THE KYOTO PROTOCOL AND

GREENHOUSE GAS EMISSIONS

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Paper prepared by the

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INTRODUCTION AND SUMMARY

Introduction and Caveats

This paper focuses on the mechanisms which signatories to the Kyoto Protocol have agreed to adopt in order to reduce the growth in anthropogenic (human-induced) emissions of greenhouse gases.

Its focus is specifically on the likely economic and environmental effects of the measures agreed to at the conference, along with appropriate government responses.

As such, it takes as its starting point the assumption that governments, including the Australian government, will adopt measures to slow the growth of net emissions of greenhouse gasses.

In taking this focus it specifically avoids addressing most of the fundamental questions in the global warming debate:

- are greenhouse gas emissions arising as a result of human activity contributing to a rise in global temperatures?
- if human activity is causing changes in climate, what is the magnitude and distribution of those changes?
- if the global climate is changing, what are the likely effects on the global environment?
- if the environment is changing, what are the likely effects on human welfare?; and
- if there are effects on human welfare, how should governments and international organisations respond?

This paper only addresses the last of these questions.

In ignoring so many fundamental questions, this paper is not trying to down-play their importance. It is not implicitly endorsing the theory of global warming by taking as its focus the actions which governments might take to reduce net emissions. Equally, in raising these issues as matters of debate rather than fact, it does not implicitly reject the existence of global warming.

Rather, it accepts the reality that:

- establishing definitive answers to these questions is beyond the capacity of this organisation, and indeed appears to be beyond the current capacities of the global scientific community (see Appendix);
- broad acceptance of the application of the precautionary principle to the issue of global warming means that governments and agencies will act to control emissions even in the absence of definitive answers to these questions;
- the Australian government and other governments are unlikely at this stage to renounce their acceptance of the need to adopt measures to reduce emissions, and have already committed to taking actions in order to stabilise emissions.

Further, while national and international debate has covered exhaustively the issue of whether actions need to be taken to address global warming, there has been rather less debate over whether the actions proposed will actually succeed in meeting their objectives.

In summary, this paper is concerned with the **effects** of implementing the measures agreed under to Kyoto Protocol, not with the validity of the conference's objective of seeking to control anthropogenic greenhouse gas emissions.

Summary

The key flaw of the Kyoto Protocol is that it seeks to address a global issue in terms of national boundaries.

In doing so, it ignores the fact that the volume of greenhouse gases emitted or absorbed within a given country is not a good measure of that country's true impact on global emissions, and will rapidly become less so if emissions-intensive production becomes harder in some countries than others.

The national focus of the Kyoto Protocol is also indirectly responsible for its second major flaw – that it is to take effect mainly in developed countries, whereas about half of current emissions and a growing proportion of likely future emissions derive from developing countries.

Unless developing countries are part of an international strategy to reduce greenhouse emissions, that strategy will not work. And unless developing countries can be accommodated in an emissions reduction strategy in an equitable way which does not preclude them from achieving economic development, they will refuse to participate.

For all of the flaws of the Kyoto Protocol, it is neither desirable nor feasible for Australia to walk away from international efforts to address climate change.

The Kyoto Protocol should be viewed as an unsatisfactory staging post on the way to establishing an effective and informed international regime addressing climate change. Further negotiations and refinements will be possible within the ongoing work of the UN Framework Convention on Climate Change. These opportunities should be pursued vigorously.

In the interim, Australia should pursue emission reduction and sequestration measures consistent with the Protocol, both as a matter of good policy and because it is prudent to anticipate what is likely to become an obligation, whether under Kyoto (if it comes into force) or some other future agreement.

However, until such time as it is obliged to do so, Government should not implement measures which would be required by its Kyoto obligations but which would be damaging both to the global environment and to the domestic economy.

Key Recommendations
An effective emissions policy should aim to:

- slow and eventually halt the growth in greenhouse gas emissions; and
- preserve and if possible increase the world's stock of greenhouse gas absorbing vegetation.

In order to meet these objectives, some combination of the following will be necessary:

- Improving the emissions efficiency of industry and households.
- Changing individuals' lifestyles and consumption patterns in order that fewer emissions-intensive products and services are consumed.
- Developing new technologies and products to replace existing emissions-intensive processes and activities.
- Improving existing technologies and products which can substitute for emissions-intensive activities but which for the present are not competitive.
- Instituting mechanisms to encourage the preservation and extension of carbon sinks.

In order that these objectives are achieved in a manner which minimises any detrimental impact on living standards, they should be pursued through mechanisms which facilitate efficiency. This would require:

- Neutrality of treatment between activities irrespective of whether they are undertaken by governments, businesses or consumers and without differentiation between sectors or locations.
- Symmetry of treatment between emission-producing and emission-absorbing activity.
- Universality, as near as possible encompassing both developing and developed countries.
- A heavily market-oriented process, so that emissions reductions are achieved at minimal cost to economic efficiency.

Many domestic initiatives should be pursued irrespective of the final fate of the Kyoto Protocol. Policy should focus on an approach of "least pain most gain".

Most of the principles outlined as part of an effective approach to international emission reductions are equally applicable within Australia, notably neutrality of treatment between different emissions sources, symmetry of treatment between emissions producing and emissions absorbing activity, and a market-oriented process.

All three of these objectives could be achieved through a comprehensive regime of tradeable emissions permits and sequestration credits.

"Least pain most gain" also requires the involvement in policy making of those who will have to put greenhouse policy into effect. Government should pursue a co-operative approach with industry so that regulators understand the effects of policy, the most effective way of implementing emissions controls and the conflict inherent in the three commitments which underpin the national greenhouse response.

Government itself has a key role in implementing appropriate policies on global warming. In particular, it can develop credible economic and environmental models and provide information and advice on policy implementation.

BACKGROUND: THE KYOTO PROTOCOL

In December 1997 parties to the Third Conference of the UN Framework Convention on Climate Change agreed in principle to a range of policies known as the Kyoto Protocol. It is intended to reduce industrial countries' greenhouse gas emissions by 5 per cent compared to 1990 levels by the first commitment period of 2008 to 2012.

The Protocol would bind 39 "Annex I" (mainly developed) signatories[1] to reducing emissions or emissions growth, and would enter into force when ratified by at least 55 parties to the Convention, including developed countries representing at least 55 per cent of the total 1990 carbon dioxide emissions from this group.

More than half of the 160 parties to the Climate Change Convention have signed the Protocol, but so far only fifteen[2] have ratified it, and these are mainly small island states. No Annex 1 country has ratified it.

Australian delegates secured recognition of the principle of differentiation at Kyoto. This allowed for different emission reduction targets between countries, and enabled Australia to negotiate a national target of an 8 per cent increase in emissions by the first commitment period, rather than the average 5 per cent reduction. This 8 per cent increase would still be almost 30 per cent below "business as usual" emission levels.

Australia also achieved in-principle recognition of credits for carbon sinks, although operational details of this and a range of other key principles have yet to be resolved.

The Australian initiatives finally incorporated into the Protocol were presented as a victory by the Government and its negotiators, and as an abrogation of responsibility by environmentalists.

ISSUES, PROCESSES AND IMPLICATIONS

The nature of the greenhouse hypothesis[1] raises novel and in some cases extremely difficult issues when seeking to find solutions to the problem.

Political Structures and Incentives

A comprehensive greenhouse response sits uneasily under existing political and institutional structures, in which the basic structure of political authority is the national government and many international bodies are coalitions of regional and/or economic association based on mutually reinforcing self-interest.

While many international treaties and conventions are binding, they typically bind governments to do things they would have done anyway, or which are evidently in their own mutual interest.

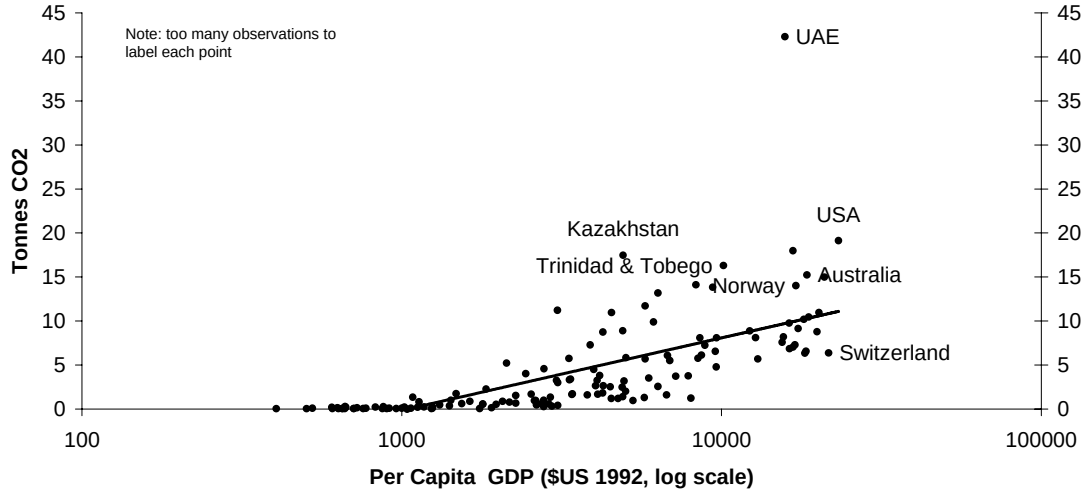
In the case of international agreements on greenhouse gas emissions the temptation to "free ride" is particularly strong. For any single national government, the optimal outcome will usually be for every country except its own to reduce emissions[3].

