

31 May 1996

ENGLISH ONLY

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Ad Hoc Group on the Berlin Mandate
Fourth session
Geneva, 8-19 July 1996

IMPLEMENTATION OF THE BERLIN MANDATE

Comments from Parties

Note by the secretariat

In addition to the submissions already received (see FCCC/AGBM/1995/MISC.1, Add. 1, 2, 3 and 4, and FCCC/AGBM/1996/MISC.1), contributions have been received from Australia, Guyana, New Zealand, Switzerland and Trinidad and Tobago.

In accordance with the procedure for miscellaneous documents, these submissions are attached and are reproduced in the language(s) in which they were received and without formal editing. Any further submissions will be issued in an addendum.

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UNFCCC - IMPLEMENTATION OF THE BERLIN MANDATE

AD HOC GROUP ON THE BERLIN MANDATE

Guyana wishes to reiterate its strong support for the draft protocol submitted by AOSIS - Document A/AC.237/L.22- and urges Members to strive for the development of legally binding measures (including targets and timetables) with the AOSIS document as a starting point.

The AGBM, in dealing with the matter of quantified emission limitation and reduction objectives within specified time-frames, should seriously consider the IPCC Assessment Reports. Guyana supports a more active role of the IPCC in the deliberations of the AGBM and other subsidiary bodies of the UNFCCC.

Policies and Measures

At AGBM 3, New Zealand put forward a number of initial criteria which we suggest should be used against which to assess policies and measures.

- **Efficacy and Cost-effectiveness** - the extent to which policies and measures offer opportunities for significant abatement at least cost.
- **Durability and Flexibility** - the ability to readily adapt policy settings to new information about the timing and magnitude of climate change and opportunities for abatement.
- **Transparency** - clarity about the environmental and economic effects of policies and measures.
- **Robustness** - the potential of policies and measures to be effective and appropriate in a wide range of national circumstances.

To date, countries have adopted a wide variety of policies and measures reflecting different national circumstances, policy preferences and degrees of commitment. The emphasis has been on least cost or “no regrets” opportunities. In this regard, the debate is being influenced by reports such as by IPCC Working Group III which suggests that significant “no regrets” opportunities are available in most countries but that the magnitude of such “no regret” potential depends on the existence of substantial market or institutional imperfections.

The nature of these imperfections or distortions will differ between countries as will the suitability of the range of targeted sectoral instruments which include information programmes, regulations and subsidies. These instruments should not be compulsory as it is only in specific national circumstances that they would represent a least cost solution.

The distortion-removing (and thus least cost) policies which will apply to all countries are the removal of subsidies, eg for energy or agriculture, unless the subsidies have been introduced in order to correct for some existing distortion. Subsidy removal should be encouraged as a first step for all countries.

Beyond this, economic instruments which equate incentives (or costs) across all mitigation opportunities in all sectors are the only measures which will enable discovery of least cost solutions and which will be applicable to all countries.

QUANTIFIED EMISSION LIMITATION AND REDUCTION OBJECTIVES

Issues and Considerations: Australian Views

Introduction

The Chairman's Conclusions from AGBM 3 on Quantified Emission Limitation and Reduction Objectives (QELROs) lay out a range of options and variations which Parties need to consider in their deliberations¹. The following outlines Australia's thinking on issues which need to be addressed in considering those various QELRO approaches and options which would best achieve the requirements of the Berlin Mandate.

As noted by the Chairman at AGBM 3, Parties have suggested a wide variety of approaches to setting emission objectives. A separate but related issue raised by Parties is whether to adopt a comprehensive multi-gas approach or a gas-by-gas approach to setting emission objectives².

In addition, the informal workshop on QELROs at AGBM 3 provided valuable new suggestions which require further analysis and assessment by Parties to establish their feasibility and appropriateness. The Workshop highlighted the importance of 'when and where flexibility' to ensure environmental goals are achieved at least possible cost; emission budget approaches to provide incentives for early abatement efforts and technology forcing over time; the concept of 'safe emission corridors' to provide guidance for policy makers to set short term emission objectives based on explicit consideration of long term climate change implications; and issues related to separating emissions arising from consumption from emissions arising from production.

Australia is at a preliminary stage in its consideration of the various specific options. However, we are firmly of the view that environmental and cost effectiveness and equity considerations must play a central role in deliberations and be a fundamental element of the AGBM outcome. While the concepts of environmental and cost effectiveness are relatively well understood, this is not necessarily the case with respect to equity considerations. Some possible approaches to equity that may be considered can be found in the IPCC Working Group III Report.

One of these approaches which may be particularly relevant to climate change rests on the ability to pay principle. The ability to pay principle requires that people with equal capacity to pay should pay the same (horizontal equity), while people with greater ability should pay more (vertical equity).

