

Some Aspects of the Climate Change Issue

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1. Some Scientific Issues

1.1. The Phenomenon¹

Global climatic changes are nothing new. The last 500 millennia have seen regular cycles in the Earth's climate, alternating between ice-ages and inter-glacial periods (Figure 1). Indeed, everything else being equal, evidence suggests that we are at the peak of one of these main interglacial periods, which accounts for the worry in the late 1970s about the onset of another ice-age (see, e.g., Hoyle, 1981). Yet these worries were not particularly acute. After all, the main cycle – with a temperature variation of 12°C – has a cooling period of over 80 thousand years. ‘*Après nous le déluge*’ becomes less problematic at these time-scales, both as statement and as attitude.

Figure 1

This situation, however, has changed dramatically, as witnessed in the recent *Third Assessment Report* of the Intergovernmental Panel on Climate Change (IPCC) (see, for example, Depledge, 2002). The global average surface temperature – having increased by about 0.6°C over the twentieth century – is projected to increase between 1.4 to 5.8°C over this century, at a rate ‘very likely [$\geq 90\%$] to be without precedent during at least the last 10,000 years’. The threat of an impending ice-age has given way to concerns about much more immediate climatic changes in the

¹ This section is based on Benito Müller, ‘The Global Climate Change Regime: Taking Stock and Looking Ahead’ in Olav Schram Stokke and Øystein B. Thommessen (eds.), *Yearbook of International Co-operation on Environment and Development* 2002/2003. London: Earthscan, 2002; pp. 27–38.

‘opposite direction’. The reason is that in the course of the last century, mankind has unintentionally become a force to be reckoned with in influencing the Earth’s climatic system. It graduated – or blundered – from ‘climate-taker’ to ‘climate-maker’.

1.1.1. Fundamental Distinctions

The most general distinction between the causes of the current climatic changes is thus between ‘natural’ on the one hand, and ‘anthropogenic’ (‘human-induced’, ‘man-made’), on the other. A paradigm of natural climate variations are the ice-age cycles of geological time scales, some of which prove to be closely correlated with anomalies in the terrestrial orbit (see, for example, Imbrie and Palmer Imbrie, 1997). Yet there are other natural causes which can lead to changes in regional and global climates.

Take the phenomenon of ‘volcanic winters’. The sulphur dioxide emissions of the volcanic eruption on the Aegean island of Thera (Santorini) in 1628 BC (Manning, 1999), for example, have been used to explain the average global cooling of 1.5°C over the following one hundred years,² which, in turn, has been suggested as one of the key factors in the downfall of the Minoan civilization during the first half of the sixteenth century BC.³ Other natural climate change events have been identified as having had equal, if not worse social impacts – the 3 to 5°C cooling following the Toba (Indonesia) eruption of about 73 thousand

² 1647BC: +0.65°C, 1559BC: –0.9°C, relative to present. J.R. Petit, et al., (1999). Data Source: ‘Historical Isotopic Temperature Record from the Vostok Ice Core’ <<http://cdiac.esd.ornl.gov/ftp/trends/temp/vostok/vostok.1999.temp.dat>>.

³ ‘...the eruption on Thera could have lowered annual average temperatures by 1 to 2 degrees across Europe, Asia and North America. ...the summer temperatures would have dropped more – suggesting years of cold, wet summers and ruined harvests’, J. Cecil (2001). For more details on the eruption see Chapter 5 of Floyd W. McCoy and Grant Heiken (2000).

years ago apparently almost spelled the end of humankind (Rampino and Ambrose, 2000:71).

Anthropogenic causes, in turn, are largely based in human energy-use and agricultural practices relating to the emission of greenhouse gases. Rice cultivated under flooded conditions generates methane emissions into the atmosphere due to the decomposition of organic matter.

Deforestation reduces the absorption of carbon dioxide (CO₂) by growing vegetation. However, the biggest anthropogenic cause of climate change by a long way is not these agricultural practices, but the use of fossil carbon – coal, oil and gas – as combustion fuels in all economic sectors: transport, domestic heating, industrial production, electricity generation, and so on.

Figure 2

There will obviously be differences in the relative shares of CO₂ emissions for these sectors within a country, but arguably the most significant differences are not within but between countries. In 1998, for example, the CO₂ emissions per head of population ranged from 20,000kg for the United States at one end of the spectrum, to least developed countries such as Sierra Leone with 110kg, at the other (Marland, Boden and Andres, 2002). Given the importance of energy in economic growth and the historic worldwide reliance on fossil energy sources, it will not be surprising to find (Figure 2) that over the last century, industrialized countries (the 'North' being OECD and the economies in transition of the former Soviet Union and Eastern Europe) have collectively emitted five times the emissions of the developing world (the 'South'),⁴ a fact which

⁴ Source: World Resources Institute (WRI) 'Contributions to global warming map' <http://www.wri.org/climate/contributions_map.html>.

gives some idea about the regional distribution of causal responsibilities for (potentially inevitable) anthropogenic climate change impacts.⁵

The reason for drawing the distinction between anthropogenic and natural causes lies in the possibility of attacking a root cause of the problem: while it is well within our ability to reduce greenhouse gas emissions, it is unlikely that our 'geo-engineering' skills will ever be able to control volcanic activity, let alone the terrestrial orbit around the Sun. However, people must not only be singled out as *causes* but also as *recipients* of climate change impacts. The fact is climate change is only a problem because of adverse impacts on life-systems. And this is true regardless of whether the impacts are anthropogenic or not.

As it happens, climate change impacts are divided not only with respect to their cause ('natural' versus 'anthropogenic'), but also relative to who or what they affect, namely 'social-' or 'human impacts' on human systems ('Society'), on the one hand, and 'ecological ones' on natural eco-systems ('Nature') on the other. One and the same cause can obviously give rise to a variety of impacts, both on different social systems – social groups, countries or regions –, and different natural eco-systems, such as tropical rain forests or coral reefs. Giving rise to both types of impacts is common to many pollution problems. What distinguishes climate change is the nature and potential seriousness of its human impacts. They transform the issue away from a purely environmental into an environment- and development-related problem. Moreover, its anthropogenic components additionally introduce issues of interpersonal justice between those who have been causing the impacts and those who suffer them.

⁵ However, one has to be cautious in interpreting such figures. If, for example, one is like me of the opinion that these responsibilities need to be compared in terms of average yearly per capita emissions, the Northern responsibility increases to fifteen fold that of the South.

1.2. Present Knowledge and Predictions: Decision-making under Uncertainty

The debate about the scientific validity of findings – such as the one in the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPPC, www.ipcc.ch), that

In the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely [66–90%] to have been due to the increase in greenhouse gas concentrations. Furthermore, it is very likely [90–99%] that the 20th century warming has contributed significantly to the observed sea level rise, through thermal expansion of sea water and widespread loss of land ice (IPCC, 2004, p.10).

– has been vociferous, although over the years the numerical strength of the ‘opposing camps’ has become more and more uneven. The great majority of the scientific community today tends to side with the IPCC and its findings, and reject what has become known as the ‘climate sceptic’ position, still upheld by a handful of individuals and institutions such as the Washington D.C. based CATO and American Enterprise Institutes (see, e.g. Moore, 2005). Yet the climate sceptics’ dwindling number has by no means diminished the strength of their belief in the correctness of their views.

Indeed, two of the best publicized climate sceptics – Patrick J. Michaels and S. Fred Singer⁶ – have recently contributed to a piece (Michaels, Singer and Douglass, 2004) which provides advice ‘to all who worry about global warming, ... chill out. The science is settled. The ‘sceptics’ – the strange name applied to those whose work shows the planet isn't coming to an end – have won.’ The piece attacks the IPCC for having claimed erroneously that ‘1) we have reliable temperature records

⁶ Michaels is a senior fellow in environmental studies at the Cato Institute, research professor of environmental sciences at the University of Virginia which is also where Singer is emeritus professor of environmental sciences. Michaels, for one, has been a contributing author to the IPCC.

showing how much the planet has warmed in the last century; and 2) computer projections of future climate, while not perfect, simulate the observed behavior of the past so well that they serve as a reliable guide for the future.’

To be more precise, their contention is that ‘as a consequence of greenhouse forcing, all state-of-the-art general circulation models predict a positive temperature trend that is greater for the troposphere than the surface. [...] However, the temperature trends from several independent observational data sets show decreasing as well as mostly negative values. This disparity indicates that the three models examined here fail to account for the effects of greenhouse forcings’ (Douglass, Pearson and Singer, 2004).

The disparity referred to has been known for quite some time, indeed in a different article (in the same volume), Michaels and Singer and some other colleagues claim that their ‘study thus makes unlikely some of the explanations advanced to account for the disparity’ (Douglass et al., 2004) on the grounds that ‘the disparity does not occur uniformly across the globe, but is primarily confined to tropical regions which are primarily oceanic’ (ibid.)

The gist of the argument which is meant to ‘settle the science’ is thus that, because certain ‘independent observational data sets’ disagree with a prediction of climate models (based on greenhouse gas forcing), the science based on such models is wrong. What is clear is that the situation where model predictions are significantly out of tune with observations is untenable, and something has to give. However, given the highly complex nature of some types of ‘observations’ it is not as self-evident as Michaels and Singer seem to think that what has to go is the model.