Further, reductions in greenhouse gas emissions are **only** beneficial to participants if other countries do the same. Even the governments of the world's largest economies cannot unilaterally stop the growth of emissions, as their contribution to global emission levels and growth is too small. So it would be pointless for any one government to pursue reductions in emissions within its own jurisdiction if other countries were not doing the same.

At the very least, this provides strong incentives not to be the first to commit to reductions. This may explain why those countries which have ratified the Kyoto Protocol so far have very

Figure 1

PER CAPITA INDUSTRIAL EMISSIONS AND GDP
142 Countries



Source: World Resources 1996-97

[1] see appendix for a summary of greenhouse and global warming issues

little to lose (they are not amongst the 38 subject to binding emissions targets) and potentially most to gain (many are island nations which could be badly affected by any rise in sea levels).

In contrast, trade liberalisation (for example) would be pursued by sensible governments whether or not other countries were doing the same. International trade is subject to binding international agreements because participating countries are net winners from most forms of trade liberalisation and gain even more from multilateral or plurilateral than unilateral dismantling of trade barriers.

National Solutions to Global Problems

The difficulty of addressing a global problem through the political frameworks of national governments is compounded because economic activity spans national boundaries.

Affluent countries certainly tend to produce more per capita emissions than poor ones (Figure 1). But per capita emissions by country are also strongly affected by resource endowments, industrial structures and export profiles. In particular, affluent countries with few energy resources tend to generate lower per capita emissions than those with many resources, but as they also tend to import energy (Figure 2) and resources, their net impact on global emissions may be just as large.

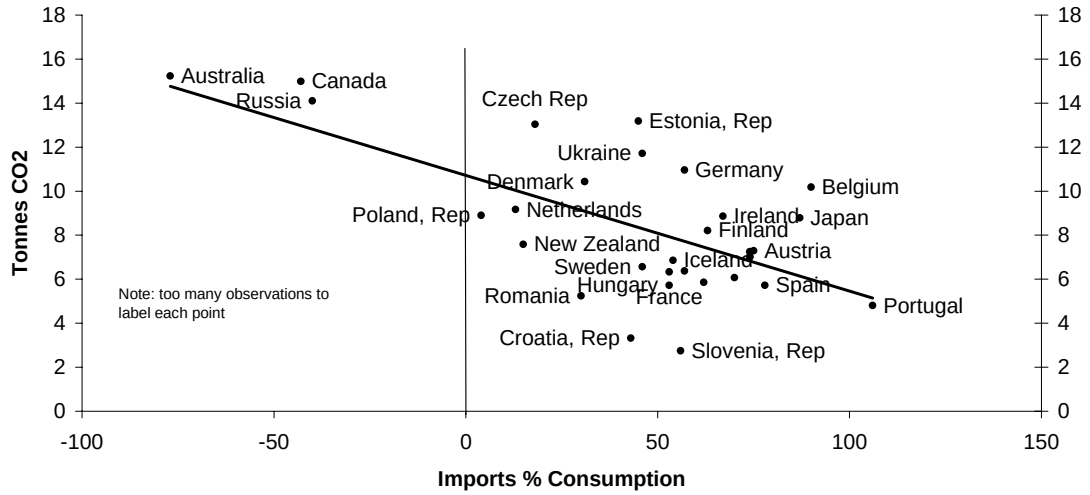
Some developing countries with large resource bases are intensive per capita emitters; but in those which are, a large proportion of emissions are generated in producing exports typically destined for developed countries.

Apparently similar economies have very different emissions levels – for example Norway emits 2½ times as much CO_2 per capita as Sweden, even though it is even less energy intensive[4] than Sweden (and much less intensive that the OECD average), and produces much domestic energy through the environmentally benign process of hydro-electricity.

Most of Norway's emissions are generated in the production of energy exports. Indeed, Norway has not been included in Figure 2 because its net exports are so large, at nearly 600

Figure 2

PER CAPITA INDUSTRIAL EMISSIONS & NET ENERGY IMPORTS
Commercial Usage, 31 Annex 1 Countries



Source: World Resources 1996-97

per cent of domestic consumption, that its inclusion would obscure the relationship between emissions and energy imports evident for other Annex 1 countries.

Trinidad and Tobago emits 2½ times as much per capita as Switzerland, which many estimates rank as the country with the world's highest GDP per capita. Trinidad and Tobago has a relatively small population (less than 1½ million) and its main export is energy.

By far the world's largest per capita CO_2 emitter is the United Arab Emirates.

Singapore is also a major emitter, not because it produces or uses unusually large amounts of oil, but because it refines it and exports the product elsewhere.

The world's demand for the products of emission-intensive industries will not abate overnight and will not disappear completely. In many cases demand levels will continue to grow unless the world economy is so badly stalled that developed economies cease to grow and under-developed countries fail to develop. Such a scenario would have even more catastrophic consequences for global human welfare than the predicted impact of global warming.

History has shown that changes in the availability of products and the competitiveness of regions and industries prompt rapid and comprehensive responses by markets, which in turn changes the composition of international economic resource use.

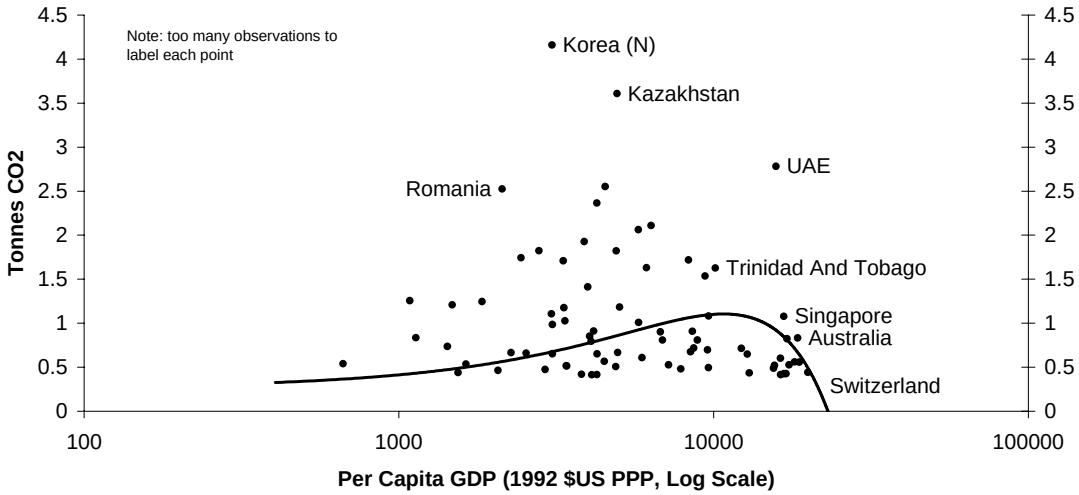
For example, OPEC's success in pushing up oil prices in the 1970s was the catalyst prompting the development of oil and gas industries from the Arctic Circle and the North Sea to Australia and South America. Norway would not be one of the world's largest per capita emissions producers but for OPEC.

A source-based policy for emissions control might be effective and equitable in reducing emissions if all sources were treated equally.

Even a source-based approach applying only to affluent countries could be equitable and at least partly effective, if all of the sources of those countries' contributions to global emissions

Figure 3

TOTAL INDUSTRIAL EMISSIONS (TONNES) PER $1,000 OF GDP
142 Countries



Source: World Resources 1996-97

were properly brought to account, along with similar treatment of emissions generated within their boundaries which contribute to consumption made elsewhere. The Kyoto Protocol does neither of these things.

Carbon Shifting

A government which institutes measures to reduce emissions from within its own borders may have no effect on global emissions if its citizens or former customers instead buy similar products sourced from countries not subject to emissions targets. This process is known as "carbon switching".

Indeed, a country-by-country approach could have some unwelcome and (probably) unintended consequences.

Industries which produce greenhouse gas emissions often produce other pollutants as well. The Kyoto Protocol could provide a veneer of respectability for the ongoing process of rich countries transferring dirty production processes to poor countries.