In the AGBM context achieving *Equitable Contributions* would mean that, in principle, all Annex I countries of comparable income should face broadly equivalent economic costs on a per capita basis. Net national economic costs (measured by per capita GDP foregone) could be used to measure a country's emission abatement effort. And realising the notion of *Appropriate Contributions* would require that Annex I countries, where individuals have, on

¹Report of the Ad Hoc Group on the Berlin Mandate on the Work of its Third Session, held at Geneva from 5 to 8 March 1996 (FCCC/AGBM/1996/5, 23 April 1996)

²Op. cit., paragraph 44 (e)

average, greater capacity to pay, should contribute more with, perhaps, such adjustments made on the basis of per capita GDP.

In the forthcoming negotiations, Parties will need to evaluate the advantages and disadvantages of the alternate approaches to setting emission objectives. Australia believes the following considerations must guide this analysis and assessment:

- . environmental effectiveness: does the approach maximise the overall Annex I Parties contribution to the global effort to address climate change and encourage individual Annex I countries to achieve their commitments;
- . cost effectiveness: does the approach ensure the global environmental benefit is achieved at the lowest possible cost. In particular, is there due recognition for the various factors which impact on the costs of abatement such as differences in starting points and approaches, economic structures and resource bases, available technologies and other national circumstances; and
- . equity - do Annex I countries of similar income face broadly equivalent economic costs on a per capita basis, and do those Annex I countries with a greater capacity to pay contribute greater amounts to the global effort to address climate change.

The challenge for the AGBM is to arrive at an outcome which not only satisfies these fundamental criteria but is robust, yet flexible enough to adapt to improvements in the science of climate change and changing economic circumstances of countries. The AGBM would need to address how the various suggested approaches could be developed and negotiated within the timeframe of the Berlin Mandate.

In order to facilitate the analytical process, the core QELRO issues have been grouped according to the following headings:

- A nature and degree of differentiation
 - e.g. no differentiation, partially or fully differentiated
- B nature of the emissions benchmark
 - e.g. based on hypothetical future levels of emissions or on actual observed levels
- C nature of the emissions criteria
 - e.g. based on a single year or on a cumulative period of years
- D timeframe for setting emission objectives
 - e.g. short timeframe or some combination of short and longer term timeframes
- E degree of comprehensiveness

A. Nature and Degree of Differentiation

This section outlines the various issues and considerations arising from the range of QELRO options relating to differentiation, among other possibilities, in terms of: uniform emission objectives; separate emission objectives for different categories of Annex I Parties; collective Annex I objectives; and differentiated emission objectives within sub-groups of Annex I Parties.

(i) *Uniform Emission Objectives*

The most familiar approach to QELROs establishes a uniform objective to be met by each Party over a target period expressed in terms of a historical base year. The FCCC's implied target, the AOSIS and some other proposals already tabled follow this approach³. In evaluating this approach, Parties may wish to consider:

- . whether the approach is cost effective, paying due regard to the factors which impact on the costs of abatement such as differences in starting points and approaches, economic structures and resource bases, available technologies and other national circumstances.
 - while the approach of basing emission objectives relative to a historical base year accounts for differences in the economic structures, available technologies and resource bases of countries at the base year (i.e. 1990), Parties may need to consider whether it adequately addresses the issue of 'starting points', or changing circumstances of countries created by the dynamism of economies and divergences in country experiences - either with respect to demand or supply pressures.
- . whether the approach would be environmentally effective, particularly over the longer term given the possible need for Parties to give practical expression to the qualifying features of FCCC Article 4.2 (a) and (b) which could require increasingly large corrections from the uniform objective to better reflect divergences in country experiences and the need for equity among countries.
- . whether the approach is equitable:
 - Parties may wish to consider the extent to which such an approach would satisfy the equity criterion of requiring all countries of broadly comparable income to incur broadly equivalent economic costs on a per capita basis, given that countries could experience wide variations in per capita emission reductions from emission trends in order to return to base year emission levels; and
 - Parties may also wish to consider whether such an approach adequately recognises the wide disparities in incomes within Annex I countries, not only between OECD countries and the Economies in Transition but also within the OECD and EIT groups themselves.

³Op. cit., paragraph 44 (a), (b) and (c)

- : if necessary, the issue of income disparities could be addressed by adopting differentiated emission objectives for individual Annex I countries, setting different emission objectives for different categories of Annex I Parties (see below) or, alternatively, adjusting the uniform objective based on per capita GDP or Purchasing Power Parity.

(ii) *Separate Emission Objectives for Different Categories of Parties*

Practical issues which Parties would need to address in operationalising this approach include⁴:

- . how many categories of countries would there be?
- . on what criteria would the categorisation be based?
- . would the commitments within each category be uniform or differentiated?
- . what, if any, graduation mechanism would there be for countries to move between categories?