As it happens, satellite observations of atmospheric variables are highly technical and inferred, which is why their validity deserves equally critical analysis as that of the models in question, particularly if these models manage to replicate very well a series of averages based on observations which are undisputed – even by the climate sceptics – namely surface temperature measurements.

And as it happens, this had been done, for example, in a *Nature* article by Fu et al (2004)⁷ even before the two sceptical articles appeared in *Geophysical Research Letters*. Fu and Johanson themselves re-iterate their findings in a recent GRL article (Fu and Johanson, 2005), finding that – *pace* Michaels and Singer – ‘tropospheric temperature trends in the tropics are greater than the surface warming and increase with height’, and that the satellite data that failed to show this increase has a ‘trend bias [which] can be largely attributed to the periods when the satellites had large local equator crossing time drifts that cause large changes in calibration target temperatures and large diurnal drifts’, which actually may well explain the sceptics’ findings that the disparity in question occurs mainly in the tropical (equatorial) regions.

Following Karl Popper’s falsification methodology (Popper, 1935), Michaels and Singer tried to discredit the models that have been used to establish the existence of a greenhouse gas related ‘anthropogenic fingerprint’ in the undisputed observed raise in global average surface temperatures, and failed. Yet, this failure by the sceptics does, of course, not mean that the anthropogenic hypothesis is proven. Indeed, to those who espouse Popper’s philosophy, such a proof is simply impossible, which is why one has to take with a pinch of salt the recent (19 February 2005) front page headline in the London-based *The Independent*:

⁷ Note the reference to ‘satellite-*inferred* temperature trends’.

'The final proof: global warming is a man-made disaster'. However, it is understandable why the article by Steve Connor (Science Editor of *The Independent* in Washington DC) about a recent *Science* paper (Barnett, et al., 2005) by Tim Barnett and colleagues at the Climate Research Division of UC San Diego's Scripps Institution of Oceanography should have been given such a spectacular heading: the study confirmed the man-made contribution to climate change on the basis of oceanic and not atmospheric data, thus increasing considerably the likelihood of the anthropogenic hypothesis.

Indeed, what the authors did was to replicate the observed changes in the oceans over the last 40 years with a model including anthropogenic greenhouse gas emissions and then test a number of hypotheses, such as whether the changes could be accounted for by the natural variability of the ocean system ('nature alone'), or by changes in solar or volcanic activity, and in each case the answer was 'no'. Of course, this still does not 'prove' the hypothesis, not just because a proof in the strict sense is in principle impossible, but also because there are unknown 'quantities' that have to be taken into account.

The key – as Dave Stainforth puts it in his recent article on the subject of uncertainty – is thus to deal appropriately with the 'known unknowns'. As concerns climate science, and more particularly climate modelling, these known unknowns, according to Stainforth, are threefold:

- 'natural variability. The climate system is chaotic, which means that small changes in one location at one point in time can lead to large differences at other locations at some future point in time. This is the familiar 'butterfly effect' whereby a butterfly flapping its wings in Indonesia is said to be able to affect whether a hurricane might hit Florida at some point in the future.

- Changing boundary conditions. The climate is affected by many factors which are considered to be separate from, or outside, the climate system. These include natural factors such as volcanic eruptions and solar output, and anthropogenic factors such as the emission of greenhouse gases.
- Scientific understanding of how the climate behaves and how it responds to changing boundary conditions such as a rapid increase in atmospheric concentrations of greenhouse gases' (Stainforth, 2005).

The study of such 'known unknowns' is the theory of probability, which is why it will be no surprise that much of the recent energy of the modelling community has gone into developing probabilistic climate models, such as the 'grand ensemble' models of the Oxford University based ClimatePrediction.net which by using thousands and thousands of (slightly) different model-runs are trying to generate a picture of the likelihood of climate change events.

In the run-up to the recent Gleneagles G8 summit, the Academies of Science of the G8 countries, as well as Brazil, China and India, published a declaration (Royal Society et al., 2005) which accordingly acknowledged under the heading '*Climate change is real*' that

There will always be uncertainty in understanding a system as complex as the world's climate. However there is now strong evidence that significant [anthropogenic⁸] global warming is occurring. The evidence comes from direct measurements of rising surface air temperatures and subsurface ocean temperatures and from phenomena such as increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. It is likely that most of the warming in recent decades can

⁸ The declaration explicitly states (footnote 1) that it uses the UNFCCC definition of 'climate change', which is 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.

be attributed to human activities. This warming has already led to changes in the Earth's climate.

In conclusion, the Science Academies' declaration – referring to the G8 nations being 'responsible for much of the past greenhouse gas emissions' and recalling the UNFCCC commitment by them 'to showing leadership in addressing climate change and assisting developing nations to meet the challenges of adaptation and mitigation' – calls on world leaders to carry out a number of actions, first and foremost among them to 'acknowledge that the threat of climate change is clear and increasing'.

As it happens, the G8 summit at Gleneagles saw the adoption of a 'Gleneagles Plan of Action', as well as a Declaration by the key developing country participants, both of which will be discussed in the next section. However, in their final Communiqué, unusually signed by each of the G8 leaders, they did indeed declare 'climate change is a serious and long-term challenge that has the potential to affect every part of the globe' and that human activities 'contribute in large part to increases in greenhouse gases associated with the warming of the Earth's surface. And equally important, they all reaffirmed their commitment to the UN Framework Convention on Climate Change and its ultimate objective of stabilizing atmospheric concentrations of greenhouse gases at levels that avoid dangerous human interference with the climate system.

2. Recent Political Issues

The international effort to combat the adverse effects of global climate change is guided by the United Nations Framework Convention on Climate Change (UNFCCC) – one of the conventions adopted at the Rio World Summit in 1992 – and its Kyoto Protocol, adopted at the 5th Session of the Conference of Parties (COP) to the UNFCCC in Kyoto in 1997. At the time of writing almost all countries recognized by the United Nations – 189 out of 193, or 98 percent – have ratified the UNFCCC, and

152 had ratified the Kyoto Protocol to that Convention. The vast majority both of the industrialized Parties with assigned targets (namely 92 percent), and of developing countries without (74 percent) have ratified the Protocol, which entered into force on 16 February 2005.

2.1. Key Developing Country Actors

The Broad Coalition. Faced with a number of handicaps in their ability to participate as equal partners in international negotiations – insufficient resources to participate in sufficient numbers, inadequate analytic capacity and so on (see Müller, 2003) – developing countries have generally resorted to the strategy of coalition building under a multilateral umbrella, of ‘finding strength in numbers’. In the United Nations context, the main coalition that had emerged for the purpose of addressing the common development interests of non-industrialized countries is the broad coalition called ‘Group of Seventy-seven and China’ (G77+China), whose membership since its creation in 1964 has risen from 77 to 132 UN members.

If there is communality of interests – if all the numbers ‘pull in the same direction’ – a broad coalition of this size can be remarkably successful, as witnessed in the climate change negotiations concerning ‘common but differentiated responsibilities’, and ‘right to sustainable development’.⁹ The significant growth of the G77+China membership since its formation is testimony to the attraction of this broad developing country coalition, but it also increases its frailty: an increase in numbers may be an

⁹ ‘For example, the G-77 and China are united in arguing that environmental rules should not hinder their ability to develop. [...] Moreover, during the climate change negotiations the G-77 and China have maintained that the historical responsibility for climate change lies with industrial countries and that these countries should bear the main responsibility for correcting the problem.’ [Chasek and Rajamani, 2003, p. 255]

increase in strength, but only if the numbers pull in the same direction – i.e. if a strong coincidence of interests is retained.

Starting the first Ministerial Meeting of the Group in Algiers (1967), a permanent institutional structure gradually developed which led to the creation of G77 Chapters in Rome (FAO), Vienna (UNIDO), Paris (UNESCO), Nairobi (UNEP) and the Group of 24 in Washington, D.C. (IMF and World Bank). The Group's work is coordinated by an influential chairman who acts as its spokesman. The chairmanship rotates on a regional basis (between Africa, Asia, and Latin America and the Caribbean) and is held for one year in all the Chapters. At the time of writing, Jamaica holds the Chair of the Group.

Narrow Coalitions. In the climate change context, the G77+China has been put under particular strain due to different interests within the coalition. The members of the Alliance of Small Island States (AOSIS), for example, 'are particularly vulnerable to climate change because a rise in sea level could destroy or render uninhabitable all or part of their territory, [while] the members of the Organization of Petroleum Exporting Countries (OPEC), stand to lose substantial revenue from measures to avert climate change' (Chasek and Rajami, 2003, p.254) which a number of them will find difficult to cope with given their low per capita income and dependence on these revenues.

There are other Groupings of developing countries – part of, or overlapping with the G77+China – that have played a distinctive role in the UNFCCC negotiations, not least the Group of Least Developed Countries (LDCs). To begin with we take a look at the position of the three large regional leaders of the G77+China: Brazil, China, and India.

2.1.1. Large Developing Countries: Brazil, China, India

At COP8 (2002) in New Delhi, India's position was forcefully summarized in Prime Minister Vajpayee's High Level Segment opening address:

India's contribution – indeed, the contribution of all the developing countries – to greenhouse gas concentrations in the atmosphere is very little, compared to that of the industrialized countries. This will be the case for several decades to come. Tragically, however, developing countries will bear a disproportionate burden of the adverse impacts of climate change. Hence, it follows that there is a need to pay adequate attention to the concerns of developing countries on vulnerability and adaptation issues in the Convention process. [...] There have been suggestions recently that a process should commence to enhance commitments of developing countries on mitigating climate change beyond that included in the Convention. This suggestion is misplaced for several reasons.