World Bank analysis of developing and developed countries' pollution patterns[5] points to a shift of polluting activity to poorer countries:

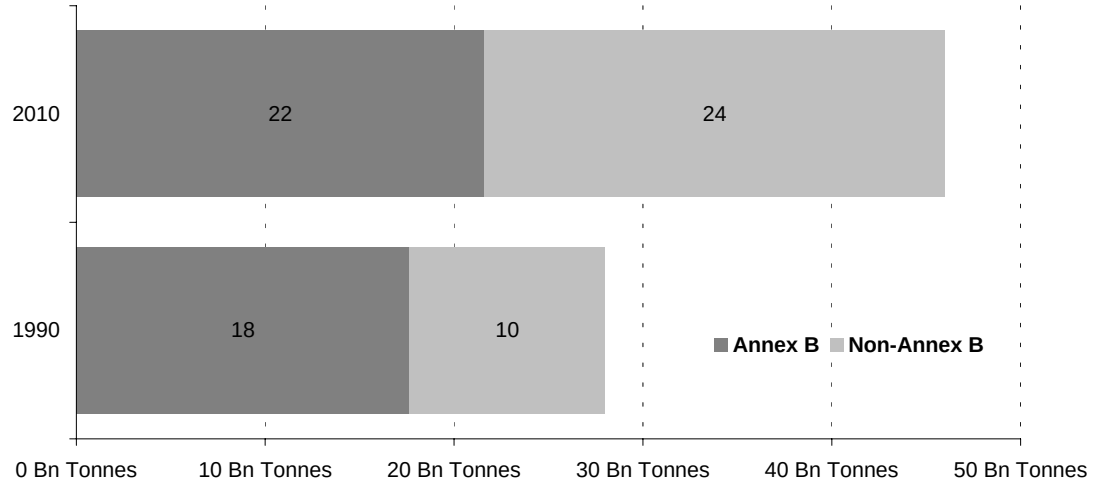
> *"Stricter regulation of pollution-intensive production in the OECD countries appears to have led to significant locational displacement, with consequent acceleration of industrial pollution intensity in developing countries. The poorest economies seem to have the highest growth in toxic intensity."*

Industrial $C0_2$ emissions as a percentage of GDP tend to show a bowed pattern (Figure 3) - they are low in very poor countries (with negligible industrial bases), highest in mid-income countries (with developing industrial bases) and relatively low in rich countries (which tend to derive most GDP from service industries).

In part this pattern reflects relatively low productivity and output levels rather than energy usage.

Figure 4

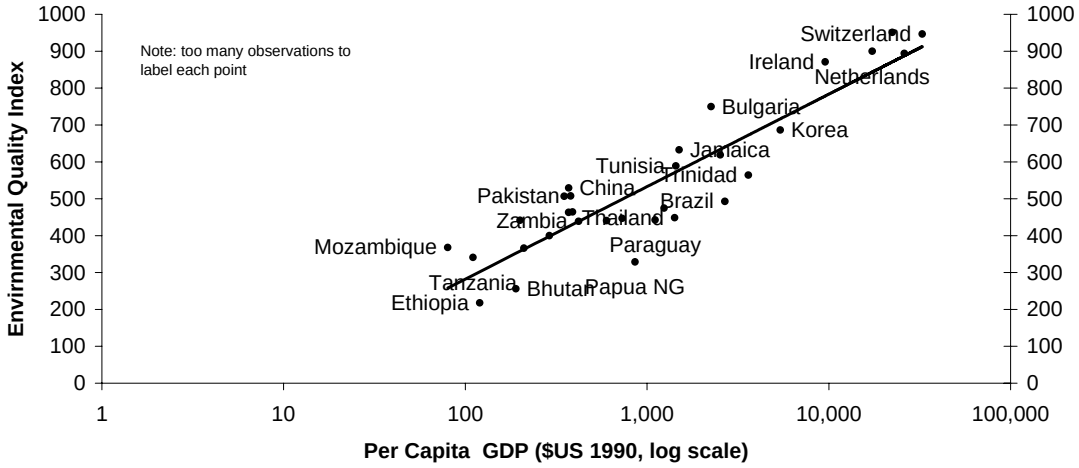
GLOBAL EMISSIONS, BILLION TONNES, CO2 EQUIVALENT
ABARE Reference Case Baseline



Source: ABARE Research Report 99.6

Figure 5

PER CAPITA GDP AND ENIVONMENTAL QUALITY INDEX
31 Countries



Source: Dasgupta, Mody, Roy, Wheeler (World Bank(*

Further, major industrial projects in developing countries increasingly use similar processes to those in developed economies – there is no necessary reason why production of a given good or service in a developing country should be more emissions-intensive than production in a developed one.

However, poorer countries quite reasonably place a lower value on environmental quality relative to economic growth than rich ones.

To the extent that demand for the products of emissions-intensive industries might increasingly be satisfied from countries with comparatively few environmental restrictions (including greenhouse gas emissions targets), there is a risk that the average quantity of greenhouse gas emissions and pollutants associated with production of a given level of output would increase. The effect of the Kyoto Protocol could be to reduce global average emissions efficiency.

The same World Bank study points to high pollution during early stages of economic development. It found that:

> *"manufacturing emissions relative to GDP grow faster than GDP at lower levels of per capita income and slower than GDP at higher levels of income"*

As developing countries escape poverty, their tolerance for environmental damage in return for economic growth tends to diminish. More affluent countries can more easily afford to protect their environments, and place a higher relative value on environmental quality.

Another World Bank study[6] found a strong positive correlation between affluence and an index of environmental quality composed of measures of water, air, land and living resources (Figure 5). It concluded that:

> *"the income elasticity of environmental policy performance is positive and highly significant in all environmental dimensions"*

It suggested that such a result is predictable and rational:

> *"Governments must make resource allocation decisions with constrained budgets, so we would expect the benefits of environmental improvement to be weighed against opportunity costs. In particular, environmental management has to share a limited social welfare budget with public health, education and other needs. Therefore the poorer the country, the more limited environmental management resources are likely to be…"*

The Kyoto Protocol could transform poorer countries' temporary acceptance of environmental damage - as the inevitable cost of initiating economic development - into a permanent source of comparative advantage.

Equity and Universality

On a per capita basis, citizens of developed countries contribute most to global emissions. (Figure 1). Most of the increase in emissions over the past 200 years arose because of developed countries' economic expansion.

Developing countries understandably argue that the existing greenhouse problem is rich countries' responsibility. Further, they claim to have the same right to pursue economic growth as those countries which industrialised earlier, even if this means making the same addition to greenhouse gas emissions in the process. Again, this is a reasonable argument.

Yet on an aggregate basis, almost half of the world's greenhouse gas emissions already come from developing countries, and most projections indicate that this share will grow rapidly over the next few decades (Figure 4). Even assuming no change in the distribution of economic activity as a result of implementing the Kyoto Protocol, reductions in emissions in the richer countries alone will not be enough to halt the growth of global emissions. A more realistic model, which assumes that some emissions-producing activity would switch from countries with emission controls to those without (see "carbon-switching" above), could see a negligible slowing in global emissions growth (and could conceivably show that the Kyoto Protocol will generate an increase in emission levels).

Australia gained some limited measure of success at Kyoto in establishing the principle of differentiation. This means that some recognition is given to issues such as differences in countries' industrial structure, relative affluence, economic growth profiles and rates of population growth. But differentiation applies only to those 38 countries which would be obliged to restrict emissions under the Protocol. The formula is inadequate to address the more extreme but more serious task of establishing an equitable baseline for an emissions reduction policy encompassing both developed and developing countries.

It looks less adequate still as a basis for a truly comprehensive policy encompassing the world's capacity to absorb greenhouse gases as well as the growth in their production.

Again, Australia gained some success in winning broad acceptance of emissions-absorbing carbon sinks at Kyoto. But the concept applies only to developed economies and takes as its baseline the status quo within those countries.

A global warming policy which fails to recognise and recompense the substantial externality benefits conferred by existing natural resources which absorb greenhouse gases (of which a large part comprises the forests and other vegetation of less developed economies) is at best highly partial.

A comprehensive policy on global warming should not only aim to slow and eventually reverse the growth of greenhouse gas emissions. It should also aim to slow and eventually reverse the diminution of greenhouse gas absorbing resources in the global environment.

In summary, the projected effects of greenhouse gas emissions constitute a global problem which can be solved only through a global response. While many other environmental issues span national barriers (eg acid rain), most have some regional or other geographic dimension. The greenhouse hypothesis implies that the activities of people in one country or region can have ramifications for people on the other side of the world; or, more accurately, everywhere in the world.

Unless developing countries are part of an international strategy to reduce greenhouse emissions, that strategy will not work. And unless developing countries can be accommodated in an emissions reduction strategy in an equitable way which does not preclude them from achieving economic development, they will refuse to participate.

Conclusions on Kyoto And Global Warming

It is to be hoped that the greenhouse sceptics are proved correct (see The Greenhouse Sceptics on page 26). But the evidence supporting the theory of global warming suggests that they may not be. And even if they are eventually proved correct, governments are acting on the basis of the "the precautionary principle", which indicates that we should take action to avert potentially catastrophic events even if we are not certain that they will in fact occur.

In many respects global warming is no longer primarily a scientific issue, but a trade, equity and economic one.

The Australian and other Governments have accepted that we should be taking action to slow the increase in greenhouse gases in the atmosphere. But the most effective actions that could be taken are not encouraged under the rules of the Kyoto Protocol.

The key flaw of the Kyoto Protocol is that it seeks to address a global issue in terms of national boundaries.

In doing so, it ignores the fact that the volume of greenhouse gases emitted or absorbed within a given country is not a good measure of that country's true impact on global emissions, and will rapidly become less so if emissions-intensive production becomes harder or more expensive in some countries than others.

The national focus of the Kyoto Protocol is also indirectly responsible for its second major flaw – that it is to take effect mainly in developed countries, whereas almost half of current emissions and a growing proportion of likely future emissions derive from developing countries.