At its simplest level such an approach could incorporate only two categories of countries: OECD countries and EITs with different uniform emission objectives for each group based on historical (e.g. 1990) emissions. Noting that this approach is designed primarily to enhance the equity of the approach adopted by the FCCC, Parties may wish to consider whether such an approach would - by itself - address the issue of equity between Annex I countries. In particular:

- . whether different uniform emission objectives for EIT and OECD countries would adequately account for the substantial differences within the EIT or OECD groupings - not only in income levels but also in 'starting points and approaches, resource bases, and other individual circumstances';
- . whether such an approach would adequately account for the substantial variation in incomes in the EIT and OECD groups of countries, and the similarities in income of some countries across the EIT and OECD groupings;
- . how such a static approach could adequately account for divergences in EIT country experience and different progress in the economic reform process; and
- . whether a process of graduation - either voluntary or based on objective criteria such as per capita income levels - would need to be developed.

(iii) *Collective Annex I Objectives*

As the Chairman's Conclusions outline, in noting this option Parties have acknowledged the distributional complexities such an approach would raise⁵. The only approach suggested thus far to addressing this distribution issue is outlined in FCCC/AGBM/1995/4, where it was

⁴Op. cit., paragraph 44 (f) (ii)

⁵Op. cit., paragraph 44 (c) and (f) (i)

noted that a collective Annex I objective could be combined with emission reductions from its emission trend. This approach is considered below (see Section B). Parties may also wish to consider further approaches to addressing the distributional complexities.

(iv) Differentiated Emission Objectives within Sub-Groups of Annex I Parties

An issue not raised since AGBM 1, but which will be necessary for Parties to consider is whether there should be provision for regional integration organisations to meet the commitments of the AGBM outcome on a joint basis or whether commitments must be met by individual Parties. These questions raise a range of issues, including legal and equity aspects, which require further examination.

B. Nature of the Emissions Benchmark

The Chairman's Conclusion from AGBM 3 notes the possibility of basing QELROs on observed historical base year emissions or on hypothetical future levels of emissions⁶. The case of historical base year emissions was considered above.

QELROs based on hypothetical future levels of emissions was further detailed in FCCC/AGBM/1995/4, which noted that a collective Annex I objective could be combined with country reductions from emission trends. Conceptually, then, under this approach, emission reduction objectives are expressed in relation to hypothetical Business-as-Usual (BAU) emission projections for future years rather than in terms of a historical (e.g. 1990) base year. For example, in one possible form of differentiation within this BAU framework, the emission objective for all countries could be expressed as $(BAU - X)\%$ where the magnitude of X (which would be equal for all countries) would depend on the overall Annex I objective. For example, if the overall Annex I objective was:

- . to stabilise emissions at 1990 levels: $X =$ weighted average BAU growth in Annex I countries; or
- . AOSIS proposal: $X =$ weighted average BAU growth in Annex I countries + 20 per cent.

While, in this example, X (expressed as a proportion of the initial emission level) is equal for all countries, the emissions reduction would differ according to each Annex I country's projected BAU growth. Countries with BAU growth above the weighted Annex I average would be required to do relatively less than under the uniform approach, while countries with BAU growth less than the average would be required to do relatively more. It should also be noted that the $(BAU - X)$ approach could also be applied to projected cumulative emissions rather than emissions projected for a single year.

In evaluating this approach, Parties may wish to consider:

- . whether the approach is cost effective: this approach would incorporate differences in the economic structures and resource bases, available technology and other individual circumstances of countries. In contrast with uniform approaches, this approach would incorporate the changing circumstances of countries but, as with uniform approaches, would not properly incorporate differences in 'starting points'.

⁶Op. cit., paragraph 44 (d)

whether the approach is environmentally effective: this approach would be aimed at achieving progressive and continuous reductions in emission trends for all Annex I countries. Parties may wish to consider whether such an approach would provide a dynamic basis for the long term and sustained effort required to mitigate climate change.

whether the approach is equitable:

- QELROs based on emission projections would satisfy the equity criterion of requiring all countries of comparable income to incur broadly equivalent per capita costs to the extent that countries had similar emission abatement functions. Parties may wish to consider to what extent this approach represents a reasonable working assumption, given the practical difficulties of calculating and reaching international agreement on the costs of abatement for each Annex I country.
- Parties could consider the need to operationalise the equity criterion of making adjustments for differences in capacities to pay by adjusting the reduction from BAU based on per capita GDP or per capita Purchasing Power Parity.

It is worth emphasising that if Parties wish to further consider this approach, it will need further analysis and assessment of the practical difficulties associated with QELROs based on emission projections. Attention would need to be given to BAU methodologies, establishing their credibility and ensuring consistency across countries.

C. Nature of the Emissions Criteria

A further issue which Parties may wish to consider is whether to express the QELROs in annual or cumulative terms⁷. Under the existing implied target approach of Article 4.2 (a) and (b), both the base year emissions and target year emissions are expressed in terms of emissions during the year (i.e. in terms of 1990 and 2000 emission levels). An alternative approach suggested by Parties and in the Informal Workshop at AGBM 3 is to consider cumulative emissions during a period.