- First, our per capita Green House Gas emissions are only a fraction of the world average, and an order of magnitude below that of many developed countries. This situation will not change for several decades to come. We do not believe that the ethos of democracy can support any norm other than equal per capita rights to global environmental resources.
- Second, our per capita incomes are again a small fraction of those in industrialized countries. Developing countries do not have adequate resources to meet their basic human needs. Climate change mitigation will bring additional strain to the already fragile economies of the developing countries, and will affect our efforts to achieve higher GDP growth rates to eradicate poverty speedily.
- Third, the GHG intensity of our economies at purchasing power parity is low and, in any case, not higher than that of industrialized countries. Thus, the assertion that developing countries generate GHG emissions, which are unnecessary for their economies, is not based on facts (Vajpayee, 2002).

And India retained a somewhat combatant mood at the recent UNFCCC Seminar for Government Experts (SOGE, Bonn May 2005), which was the fruit of protracted negotiations at COP10 in Buenos Aires concerning the way in which the post-2012 issue should at present be raised, if at all, in the UNFCCC context. In his presentation, the Indian expert, Surya P. Sethi, concluded that:

- Annex I [industrialised country] commitments not met – emissions still rising, transfers of finance/technology minimal.
- Low per-capita GHG emissions in India are due to sustainable lifestyles & not poverty alone
- India is doing enough in mitigation of GHGs. Technological and Financial barriers to achieving identified energy initiatives must be removed (Sethi, 2005).

By contrast, China – while also stressing its developing country status and low per capita emissions and highlighting its existing greenhouse gas mitigation measures – recognized the need for additional measures and urged ‘the international community to engage in practical technological cooperation in the future so as to combat climate change effectively and promote global sustainable development.’¹⁰

Two months later, on 6–8 July, the Heads of China and India – joined by those of Brazil, Mexico, and South Africa – used the occasion of their participation in the G8 Gleneagles Summit Introduction to issue a *Joint Declaration*. While somewhat overshadowed by the G8’s own *Gleneagles Plan of Action*, this Joint Statement is of considerable importance because it does indicate the areas on which there is a consensus among the key representatives of the developing world.

The second paragraph of the preamble, for example, contains a very strong general endorsement of multilateralism and, indeed the UN system:

the Gleneagles Summit is an opportunity to give stronger impetus to [the process of UN reforms aimed at providing a greater voice to developing countries in UN decision-making], and to send a positive message on international cooperation. This should be achieved through the promotion of multilateralism, the enhancement of North-South cooperation, as well as through a renewed commitment to sustainable development and the harnessing of the benefits of globalization for all.

¹⁰ Abstract for the Seminar of Government Experts May 16–17, 2005 Bonn, Germany, Submitted by the People’s Republic of China, <http://unfccc.int/meetings/seminar/items/3410.php>

This sentiment was again reflected in the Joint Declaration articles on climate change. Article 12, for example, states that ‘the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol establish a regime that adequately addresses the economic, social and environmental aspects of sustainable development.’

With a reference to the Principle of Common but Differentiated Responsibilities of the Framework Convention, Articles 13 and 14 urge industrialized countries to ‘take the lead in international action to combat climate change by fully implementing their obligations of reducing emissions and of providing additional financing and the transfer of cleaner, low emission and cost-effective technologies to developing countries’ and highlight the fact that the Convention and the Kyoto Protocol ‘do not provide for any quantitative targets for emission reductions for developing countries’.

Yet, significantly, Article 14 also highlights the fact that the developing countries do have commitments under these treaties, namely ‘to implement appropriate policies and measures to address climate change, taking into account their specific circumstances and with the support of developed countries’. Highlighting furthermore the fact that ‘the Convention establishes economic and social development and poverty eradication as the first and overriding priorities of developing countries’ Article 16 consequently concludes the G8 Summit should recognize that ‘there is an urgent need for the development and financing of policies, measures and mechanisms to adapt to the inevitable adverse effects of climate change that are being borne mainly by the poor’.

In conclusion (Art. 18) the Joint Declaration urges the G8 leaders and the international community ‘to devise innovative mechanisms for the transfer of technology and to provide new and additional financial resources to developing countries under the UNFCCC and its Kyoto

Protocol'. For this purpose, the Declaration proposes a new paradigm for international cooperation that must ensure:

- Accessibility and affordability of climate friendly technologies to developing countries (requiring 'a concerted effort to address questions related to intellectual property rights')
- Additional financial resources (over and above current ODA) to enable developing countries to access such technologies
- Encouragement of North-South collaborative research on such technologies.

2.1.2. Oil-producing Countries

Organization of Petroleum Exporting Countries (OPEC). The official OPEC position – judging from the statements made by OPEC's Secretary General to the Sessions of the Conference of Parties (COP) to the UN Framework Convention on Climate Change¹¹ – has been remarkably stable over the last five years at least. The two key issues raised by OPEC in the negotiations have been the rejection of (new) developing country commitments, and what has become known as the 'impact of response measures', both of which have led to some controversy in the negotiations.

Developing Country Mitigation Commitments. In his statement to COP8 in New Delhi (November 2002), the then OPEC Secretary General Alvaro Silva-Calderon reminded the Conference that 'we need to keep our focus firmly on the principle of "common but differentiated responsibilities". Industrialized countries, whose activities over decades — and even centuries — have been responsible for the lion's share of adverse impacts

¹¹ <http://www.opec.org/home/Environmental%20Issues/Statements/cop10.htm>

on the environment, should recognize and honour their obligation to provide the lion's share of the response measures.' The same point had already been made, in a somewhat more poignant form, at COP6 (The Hague, November 2000) by Rilwanu Lukman when he declared that 'developing countries should not be roped into making commitments to emissions-reduction targets'. And it was re-iterated by Silva-Calderón (COP9, Milan, December 2003), and Maizar Rahman (COP10, Buenos Aires, December 2004), who both pointed out that 'new commitments [for developing countries] would affect the ability of many sovereign states to achieve sustained economic growth, develop their social infrastructures and eradicate poverty.'

Impacts of Response Measures. The positions of all Parties are to a large degree shaped by their wider, or more narrow economic self-interests. There is wide-reaching consensus – both among their supporters and detractors – that OPEC and oil producers in general, and Saudi Arabia, in particular, have been extremely successful in their climate change negotiations. One of their main achievements has been the introduction of the issue of impacts of response measures in several places in the language of both the UNFCCC and the Kyoto Protocol (see Box 1).

Box 1

The term 'impacts of response measures' has become shorthand for 'adverse social and economic impacts of measures taken to reduce greenhouse gas emissions (particularly in industrialized countries) on the developing countries whose economies are highly dependent on the production and export of fossil fuel'. OPEC's position concerning these impacts has been shaped by concerns about their projected size and a sense of inequity.

Following a modelling study (see discussion below) undertaken at the OPEC Secretariat by the director of its Research Division, Shokri Ghanem, the author himself delivered the official OPEC statement to COP5 (1999, Bonn) in which he said that ‘the Kyoto Protocol, if fully implemented, would lead to a dramatic loss of revenue for oil-exporting developing countries, including OPEC's own Members. The financial impact on our countries has been estimated at tens of billions of US dollars per year, according to OPEC's calculations.’ This was re-iterated in the following year by Lukman, when he told Conference that ‘independent studies estimate the loss at tens of billions of US dollars per year for OPEC's Members’.

The issue of inequity was raised at a very early stage. Ghanem himself stressed (COP5) that ‘a sense of equity across all nations must prevail. In short, there must be no net winners and no net losers from these negotiations, as they run their course,’ a sentiment reiterated most recently (COP9) by Silva-Calderón when declaring that ‘We insist once again that oil-producing developing countries do not end-up as net losers from the climate change negotiations. We are still not satisfied that our legitimate concerns about the adverse impact of response measures on our hydrocarbon-dependent economies have been properly addressed.’

Apart from this egalitarian argument, there has also been a moral argument based on the ‘principle of common but differentiated responsibilities’ as put forward by Lukman who reminded COP6 that ‘the established industrial nations bear the principal responsibility for the purported phenomenon of global warming, and not the developing countries. The onus, therefore, is upon the rich nations to minimize and finance the negative impact of their response measures on the poor countries of the south,’ a sentiment re-iterated at the subsequent COP Sessions.

Other Issues. While there has been this remarkable stability in the official OPEC position on climate change issues, certain changes albeit sometimes in nuances can be detected in the official OPEC statements over the past five years. Thus while Lukman (COP6) made reference to both ‘minimizing’ and ‘financing’ the negative impacts of response measures, later statements only contain references to the former. Alí Rodríguez Araque’s COP7 statement, however, did contain the acknowledgement that ‘it was encouraging, therefore, to see that the Bonn Agreement included the establishment of a Special Climate Change Fund, to assist with the diversification of economies in countries which may suffer from the adverse effects of mitigation measures’.