It is understandable that developing countries would be reluctant to participate in a greenhouse gas reduction program along the lines agreed at Kyoto.

It starts with *status quo ante* as its baseline for emission targets, presenting a clear advantage for countries and regions which have already industrialised compared to those which hope to do so.

It pays scant and ill-defined regard to relative resource endowments, economic and industrial structures, rates of population growth or the impact of current levels of (rather than change in) carbon sinks.

If the measures adopted to reduce greenhouse gas emissions are to be effective, they must go beyond the processes proposed in Kyoto. Finding effective ways of reducing global greenhouse gas emissions is a task of unprecedented complexity and difficulty. But the alternative is to continue pursuing solutions which will be inadequate.

POLICY IMPLICATIONS AND PRINCIPLES

For all of the flaws of the Kyoto Protocol, it is neither desirable nor feasible for Australia to walk away from international efforts to address climate change.

If the threat of climate change is real then it is appropriate that Australia should participate in efforts to avert its potential effects.

It is also appropriate that developed countries should spearhead efforts to reduce emissions.

While a global effort must ultimately include developing as well as developed economies, this will only be possible when developing countries can be brought into an emissions reduction regime without penalising them for their lack of past development or preventing them from achieving development in future. This is likely to take some considerable time.

On a more practical level, Australia has far more prospect of achieving beneficial changes in international agreements on reducing emissions if it is a participant in the process. The concessions on carbon sinks and an increased emissions target which Australia negotiated at Kyoto could not have been achieved if Australian negotiators were not present.

Australia is rightly recognised as a country with more to lose than most from inappropriate climate change policy (see page 17). Inevitably this has tended to mean that its credibility suffers from the suspicion that it is motivated more by self-interest than good policy design. In reality, the two objectives coincide to a large extent, although even an optimal policy will leave Australia carrying proportionately more costs than most.

In short, the Kyoto Protocol should be viewed as an unsatisfactory staging post on the way to establishing an effective international regime addressing climate change. Further negotiations and refinements will be possible within the ongoing work of the UN Framework Convention on Climate Change. These opportunities should be pursued vigorously.

An Effective Global Emissions Policy

At the risk of stating the obvious, an effective policy to stabilise net greenhouse gas emissions should aim to:

- slow and eventually halt the growth in greenhouse gas emissions; and
- preserve and if possible increase the world's stock of greenhouse gas absorbing vegetation.

In order to meet these objectives, some combination (probably all) of the following would be necessary:

- Improving the emissions efficiency of industry and households.
- Changing individuals' lifestyles and consumption patterns in order that fewer emissions-intensive products and services are consumed.
- Developing new technologies and products to replace existing emissions-intensive processes and activities.
- Improving existing technologies and products which can substitute for emissions-intensive activities but which for the present are not competitive.
- Instituting mechanisms to encourage the preservation and extension of carbon sinks.

In order that these objectives are achieved in a manner which minimises any detrimental impact on living standards, they should be pursued through mechanisms which facilitate

efficiency – that is, they should yield the maximum environmental benefit for the minimum economic cost. This would require:

- Neutrality of treatment between different emissions sources – any emissions penalties (such as carbon taxes or charges for emissions permits) should be applied equally to all activities irrespective of whether they are undertaken by governments, businesses or consumers and without differentiation between industries or locations.
- Symmetry of treatment between emission-producing and emission-absorbing activity, so that the benefit from enhancing the world's capacity to absorb greenhouse gases is proportional to the penalty for adding a similar amount to emissions.
- Universality, as near as possible encompassing both developing and developed countries.
- A heavily market oriented process, so that individuals' preferences are the ultimate determinant of where economic activity shifts to and from, and competition ensures that businesses have the incentive and opportunity to meet these preferences as effectively as possible.

Such an approach would start to address some of the equity issues which currently prohibit the inclusion of developing as well as developed countries in the emissions reduction process. In particular, it would mean that:

- The externality costs of contributing to emissions reductions would be reflected in prices and be carried in proportion to the extent that an individual, country or business contributes to net emissions. Rich countries and individuals would typically pay most.
- The externality benefits of carbon sinks would be reflected in carbon credits or some other mechanism which would encourage the preservation and enhancement of vegetation resources. This would tend to benefit under-developed countries, although its impact would be highly uneven.

Australia's Response to Kyoto and International Negotiations

Realistically, the achievement of such an agenda is a very long way off. Nonetheless, without most or all of these features a policy aimed at reducing the growth of global emissions is unlikely to be effective.

Given its commitment to participate in efforts to reduce the growth of emissions, the Australian government's international focus should be to move international emissions policy towards a move effective mechanism for controlling the growth of greenhouse gasses. In particular, its longer term aims should be:

1. To pursue measures to promote a positive variation on "carbon shifting", by encouraging emission-intensive activities into locations, jurisdictions, markets and technologies where they can be pursued most efficiently in terms of emissions per unit of output. In the long term, location and jurisdiction should make no difference to the treatment of emissions producers.

2. To pursue means of equitably including developing as well as developed countries within the global greenhouse gas emissions regime.

In the short to medium term, there are measures which Australia can pursue which will improve the effectiveness of current international arrangements. Policy should aim to:

1. Support an Australian negotiation position which changes the calculation of Annex 1 countries' net impact on global emissions to more effectively recognise the impacts of international trade by:

- More fully reflecting the effects of consumption on global emissions whether those emissions arise from production within that country's boundaries, in the production of exports in another Annex 1 country, or in the production of exports in a country not bound by the Kyoto Protocol.
- More fully reflecting the net emissions arising from exports irrespective of whether those exports are destined for another Annex 1 country, and accounting for substitution effects.
- Pursuing measures to minimise detrimental "carbon shifting" (the transfer of emission-producing activities from Annex 1 countries to non-Annex 1 countries) if those countries are relatively inefficient in terms of emissions produced per unit of output.

3. Pursue a clearer and more appropriate definition of carbon sinks.

4. Ensure that measures to reduce emissions are flexible and market driven with the aim of maximising efficiency and minimising the economic cost of achieving emission reductions.

5. Encourage further research on the global and regional magnitude and impacts of climate change and the economic and social implications of policies to address that change.

Australia's Response to Climate Change

It is far from clear when (or whether) the Kyoto Protocol will be ratified by enough countries for it to enter into force, let alone the degree of success which might be achieved by the Australian Government in negotiating a more equitable and effective international response to global warming.

Further scientific research may reveal new data on the effects of human activity on global temperatures.

In the interim, the Australian government has committed to a range of actions to reduce the rate of growth of net emissions from Australia.

In this context, Australia should pursue emission reduction and sequestration measures consistent with the Protocol, both as a matter of good policy and because it is prudent to anticipate what is likely to become an obligation, whether under Kyoto (if it comes into force) or some other future agreement.

However, until such time as it is obliged to do so, Government should not implement measures which would be required by its Kyoto obligations but which would be damaging both to the global environment and to the domestic economy.

The Australian Government has committed[7]. to:

- meet its commitments under the Kyoto Protocol;
- protect the hard-won international competitiveness of Australian industry; and,
- achieve significant growth in the Australian economy and the number of available jobs.

These commitments are mutually incompatible. Although negotiation of an improved international framework for global warming policy would go a long way towards addressing the key flaws of the Kyoto Protocol, in reality even an optimal policy would imply costs for the Australian economy. This reality must be faced if a realistic and appropriate domestic agenda for reducing global emissions is to be developed (see below).

Within Australia, policy should focus on an approach of "least pain most gain". Most of the principles outlined as part of an effective approach to international emission reductions (page 13) are equally applicable within Australia, notably:

1. Neutrality of treatment between different emissions sources irrespective of whether they are generated by governments, businesses or consumers and without differentiation between industries or locations.

2. Symmetry of treatment between emissions producing and emissions absorbing activity.

3. A market-oriented process which allows business innovation and competition in conjunction with consumer preferences to be the key determinant of how resources shift in response to greenhouse policy.

All three of these objectives could be achieved through a comprehensive regime of tradeable emissions permits and sequestration credits. Such mechanisms may ultimately form part of global emissions control, but a range of equity, administrative and jurisdictional issues will have to be resolved before this can be achieved. These issues do not apply within national boundaries. Emissions trading is the mechanism most likely to ensure that limits on total emissions are accommodated in the most economically efficient manner.

"Least pain most gain" also requires the involvement in policy making of those who will have to put greenhouse policy into effect. Government should pursue:

4. A co-operative approach with industry so that regulators understand the effects of policy, the most effective way of implementing emissions controls and the conflict inherent in the three commitments which underpin the national greenhouse response.

5. A primary focus on voluntary and "no regrets" measures, such as the Greenhouse Challenge.

6. Support for networking, information exchanges etc, such as the Australian Industry Greenhouse Network.

Government itself has a key role in implementing appropriate policies on global warming. In particular, it should focus on:

7. Development of credible economic and environmental models to test the effects and magnitude of global warming and the implications of different approaches to greenhouse policy on the environment, the economy and the community.

8. Greenhouse policy should be co-ordinated and integrated across government activities, agencies and jurisdictions.

9. Providing information and advice on policy implementation, and in particular educating the public on ways of improving households' energy efficiency and reducing their contributions to net emissions.