It is worth noting that any QELRO can either be expressed as emissions during a particular year (i.e. the current approach) or emissions during a period (i.e. on a cumulative basis). In other words, the nature of the emissions criteria impacts most strongly on the issues of environmental and cost effectiveness. It does not properly address equity which depends on the form of the QELRO (i.e. differentiated or uniform).

On this basis, Parties may wish to further consider the environmental and cost implications of adopting either approach. In particular, Parties may wish to consider the extent to which such approaches address difficulties that arise from the timing of business cycles and one-off factors in both the target year and the historical base year.

Under the current approach as reflected in the implied FCCC target, some countries have found it necessary to modify the 1990 (base) emission levels to account for

⁷Op. cit., paragraph 44 (f) (iii)

factors such as unusually high levels of imported electricity or unusually mild winters. Parties may wish to consider whether or the extent to which such corrections would be necessary if the base year was the average of a number of years. The significance of one-off factors in the target year (e.g. 2005, 2010 and 2020) would similarly be reduced under a cumulative approach.

If Parties decided on the desirability of adopting a cumulative approach, Parties would need to reach agreement on the appropriate historical base years. In other words, Parties would need to consider whether average emissions during the period should be compared to emissions from a single year (e.g. 1990) or whether cumulative emissions over the specified time frame (e.g. 2000-2005) should be compared to cumulative emissions over a base period to be agreed upon in the negotiating process.

Similarly, an emission objective based on a single year emission projection (e.g. an x per cent reduction from BAU by a specified year (e.g. 2005, 2010 or 2020)) would also be impacted by one-off factors in the target year. Parties may wish to consider whether cumulative QELROs would, to some extent, address this deficiency.

Parties have also suggested the possibility of including some mechanism for emission banking and creating incentives for early action⁸. The Informal Workshop highlighted the importance of such approaches in providing countries the flexibility to engage in emission abatement activities in a timeframe appropriate to their particular circumstances (e.g. investment cycles) while nonetheless ensuring an environmentally sound outcome. If Parties were to consider adopting such an approach, reaching agreement on an appropriate discount rate would be an important element of the AGBM outcome. The IPCC Working Group III Report, Chapter 4 could provide some guidance on this issue.

D. Timeframe for Setting Emission Objectives

As required by the Berlin Mandate, Parties will also need to consider the appropriate timeframe to apply for the AGBM outcome (e.g. 2005, 2010, and 2020). In particular, Parties will need to address the considerations which arise in respect of various alternatives. For instance, they will need to consider whether a single short or medium timeframe would provide an appropriate AGBM outcome or, alternatively, whether a shorter term objective combined by a longer term indicative objective would provide a more appropriate framework for long term planning, investment decisions and research and development of new technologies.

E. Degree of Comprehensiveness

A final issue Parties will need to consider is the degree of comprehensiveness that any approach to setting emission objectives might involve. A 'comprehensive approach' is embedded in the FCCC (Articles 3.3, 4.1 and 4.2) and in the Berlin Mandate (Paragraph 1(f)). Moreover, the Second Assessment Report of the IPCC recognises the possibility and feasibility of greenhouse gas mitigation through implementing policies and measures based on the comprehensive approach (see, for example, section 8 of the Summary for Policy Makers of IPCC Working Group III).

⁸Op. cit., paragraph 44 (f) (v)

The Chairman's Conclusions indicates a range of views on the degree of comprehensiveness QELROs might involve⁹. Australia believes it would be appropriate to guide the analysis and assessment of any proposals by considering the threshold questions of ensuring an effective environmental outcome is achieved in a cost effective manner which takes account of differences in national circumstances and ensures equity between Annex I countries. Practical issues relating to the implementation of various approaches, including methodological issues, would also need to be identified and analysed.

⁹Op. cit., paragraph 44 (e)

THE TREATMENT OF QUANTIFIED EMISSION LIMITATION AND REDUCTION OBJECTIVES AND POLICIES AND MEASURES IN A PROTOCOL OR ANOTHER LEGAL INSTRUMENT

The Ad Hoc Group on the Berlin Mandate at its third session requested the Secretariat to compile proposals that have been tabled to date or received by 15 April 1996, relating to *inter alia* the treatment of quantified emission limitation and reduction objectives and policies and measures in a protocol or another legal instrument. This paper sets out views from New Zealand; these do not attempt to comprehensively cover all relevant issues and the paper is not intended to be exclusive of other ideas. The paper includes principles and options for the development of new commitments.

Principles

The ultimate objective of the FCCC (Article 2) sets out a performance measure in terms of environmental outcomes. It is balanced by wording regarding the economic costs of achieving this outcome both within Article 2 (“...to enable economic development to proceed in a sustainable manner”) and in the principles (Article 3), eg “...policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost”. The Convention also notes concerns relating to the distribution of impacts and the costs of measures, taking account of different responsibilities and capabilities.

The guiding principle for policy development is that of cost-effectiveness, that is prevention of dangerous anthropogenic interference with the climate system at least cost. Countries have two main concerns.

