech, the Intergovernmental Panel on Climate Change (IPCC) held its first meeting and I became chairman of the Panel's scientific assessment. Because of the importance of climate change to all countries, we involved as contributors or reviewers hundreds of scientists drawn from as many countries as possible. Our task was honestly and objectively to distinguish between what is known with reasonable certainty from those areas of knowledge where the uncertainty is large. Over the past 15 years the IPCC has produced three very thorough assessments - in 1990, 1995 and 2001 – all covering science, impacts and analyses of policy options. The IPCC 2001 report is in four volumes each of about 1000 pages and containing many thousands of references to the scientific literature[1]. Because the IPCC is an intergovernmental body, the reports' Summaries for Policymakers were agreed sentence by sentence by meetings of governmental delegates from about 100 countries - including the United States and all the world's major countries. No assessments on any other scientific topic have been so thoroughly researched and reviewed.

The work of the IPCC is backed by the worldwide scientific community. A joint statement of support was issued in May 2001 by the national science academies of Australia, Belgium, Brazil, Canada, the Caribbean, China, France, Germany, India, Indonesia, Ireland, Italy, Malaysia, New Zealand, Sweden and the UK. It stated 'We recognize the IPCC as the world's most reliable source of information on climate change and its causes, and we endorse its method of achieving consensus.' In 2001, the United States National Academy of Sciences was commissioned by the President George W Bush administration to assess the current understanding of climate change. Its report, published in June 2001[2], is generally supportive of the IPCC's conclusions. In particular it states "The IPCC's conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations accurately reflects the current thinking of the scientific community on this issue."

Let me give a quick summary of some of the science of Global Warming. By absorbing infra-red or 'heat' radiation from the earth's surface, "greenhouse gases" present in the atmosphere, such as water vapour and carbon dioxide, act as blankets over the earth's surface, keeping it warmer than it would otherwise be. The existence of this natural "greenhouse effect" has been known for nearly two hundred years; it is essential to the provision of our current climate to which ecosystems and we humans have adapted.

Since the beginning of the industrial revolution around 1750, one of these greenhouse gases, carbon dioxide, has increased by over 30% and is now at a higher concentration in the atmosphere than it has been for many thousands of years. Chemical analysis of the carbon demonstrates that this increase is due largely to the burning of fossil fuels - coal, oil and gas. If no action is taken to curb these emissions, the carbon dioxide concentration will rise during the 21st century to two or three times its preindustrial level.

The climate record over the last 1,000 years shows a lot of natural variability – including, for instance, the 'medieval warm period' and the 'little ice age'. The rise in global average temperature (and the rate of rise) that has occurred during the 20th century is well outside the range of known natural variability. The year 1998 is the warmest year in the instrumental record. A more striking statistic is that each of the first 8 months of 1998 was the warmest on record. It is likely that most of the warming over the last 50 years is due to the increase of greenhouse

---

[1] *Climate Change 2001* in four volumes, published for the IPCC by Cambridge University Press, 2001. Also available on the IPCC web site www.ipcc.ch. My book, John Houghton, *Global Warming: the complete briefing*, 3rd edition, Cambridge University Press, 2004 is strongly based on the IPCC reports.

[2] Report available on http://books.nap.edu/html/climatechange/

gases, especially carbon dioxide. The period of "global dimming" from about 1950 to 1970 is most likely due to the increase in atmospheric particles (especially sulphates) from industrial sources. These particles reflect sunlight, hence they tend to cool the surface and mask some of the warming effect of greenhouse gases.

Over the 21st century the global average temperature is projected to rise by between 2 and 6 ºC (3.5 to 11 ºF) from its preindustrial level, depending on the assumptions that are made about emissions of greenhouse gases and the sensitivity of the climate model used in making the estimate. Considering that it is the global average temperature that is being considered, a rise of this amount is large. The difference in global average temperature between the middle of an ice age and the warm periods in between is only about 5 or 6 ºC (9 to 11 ºF). So, associated with the likely warming in the 21st century will be a rate of change of climate that is the equivalent of, say, half an ice age in less than 100 years – a larger rate of change than for at least 10,000 years. Adapting to such a rate will be difficult for both humans and many ecosystems.

Talking in terms of changes of global average temperature, however, tells us rather little about the impacts of global warming on human communities. Some of the most obvious impacts will be due to the rise in sea level that occurs because ocean water expands as it is heated. The projected rise is of the order of half a metre (20 inches) a century and will continue for many centuries – to warm the deep oceans as well as the surface waters takes a long time. This will cause large problems for human communities that live in low lying regions. Some areas, for instance in Bangladesh, southern China, islands in the Indian and Pacific oceans and similar areas in many parts of the world, will be impossible to protect and many millions will be displaced.

There will also be impacts from extreme events. The extremely unusual high temperatures in central Europe during the summer of 2003 led to the deaths of over 20,000 people. Careful analysis leads to the projection that such summers are likely to be average by the middle of the 21st century and cool by the year 2100.