Why It Matters: Implications of Global Warming Policies for WA and Australia

The Kyoto Protocol

Australia has more to lose than most other "Annex 1" countries from both the economic changes which the Kyoto Protocol seeks to impose, and from the predicted climatic changes which it will fail to prevent.

Australia could be characterised as a country with a first world living standard and a third world export profile. Hence its standard of living means that it is among the "Annex 1" countries committed to reducing emissions.

But its export profile is such that:

- Australia's export sector has a higher representation of emissions-intensive industries such as agriculture and resources than most other developed economies.

- The alternative sources of these products – and hence Australian businesses' competitors – are often from developing rather than developed economies. Any measures to reduce Annex 1 countries' production of agricultural and resource commodities would be more likely to generate a shift in demand towards non-Annex 1 countries than a reduction in their overall usage. The net effect on global emissions will depend on whether non-Annex 1 countries are more or less efficient in the production of these commodities.

- A large proportion of Australia's exports are sold to non Annex 1 countries. The Kyoto Protocol makes no provision for credits for activities which generate emissions in Australia but also lead to a reduction in emissions in the countries to which it exports.

These features are the main reason[2] for Australia's relatively high per capita emissions compared to other developed economies.

Australia also faces a bigger challenge than most Annex 1 countries because of its relatively rapid population growth. Over the past 20 years Australia has experienced the third fastest population growth in the OECD (after Turkey and Mexico, neither of which are Annex 1 countries). Although population growth is slowing, Australia's population is still projected to increase by more than 20 per cent between 1990 and 2010. In contrast, many other Annex 1 countries are likely to have static or even falling populations over the same period.[8] In this context, the 8 per cent increase in emissions which Australia negotiated at Kyoto is a very difficult target.

For most of Australia's agricultural and resource exports, international trade is commonplace and a range of alternative sources exists. So if Australia reduced its production or raised its costs for these products, the effect would most likely be that customers would buy from non-Annex 1 countries[9]. Unless world demand for these commodities is reduced, or non-Annex 1 countries produce them in a less emission-intensive manner than Australia, the net effect on world emissions will be negligible (or negative) while the impact on Australia's economy could be severe.

Western Australia's industrial and export profile is even more heavily based on resources and agriculture than the rest of Australia. WA has more to lose than any other state if greenhouse

[2] other factors include Australia's large area and low population density, which necessitate more business and personal transport activity than in smaller countries.

gas control policies do not take better account of the distinction between the place where emissions are generated and the net effect of production on world emissions.

To an extent, Australia is fortunate that the Kyoto Protocol takes *status quo ante* as its baseline. Its economy in 1990 (the baseline for emissions targets) was similarly more reliant on primary production and exports than other developed economies, and also produced more emissions per capita than other developed economies. The contributions of mining and agriculture to national output and exports have changed little since then, and have if anything declined somewhat[10].

Yet changes *within* Australian illustrate the dangers of prescriptive or geographically determined approaches to emissions reductions. While the overall contribution of resources to the Australian economy has not changed much in recent years, its distribution has. In particular, Western Australia's share of national resource sector output has risen from 30 per cent in 1989-90 to 44 per cent in 1997-98, as a range of mining activities and especially the energy sector have expanded[11]. Such changes in the location and distribution of resource industries are not uncommon, and are driven by discoveries of new resources, price changes or technological changes which make exploitation of resources viable. Any effective greenhouse policy must accommodate such shifts in viability, whether within countries or between them.

Finally, the large land area and low population density of Western Australia and Australia make it plausible that their net contributions to greenhouse gas emissions could be more easily reduced through increasing absorption (through sequestration, or the development of carbon sinks), rather than relying mainly or exclusively on reducing emissions.

In short, Australia's and Western Australia's economies are particularly vulnerable to the deficiencies of the Kyoto Protocol because:

1. Their competitors are largely in non-Annex 1 countries. Producers may lose markets if government policies on climate change place Australian producers at a cost or regulatory disadvantage. Such a switch would have no beneficial effect on global emission levels.

2. Many of their key export destinations are also non-Annex 1 countries. Trade with these countries may increase Australia's emission levels but reduce global emissions, by substituting emission-intensive for less-intensive products (for example, producing LNG for export generates emissions in Australia but reduces emissions globally, as the gas is substituted for more emission-intensive fuels such as coal).

3. Australia and Western Australia could potentially make a significant contribution to reducing the build-up of greenhouse gases by increasing their stock of greenhouse gas absorbing vegetation. Such sequestration measures were only included in the Kyoto Protocol at Australia's insistence, and are still poorly defined.

Effective Policy

Even without these problems arising from the particular approach to emissions reductions adopted at Kyoto, Australia would bear a disproportionate economic burden from a genuine effort to reduce growth in global greenhouse gas emissions.

An effective greenhouse gas policy would see the use of emission-intensive products diminish, in some cases in absolute terms and in others relative to growth in the world economy. It would see the cost of emission-intensive products and production increase, and a tendency for demand to shift towards substitutes. All of these effects would be unavoidable consequences of an effective international effort to reduce the growth of emissions, and should be recognised and accepted.

These effects may well coincide with particularly adverse climatic changes in Australia arising from global warming. Although the climate change models are a long way from predicting national and regional effects with any certainty (see Appendix), the suggested outcomes include more frequent episodes of extreme weather conditions (cyclones, droughts and flood) and more frequent occurrences of the El Nino effect.

In addition, Australia shares with other Annex 1 countries the challenge of reducing the level of emissions which arise from its domestic activities. Among other effects this could entail substantial increases in fuel and energy prices, changes in industrial and agricultural production methods, changes in building design and transport use, and a host of other adjustments.

This prospect is nothing like so daunting as it might appear. Economic change is a fact of life in developed economies and, over time, produces similarly profound alterations in industrial structure and individual lifestyles as a matter of course.

But it does mean that facing up to Australia's responsibilities under an effective climate change policy will entail costs. Prices of some products will increase. Individuals' lifestyles, transport patterns and consumption patterns will have to change. The relative contributions of industries, regions and activities to economic life will alter markedly, and there will be major losers as well as winners from the process. A co-ordinated approach to Government policy could help enormously in this respect, for example by ensuring that rural community which are net losers from efforts to reduce agricultural emission levels are also net winners from the new benefits flowing from sequestration.

While Australia will be a net loser under such a process, it would create opportunities as well as costs. If Australian businesses take advantage of the shift in domestic and world production towards reducing the emissions levels associated with existing activities, or looking for less emissions-intensive alternatives to existing products and processes, it will help to mitigate the costs to the domestic economy.

Once again, the key here is for governments to adopt policies which are neutral between different industries and activities, and market-oriented. A policy response which saw government subsidising uneconomic activities in the name of greenhouse policy, or other attempts to "pick winners", would be most likely to lead to an outcome of "most pain least gain".

In summary, for governments which accept the greenhouse hypothesis, or at least the precautionary principle, the key question becomes one of implementing emissions policies which:

- are effective in meeting the government's objectives of controlling net emissions; and
- achieve those objectives in a way which inflicts least cost on standards of living for most environmental benefit.

At international, national and state levels, such an approach is still a long way off.

POLICY IMPLEMENTATION

It is vital that any policy measures to address climate change are devised in a co-ordinated and consistent manner within a clear framework of policy principles. The preceding sections have outlined what those principles should be, and why they are important.

The following section contains a discussion of measures which might be adopted within that framework. It includes some examples of what industry is already doing to address greenhouse issues, some firm suggestions on what government ought to be doing and some tentative discussion of further measures which might prove beneficial.

Tradeable Emissions Permits and Sequestration Credits

Tradeable emissions permits and sequestration credits represent the mechanism most likely to ensure that limits on net emissions are achieved in the most economically efficient manner.

The key benefit of tradeable permits is that emissions will tend to be incurred or offset in the most economically efficient way. Low-value producers will find it more profitable to sell permits and withdraw from emissions-producing activity than to continue production. High-value users will be able to enter the market and engage in production without being debarred through prohibitions on new emitters.

The adoption of new technology will be accelerated, both because there is a price incentive to innovate to reduce emissions, and because newer, more efficient technology will have a competitive edge and be able to outbid older and less efficient producers in competition for emissions rights.

Such a mechanism relies on markets rather than regulators to make the adjustment to an environment in which net additions to greenhouse gases are controlled.

If it is less costly to create a carbon sink than to withdraw from emissions production, then businesses will plant trees and continue to produce, yielding the same net effect on emissions at the least economic cost.

Tradeable credits and permits would be most effective if their application is consistent with the policy principles of equity and symmetry. So all emissions should be substitutable regardless of the industry or location of the emitter, and the value of sequestration measures which reduce net emissions should be equal to the cost of generating a comparable level of emissions.

However, the efficacy of any system of traded emissions permits will depend crucially on how it is implemented. There should be parallel consideration of other flexibility mechanisms such as Joint Implementation and the Clean Development Mechanism.