- That emission reductions are achieved at minimum global cost (an efficiency objective).
- That an individual country is not asked to bear a disproportionate economic cost relative to other countries (an equity objective).

Good policy outcomes are achieved through focusing on efficiency and adjusting policy only if the expected equity outcome is unacceptable. There are limits to an efficiency outcome built into the Berlin Mandate itself through the focus on Annex I Party commitments, and because of the potential leakage of emissions to non-Annex I countries. At this point it is important to achieve an efficient solution for Annex I Parties in the expectation that efficiency improvements ultimately achievable through a global solution will be obtained at a later date. It is also important that actions by Annex I parties do not simply result in the transfer of emissions to non-Annex I Parties.

Quantified Emission Limitation and Reduction Objectives

This paper does not propose a target. Rather it provides some thoughts regarding how a different target might be set and its allocation.

The current system of having the same implicit target for all countries is not efficient. Some countries are expecting to achieve significant reductions in emissions largely under “business as usual” scenarios whereas other countries have large projected increases and significant and seemingly unacceptable costs in containing these; in effect the current target is unachievable for many countries. Countries differ widely with respect to the costs of mitigation and, for a targeted physical quantity of emissions, the least cost solution will be found through different rates of mitigation in each country. However, it is unlikely that the efficient allocation of these different rates of mitigation can be modelled; it could be “discovered” through placing an equal price on emissions wherever they occur and enabling market transactions to lead towards this efficient allocation.

This might be achieved, for example, through setting an equal price on carbon in all (Annex I) countries at a level that will achieve a “bubble” target or through establishing a system of emission permits for trading within that “bubble”. These solutions are a long term and desirable goal but they are unlikely to be achievable in the next period. Nevertheless, it is important that any new commitments are not incompatible with an efficiency principle nor with a long term move towards international economic instruments.

In the current period there are considerations that need to be made with respect to both the level of the Annex I targets and their distribution.

On the level of target, it is evident that many countries agreed to the current targets without fully understanding their ability to meet them. This leads either to failure to meet the target or to vastly disproportionate and globally inefficient allocation of policy effort. In setting new targets it is clear that greater action is required but targets have to be achievable. What is achievable for an individual country has both technical and cost considerations. A potentially useful phrase and acronym which summarises the concerns for target setting is that any target agreed under the Berlin Mandate process needs to be the Best Achievable Quantified Objective at Least Aggregate Cost (BAQOLAC).

We want the best target that is achievable. We would suggest that targets would have least aggregate cost if they had the objective of equating the costs of mitigation across countries, ie ensuring that the marginal costs of abatement (per unit of emission reduction) to meet a given target in one country were not significantly different from the marginal costs in another country with a target. Further, if marginal abatement costs were similar between countries this would go a long way towards allaying equity concerns.

With respect to the distribution of targets, there are a range of studies which demonstrate that:

- equal targets for all countries are simple but more costly than alternative specifications;

- costs can be reduced through achieving **spatial efficiency** through permit trading or Joint Implementation within a single time period;
- costs can be reduced further through achieving **spatial and intertemporal efficiency** through permits or JI and use of cumulative targets, ie allowing countries to spread their emission reductions over time.

This means that the level of target to be adopted needs to be considered in concert with the means to achieve it, which might include specific policies or measures (eg economic instruments) or approaches to cost distribution (eg Joint Implementation).

A “bubble” target for Annex I Parties would be first best only in the context of an agreement on how to distribute emission reductions within that “bubble”, eg through an economic instrument which equates the size of the incentive to mitigate emissions across all opportunities. Achieving agreement on such an instrument is likely to be difficult in the short term but there may be other solutions which would enable agreement on target sharing within the bubble which maintains the focus on the overall (Annex I) effort. However, seeking agreement on rules for apportioning responsibility (eg on the basis of emissions per capita, per GDP or specific economic structures or fuel mixes) will rapidly lead towards special pleading on the grounds of individual national circumstances which are unlikely to be either testable or economically efficient.

An alternative approach is for each country to have the same target (eg maintain emissions at 1990 levels, 10% reduction) but that Joint Implementation (JI) activities in other Annex I Parties (or potentially any other country with an equivalent target) could be credited towards achievement of the national target. JI between countries with and without targets could lead to strategic behaviour without an overall reduction in emissions. JI between countries with targets could lead towards greater efficiency; it could not be expected to ensure that incentives were equated across all opportunities in the way that tradeable permits would although it would be a move in that direction. Countries expecting to meet their national target would face opportunity costs if they did not take actions further to reduce emissions. Emission reductions would have a value to other countries and these countries would forsake the opportunity to “sell” these through not undertaking additional actions.