An issue that was raised from time to time in Climate Change negotiations is the perceived unfair, if not illegitimate, fossil fuel consumption taxation in industrialized countries. As stated at COP7: ‘And, while oil is taxed so heavily, other fuels are taxed at far lower levels and are sometimes even subsidised. The time is ripe to reconsider the entire philosophy of energy taxation, by restructuring fiscal systems to address broader concerns than the financial needs of governments, and to ensure consistency with international trade rules.’ The view is that the need for emission mitigation provides an additional argument against these prevailing taxes and subsidies, which are seen to favour coal over the less polluting petroleum products. Another issue has recently made its appearance in the official OPEC position: carbon sequestration. At COP8, Silva-Calderón remarked that

...while there is the understandable call to develop renewables, the fact remains that the technology is still in its infancy. Therefore, while the renewable energy industry is being developed, all other available resources, which are friendly to the environment, must also be accessed, enhanced and utilised to tackle the dire problems of mankind and ensure sustainable development. Petroleum will feature prominently in this. Advances in technology continue to make oil and gas cleaner fuels. The successful development of carbon dioxide sequestration technology will ensure that fossil

fuels, including oil, continue to serve the needs of mankind for the foreseeable future.¹²

And this sentiment was reflected in the assertion, at both of the subsequent Sessions, that ‘proven reserves of oil and gas are sufficient to meet rising world demand for decades to come, while advances in technology help them meet the toughest environment regulations and make a substantial contribution towards sustainable development’.

And finally, at the same last two Sessions, OPEC reaffirmed its commitment to its policy of promoting clean fossil fuel technology and market stability ‘in the interests of rich and poor nations alike, with secure supply, reasonable prices and fair returns for investors’ (Silva-Calderon, COP9) with the proviso that ‘to be effective in this, however, requires steady, predictable demand, built upon a clear, definitive vision of the evolution of the global environment in the years to come’ (Silva-Calderon, COP9 and Rahman COP10).

Organization of Arab Petroleum Exporting Countries (OAPEC). After the ratification of the Kyoto Protocol by the Russian Duma on 22 October 2004, the OAPEC Editorial in the November edition of their Monthly Bulletin was dedicated to the ‘UNFCCC and the Kyoto Protocol’ (OAPEC, 2004). In it, the OAPEC General Secretariat tells the reader – in consonance with the OPEC position – that ‘the Russian Federation’s accession to the Protocol and the Protocol’s implementation will have repercussions for all fossil fuel exporting countries, but especially OAPEC member countries’.

Yet, the editorial is quite circumspect as concerns the level of these repercussions:

¹² Given the importance of this to fossil fuel producers, the issue of carbon sequestration is treated in a separate next Chapter by Professor Lackner.

however, it is difficult to predict with a high degree of accuracy a drop in oil demand due to the implementation of the protocol. Forecasts show that demand in developing countries will rise as they strive to implement development programs that enhance their peoples' living conditions. At the same time, demand growth rates are predicted to fall compared to the situation if the Protocol is not implemented. The Climox model shows that OPEC revenues will grow 65% between 1995 and 2010 in the base scenario, while the growth rate drops to 49% if the Kyoto Protocol is implemented [see Bartsch and Müller, 2000, 211].

Interestingly, the editorial does not stop at this point, but highlights some non-contentious options in which these expected adverse impacts of response measures could be minimized. For one, the editorial highlights that 'studies show that OPEC countries' revenue loss will be less if emissions trading is employed, although an OPEC study predicts that revenues will drop by a half if this mechanism is implemented fully'.

Moreover, the editorial also emphasizes that the loss of OPEC countries will be reduced considerably if the clean development mechanism is implemented, which OPEC member countries are allowed to employ in several areas related to oil projects, such as curbing flared gas, cutting emissions and pollution from various branches of the oil industry, using clean technology, producing clean fuel, and conserving energy and rationalizing consumption in energy consuming industries.

The editorial by the General Secretariat concludes by stressing,

the importance of member countries joining the Protocol so as to participate fully in the meetings of the Conference of Parties, which operates as an assembly for the parties to the Protocol. At its first meeting the Conference of Parties is expected to discuss several draft resolutions relating to the implementation of certain articles in the Convention and the Protocol that protect OPEC members' vital interests. They should also take advantage of the clean development mechanism for the mutual benefit of petroleum exporting countries and consuming industrial countries.

Before the Russian Ratification, with its consequent entry-into-force of the Kyoto Protocol, the only OPEC member which had adopted the Protocol was Tunisia (22 January 2003), although Egypt had signed it in

1999. Since that time, all OAPEC members eligible to adopt it – except Bahrain and Libya – have indeed acceded to it in rapid succession: Qatar (11 January 2005), United Arab Emirates (26 January), Saudi Arabia (31 January), Algeria (16 February), Kuwait (11 March).

2.2. The Lead Industrialized Protagonists

Among the 38 industrialized Parties – listed in Annex I of the UNFCCC – who did put their signature to the emission targets of the Kyoto Protocol (specified in its Annex B, see Table 1), there is a by now deep-seated divide between the 35 (spearheaded by the EU) who have ratified the treaty, and the two (led by the USA) who have repudiated it, with only Monaco still making up its mind.

Table 1

2.2.1. The United States I: The Asia-Pacific Partnership on Clean Development and Climate

The most significant step with regard to the international climate change debate taken by the Kyoto repudiators – i.e. the USA and Australia – is no doubt the *Asia-Pacific Partnership on Clean Development and Climate*. Robert Zoellick, US Deputy Secretary of State, who formally announced the pact at the sidelines of the Association of South-East Asian Nations meeting in Vientiane, Laos, was at pains to emphasize that the agreement was not in direct competition to the Kyoto protocol ('We view this as a complement, not an alternative'¹³)

¹³ 'Six nations agree new climate pact' CNN, 28 July 2005 <http://edition.cnn.com/2005/WORLD/asiapcf/07/28/sixnations.climate.ap>

According to a White House Fact Sheet, the Partnership ‘will focus on voluntary practical measures taken by these six countries in the Asia-Pacific region to create new investment opportunities, build local capacity, and remove barriers to the introduction of clean, more efficient technologies [and] help each country meet nationally designed strategies for improving energy security, reducing pollution, and addressing the long-term challenge of climate change.’¹⁴

The aims of the Partnership were further elaborated in a *Vision Statement* according to which it ‘will collaborate to promote and create an enabling environment for the development, diffusion, deployment and transfer of existing and emerging cost-effective, cleaner technologies and practices’. Areas for near-term collaboration mentioned included: energy efficiency, clean coal, integrated gasification combined cycle, liquefied natural gas, carbon capture and storage, combined heat and power, methane capture and use, civilian nuclear power, geothermal, rural/village energy systems, advanced transportation, building and home construction and operation, bio-energy, agriculture and forestry, and hydropower, wind power, solar power, and other renewables. Medium- to long-term collaborations were envisaged on hydrogen, nanotechnologies, advanced biotechnologies, and next generation nuclear fission, and fusion energy.

According to *The Guardian* ‘the existence of the pact, and the fact it was designed as an alternative to Kyoto, were disclosed by Australia's environment minister, Senator Ian Campbell’¹⁵ the day before Mr

¹⁴ White House Fact Sheet: President Bush and the Asia-Pacific Partnership on Clean Development, Office of the Press Secretary, 27 July 2005, <http://www.whitehouse.gov/news/releases/2005/07/print/20050727-11.html>

¹⁵ ‘US in plan to bypass Kyoto protocol’ *The Guardian*, Paul Brown and Jamie Wilson in Washington, 28 July 2005 <http://www.guardian.co.uk/international/story/0,,1537565,00.html>. ‘He said: “It is quite clear that the Kyoto protocol won't get the world to where it wants to go. We have got to find something that works better. We need to develop technologies which can be developed in Australia and exported around the world – but it also shows that what we're doing now, under the Kyoto protocol, is entirely ineffective. Anyone who tells you that the Kyoto protocol, or signing the Kyoto protocol is the answer, doesn't understand the question.” Kyoto would fail because “it engages very few countries, most of the countries in

Zoellick's official announcement. CNN added that 'Canberra and Washington had negotiated the new agreement for the past 12 months among the countries accounting for 40 percent of the world's greenhouse gas emissions. The pact was finalized during secret talks in Honolulu on June 20–21, a diplomat said, speaking on condition of anonymity.'¹⁶

While the Vision Statement stresses in its ultimate paragraph that 'the partnership will be consistent with and contribution to our efforts under the UNFCCC and will complement, but not replace, the Kyoto Protocol' – a fact emphasized by Zoellick in his official announcement ('We are not detracting from Kyoto in any way at all. We are complementing it.'¹⁷) – comparisons with Kyoto were inevitable, especially after Australian Prime Minister John Howard said: 'The fairness and effectiveness of this proposal will be superior to the Kyoto protocol.'¹⁸

However, neither of Zoellick's assurances – even after having been echoed by Alexander Downer, Australia's foreign minister¹⁹ – convinced the European media that the Partnership was not intended as an attack against the Kyoto Protocol, indeed, more generally against the involvement of the United Nations in the effort to deal with global climate change, as can be gauged from the subsequent press headlines:

'US unveils alternative plan to Kyoto treaty' *Financial Times*

'Asia deal on table to counter Kyoto' *Financial Times*

'US in plan to bypass Kyoto protocol' *The Guardian*

it will not reach their targets, and it ignores the big looming problem – that's the rapidly developing countries".'