Similarly, further research and consultation is needed before a suitable basis for sequestration credits can be established. All net sinks should be included, not just the current definitions of “forest” and “reafforestation” being developed under the negotiations for the Kyoto Protocol. Industry is interested in the possibilities for purchasing emission credits. Business groups such as ACCI could provide a focus for business involvement on this topic.

Cost Benefit Analysis

Evaluating “least pain most gain” policies is more formally known in economic jargon as cost-benefit analysis. The techniques of cost-benefit analysis should be applied in evaluating and establishing priorities for the implementation of measures to combat climate change.

Priority should be given to measures which yield the most benefit in net emissions reductions relative to the costs incurred. This paper emphasises that the first step of a greenhouse policy should look at "no regrets" measures because they have negligible or positive impacts on costs. Such measures may not prove adequate to deliver a sufficient deceleration in net emissions, but they have the merit of providing immediate and cost-free benefits while more costly and complicated measures are given proper consideration.

Information Provision

Many businesses have already made significant progress in pursuit of "no regrets" emissions-reducing measures. These are actions which improve emissions levels with negligible or even positive effects on the bottom line (such as improvements in energy efficiency). Such measures have been adopted most frequently (though not exclusively) in larger businesses in emissions-intensive industries.

Governments can play a useful role in signalling opportunities for low cost or no cost "no regrets" measures in areas where take-up has been lower, such as households and smaller businesses. Simple public information campaigns could provide pointers to energy saving and other emissions-reducing activities across the community.

Information Exchange

Ministerial Greenhouse Council
A key function of the National Ministerial Greenhouse Council and the Australian Greenhouse Office is to develop jointly an understanding of how Australia will be affected by international decisions, and to explain this joint understanding to governments, emitters, managers of sinks and non-government organisations.

Business Associations
Business groups and associations (including CCIWA and ACCI) have an important role in communicating the impacts of government decisions on businesses and advising its members. One mechanism currently used for information exchange is the Australian Industry Greenhouse Network.

Many businesses are already active in assessing and implementing "'no regrets" measures for greenhouse gas abatement. Many significant industrial emitters are active participants in the Greenhouse Challenge Program, which provides a structure for detailing the effectiveness of emissions reduction efforts.

Business groups such as ACCI and CCIWA should publicise these achievements as a means of encouraging more widespread adoption by industry, and of countering public misconceptions that industry is doing nothing to address greenhouse issues.

ACCI already provides a national focus for a range of issues of common interest to its State and sectoral members. The meetings of the Australian Manufacturers Environmental Group and the Environmental Officers Group have included greenhouse issues over several years. Individual States are proceeding at different paces and with different emphasis.

State and sectoral industry bodies should be encouraged to adopt the above national policy framework and to implement the most cost-effective measures within their memberships.

Research

One of the key difficulties in developing an international policy on climate change is the uncertainty surrounding the magnitude (or even existence) of any impact of human activity on

the global climate, and the impact of climate change on human welfare at a global or regional level (see Appendix). These difficulties are further compounded by an equally poor understanding of the effects on human welfare of measures to combat climate change.

At an international and national level, proper policy formulation is hamstrung by such uncertainties. Reaction to the Greenhouse issue should be based on the most accurate predictions of its effects. For example, options for development of longer-term sinks will be influenced by changes in rainfall patterns.

Besides encouraging international research to develop a clearer picture of global climate change, government should encourage academic initiatives to improve the predictions of climate change at the global and regional scale, and to use these predictions to inform decision-making on priorities for emission abatement and adaptation strategies.

Policy cannot be effective without the development of an internationally accredited, scientifically valid mechanism for greenhouse gas inventories, and its use in estimating a national inventory for tracking progress on emissions. The inventory must provide a sound base for establishing priorities using benefit-cost analysis.

Policy Administration

Australian Greenhouse Office
Greenhouse is designated as a whole-of-government issue, with joint implementation through a Ministerial Council. However, the administrative responsibility for the Australian Greenhouse Office rests with Minister for Environment, and other Ministers and their departments appear to have little influence on its deliberations. A more balanced outcome could be by having more input from economic agencies with responsibility for development and trade.

Implementation Plan for the National Greenhouse Strategy
It is in the national interest that the Implementation Plan for the National Greenhouse Strategy is both comprehensive and integrated, and reflects economic and social as well as environmental impacts. To be effective, the response also must be timely and based on sound information. Significant resources are required to complete this task well, and are needed as a matter of urgency to address priority issues.

No State Regulation
The profound deficiencies of the international policy framework for dealing with greenhouse issues necessitate a somewhat different agenda being adopted within Australia.

There is (or should be) no comparable deficiency in the capacity of the national government to implement climate change policy which would warrant an additional layer of regulations within state jurisdictions.

Further fragmentation of climate change regulations would compound the deficiencies of trying to address a global problem within geographically defined jurisdictions, as outlined in section National Solutions to Global Problems on page 6. However, State-based agencies can play a number of useful roles in developing and implementing greenhouse policy. These include:

- developing local inputs into policy formulation
- tailoring local responses to the greenhouse issue,
- providing information relevant to the practices of local businesses and communities

Issues Specific to Western Australia

Whole-of Government Approach
CCIWA has taken the view that Greenhouse requires a whole-of-government response, focussed within the Department of Premier and Cabinet, rather than the current delegation to Minister for the Environment and Department of Environmental Protection.

It is in the interests of the State to develop a State Implementation Plan for the National Greenhouse Strategy that is both comprehensive and integrated, and reflects economic and social as well as environmental impacts. To be effective in ensuring that the State's interests are protected, the response also must be soundly based and timely. There are significant resourcing issues for this task, both for government and for agencies such as CCIWA which want to participate.

WA Greenhouse Council
A key function of the WA Greenhouse Council is to develop jointly an understanding of how WA will be affected by national decisions, and to explain this joint understanding to government, emitters, and managers of sinks. CCIWA will continue to advise its members of the implications of the national and state response for their businesses. One current mechanism is development of a State Industry Greenhouse Network.

Government-Business Co-Operation
As discussed above (page 22) it is not desirable that State governments implement a further layer of regulation in addition to the Commonwealth's policies on climate change. In particular, there should be no State emissions target. CCIWA will continue to push for a substantial rewrite of the EPA Guidance for Greenhouse Gas Emissions for environmental impact assessment, which is based on applying national targets to a limited number of emission sources.

However, there are a range of other functions which can usefully be performed by the WA government, and in many of these CCIWA can make a contribution which will be beneficial to members.

WA's efforts on the issue of sequestration should continue. All net sinks should be included, not just the current definitions of "forest" and "reafforestation" being developed under the negotiations for the Kyoto Protocol.

CCIWA and the State Government can both help to publicise and encourage cost-effective measures by industry to reduce greenhouse gas emissions through mechanisms such as the WA Energy Efficiency Awards and Cleaner Production programs. Also, information will continue to be available on workshops and case studies in energy efficiency and specific issues such as emissions trading.

CCIWA is developing a Facilitative Agreement under the Greenhouse Challenge program. Consideration of an integrated program focused on the Kwinana Industrial Area is at the initial stages.

APPENDIX 1: THE GREENHOUSE EFFECT

The Greenhouse Hypothesis

The United Nations Framework Convention on Climate Change says that:

> *"Most of the infra-red radiation emitted upwards by the earth's surface is absorbed in the atmosphere by water vapour, carbon dioxide, and the other naturally occurring "greenhouse gases". These gases prevent energy from passing directly from the surface out into space. Instead, many interacting processes (including radiation, air currents, evaporation, cloud-formation, and rainfall) transport the energy high into the atmosphere. From there it can radiate into space. This slower, more indirect process is fortunate for us, because if the surface of the earth could radiate energy into space unhindered, the earth would be a cold, lifeless place - a bleak and barren planet rather like Mars.*
>
> *By increasing the atmosphere's ability to absorb infra-red energy, our greenhouse gas emissions are disturbing the way the climate maintains this balance between incoming and outgoing energy. A doubling of the concentration of long-lived greenhouse gases (which is projected to occur early in the next century) would, if nothing else changed, reduce the rate at which the planet can shed energy into space by about 2 per cent. Energy cannot simply accumulate. The climate somehow will have to adjust to get rid of the extra energy -- and while 2 per cent may not sound like much, over the entire earth that amounts to trapping the energy content of some 3 million tons of oil every minute."*.

It concludes that:

> *"the most direct result, says the scientific consensus, is likely to be a "global warming" of 1 to 3.5°C over the next 100 years. That is in addition to an apparent temperature increase of around half a degree Centigrade since the pre-industrial period before 1850, at least some of which may be due to past greenhouse gas emissions"*[12].

The development of international climate change policy is based, somewhat loosely, on the science as presented by the Inter-governmental Panel on Climate Change - an international committee of experts set up under the United Nations Environment Program. Its most recent statement[13] set the scientific framework for the negotiations at Kyoto.

Its main findings were:

1. **Greenhouse gas concentrations have continued to increase**. These trends can be attributed largely to human activities, mostly use of fossil fuels, changes in land use and agriculture. If CO_2 emissions stay near current levels, the atmospheric level will increase for at least two centuries, approaching double the pre-industrial concentration of 280ppmv by the end of the 21st century.

