



The Intergovernmental Panel on Climate Change

April 1996

Management Briefs are intended primarily for internal briefing purposes. However, those not classified confidential may be given to external contacts at the discretion of the recipient.

Summary

- The IPCC will shortly publish its Second Assessment Report (SAR) on Climate Change. This is the most comprehensive treatment of the subject ever produced and will cover the science, impacts, mitigation, adaptation, economics and socio-economic dimensions.
- The overall message can be paraphrased as:
 - Climate change poses a significant risk to society and to ecosystems.
 - Existing and foreseeable technology options can substantially reduce future emissions.
 - Governments have a wide range of policies available to address climate change.This would appear to be an invitation for political action. It offers no excuses for inaction.
- The most controversial statement in the report is:
"The balance of evidence suggests a discernible human influence on global climate." The world's press has already taken this to mean that climate change is already occurring, but this is a simplification of a complex issue that has no clear cut answers.
- There have been many criticisms of IPCC concerning scientific bias, technical weaknesses, and political influence but the IPCC has broadly succeeded in achieving objectivity and balance. However, Summaries for Policy Makers, the subject of a political negotiation process, have not succeeded so well in these respects.

This Management Brief gives an overview of the work of IPCC since its formation in 1988 and summarises the findings of the SAR with some counterbalancing Shell views.

Climate change is potentially the most serious and intractable environmental issue faced by mankind. If man is changing the climate, the environmental consequences could be severe. But also damaging would be the economic effects of unwarranted actions to limit greenhouse gas emissions. The problem is intractable because, for the most part, emissions of greenhouse gases and economic development are inextricably linked and because there is no single major source of emissions that can be targeted either by economic sector or by country. Carbon dioxide (CO₂), one of the main greenhouse gases of concern, has an atmospheric lifetime of more than 100 years so that its release into the atmosphere is for practical purposes irreversible.

Moreover, the science of climate change is highly uncertain both as to whether climate change is occurring already, and as to the magnitude, nature, regional distribution and

consequences of any climate change that might occur in the future.

The Intergovernmental Panel on Climate Change (IPCC) was jointly established in 1988 by the World Meteorological Organisation and the United Nations Environment Programme, to:

- assess the available scientific information on climate change
- assess the environmental and socio-economic impacts of climate change, and
- formulate appropriate response strategies

Parallel to the scientific and technical work of IPCC, a political process was initiated which culminated in the 'Rio' Conference on Environment and Development in June 1992 at which the Framework Convention on Climate Change (FCCC) was signed by 152 countries (plus the EU). The FCCC came

into force in March 1994 following ratification by the required number of signatories and this triggered a political process of negotiations that is independent of IPCC.

The Intergovernmental Panel on Climate Change

The IPCC is a unique international scientific body that has undertaken an unprecedented task to establish an accurate and objective assessment of the state of knowledge of how the natural world works and the likely impact of human activities on it, and to communicate that knowledge to governments.

The work of IPCC is organised into three Working Groups (WG) (see below).

The process is also unique. Governments nominate acknowledged leading experts in the field to join the WGs. Writing teams are selected by each WG Bureau from the government nominees. They are balanced as far as possible with respect to geographical representation and the range of views that exist. The teams have to develop some consensus for themselves.

Reports contain two types of material:

- Full Scientific Materials (FSM): these form the body of the reports and consist of the full length scientific reviews of the available literature, plus their technical summaries.
- Summaries for Policymakers (SPM): these are drafted initially by the WG Bureau but subject to member government revision.

FSM and SPM are formally reviewed and authorised in two stages. They are reviewed first by experts (including individuals in Shell and other oil companies), then by governments and non-governmental organisations (including IPCEA).

The plenary meeting of the WG must authorise both FSM and SPM before passing them to IPCC Plenary for final authorisation. The WG plenary may suggest changes to FSM but final responsibility for the text lies with the lead authors. The SPM is authorised in line by line detail to accommodate the differing views of governments. The SPMs are key, since these are the parts of the report most likely to be read by politicians and on which policies and actions are likely to be based.

The IPCC First Assessment Report – 1990

IPCC published its first full assessment in 1990 in four volumes. It has become a standard work of reference widely used by scientists and others.

The main scientific conclusions are summarised in the February 1995 Management Brief *"Climate Change"*.

Most importantly, it emphasised that "... there are many uncertainties in our predictions particularly with regard to the timing, magnitude and regional patterns of climate change, due to incomplete understanding of ..." key processes.