In order to achieve intertemporal efficiency, consideration needs to be given to the adoption of cumulative targets in which the responsibility is for limiting the total emissions within a time period (eg the ten years 2000-2010) rather than measuring emissions in a specific year (eg 2005). Such an approach allows flexibility in terms of emission abatement over time while smoothing year on year fluctuations in the costs of abatement, while not compromising the overall objective of the Convention. These considerations would suggest allowing countries to “borrow” emission reductions from the future, ie do less now and more later, or to “bank” emission reductions - do more now and less later. Any credibility concerns with borrowing that might arise could perhaps be alleviated either through shortening the period over which borrowing can occur. Alternatively borrowing might be prohibited and only banking allowed.

Other approaches to target setting, eg to differentiate between countries depending on their emission intensity (per capita or per GDP), depart from the objective of an efficiency outcome and would not be first best solutions.

Consistent with a least cost approach to meeting the overall objective of the Convention, any new targets should encourage mitigation across the full range of available opportunities. This would imply that new targets were both comprehensive, ie all gases, and took account of opportunities both in emission reduction and sink enhancement.

POSSIBLE FEATURES OF A PROTOCOL OR ANOTHER LEGAL INSTRUMENT

Issues and Considerations: Australian Views

Introduction

Australia notes that the two primary options for the legal form of the AGBM outcome which have so far been canvassed in the AGBM process are a protocol or an amendment to the Framework Convention on Climate Change. Australia is still considering its position on aspects of these options. The following outlines Australia's current thinking on issues which these options raise and the resulting considerations which would need to be addressed in determining which of these two options should be the legal form of the outcome resulting from the AGBM process. The discussion below generally follows the structure of the table provided in the Secretariat paper on agenda item 6 of AGBM3 (Possible Features of a Protocol or Another Legal Instrument - FCCC/AGBM/1996/4, Annex) and addresses the following specific issues:

- A Majority for Adoption
- B Entry into Force
- C Relationship with FCCC
- D Rules of Procedure
- E Decision Making
- F Separate Institutions
 - i. A secretariat
 - ii. Subsidiary Bodies
 - iii. Financial Mechanism
 - iv. Communication of Information
 - v. Multilateral Consultative Process
 - vi. Settlement of Disputes
 - vii. Financial Procedures
- G Changes to the FCCC
- H Parties to the Instrument
- I Reservations

A summary of the issues, which modifies the table in FCCC/AGBM/1996/4, is attached to this paper.

Australia hopes that the following discussion may assist in casting some light on what may be next steps for parties in resolving some of the issues that are raised in the choice between a protocol or an amendment. In most cases it would appear that further progress on the issues may be dependent on the parties reaching a clearer idea of the substantive content of any proposed instrument. Some issues may however depend on other factors. For instance, the question of the majority for adoption may be resolved by further consultation among parties

on the draft rules of procedure for the COP. Some issues may perhaps be resolved on the basis of directions already set by the AGBM or the FCCC itself. For instance, AGBM3 agreed on the need to avoid the proliferation of new bodies. Conclusions of AGBM3 also reflected widespread preliminary agreement that most of the existing institutions under the Convention could serve either an amendment or a protocol.

A. Majority for Adoption

An issue that parties would need to address is the important question of the respective majorities required for adoption of a protocol compared with an amendment. In respect of a protocol, as long as the deadlock over voting majorities in the draft rules of procedure continues, a consensus will presumably be required for the adoption of a protocol. This requirement will continue to apply so long as any party objects to adoption of the rules of procedure or if the rules of procedure, once adopted, require a consensus for such a decision.

The text of an amendment, however, may, as a last resort, be adopted by a 3/4 majority (FCCC article 15.4).

B. Entry into Force

The implications of entry into force requirements for the outcome of the AGBM is also an issue parties would need to consider. The FCCC already provides a rule for entry into force in respect of an amendment (FCCC article 15). An appropriate entry into force requirement would need to be decided by parties if the protocol route is pursued.

The entry into force requirements for an amendment (i.e. 3/4 majority of parties to the FCCC) could result in a situation where the amendment enters into force with only a few Annex I parties having ratified and being bound by its provisions. Given that the main focus of action under the AGBM outcomes will be Annex I parties, this could give rise to significant anomalies or inequities. Those Annex I parties which have ratified the amendment could be bound to fulfil their commitments (which may have been negotiated in the AGBM on the basis of all Annex I parties participating and contributing equitably to the strengthened commitments) in a context where a non-ratifying Annex I party or parties remained free to subsequently act inconsistently with the commitments they had participated in negotiating in the AGBM. As well as resulting in potential inequity for individual parties, such a situation could adversely affect the effectiveness and operation of the FCCC regime as a whole, for instance through the potential for a continuing "free rider" problem.

Parties may wish to consider the implications of this scenario as a possible outcome of the amendment route and whether there are any options available under an amendment route to prevent this. FCCC article 15 does not appear to allow for the possibility that parties may decide in respect of an amendment to adopt other entry into force requirements than those provided for by that article (as for instance as is done with respect to the question of application of dispute settlement procedures to any related legal instrument (FCCC article 14.8)). There may however be scope for additional entry into force requirements provided for in an amendment, so that the amendment could not enter into force until the entry into force requirements set out both in the FCCC and the amendment have been satisfied.