2. **Anthropogenic aerosols tend to produce negative radiative forcings**. Locally, microscopic airborne particles resulting from combustion of fossil fuels and biomass, can offset the effects of greenhouse gases. However, these particles only stay in the atmosphere for a short time.

3. **Climate has changed over the past century**. Global average surface air temperature has increased by between about 0.3 and 0.6degC since the late 19th

century. The greatest increases have been in night time temperatures over land in the mid-latitudes in winter and spring. Global sea level has risen by between 10 and 25cm, and much of the rise may be related to the increase in global mean temperature. There are inadequate data to determine whether there have been consistent global changes to climate variability or weather extremes this century. Regional level changes have occurred but they are inconsistent.

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

5. **Climate is expected to continue to change in the future.** Current "best estimate" modelling project an increase in global mean surface air temperature relative to 1990 of about 2 degrees (Centigrade) by 2100. Models project an increase of sea level of about 50cm between 1990 and 2100. The greatest temperature increases are expected over land in high northern latitudes in winter, resulting in a more vigorous hydrological cycle.

6. **There are still many uncertainties.**

There is no unanimous "scientific consensus" on the existence of a greenhouse effect, its magnitude or its consequences. The United Nations' own estimate of the impact of greenhouse emissions on global temperatures has been revised downwards as research methods have improved.

That said, there is enough weight of scientific opinion supporting the proposition that human activity is contributing to potentially harmful climatic changes to make this the most probable of prevailing theories.

Most importantly, the possible effects of global warming induced by human activity are so severe that they warrant a response even though we do not have complete certainty that the theory is correct.

The lack of scientific unanimity presents a case for further research, not a case for doing nothing.

Effects of Global Warming

The Inter-governmental Panel on Climate Change found that increases in Greenhouse gases will result in a more vigorous hydrological cycle.

This means that there will be more severe and extensive droughts and floods, and more intense storms. Regional changes in rainfall patterns are expected. Whether the country by country effects on agricultural production and quality of life are positive or negative will depend on the direction and magnitude of these changes, which are still highly uncertain.

Increases in temperature and altered rainfall could result in altered patterns of human, animal and crop diseases, and the spread of pests. Sensitive ecosystems could undergo significant change.

Changes in sea level and water temperature would affect island and coastal nations. Some rise in sea levels is already evident, but it is not yet clear whether this is attributable to global warming induced by human activity.

The Greenhouse Sceptics

In summary, the greenhouse hypothesis can be sketched as follows:

1. the concentration of greenhouse gases in the atmosphere has increased as a result of human activity;
2. that growing concentration has contributed to a discernible rise in global average temperatures, and will cause a further rise in average temperatures over the next century;
3. the effects of this rise in average temperatures will have negative impacts on the environment and on human welfare; and
4. governments can and should respond by taking actions to reduce the contributions of human activity to the growth of greenhouse gases, and eventually to stabilise emissions.

Greenhouse sceptics do not have a single common view of the flaws in this hypothesis. Some accept parts of the hypothesis but not all of it; others argue that current state of knowledge and climate models is not adequate to demonstrate the truth or otherwise of the hypothesis. Still others have expressed concern at the processes underpinning the development of the analysis and conclusions of the Inter-Governmental Panel on Climate Change (IPCC).

The key arguments are summarised below.

Quality of the Modelling

Detailed modelling of the global climate is a new and developing science, made possible only by the increasing power of computers to model extremely complex systems.

As models have been refined and adapted, IPCC estimates of the effect of anthropogenic emissions on the global climate have been revised downwards in successive reports[14]. This would indicate that initial policy responses to the threat of global warming were based on an exaggerated expectation of its effects. It might also indicate that further refinements of the models could lead to further reductions in estimated climate effects.

The models themselves may not be particularly accurate representations of the global environment.

The IPCC's models predict that past increases in emissions should have generated an increase in global mean temperatures in the range of 0.7 to 1.4 ^{o}C between 1975 and 1990, far higher than the 0.3 to 0.6 ^{o}C rise reported as having occurred[15].

If the models cannot describe the past, they many be inadequate to predict the future.

Scale and Complexity of the Issue

Some 98 per cent of total global greenhouse gas emissions are natural, mostly water vapour from plants and carbon dioxide from plant decay.

In this context, the contribution of even large changes in anthropogenic emissions could be

Sceptical Scientists' Views

The following petition circulated by the Oregon Institute of Science and Medicine has been signed by over 17,000 US scientists, including over 2,000 physicists, geophysicists, climatologists, meteorologists, oceanographers, and environmental scientists and over 4,000 specialists in chemistry, biochemistry, biology, and other life sciences.

"*We urge the United States government to reject the global warming agreement that was written in Kyoto, Japan in December, 1997, and any other similar proposals. The proposed limits on greenhouse gases would harm the environment, hinder the advance of science and technology, and damage the health and welfare of mankind.*

"There is no convincing scientific evidence that human release of carbon dioxide, methane, or other greenhouse gasses is causing or will, in the foreseeable future, cause catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate. Moreover, there is substantial scientific evidence that increases in atmospheric carbon dioxide produce many beneficial effects upon the natural plant and animal environments of the Earth."

swamped by other influences on climate. Further, the scale of changes in human activity necessary to induce a sufficient change in total greenhouse gas concentrations to influence climate would be very large.

Many sceptics agree that the global average temperate has risen by about ½°C since 1860. But some do not, arguing that:

- estimates are derived from land-based stations which at best represent only a third of the earth's surface
- many are in or near urban locations and their readings may be influenced by the increases in heat generated in those environments; and
- satellite data show no warming trend (and possibly cooling), but of course cannot supply a long time series of data (see Figure 6). Temperature readings from balloons go back somewhat further, and also show no warming trend.

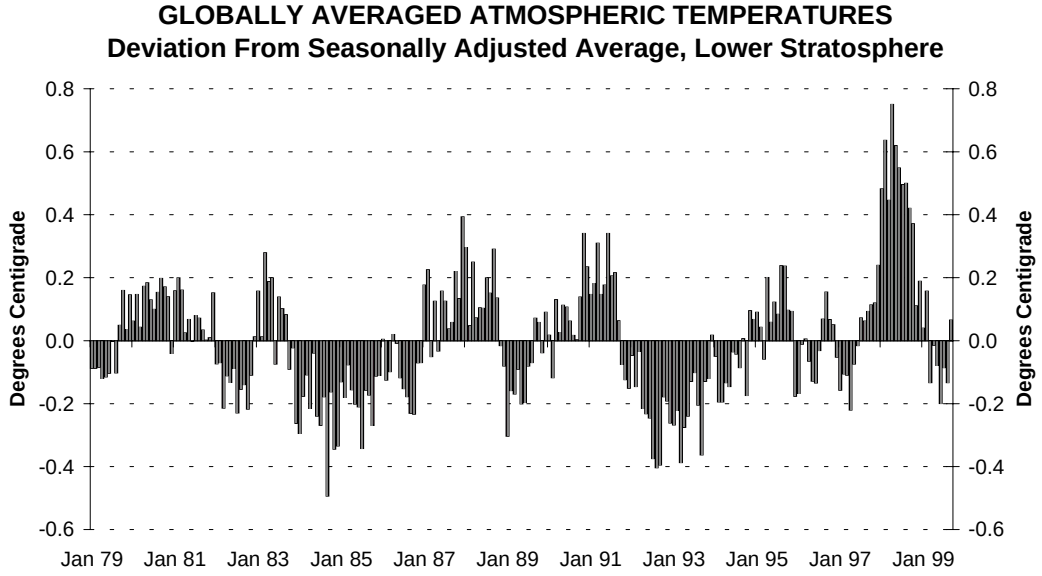
It may be that the earth's surface is warming while its atmosphere is not, in which case both sets of data are correct. But such a trend would contradict the predictions of climate change models. Dr. Roy Spencer[16], Senior Scientist for Climate Studies at the NASA/Marshall Space Flight Center argues that:

> *"The Intergovernmental Panel on Climate Change's (IPCC) 1995 estimate of average global warming at the surface until the year 2100 is +0.18 deg. C/decade. Climate models suggest that the deep layer measured by the satellite and weather balloons should be warming about 30% faster than the surface (+0.23 deg. C/decade). None of the satellite or weather balloon estimates are near this value"*

The land-based data show considerable variation (Figure 7). Most of the recorded warming occurred before 1940. Most of the increases in greenhouse gas emissions occurred after 1940. From 1940 global mean temperatures fell, though they picked up again from the late 1970s.