¹⁶ 'Six nations agree new climate pact' CNN, 28 July 2005 <http://edition.cnn.com/2005/WORLD/asiapcf/07/28/sixnations.climate.ap>

¹⁷ 'US unveils alternative plan to Kyoto treaty', *Financial Times*, July 27 2005 20:11 <http://news.ft.com/cms/s/c4ed87d8-fed1-11d9-94b4-00000e2511c8.html>

¹⁸ Alister Doyle, 'U.S.-led climate plan won't supplant Kyoto –experts', Reuters, 28 July 2005, <http://go.reuters.co.uk/newsArticle.jhtml?type=scienceNews&storyID=9202317§ion=news&src=rss/uk/scienceNews>

¹⁹ 'U.S., Australia deny climate deal threat to Kyoto' Reuters Alert Net 28 July 2005 <http://www.alertnet.org/thenews/newsdesk/BKK265196.htm>

‘Le pacte climatique Asie-Pacifique « supérieur » à Kyoto (Canberra)’ *Le Monde*²⁰

‘Bush startet Alternative zu «Kyoto»’ *Neue Zürcher Zeitung*²¹

‘Clima, accordo a sei parallelo a trattato di Kyoto’ *Corriere della Sera*.²²

Initial official reaction from outside the Partnership was less sceptical about the relation of the Partnership and the UN climate change regime. Thus the UK government ‘welcome[d] any action taken by governments to reduce greenhouse gases [...] The announcement from Australia and others certainly does not replace the Kyoto process. Kyoto represents a historic first step in world cooperation but needs to be built on post 2012 – that process continues in Montreal later this year. We made excellent progress on climate change at Gleneagles.’²³

Barbara Helferrich, the European Commission's environment spokeswoman, in turn, welcomed the initiative but cautioned that it ‘has to be seen in a global context. [...] If it is simply technology and clean coal, it is no substitute for agreements like the Kyoto Protocol and we do not expect it to have a real impact on climate change. There will have to be binding global agreements, but on what scale and what basis is yet to be decided.’²⁴

Box 2

2.2.2. The United States II: Domestic Sub-national Initiatives

However, there are a number of domestic activities happening in the USA that must be kept in mind, if only because most of the key environmental

²⁰ 28 July 2005 <http://www.lemonde.fr/web/depeches/0,14-0,39-25409998@7-50,0.html>

²¹ 28 July 2005, <http://www.nzz.ch/2005/07/28/al/newzzEBOI2VIA-12.html>

²² 28 July 2005 http://www.corriere.it/Primo_Piano/Esteri/2005/07_Luglio/28/kyoto.shtml

²³ ‘US in plan to bypass Kyoto protocol’ *The Guardian*, Paul Brown and Jamie Wilson in Washington, 28 July 2005 <http://www.guardian.co.uk/international/story/0,,1537565,00.html>.

²⁴ ‘EU pushes binding climate deal’ by Richard Black 28 July 2005 BBC, <http://news.bbc.co.uk/1/hi/sci/tech/4724877.stm>

and other actions by the Federal government in Washington DC – with or without international aspects – are primarily due to precisely such domestic activities: given the current geo-political constellation, the only way in which Washington can be pressured into doing something is by its domestic constituencies. The activities currently underway are actually too numerous to discuss in this context, as even the listing of some of the activities and actions initiated at state level *in the present year alone* in Box 2 will demonstrate. These, and the numerous other current initiatives, not just at state, but at community level and in the corporate sector will make it very likely for the federal government in Washington sooner or later to be faced with sufficient pressure to harmonize these activities (‘create a level playing field’) to introduce binding domestic targets at the federal level.

The European Union. Probably the most important recent ‘domestic’ step in the EU was the launch of the European Emission Trading Scheme (EU ETS). In June 2003, the European Council and Parliament adopted (the Directive for) the EU ETS as the primary instrument for controlling industrial sector CO₂ emissions in Europe.

When it came into operation on 1 January 2005, it was immediately the largest ever emission trading scheme, covering all the largest ‘point source’ CO₂ emissions across the EU25 – namely power stations, cement manufacturing, iron and steel, pulp and paper, oil refining, glass and ceramics, and all other industrial facilities larger than 20MW thermal capacity – accounting for about 46 percent of European CO₂ emissions.

The EU ETS Directive specifies two phases: A Phase 1 2005–07 (‘precursor period’) in which member states retain the option of a conditional ‘opt out’ for the named sectors and facilities, and a Phase 2 2008–12 (‘Kyoto period’) when they are all mandatorily covered by the scheme, and governments have the option to ‘opt-in’ additional sectors

and facilities. In Phase 1 (Phase 2) governments can auction up to 5 percent (10 percent) of permitted allowances to their domestic sectors.

The follow-up EU's Linking Directive, adopted in May 2004, allows companies also to use emission credits generated under Kyoto's project mechanisms towards compliance under the EU ETS, capping the volume of credits to be imported into the EU at 6 percent of total emissions (with an envisaged review when the cap is reached).

The Directive specifies a penalty to be levied in case of non-compliance, rising from €40/tCO₂ in Phase 1 to €100/tCO₂ in Phase 2. In addition, there is a requirement to make good the allowance shortfall by purchasing credits in the market, adding to the compliance incentives.

On 9 February 2005, the European Commission adopted a Communication ('Winning the Battle Against Global Climate Change'²⁵) that set out its future policies of climate change. It also put forward a set of proposals designed to structure the EU's post-2012 international climate change negotiations.

- Broader international participation in reducing emissions. The EU should continue to lead multilateral efforts to address climate change, but identify incentives for other major emitting countries, including developing countries, to come on board. During 2005, it should explore options for a future regime based on common but differentiated responsibilities.
- Inclusion of more sectors, notably aviation, maritime transport and forestry since deforestation in some regions significantly contributes to rising greenhouse gas concentrations in the atmosphere.

²⁵ Commission of the European Communities, 'Winning the Battle Against Global Climate Change', Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, COM(2005) 35 final, http://www.europa.eu.int/comm/environment/climat/future_action.htm

- A push for innovation in the EU to ensure the development and uptake of new climate-friendly technologies and the right decisions on long-term investments into the energy, transport and building infrastructure.
- The continued use of flexible market-based instruments for reducing emissions in the EU and globally, such as the EU emissions trading scheme.
- Adaptation policies in the EU and globally, which require more efforts to identify vulnerabilities and to implement measures to increase resilience.²⁶

The Communication, together with a Commission Staff Working Paper, gives a detailed account of these proposals. Based on the ultimate objective of the UN Framework Convention on Climate Change – namely

to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.²⁷

– the European Council adopted in 1996 the policy goal of limiting average global temperature increases to no more than 2°C of pre-industrial levels (see the EU 6th Environmental Action Programme²⁸). Pending further scientific information, the EU is basing its decisions on the assumption that reaching the 2°C target would translate into a long-term greenhouse gas concentration level of 550ppm CO₂-equivalent, and that such a concentration level would translate into a global emission

²⁶ ‘Climate change: Commission outlines core elements for post-2012 strategy’ Commission press release, 9 February 2005, http://www.europa.eu.int/comm/environment/climat/future_action.htm

²⁷ Article 2, UNFCCC.

²⁸ <http://europa.eu.int/comm/environment/newprg/index.htm>.

reduction of 15–20 percent by the year 2050 compared to 1990 emission levels (or by 50–60 percent compared to a ‘business as usual’ scenario).

Following sections on ‘The Climate Challenge’ and ‘Benefits and Costs of Limiting Climate Change’, the Communication identifies three challenges: The Participation Challenge, The Innovation Challenge, and The Adaptation Challenge. With regard to The Participation Challenge, the Communication points out that the EU, alone, cannot solve the problem:

even if the EU were to cut its emissions by 50 % by 2050, atmospheric concentrations would not be significantly affected, unless other major emitters also made substantial emission cuts. Therefore, effective action to tackle climate change requires widespread international participation on the basis of common but differentiated responsibilities and respective capabilities.

Highlighting that emission reduction measures – such as significant improvements in energy efficiency and the introduction of low carbon energy sources – do not necessarily pose a threat to economic growth, indeed may even contribute to sustaining rapid economic growth, the Communication contends that the recently adopted EU Action Plan on Climate Change and Development could be instrumental in supporting developing countries addressing these issues.

Referring to the well-known US argument that the absence of emission reduction targets for the large developing country emitters in the Kyoto Protocol gives them an unfair competitive advantage, the Communication recommends that

the EU should support efforts to resolve this impasse. Indeed a relatively small group – EU, USA, Canada, Russia, Japan, China and India – accounts for about 75 % of world greenhouse gas emissions. It might be worthwhile to try to accelerate progress at the global level by discussing reductions among this smaller group of major emitters in a forum similar to the G8, in parallel with vigorous efforts to reach agreement in the UN context.

And in the Conclusions, ‘the Commission recommends that the EU explore options for a post-2012 strategy with key partners. [...] In bilateral contacts with interested countries, including the large emitters, actions should be identified that they are ready to take within specified time horizons and conditions’.

Given that more than half of the countries mentioned in the Communication’s ‘relatively small group’ are already part of the earlier-mentioned *Asia-Pacific Partnership on Clean Development and Climate* it would seem rational for the EU to join this Partnership. Yet it is not certain whether all the Partners would welcome such an enlargement – and not just because the EU presence in the Pacific is rather small (albeit very attractive, including Tahiti), for it is not altogether clear whether everyone in this Partnership would be happy about the EU’s suggestion that

the outcomes of bilateral discussions could then be fed into the UNFCCC negotiations, through commitments to act or to meet targets. The objective is to establish a multilateral climate change regime post-2012 with meaningful participation of all developed countries and the participation of developing countries which will limit the global temperature increase to 2°C, and which is considered as a fair sharing of effort by all key players.