These cautionary words were well advised in the light of subsequent assessments which, while reinforcing the qualitative conclusions, have tended to suggest that the

quantitative effects will be less marked than suggested in the report.

The IPCC Supplementary Report – 1992

With the negotiations leading up to the Rio Conference and the FCCC, IPCC in 1991 requested that each of its three working groups should produce updates to their 1990 reports. These were published in 1992.

While this broadly confirmed the previous reports, the uncertainties in the estimates were re-emphasised. In particular it was recognised that the presence of sulphate and other aerosols in the atmosphere (e.g. from the eruption of Mt Pinatubo in June 1991) may have cooled the atmosphere, countering some of the warming that might have occurred due to greenhouse gases alone. The warming of 0.3 to 0.6 deg. Centigrade over the last 100 years was seen to be "broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability ... the unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more."

Climate Change 1994 (IPCC)

IPCC then undertook to produce a complete Second Assessment Report by the end of 1995. However, recognising that in the parallel political process, the First Conference of the Parties (COP) to the FCCC would be meeting in March/April 1995 in Berlin, IPCC agreed to produce a special report covering a limited range of topics of relevance to that Conference. The resulting volume covered "Radiative Forcing of Climate Change" and "An Evaluation of the IPCC IS92 Scenarios".

The most important conclusion from the policymakers' perspective was that stabilisation of greenhouse gas concentrations in the atmosphere at any level below 750 ppm (approx twice the present level) would require reductions in anthropogenic emissions well below 1990 levels. Implicit in this analysis was that 750 ppm CO₂ equivalent concentration in the atmosphere might be taken by policymakers as a quantitative target. The FCCC is silent on this issue, merely stating as its objective to stabilise "... greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system". IPCC has not made a determination of what level would be "dangerous", deciding that it needs political rather than scientific definition.

The IPCC Second Assessment Reports – 1996

The latest assessment is due to be published in April 1996. Started in 1992 it is a truly heroic product of over 1,000 authors contributing to 50 chapters in three volumes plus an IPCC Synthesis Report drawing together the results of all the working groups.

The major conclusions of the three WGs and the corresponding Shell comments (in italics) are summarised below.

WG1 The Science of Climate Change

- The balance of evidence suggests a discernible human influence on global climate.

This is probably the single most important and controversial statement in the whole of the 1996 Assessment. Leaks of the WG1 documents to the Press resulted in headlines such as "Global Warming is Already Underway" (Time Magazine, 02/10/95) and similar sensationalised versions are likely to appear on publication of the final assessment. It is a simplification of a very balanced treatment of the subject in Chapter 8 of the Assessment. A more balanced statement would be:

"The best evidence to date suggests that global mean temperature changes over the last century (0.3-0.6 deg. Centigrade) are unlikely to be due entirely to natural causes."

The main problem is the uncertainty in estimates of natural variability. This makes it difficult to detect whether climate change has occurred and whether any change can be attributed to human activities. The WG itself felt unable to predict when it would be possible to make a more confident statement about the detection and attribution of human induced climate change.

- General Circulation Models (GCMs), which are complex computer models of the global climate system taking account of interactions between the oceans and atmosphere, can now better simulate historic climate trends. In particular the cooling effects of sulphate and other aerosols in offsetting the warming effects of greenhouse gases in the atmosphere can be modelled and this provides a plausible explanation of why models that ignore this do not replicate the global temperature of the last century during which CO₂ equivalent concentrations have increased by some 40%.

Despite the improvements, climate models continue to have serious limitations to their ability to model the climate system. In particular, when ocean and atmosphere models which work well on their own, are 'coupled', large arbitrary 'flux corrections' have to be made to make the two parts compatible. In this way models are tuned or forced to simulate historic climate trends. This indicates that the models are imperfect. Several other important processes which may have negative or positive feedbacks on the climate are still not well represented, such as the role of clouds. The ability of models to discriminate regional patterns of climate is limited and the resolution is poor (grids of some hundreds of kilometres in size).

- To stabilise CO₂ concentrations at levels below 1,000 ppm (nearly three times today's level) greenhouse gas emissions must eventually fall well below 1990 levels.

This statement is widely accepted. It is important to understand the difference between the concentrations of greenhouse gases in the atmosphere and the levels of emissions. Even if global emissions were to remain constant at 1990 levels, atmospheric concentrations would continue to rise for the next two centuries reaching about 500 ppm by 2100.