Water is becoming an increasingly important resource. A warmer world will lead to more evaporation of water from the surface, more water vapour in the atmosphere and more precipitation on average. Of greater importance is the fact that the increased condensation of water vapour in cloud formation leads to increased latent heat of condensation being released. Since this latent heat release is the largest source of energy driving the atmosphere's circulation, the hydrological cycle will become more intense. This means a tendency to more intense rainfall events and also less rainfall in some semi-arid areas. Since, on average, floods and droughts are the most damaging of the world's disasters, a greater frequency and intensity of floods and droughts is bad news for most human communities but most especially for those regions such as south east Asia and sub-Saharan Africa where such events already occur only too frequently.

Sea level rise, changes in water availability and extreme events will lead to increasing pressure from environmental refugees. A careful estimate[3] has suggested that, due to climate change, there could be more than 150 million extra refugees by 2050.

In addition to the main impacts that I have summarised above are changes about which we are less certain, but if they occurred would be highly damaging and possibly irreversible. For instance, large changes are beginning to occur in polar regions. If the temperature rises more than about 3 ºC (~5 ºF) in the area of Greenland, it is estimated that melt down of the ice cap would begin to occur. Complete melt down is likely to take 1000 years or more but it would add 7 metres (23 feet) to the sea level.

A further concern is regarding the Thermo-Haline Circulation (THC) – a circulation in the deep oceans that is partially sourced from the water that has moved in the "Gulf Stream" from the tropics to the region between Greenland and Scandanavia. Because of evaporation on the way, the water is not only cold but salty, hence of higher density than the surrounding water. It therefore tends to sink and provides the source for a slow circulation at low levels that connects all the oceans together. This sinking assists in maintaining the Gulf Stream itself. In a globally warmed world, increased precipitation together with fresh water from melting ice will decrease the water's salinity making it less likely to sink. The circulation will therefore weaken and possibly even cut off, leading to large regional changes of climate. Evidence from paleoclimate history shows that cut-off of this circulation has occurred at times in the past.

I have spoken so far about adverse impacts. You might ask, "Are none of the impacts positive?" There are some positive impacts. For instance, in Siberia and other areas at high northern latitudes, winters will be less cold and growing seasons will be longer. Also, increased concentrations of carbon dioxide have a fertilising effect on some plants and crops which, providing there are adequate supplies of water and nutrients will lead to increased crop yields in some places, probably most notably in northern mid latitudes. However, careful studies demonstrate that

[3] Myers, N., Kent, J. 1995. *Environmental Exodus: an emergent crisis in the global arena*. Washington DC: Climate Institute.

adverse impacts will far outweigh positive effects, the more so as temperatures rise more than 2 or 3 ºC (3.5 to 5.5 ºF) above preindustrial.

The question is often asked as to how strong is the scientific basis for the projections of climate change I have outlined. The basic link between increases in atmospheric greenhouse gas concentrations and global average surface temperature is well established science that has been understood for nearly two centuries. Where the main uncertainties lie is in our knowledge of the feedbacks in the climate system, some of which are positive (tending to enhance the warming) and some negative (tending to reduce the warming). Although uncertainties remain, especially in our understanding of the effects of clouds, scientific research over the past decade has tended to confirm the importance of some of the positive feedbacks and to suggest that some of the IPCC's initial projections were too conservative.

Unfortunately, there are strong vested interests that have spent tens of millions of dollars on spreading misinformation about the climate change issue. First they tried to deny the existence of any scientific evidence for rapid climate change due to human activities. More recently they have largely accepted the fact of anthropogenic (or human-induced) climate change but argue that its impacts will not be great, that we can "wait and see" and in any case we can always "fix" the problem if it turns out to be substantial. The scientific evidence cannot support such a view.

The Earth Summit at Rio de Janeiro in 1992 addressed the climate change issue and the action that needed to be taken. The Framework Convention on Climate Change (FCCC) - agreed by over 160 countries, signed by President George Bush for the USA and subsequently ratified unanimously by the US Senate – agreed that Parties to the Convention should take "precautionary measures to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects. Where there are threats of irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures."

More particularly the Objective of the FCCC in its Article 2 is "to stabilise greenhouse gas concentrations in the atmosphere at a level that does not cause dangerous interference with the climate system" and that is consistent with sustainable development. Such stabilisation would also eventually stop further climate change. However, because of the long time that carbon dioxide resides in the atmosphere, the lag in the response of the climate to changes in greenhouse gases (largely because of the time taken for the ocean to warm), and the time taken for appropriate human action to be agreed, the achievement of such stabilisation will take at least the best part of a century. Increases in greenhouse gases that have already occurred already commit us to substantial climate change during this period. Thus, while we need to make very serious efforts to mitigate or reduce the impacts of climate change by reducing emissions of greenhouse gases, we will also have to find ways to adapt to the climate changes that we have already set in motion.

Global emissions of carbon dioxide to the atmosphere from fossil fuel burning are currently about 25 billion tonnes per annum and rising rapidly. Unless strong measures are taken they will reach two or three times their present levels during the 21st century. Carbon dioxide concentration in the atmosphere is currently about 377 parts per million (ppm), about 35% above its preindustrial level. To stabilise carbon dioxide concentrations in the range 400-550 ppm, emissions must reduce to a fraction of their present levels during the 21st century.