As concerns developing countries, probably the most important evolution in the EU position has been that they are not going to ask for developing country emission reduction commitments in the post 2012 negotiations, as declared by the EU Presidency in the recent roundtable discussion in Ottawa, Canada.

Russia. Finally, a few words on the Russian situation. The Russian Federation had been centre stage from COP9 in Milan (December 2003) when one of President Putin’s economic advisors started to question whether Russia would actually ratify the Kyoto Protocol, until 22 October

2004, when it did (which was sufficient to have it enter into force 90 days after). Since then, things have calmed down considerably. The most important questions being asked about Russia with regard to climate change is whether it will be ready in time (2008) to participate in the Kyoto flexibility mechanisms or not.

The key issues are the need for institutional capacity and the requirement of an adequate national greenhouse gas inventory.

According to PointCarbon,²⁹ a leading analyst of carbon market issues, it is expected that the rules for *Joint Implementation* (JI) – the project-based Kyoto mechanism applicable in Russia – will be adopted by the Russian government by the end of 2005, while the inventory is being built up with the help of the EU’s technical assistant programme *TACIS* and the World Bank.

3. A Key Economic Issue: Competitiveness

Irrespective of whether the future climate change regime involves an international emission ‘cap and trade’ regime, a key issue in the post-2012 debate will be that of (unfair) competitive disadvantages due to differentiated emission mitigation requirements. Indeed, competitiveness will be an issue for the EU even before 2012 in the debate on the 2008–12 National Allocation Plans for the EU ETS.

A clear definition of ‘competitiveness’ and how it can be measured is essential for a reasoned discussion on the issue. Arguably, the most appropriate interpretation is in terms of ‘profitability’, where changes in competitiveness are gauged from changes in (relative) profitability. The question then becomes whether, and to what extent, profits are affected by differentiated mitigation targets for certain industrial sectors.

²⁹ Point Carbon: ‘02.03.05 RUSSIA TO BE READY FOR JI BY 2007’
<http://www.pointcarbon.com/article.php?articleID=6943&categoryID=470>

Carbon/energy-intensive sectors such as steel, aluminium, chemicals, cement, refineries and utilities are usually considered prime candidates for having profitability affected by mitigation targets. However, not all carbon/energy-intensive sectors are equally vulnerable. For example, if a local utility is not directly in competition with non-abating regions, there can be no loss in competitiveness. Even where there is competition, several factors are involved in determining the impact on profitability – such as the way in which the abatement is imposed (for instance, through carbon taxes or by ‘grandfathering’ emission allocations).

Many other low-intensity sectors (often generating by far the larger proportion of GDP, particularly in industrialized countries), meanwhile, have low energy costs compared to their turnover and may even gain in profitability and competitiveness by adopting further energy efficiency measures (Azar 2005).

Even if there is a significant risk of some carbon/energy-intensive industries relocating production to regions with weaker or no carbon constraints, stricter carbon policies are likely to promote the domestic development of carbon efficient technologies, which in turn will prove economically beneficial in the longer term. It stands to reason that the development of more energy efficient technologies – particularly in globalized markets for consumer goods such as automobiles and electric appliances – will set new standards in other parts of the world (Grubb, Hope and Fouquet, 2002; Müller, 2003).

‘Early movers’ in new technological innovations focused on energy efficiency could even gain a competitive advantage in new markets as other countries and regions follow with tightened carbon controls – also known as the ‘Porter hypothesis’ (Porter & van der Linde, 1995) [Azar (2005)]. The experience of the Danish wind power sector is an example of this kind of an advantage.

Therefore, one should not expect universal truths in the question on the impact of climate change mitigation measures on industrial sectors, but only answers to questions concerning specific economic contexts. Such answers will usually involve some modelling exercises. The UK Carbon Trust, just to name one – albeit important – example, relies heavily on modelling exercises (see Oxera, 2004) in their recent study concerning the impact of the European Emissions Trading Scheme (EU-ETS) on industrial competitiveness. The results are worth considering in some detail in the present context (Carbon Trust, 2004).

3.1. The Carbon Trust Study (CTS)

The aim of the EU ETS – like any other such scheme – is to minimize mitigation costs, in this case to industry in the twenty-five member European Union (EU25). The CTS raises the point that if energy-intensive sectors in Europe face a significant reduction in profits as a result of the ETS, they may be tempted to move operations abroad, to places where CO₂ emissions are not controlled; or consumers may preferentially buy more goods from regions where emissions are not controlled. This would not achieve anything in terms of global emissions – and if the facilities concerned were less efficient than current European operations, it would even result in increased global emissions. The competitiveness implications of the EU ETS are thus a central concern, for environmental as well as economic reasons (Carbon Trust 2004, p.5).

The study focuses on a number of determinants of a sector's inherent potential exposure to the ETS:

- *Energy intensity.* Energy-intensive industrial sectors – regardless of whether covered by the ETS or not – will see their input costs rise if they fail to reduce their CO₂ emissions and/or energy

consumption (indeed, according to the CTS the impact of the scheme on electricity prices represents a greater cost risk to many sectors than the direct impact of the scheme).

- *Ability to pass cost increases through to price* determined, *inter alia*, by the nature of the competition – ‘In general, markets with more players are more competitive and costs affect sector pricing more directly’[p.6] – and the level of competition from outside the EU ETS.
- *Price-responsiveness of demand*. Sectors in which demand is not very sensitive to price will not suffer a significant loss in volume of sales when prices are increased, particularly if possible substitute products are exposed to similar cost uplifts as a consequence of the EU ETS.
- *Opportunity to abate carbon*. With increasing CO₂ prices, investment in abatement becomes more and more attractive a means to both limit exposure to the ETS, and potentially to benefit from the (energy) cost savings associated with abatement activity.

3.2. The CTS Sectors and Scenarios

The modelling work for the CTS involved an in-depth analysis of five industrial sectors in the UK (all except the last covered by the ETS):

1. *Electricity*, representing a large proportion of EU emissions and widely considered to be the key sector with unique characteristics, generally not exposed to international competition and seen by many as a possible winner from the ETS.
2. *Cement manufacture*, a highly energy-intensive sector with some degree of international/country-to-country competition.

3. *Paper* (newsprint) – part of the pulp and paper industry, a highly international sub-sector with material energy costs.
4. *Steel manufacture*, a highly energy-intensive sector with strong but differentiated international competition;
5. *Aluminium* (smelting) – a sector not part of the EU ETS but unusually dependent upon electricity, and a fully global commodity market.[p.7]

These sectors are treated as ‘carbon price-takers’ in the context of the EU-ETS, and the modelling exercise is centred around three price and allocation scenarios, of which the ‘Kyoto scenario’ is the most interesting in the present context.

For this scenario, during the second (‘Kyoto’) Phase of the EU-ETS (2008–12), the CTS assumes an allocation to companies similar to the national Kyoto targets, some use of Russian surplus allowances, and certain protective measures concerning ‘business-as-usual’ foreign credits under the Linking Directive (which links the ETS to other flexibility mechanisms).

The chosen carbon permit price was €10/tCO₂, and allocations were based on the principles of the UK National Allocation Plan (NAP) strengthened and extended to 2008–12. The NAP is led by cutbacks in the electricity sector, sufficient to achieve a national 20 percent reduction. Other sector allocations are not part of NAP. In the model, they reflect other UK Climate Change Agreement targets.

Conforming to the proposed definition of competitiveness earlier in this paper, the CTS sees the impact of the EU ETS on competitiveness as closely related to its impact on operating profit. As a measure of this, OXERA’s Cournot model calculates the impact on the sector’s total earnings before interest, tax, depreciation and amortization (EBITDA).

The impact itself is determined by five related factors, all measured in relation to current operating profits:

1. *Gross Carbon Costs.* At the outset, the model considers the potential ‘gross carbon costs’, that is to say the gross impact on the sector’s production costs given the (assumed) carbon price, before taking into account allowance allocations or (product) price responses. In other words, it shows the potential cost that would arise from a pure carbon tax (on all emissions) at the same price levels. In the Kyoto scenario, this increases marginal costs of the UK electricity sector by 23 percent, which taken in isolation would be sufficient to offset the sector’s operating profit.
2. *Net Value at Stake.* The next step in calculating the competitiveness impact of the ETS is to net-off the value of the ‘grandfathered’ free allowances. For the UK electricity sector the Kyoto scenario net value at stake is still in the region of one-third of the operating profit.
3. *Product Price Adjustments.* While being a ‘carbon price taker’, the sector may – depending on the exposure of the sector to lesser carbon constrained competition – actually be a product ‘price-maker’ and able to pass a significant part of the marginal cost increases on to the consumer by increasing the product price levels. The important fact here is that the marginal unit produced will incur a carbon cost, but those covered by the ‘grandfathered’ allowances will clearly not. However, an increase in price would apply to *every* unit produced, even those that are covered by these free allowances, which is why it is possible that carbon constraints can actually *increase* the sectors’ profits, and thus its competitiveness. The UK utilities are indeed projected to be able to pass through 90 percent of the above-mentioned marginal cost

- increases in the Kyoto scenario, leading to a price increase for the consumer of 15 percent.
4. *Demand Adjustments.* Any price adjustments will have an effect on demand, which will vary depending on the ‘elasticity’ of the demand in question. Given the relatively ‘inelastic’ nature of electricity demand – people do not tend to vary their electricity use much in response to price variations – the Kyoto scenario impact on UK electricity demand remains at a modest 6 percent reduction.
 5. *Abatement Adjustments.* In many cases, it will prove to be more profitable to abate the sectoral emissions than to buy in the permits not covered by the grandfathered allowances, not only because of reducing the permit purchasing costs, but often also energy costs. For the electricity sector, the main abatement option is fuel switching from coal to gas. The estimated impact of this for the UK sector under the Kyoto scenario yields a final position concerning the EU ETS impact of an *increase in profitability (EBITDA) of 63 percent.*

3.3. The Sectoral CTS Results

The electricity sector – used above to illustrate the modelling method – is, of course, typically atypical in the context of concerns about international competitiveness due to differentiated carbon targets, because there is, in most cases, no competitive international market in electricity. The results for the other sectors considered in the CTS – in particular the cement and steel sectors – may thus be more relevant to the international competitiveness issue. As it happens, none of the sectors studied in the UK has any change in the number of firms operating, and they are all, except aluminium smelting, projected to

make carbon windfall profits, some of them, particularly cement and steel, significant (Cement +25%, Steel +17%), as listed in Table 2.