- For the 'mid-range' IPCC emission scenario (IS92a), projected global changes through 2100 are now 1-3 deg. Centigrade for the global mean temperature, with a 'best estimate' of 2 deg. Centigrade, and

15-95 cm for mean sea level rise with a best estimate of 50 cm.

These are lower than the 1990 'best estimates' of 3 deg. Centigrade and 65 cm respectively. These reductions are due to lower emissions scenarios (particularly for CO₂ and chlorofluorocarbons (CFCs)), the inclusion of the cooling effects of sulphate aerosols and improvements in the treatment of the carbon cycle and the melting of ice.

The main issue here is the 'relevance creep' of the IS92a scenario. This scenario was originally developed as one of a set of illustrative scenarios to drive climate models. The fact that it came around the middle of the range of IPCC scenarios and was labelled 'Business as Usual' has led to its frequent use as the conventional wisdom forecast of emissions in the absence of climate change policies. The scenario is known to contain a number of internal inconsistencies. Coal increases by a factor of 7 by the middle of the next century, which would require the use of coal reserves considered by Shell to be beyond those economically recoverable. Nonetheless it is generally agreed that all emissions scenarios would lead to global temperature and sea level rises.

WG 2 Impacts, Adaptations and Mitigation of Climate Change

- There are substantial risks to society and ecosystems from:
 - sea level rise
 - temperature change
 - altered hydrological cycles
 - ecosystem shifts and degradation (possibly irreversible)
 - agricultural shifts
 - health effects (vector borne disease, heat stress etc.)
 - increases in extreme weather (floods, droughts, storms)

One of the major difficulties in establishing the impacts of climate change is to differentiate between the very considerable human induced impacts that are likely to occur even in the absence of climate change from the (sometimes smaller) effects superimposed on this due to climate change.

The above formidable list of impending crises fails to acknowledge that there will be beneficial effects of climate change in a number of areas, while in others the effects are probably of little consequence. Agriculture could well benefit in some areas from the CO₂ fertilisation effect, although other areas might suffer from reduced rainfall. Most economic activities (industry, transport, etc.) are relatively resilient to the postulated effects, and some countries (e.g. in Northern Europe) may actually prefer a change in climate. Health effects of climate change are emotive, but with little foundation. It is likely that the provision of health services related to economic development will be a much more important determinant. The suggestion that there will be increases in extreme weather events is one of the predictions from computer modelling. However, it is not supported by historical analysis of weather patterns. WG1 states "...data are inadequate to determine whether there

have been worldwide changes in variability and extremes [of weather]", although there are some regional increases and decreases in extreme events.

Ecosystem shifts and other irreversible effects that are not captured by conventional economics are indeed of concern. Possible non-linear effects of greenhouse gases on the climate system and ecosystems are also of concern.

- There is a large portfolio of mitigation and adaptation options available:
 - energy efficiency and supply:
 - 10% below baseline in 2-3 decades at little or no cost
 - 50-60% technical potential over 50 to 100 years
 - fuel substitution
 - carbon removal from combustion gases and storage (e.g. in deep ocean)
 - renewable energy
 - forest restoration and preservation
 - agricultural practices (reduction of nitrous oxide (N₂O) formation, increased carbon sinks in soil)
 - adaptation (e.g. sea defences, shifts in agricultural production areas)

WG3 Economics

- Significant 'no regrets' opportunities are available in most countries.

Economists argue that there is no such thing as a 'no regret' opportunity since allocation of resources in one area means that there will be regret that resources were not allocated in another area. In the context of the climate change debate 'no regrets' opportunities are defined as those that are economically justified in the absence of climate change. Market forces along with selected market stimulation programmes, will drive such changes.

- The risk of aggregate net damage due to climate change, consideration of risk aversion and the precautionary approach, provide rationales for actions beyond 'no regrets'.

This is the second of the two most contentious conclusions of the Assessment. Most industries have lobbied hard for actions to be limited to 'no regrets'. If the opportunities for 'no regrets' actions are large, then the need for actions beyond 'no regrets' is not obvious. Moreover, the Assessment provides no guidance on the degree of additional response required, which would be a matter of policy preference. On the other hand many economists argue that the scope of 'no regrets' actions is limited and that the economic costs of the scale of emissions limitations necessary to have a significant effect on atmospheric concentrations will be considerable in relation to the benefits obtained.

- Damage estimates are a few % of GDP, higher in developing countries.