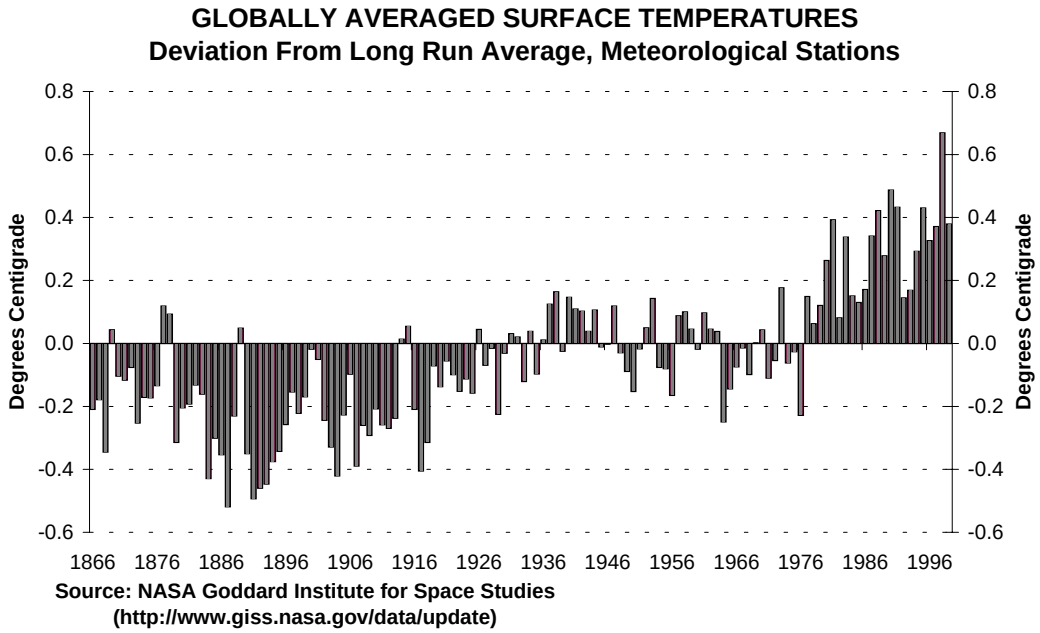
Long-term studies indicate that past temperatures have been significantly higher (and lower)

Figure 6



Source: NASA/Marshall Space Flight Center (http://science.nasa.gov)

Figure 7



than they are today. Dr. Sallie Baliunas[17] argues that:

> *Evident are periods like the Little Ice Age, reaching its coldest during the 17th and 18th centuries, and the Medieval Climate Optimum, a warming in the 10th - 11th centuries. That record does not stretch as far back as the Holocene Optimum, 6500 years ago, the warmest interval of the last 10,000 years after the end of the last major ice age. The record of natural variability indicates that the warming of the early 20th century is not unusual, either in amplitude or speed."*

Among scientists who accept the evidence that the global mean temperature has risen, many do not believe that the changes in climate over the past 140 years can be attributed to human activity because:

- the measured temperature variations are with 'normal" ranges; or
- other factors (such as variations in the brightness of the sun or the earth's orbit) could be driving climate change; or
- variations in temperature over that period, and especially the cooling recorded in the middle of this century, do not accord with the hypothesis.

On the IPCC's climate models, Baliunas concludes:

> *"As a result of looking at the temperature information, one concludes two things: (1) the climate scenarios exaggerate the warming that should have already occurred (and likely also the future warming) as a result of increased greenhouse gases; and (2) most of the warming this century cannot have been caused by increased greenhouse gases, because the warming predates the greatest increases in the greenhouse gases."*

Her view is that changes in the energy output of the sun may be responsible for variations in global temperatures.

Impacts

Some of the more alarmist early claims for the detrimental effects of global warming have now largely been discounted.

A small increase in global temperature will not melt the polar icecaps. The IPCC model predicts a rise in average sea levels of around 30 centimetres, arising from the expansion of the oceans not from melting icecaps.

Some scientists[18] argue that sea levels will fall, because higher average temperatures would increase evaporation from the oceans, while the predicted changes in weather patterns would release that evaporation as increased night time and winter precipitation in the high latitudes, meaning that the size of the icecaps should increase.

Some impacts might be beneficial.

Predicted warming is greatest at high latitudes, in winter and at night. Precipitation is forecast to increase. These effects could lead to beneficial outcomes in terms of the environment and human welfare, for example through longer growing seasons.

Increased CO_2 in the atmosphere should stimulate plant growth through the fertiliser effect, again with potentially beneficial effects on both the environment and human welfare.

Can it be Stopped?

This paper argues that the effect of implementing the Kyoto Protocol would be to re-distributed emissions producing activity, not to reduce it.

Even IPCC forecasts indicate that only very large reductions in anthropogenic emissions will avert global warming. The aim of the UNFCCC is to slow the growth of emissions and eventually stabilise them, not to restore current or historical concentration levels. If the greenhouse hypothesis is correct, this will still lead to a rise in average temperatures.

Is Prevention Better Than Cure?

Estimates of the economic impacts of efforts to reduce and eventually stabilise anthropogenic emissions vary considerably.

The cost of delaying a response to the greenhouse hypothesis may be less than the cost of implementing a response which may be unnecessary or even counter-productive.

Notes and References

[1] Annex 1 countries (with emission targets as % 1990 levels in brackets) are: Australia (108); Austria (87); Belgium (92.5); Bulgaria (92); Canada (94); Croatia (95); Czech Republic (92); Denmark (79); Estonia (92); Finland (100); France (100); Germany (79); Greece (125); Hungary (94); Iceland (110); Ireland (113); Italy (93.5); Japan (94); Latvia (92); Liechtenstein (92); Lithuania (92); Luxembourg (72); Monaco (92); Netherlands (94); New Zealand (100); Norway (101); Poland (94); Portugal (127); Romania (92); Russian Federation (100); Slovakia (92); Slovenia (92); Spain (115); Sweden (104); Switzerland (92); Ukraine (100); UK (87.5); USA (93); EC Average (92)

[2] At 15 October 1999 countries which had ratified or acceded to the protocol were: Antigua and Barbuda, Bahamas, Cyprus, El Salvador, Fiji, Georgia, Guatemala, Jamaica, Maldives, Micronesia, Niue, Panama, Paraguay, Trinidad and Tobago, and Tuvalu .

[3] The exception would be where reductions in greenhouse gas emissions are associated with economic or environmental benefits, such as reductions in pollution or the adoption of more efficient uses of energy. This may be why the European Union was one of the keenest advocates on the Kyoto approach to greenhouse gas emissions. Its emissions were anyway likely to fall through a combination of falling population, cleaning up or closing down polluting industries in the former Eastern Bloc, and the UK switching from coal to gas fired powered generation.

[4] OECD data, measuring energy efficiency as domestic energy efficiency as million tonnes of oil equivalent in the production of energy for domestic use divided by real GDP, show energy efficiency of 0.16 in Norway, 0.22 in Sweden, and 0.26 for the OECD as a whole (Source: **OECD In Figures 1998**).

[5] Lucas, Wheeler, and Hettige (December 1992) **Economic Development, Environmental Regulation, and the International Migration of Toxic Industrial Pollution 1960-1988**, The World Bank Policy Research Working Paper Series 1062

[6] Dasgupta, Mody, Roy, Wheeler (March 1995) **Environmental Regulation And Development: A Cross-Country Empirical Analysis** The World Bank

[7] Howard, The Hon John (Nov 1997) **Safeguarding the future: Australia's response to climate change**, Statement by the Prime Minister of Australia

[8] See Australian Bureau of Statistics **Population Projections 1997 to 2050**, United Nations **World Population Prospects**, OECD **Economic Outlook**

[9] for example iron ore from Brazil, wheat from Russia, nickel from Indonesia, wool from Argentina, alumina or aluminium from Brazil, ilmenite from Malaysia or India, gold from South Africa, etc

[10] According to the Australian Bureau of Agricultural and Resource Economics' 1998 **Australian Commodity Statistics**, the contribution of commodities to total Australian exports has fallen from 82 per cent in 1990 to 75 per cent by 1997-98. The combined contribution of mining and agriculture to nominal GDP fell from 8.2 per cent to 6.8 per cent over the same period.

[11] source: Australian Bureau of Statistics catalogue 5220.0 **State Accounts 1997-98**

[12] **Understanding Climate Change: A Beginner's Guide To The UN Framework Convention**

[13] Inter-governmental Panel on Climate Change (1997), **Summary for Policymakers: The Science of Climate Change** – IPCC Working Group 1, published at http://www.ipcc.ch/cc95/wg1.htm#four

[14] The United Nations IPCC **Second Assessment Synthesis of Scientific-Technical Information** relevant to interpreting Article 2 of the UN Framework Convention on Climate Change reports states that" "For the mid-range IPCC emission scenario, IS92a, assuming the "best estimate" value of climate

sensitivity and including the effects of future increases in aerosol concentrations, models project an increase in global mean surface temperature relative to 1990 of about 2°C by 2100. This estimate is approximately one-third lower than the "best estimate" in 1990. This is due primarily to lower emission scenarios (particularly for CO2 and CFCs), the inclusion of the cooling effect of sulphate aerosols, and improvements in the treatment of the carbon cycle." (paragraph 2.6)

[15] Ibid. p. (p 190)

[16] Spencer, R (August 1998). **Measuring the Temperature of Earth From Space** NASA Space Science News. Published at http://science.nasa.gov/newhome.

[17] Sallie Baliunas, Ph.D (August 1998) **Hot Times or Hot Air: The Sun in the Science of Global Warming** Paper prepared for the Cooler Heads Coalition and presented on August 7, 1998 in Washington, DC (http://www.marshall.org/baliunascei.htm)

[18] see for example Dr S Fred Singer, (1997) **Hot Talk, Cold Science: Global Warming's Unfinished Debate** The Independent Institute