In the case of the protocol route the freedom of parties to choose any entry into force requirement is clear. Entry into force requirements that parties might consider to achieve this outcome could include: entry into force following ratification by all Annex I parties, entry into force following ratification by parties accounting for a certain percentage of total Annex I party emissions, entry into force following ratification by parties accounting for a certain

percentage of global emissions of greenhouse gas emissions, ratification by all OECD member countries and by parties representing a certain percentage of the emissions from the economies in transition and/or ratification by a particular majority of parties to the FCCC. Such technically oriented entry into force requirements are utilised in other treaty regimes. For example, the Montreal Protocol utilises such an entry into force requirement stating that it will enter into force on a particular date provided that appropriate instruments have been deposited by states or regional integration organisations representing at least two-thirds of 1986 estimated global consumption of controlled substances. This approach is also adopted for some treaties concluded under the auspices of the International Maritime Organisation. The International Convention for the Prevention of Pollution from Ships, London, 1973 (the MARPOL Convention) provides that entry into force shall occur 12 months after which not less than 15 states, the combined merchant fleets of which constitute not less than fifty per cent of the gross tonnage of the world's merchant shipping, have become parties.

C. Relationship with FCCC

The general nature of the relationship between the FCCC and any AGBM outcome is an issue parties should carefully consider.

The statements in FCCC/AGBM/1996/4 (e.g. paragraph 10 and Annex) on the creation of a "new regime" may need further consideration, reflecting all aspects of the relationship between an amendment and the FCCC, including differences in obligations between parties. The differences between an amendment and a protocol in this respect appear to warrant further consideration.

A broad question which parties may find pertinent is the general nature of the relationship between an amendment and the original instrument. In a fundamental sense, an amendment is inseparable from the instrument it amends. Apart from technical provisions, it is likely that most of the provisions of an amendment would only exist to alter the provisions of the FCCC and then, in effect, a new instrument - the FCCC *as amended* - would be the primary instrument of focus.

One question that then arises, in this general context, is the question of the legal relationship of parties which have ratified the amendment and those which have not. This relationship is governed by article 40.4 and article 30.4(b) of the Vienna Convention on the Law of Treaties. Article 40.4 provides that a State already party to a treaty is not bound by an amending agreement to which it does not become a party. Article 30.4 (b) provides that the mutual rights and obligations of a party which is a party to both treaties and a party which is party to only one of the treaties is governed by the treaty to which they are both party. In other words the original provision of the FCCC would apply between such parties.

The relationship between parties to an amendment and parties which have not become parties to an amendment has been compared by legal authors to the relationship between parties to an instrument where one or more of the parties enter a reservation. In essence this amounts to parties having different rights or obligations under one instrument. It thus seems likely that an amendment would not result in two separate regimes, but could result in one regime with some parties having different rights and obligations to others.

Similarly the FCCC has three distinct sets of parties existing under one regime with distinct rights and obligations: Annex I, Annex II and non-Annex I parties. The additional complexity that would be introduced by an amendment is the likelihood of parties changing from one status to another at different times. Also careful crafting will be required to ensure

that ambiguities are not created in the amendment process in respect of existing provisions of the FCCC.

A protocol would seem, however, to set up a separate regime to the FCCC. In the case of a protocol parties still may have different obligations, but unlike the case of an amendment, those different obligations would be under separate legal regimes.

This distinction seems to us to be important in interpreting the way that an amendment, as opposed to a protocol, would operate. The distinction is pertinent for instance to interpreting the powers and functions of the secretariat in respect of amended provisions, and in determining what would be the entitlement of parties in respect of decision making under the amended FCCC. Different conclusions may well be reached on such questions if an amendment were to be considered to establish a separate regime.

It is also noteworthy that whether an amendment or a protocol is pursued the ultimate objective of the FCCC as set out in article 2 would apply to the new instrument.

D. Rules of Procedure

Parties will need to further consider the issue of rules of procedure in the context of either an amendment or a protocol. An amendment would not appear to require separate rules of procedure. A Protocol may do so however.

In considering a protocol route the example of the Montreal Protocol is relevant. The parties to the Montreal Protocol adopted separate rules of procedure for the Montreal Protocol (as opposed to the Vienna Convention for Protection of the Ozone Layer). Nonetheless, those separate rules were identical in many respects to the rules of procedure for the Convention.

An alternative course of action to separate rules of procedure for a protocol canvassed in FCCC/AGBM/1996/4 (paragraph 20) is the application (*mutatis mutandis*) of the rules of procedure of the Conference of the Parties to the protocol. This course of action would need to be decided by the meeting of the parties under a protocol (as the relevant decision making body). The Conference of the Parties to the FCCC does not appear to have authority to impose its rules on the meeting of the parties for a protocol. This has implications for *mutatis mutandis* application: it can be envisaged that difficulties would arise should the Conference of the Parties for the FCCC, or the meeting of the parties for any protocol, wish to change the rules of procedure, should there be only one such set of rules. Parties may wish to consider the options available to deal with rules of procedure.