The reductions in emissions must be made globally; all nations must take part. There are very large differences in average per capita greenhouse gas emissions in different countries. Expressed in tonnes of carbon per capita per annum, they vary from about 5.5 for the USA, 2.5 for Europe, 0.7 for China and 0.2 for India. Ways need to be found to achieve reductions that are both realistic and equitable.

The UK government has taken a lead on this issue and has agreed a target for the reduction of greenhouse gas emissions of 60% by 2050 - predicated on a stabilisation target for carbon dioxide concentrations of 550 ppm together with a recognition that developed countries will need to make greater reductions to allow some headroom for developing countries. Economists in the UK government Treasury Department have estimated the cost to the UK economy of achieving this target. On the assumption that the UK economy would maintain an average growth of 2.25 % p.a., they estimated a cost of no more than the equivalent of 6 months' growth over the 50 year period. Similar costs for achieving stabilisation have been estimated by the IPCC.

Industrialists are also beginning to recognise the gravity, urgency and opportunity of the issue. Mack McFarland of Dupont will be speaking about this. Let me just quote from a recent speech by Lord John Browne, Chief Executive Officer of British Petroleum, one of the world's largest oil companies, who proposed "stabilisation in the range 500-550 ppm" that "with care could be achieved without disrupting economic growth."

To achieve reductions in carbon dioxide emissions three sorts of actions are required. First, large improvements in the efficiency of energy generation and use can easily be made. Approximately one third of energy is employed in

buildings (domestic and commercial), one third in transport, and one third by industry. Large savings can be made in all three sectors, many of them with significant savings in cost. Secondly, a wide variety of non-fossil fuel sources of energy are available for development and exploitation, for instance, biomass (including waste), solar power (both photovoltaic and thermal), hydro, wind, wave, tidal and geothermal energy. Thirdly, there are possibilities for sequestering carbon that would otherwise enter the atmosphere either through the planting of forests or by pumping underground (for instance in spent oil and gas wells). The opportunities for industry for innovation, development and investment in all these areas are great.

People often say to me that I am wasting my time talking about Global Warming. “The world” they say “will never agree to take the necessary action.” I reply that I am optimistic for three reasons. First, I have experienced the commitment of the world scientific community (including scientists from many different nations, backgrounds and cultures) in painstakingly and honestly working together to understand the problems and assessing what needs to be done. Secondly, I believe the necessary technology is available for achieving satisfactory solutions. My third reason is that I believe God is committed to his creation. He demonstrated this most eloquently by sending his son Jesus to be part of creation and by giving to us the responsibility of being good stewards of creation. What is more I believe that we do not do this on our own but in partnership with him – a partnership that is presented so beautifully in the early chapters of Genesis where we read that God walked with Adam and Eve in the garden in the cool of the day.

A particularly strong challenge to our stewardship comes from the realisation that the adverse impacts will fall disproportionately on the poorer nations, partially because of the nature of climate changes, especially climate extremes, in their countries and partially because they lack the infrastructure that would enable them to adapt. We, in the developed countries, have already benefited over many generations from abundant fossil fuel energy. Further, it is possible that some countries (for instance the United States) may continue to benefit for a while from positive impacts of increased carbon dioxide on the yields of some cereal crops. There is already a strong tendency in the world for the rich to get even richer while the poor get poorer. The impacts of human induced climate change will tend to further bolster that trend. Let me remind you of words of Jesus spoken after he had told the parable contrasting the faithful and unfaithful stewards, “For unto whomsoever much is given, of him shall be much required” (Luke 12:48). The challenge to our Christian churches and the opportunities with which they are presented are unmistakeable.

Finally, let me address those who argue that we can 'wait and see' before action is necessary. That is not a responsible position. The need for action is urgent for three reasons. The first reason is scientific. Because the oceans take time to warm, there is a lag of thirty years or more in the response of climate to the increase of greenhouse gases. Because of human induced greenhouse gas emissions to date, a commitment to substantial climate change already exists, much of which will not be realised for several decades. Additional emissions just add to that commitment. The second reason is economic. Energy infrastructure, power plants for instance, lasts typically for 30 to 50 years. It is much more cost effective to begin now to phase in the required infrastructure changes rather than having to make them much more rapidly later. The third reason is political. Countries like China and India are industrialising very rapidly. They need to do so in ways that are much more efficient and with much smaller greenhouse gas emissions than has been done in the developed world. I heard a senior energy adviser to the Chinese government speak recently. He said that China would not be bringing in the necessary innovation and initiatives by itself. When the developed nations of the west take action, they will take action. They will follow, not lead. We in the west need to show urgent and effective leadership not least through our example.

My wife always reminds me when I speak on this subject that I need to suggest actions that individuals can take. There are some things that all of us can do. For instance, when purchasing vehicles or appliances we can choose ones that are fuel efficient; we can ensure our homes are as energy efficient as possible; we can use public transportation or car-share more frequently and we can support leaders in government or industry who are advocating or organising the necessary solutions. To quote from a British parliamentarian of 200 years ago, “No one made a greater mistake than he who did nothing because he could do so little.”