Table 2

Moreover, given the current carbon price of around €25/tCO₂ is more than twice the value assumed in the Kyoto scenario, it stands to reason that these windfall profits could be considerably larger than even the projected figures of the CTS, *if* the firms manage to pass the costs through to the consumer.

4. Summary

4.1. Science

Given the stakes of the perceived potential economic costs of tackling man-made climate change, it is not surprising that it has been among the publicly most heatedly debated scientific topics in recent times, rivalled possibly only by the debate on nuclear safety. However, a heated public debate does not necessarily imply a lack of scientific consensus. And while there are inevitable uncertainties – as in any other empirical debate – the vast majority of the relevant scientific community has come to the consensus taken up by the G8 heads at the Gleneagles Summit that ‘climate change exists, that it is a serious and long-term problem, and to a large extent a man-made one’.

Indeed, as concerns climate change politics, the question of scientific accuracy has in a large part of the world become a non-issue. If anything, the focus has shifted to what sort of impacts can be attributed to man-made climate change, as witnessed in the recent debate about the connection with tropical storms in the aftermath of the devastations

caused by Hurricane Katrina in the US Gulf coast. Most policy makers in the European Union and the other Parties to the Kyoto Protocol have adopted the scientific consensus that there is anthropogenic climate change and are now concerned mostly with how to tackle the problem.

4.2. Politics

International climate change politics at present is characterized by a polarization that goes far beyond the issue of climate change, namely the question of whether the world should be governed multilaterally through the United Nations or through bilateral/regional agreements. The position of the United States under the present administration has tended towards the bilateral/regional position. This has been witnessed not only in the tough stance taken up by the recently appointed US Ambassador to the UN but also in the more narrow context of climate change, in the establishment of the regional *Asia-Pacific Partnership on Clean Development and Climate*. Although this pact was officially not meant to replace the UN Kyoto Protocol, most commentators, particularly in Europe, saw it as an attempt by the USA and Australia to do precisely that.

The European Union – in the climate change context at least – has become the main champion of the UN approach and the Kyoto Protocol. In this, it has the support not only of China and India, but of most of the Kyoto Parties, industrialized or developing. For the EU, the Kyoto regime – at least with regard to its first commitment period (2008–2012) – is a fact and will not be undone. Indeed, the EU is committed to continuing its Kyoto-style Emission Trading Scheme ETS beyond this period.

The international political debate on climate change is indeed focusing more and more on the issue of what is to happen once the first

commitment period of the Kyoto Protocol expires at the end of 2012. The lead protagonists have begun to put their cards on the table. The European Union is determined not only to keep the United Nations system at the heart of the international climate change process, but also to retain the broad architecture of the Kyoto Protocol, with binding absolute emissions caps and flexibility mechanisms at its core. The United States will, for the near to medium term at least, continue to reject this 'Kyoto architecture' and will instead focus its attention on voluntary bilateral regional agreements, such as the Asia-Pacific Partnership on Clean Development and Climate.

The question which of the two models will prevail essentially depends on economic factors. While the voluntary US model may at first sight seem to be more attractive to the business sector, one should not forget that with the introduction of the EU Emissions Trading Scheme, a considerable amount of assets have been created that would be lost in the absence of such a scheme, a fact which does give substantial support to the EU position. The main potential obstacle to the continuation of this model is whether it can be achieved without raising too many objections with regards to unfair effects on industrial competitiveness.

4.3 Economics

The issue of such impacts on competitiveness cannot be discussed in abstract, which is why the recent study about the effects of the EU ETS by the UK Carbon Trust is of considerable value. Contrary to the widespread opinion that the Kyoto Protocol would spell competitive doom for EU industrial sectors due to the absence of developing country emission reduction targets, this study shows that:

- It is possible that some low carbon/energy sectors gain in competitiveness under such an asymmetric regime ('reversed Dutch disease' phenomenon).

- Practically all of the prima facie most vulnerable carbon/energy-intensive industries in Europe will *not* face a worsening in their competitiveness. On the contrary, they will reap a (windfall) increase of it, if measured in terms of their profitability.
- However if, as is not unlikely, in the longer term permit price will be in the tens of Euros per ton of CO₂ there is the potential that the costs may not be passed through to the consumer which may indeed lead to competitiveness problems for energy-intensive industries from companies that do not face similar carbon penalties.

It is therefore clear that any demands for protective measures by EU industry sectors (such as electricity, steel, cement and so on) will need to be very carefully and specifically analysed for in the near to medium term it looks as if only a few of them will be facing competitive disadvantages.

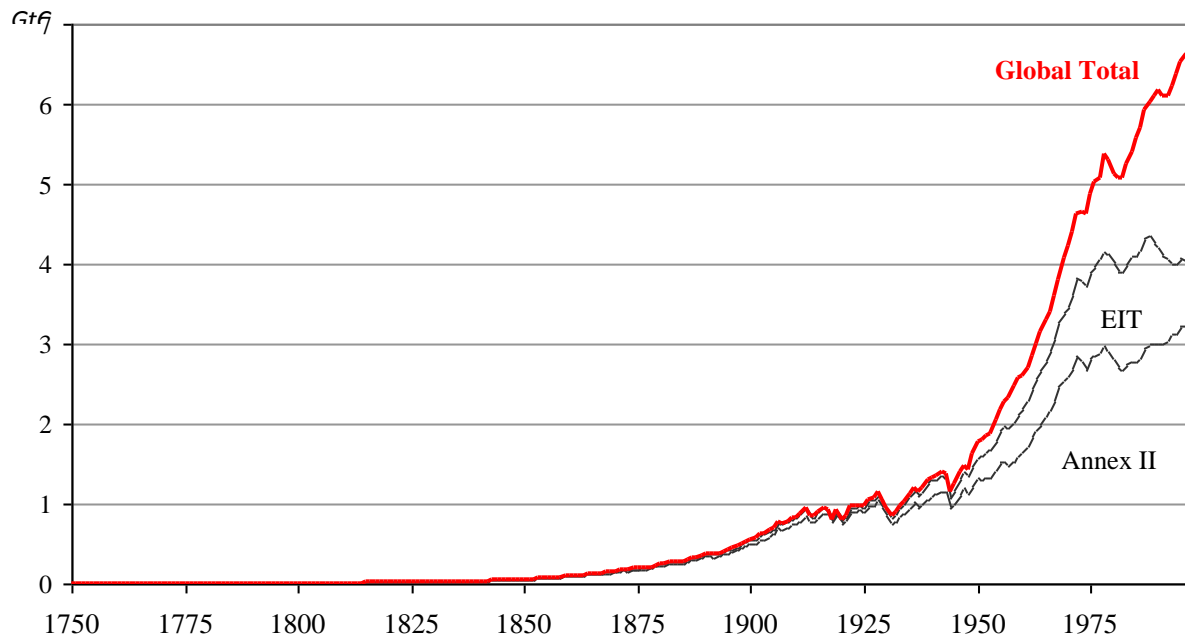


Figure 2: CO₂ Emissions. Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring. 1751-1998

‘Annex II’ ≈ 1990 OECD, ‘EIT’ = Economies in Transition (FSU and Eastern Europe)

Source: G. Marland, T.A. Boden, and R.J. Andres (2001), ‘Global, Regional, and National Annual CO₂ Emissions from Fossil-Fuel Burning, Cement Production, and Gas Flaring: 1751-1998 (revised July 2001)’, <<http://cdiac.ornl.gov/ftp/ndp030/region98.ems>>