A major problem for WG3 has been how to value the damage due to climate change. This is difficult enough for effects that have market prices (such as agricultural output) but is more so for non market items such as the value of human life (with considerable controversy over higher

values given by economists to life in developed countries as compared with less developed) and the loss of biodiversity. Many may consider that the uncertain loss of just a few per cent of global GDP at some ill-defined point in the future is a tolerable risk compared with the certain and near future loss of considerable GDP that would result from drastic emissions limitation. However, any economic losses will not be evenly distributed. Major losers are likely to be areas that emit relatively little greenhouse gases. This raises considerable problems of equity and burden sharing, two of the principles enshrined in the FCCC.

- Direct mitigation costs are likely to be offset by:
 - secondary environmental benefits such as the reduction of local pollution (SO_x, particulates) and maintenance of biodiversity
 - so called 'double dividends' from (carbon) tax recycling
 - benefits to non-market factors such as health, biodiversity, ecosystems maintenance

There would undoubtedly be some secondary as well as non-market benefits of actions to limit greenhouse gas emissions. In the European Union it is argued that the burden of taxation could be shifted from labour to resources like energy with the 'double dividend' of reduced unemployment and environmental improvements. In practice double dividends prove to be elusive and so far governments have looked at environmental taxes to help balance budgets rather than to reform the taxation system.

- Estimates of costs and benefits are sensitive to many factors:
 - future greenhouse gas concentration changes
 - the paths chosen for emissions abatement
 - assumptions about the availability of new technology

The most important factor as far as effects on the climate system is concerned is the amount of cumulative CO₂ emissions over a given period of time. However, the costs depend on the profile of emissions with time. Some analysts have argued for unrestricted emissions in the short term recognising the likely need for severe restrictions in the future. The risks from climate change would then become better understood and better and cheaper abatement options would become available. Nonetheless actions would need to be taken now so that the options to restrict emissions more severely in the future would be available. This is a strategy of "Learn then Act".

- The choice of policy options between rapid emissions abatement and delay awaiting further knowledge and possibly cheaper solutions, both involve economic and other risks.

This is the fundamental dilemma for the policy makers. It argues for a strategy of 'Act-Learn-Act'. Although climate change is a long term issue, today's responses do not have to be long term. They can be modified as further information becomes available. 'Irreversible' actions need to be avoided.

Policy Options arising from WGs 2 and 3

IPCC's mandate covers the analysis of policy options, but not policy recommendations. The main policy options put forward without any indication of priorities were:

- Putting in place appropriate institutional and structural frameworks
- Energy pricing strategies – for example, carbon or energy taxes, and reduced energy subsidies
- Reducing or removing other subsidies, for example agricultural and transport subsidies which increase greenhouse gas emissions
- Tradable emissions permits
- Voluntary programmes and negotiated agreements with industry
- Utility demand-side management programmes
- Regulatory programmes including minimum energy efficiency standards, such as for appliances and fuel economy
- Stimulating research, development and demonstration to make new technologies available
- Market pull and demonstration programmes that stimulate the development and application of advanced technologies
- Renewable energy incentives during market build-up
- Incentives such as provisions for accelerated depreciation and reduced costs for consumers
- Education and training; information and advisory measures
- Options that also support other economic and environmental goals.

The Future of IPCC

A Subsidiary Body for Scientific and Technical Assessment (SBSTA) was set up in the latter part of 1995 as mandated under the FCCC. The purposes of this body would appear to overlap with those of IPCC. However, a number of groups, including government delegations to FCCC negotiations have valued the attempts of IPCC to remain independent and apolitical and have wished it to continue its work. Accordingly the work of IPCC will become more closely linked to the COP process, and its inputs to SBSTA will be of considerable importance.

The work of IPCC will therefore continue into the foreseeable future. A Third Assessment is planned for the year 2000 and during this period IPCC will undertake special reports in support of the FCCC process commissioned with the approval either of a subsidiary body (such as SBSTA) or of the plenary of IPCC.

Future Group Activities

The Corporate Centre will continue to monitor the FCCC process and is reviewing the Group position on the issue. It will contribute to the public debate as necessary. These activities will be carried out mainly through industry associations such as IPIECA and ICC.

Shell Reference Sources

- Management Brief
 - Climate Change (February 1995)
- Speech
 - Future Sustainable Energy Supply (J.S. Jennings, October, 1995)

Copies of this Management Brief are available from Shell International Limited, SLBPA (JB).

Shell companies have their own separate identities, but in this publication the collective expressions 'Shell' and 'Group' are sometimes used for convenience in contexts where the reference is to companies of the Royal Dutch/Shell Group in general, or where no useful purpose is served by identifying the particular Shell company or companies.