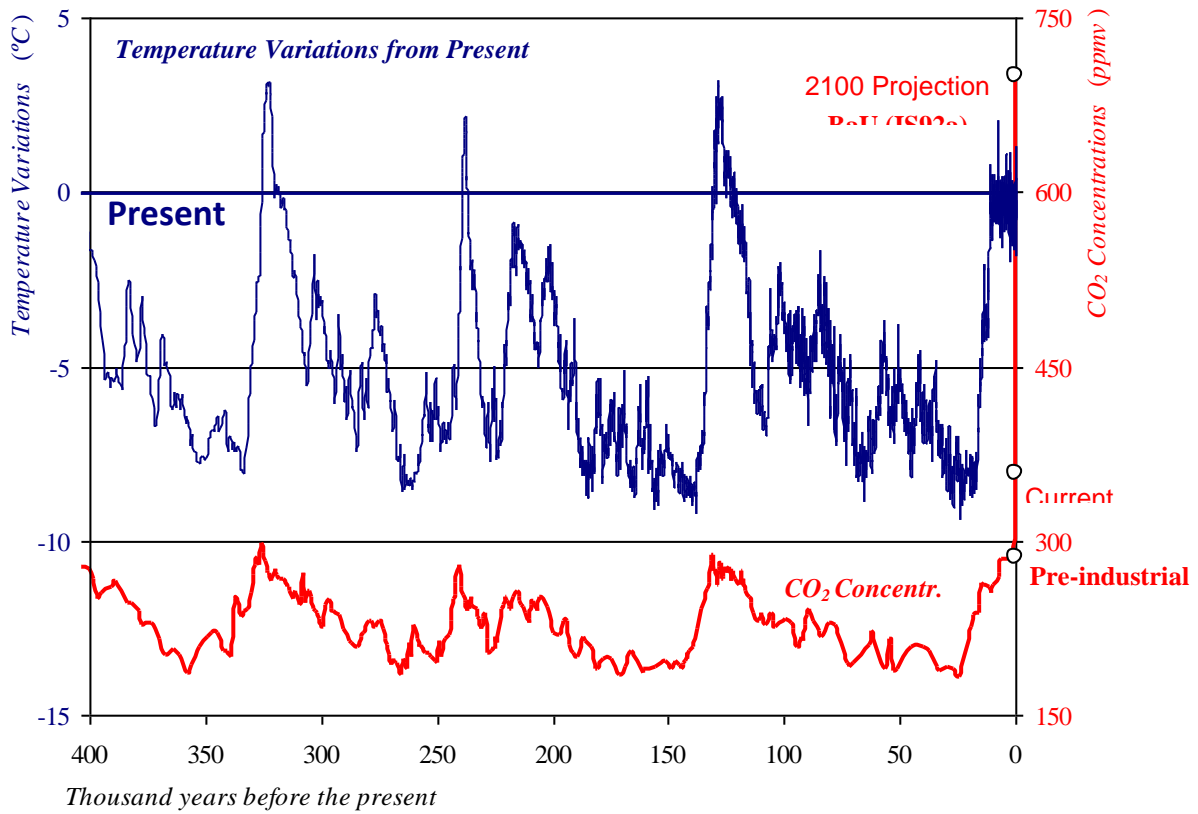


Figure 1: CO₂-Concentrations and Temperature Variations (from Present).

Sources: Pre-historic Temperature and CO₂ Concentrations: Petit *et al.* (1999);

CO₂ Concentrations: Pre-industrial (= 280ppm), Current (1998 = 365ppm), 2100 Projections (= 540 - 970ppm, IS92a = 710ppm): IPCC TAR1

		%			%
Pro			Contra		
Austria	92	Latvia	92	Australia	108
Belgium	92	Liechtenstein	92	USA	93
Bulgaria	92	Lithuania	92		
Canada	94	Luxembourg	92		
Croatia	95	Netherlands	92		
Czech Republic	92	New Zealand	100		
Denmark	92	Norway	101		
Estonia	92	Poland	94		
EU	92	Portugal	92		
Finland	92	Romania	92		
France	92	Russia	100		
Germany	92	Slovakia	92		
Greece	92	Slovenia	92		
Hungary	94	Spain	92		
Iceland	110	Sweden	92		
Ireland	92	Switzerland	92		
Italy	92	Ukraine	100		
Japan	94	UK	92		

* = % (in most cases) below 1990 levels

<i>Sector</i>	<i>marginal cost increase</i>	<i>price increase</i>	<i>marginal cost increase passed on to customers</i>	<i>Change in quantity demanded</i>	<i>Change in operating profit (EBITDA*)</i>	<i>'Net Value at stake'</i>
Aluminium smelting	5	3	66	-6	-31	51
Cement (base line)	55	14	83	-4	25	1.9
Cement (competition**)	55	11	66	-8	13	1.9
Cold-rolled steel	7	3	67	-5	17	4

* Earnings Before Interest, Tax, Depreciation and Amortisation
** The base-line case assumes that the UK cement market is largely domestic, which is why a 'competition' scenario was also modelled, largely on the situation in Spain, assuming 30 percent non-EU imports.

Box 2: Sub-national Climate Change Activities initiated between January and July 2005

The U.S. *Conference of Mayors* – representing 1,183 cities from all 50 states – on 13 June votes unanimously to support the Climate Protection Agreement which mirrors the Kyoto Protocol's goal of reducing GHG emissions 7% below 1990 levels by 2012. Before the Mayors' Conference convened in June, 164 mayors from around the country had signed onto the agreement.

Arizona: (February) An executive order creates a state Climate Change Advisory Group, charged with developing recommendations to reduce Arizona's greenhouse gas emissions, culminating in the submission of a Climate Change Action Plan by June 2006. The Governor signs another executive order requiring new state-funded buildings to derive at least 10% of their energy from renewable sources, either directly or through the purchase of renewable energy credits.

California: (June) The Governor Schwarzenegger signs an executive order directing state officials to develop plans to reduce the state greenhouse gas emissions by 11% below current levels over the next five years (=2000 level), 25% by 2020 (=1990 level), and 80% by 2050.

Illinois: (July) The state Commerce Commission passes a resolution calling for both Renewable Energy and Energy Efficiency Portfolio Standards. The state utilities have agreed to acquire 2% of their electricity from renewable sources by the end of 2006 and reach 8% by 2013. They will also create new programs to reduce the increase in electricity demand 10% by 2008 with the ultimate goal of reducing the state's electricity demand growth by 25% in 2015.

Iowa: (April) The Governor signs an executive order instructing state agencies to increase their operational energy efficiency and renewable energy use. The order mandates a 15% improvement in energy efficiency at state facilities by 2010, and the procurement of hybrid or alternative-fuel vehicles for non-law enforcement state vehicles.

New Mexico: (March) The legislature passes three bills to promote energy efficiency and renewable energy investments. (June) The Governor signs an executive order setting greenhouse gas target for the state: 2000 emissions levels by 2012, 10% below 2000 levels by 2020, and a 75% reduction below 2000 emission levels by 2050. New Mexico is the *first major coal, oil and gas producing state to set targets* for cutting greenhouse gas emissions.

New York: (July) Governor Pataki signs into law the *Appliance and Equipment Energy Efficiency Standards Act of 2005* which sets energy efficiency standards for appliances such as commercial washing machines; commercial refrigerators, freezers, and other commercial and household items. It is estimated that the standards will save consumers up to 2,096 GWh per year and up to \$284 m savings, while reducing carbon dioxide emissions by 870 kilo tons

North Dakota: (April) The Governor signs into law a legislative package encouraging wind power, ethanol, and bio-diesel and allowing in-state generated *Renewable Energy Credits* to be sold to out-of-state buyers, as well as lowering the barriers to siting wind power and investing in new transmission.

Rhode Island: (July) The Governor signs the Energy and Consumer Savings Act, under which joins *Washington, Maryland, Connecticut, Arizona, New Jersey, and California* in setting efficiency standards for household and commercial appliances.

Washington State: (April) The Governor signs a bill mandating that new public buildings meet the US Green Building Council's Leadership in Environmental Design (LEED) Silver standards. (May) The governor signs three bills, two with the aim of increasing supply and demand of renewable energy by ways of tax breaks to producers of solar equipment and 'feed-in' credits for solar and wind energy, and the third one adopting California's vehicle greenhouse gas emission standards for the state, making it the tenth state to do so. (May) Washington State joins Maryland, Connecticut, Arizona, New Jersey and California in adopting efficiency standards for 12 types of appliances.

Source: For more on these and other US domestic initiatives to combat climate change see 'State and Local News' at the Pew Center website: http://www.pewclimate.org/what_s_being_done/in_the_states/news.cfm

Box 1: Language pertaining to Impacts of Response Measures

FCCC

PREAMBLE

Affirming that responses to climate change should be coordinated with social and **economic development in an integrated manner with a view to avoiding adverse impacts on the latter**, ...

ARTICLE 4: COMMITMENTS

Art 4.1. All Parties ... shall:

(g) Promote and cooperate in ... research, systematic observation and development of data archives ... intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of **climate change and the economic and social consequences of various response strategies**;

(h) Promote and cooperate in the full, open and prompt exchange of relevant ... information related to the **climate system and climate change, and to the economic and social consequences of various response strategies**;

Art 4.8. In the implementation of the commitments in this Article, the Parties shall give full consideration to what actions are necessary under the Convention ...to meet the specific needs and concerns of developing country Parties **arising from the adverse effects of climate change and/or the impact of the implementation of response measures**, especially on:

(h) Countries **whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels** and associated energy-intensive products;

Kyoto Protocol

Art. 3.14. Each Party included in Annex I shall strive to implement the commitments mentioned in paragraph 1 above in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties, particularly those identified in Article 4, paragraphs 8 and 9, of the Convention. In line with relevant decisions of the Conference of the Parties on the implementation of those paragraphs, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, consider what actions are necessary to minimize the adverse effects of climate change and/or the impacts of response measures on Parties referred to in those paragraphs. Among the issues to be considered shall be the establishment of funding, insurance and transfer of technology.

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