E. Decision Making

Parties would also need to address questions of decision making in respect of either an amendment or a protocol. This appears to be an area where there is a significant difference between a protocol and an amendment.

For a protocol a new decision making body is required under FCCC article 17.5, which provides: *Decisions under any protocol shall be taken only by the Parties to the protocol concerned.* This provision makes it very likely that it would be necessary to set up a separate meeting of the parties to the Protocol to make decisions under it. It is noteworthy that article 16 of the Vienna Convention for Protection of the Ozone Layer also provides that: *Decisions concerning any protocol shall be taken only by the parties to the Protocol.* This resulted in a separate "meeting of the parties" being established to make decisions under the Montreal

Protocol. The meeting of the parties functions as a separate institution to the Conference of the Parties under the Vienna Convention.

In the case of an amendment however parties appear to have the option to utilise the existing Conference of the Parties or to provide for separate decision making.

FCCC/1996/AGBM/4 (paragraph 10) presumes that "decisions pertaining to amended provisions would be taken only by those Parties having 'accepted' the amendments". This statement may as a matter of principle be correct, but practice may be otherwise unless this understanding is made explicit by parties. This appears to be a matter to be further considered by parties. The practice under the Montreal Protocol for instance appears to be that all Montreal Protocol Parties participate in such decisions under an amendment irrespective of whether they are parties to the amendment at the time of the decision. It may therefore be necessary to explicitly set out which parties (i.e. all parties to the FCCC or just parties to the amendment) would be entitled to make decisions in respect of an amendment, should that course of action be pursued. This could be done by an explicit provision in the amendment itself or by an amendment to the draft rules of procedure (i.e. rule 42 or a new rule would need to provide explicitly that only parties to the amendment have the right to vote on matters arising in respect of those amendments).

F. Separate Institutions

Parties will need to consider also the need and modalities of any new institutions for the AGBM outcome. The presentation of this issue in FCCC/AGBM/1996/4 (Annex) emphasises the possibility that a protocol regime may require separate institutions whereas an amendment may be accommodated within existing institutions. The institutions that parties may need to consider as to their relevance for the effective functioning of either a protocol or amendment correspond to the existing institutions under the Convention: i.e. a decision making body, a secretariat, subsidiary bodies dealing with technological and implementation issues, a financial mechanism, a process for communication and review of information, a multilateral consultative process, a dispute settlement procedure, and rules of procedure and financial procedures. Apart from a decision making body and the rules of procedure (addressed above) these issues are dealt with below in turn.

(i) *A secretariat*: In the case of an amendment being pursued (given that an amendment extends an existing regime rather than creating a new one), the existing Secretariat would have appropriate functions in respect of such amendments, given FCCC article 8.

Secretariat arrangements for a protocol would appear to be a matter to be decided by the parties to the protocol. In this respect there do not appear to be any legal (or significant practical) impediments to the parties requesting the United Nations (which provides secretariat services under the FCCC) to also provide secretariat services for a protocol. Indeed FCCC article 8.2 (g) explicitly envisages the extension of secretariat services to a protocol or other instrument: *To perform the other secretariat functions specified in the Convention and in any of its protocols and such other functions as may be determined by the Conference of the Parties.*

The Montreal Protocol on Substances that Deplete the Ozone Layer and the Vienna Convention for the Protection of the Ozone Layer provide a possible precedent for handling of secretariat issues which parties may wish to consider. UNEP was selected as both the interim and permanent secretariat of the Vienna Convention. The Vienna Convention secretariat was also made the Montreal Protocol Secretariat when the Montreal Protocol entered into force. In technical terms this was achieved simply by the Montreal Protocol text defining the word

"secretariat" in the Montreal Protocol to mean the Vienna Convention Secretariat. Following this model, the formal extension of secretariat services to any protocol would be a simple matter.

Funding of the new secretariat functions is more complex however, particularly for a protocol. Again in the case of the Montreal Protocol, separate trust funds were established to finance the work of the Secretariat under each of the Vienna Convention and the Montreal Protocol by the meeting of the parties under each instrument. Each trust fund has its own terms of reference. Parties to the Montreal Protocol contribute to the Protocol fund and parties to the Vienna Convention contribute to the Convention fund. Each set of parties approves expenditure for its respective fund. Also article 13 of the Montreal Protocol explicitly provides that "The funds required for the operation of this Protocol, including those for the functioning of the Secretariat related to this Protocol, shall be charged exclusively against contributions from the Parties" (article 13.1). This established a separation of Vienna Convention and Montreal Protocol finances, although the same body provided secretariat services and administered those separate funds.

In the event of a protocol route being pursued for the FCCC, an approach to these issues would need to be considered by the parties. The situation may not be greatly different however in the case of an amendment. Parties would still need to decide as a matter of principle, who should contribute to the financing of activities under the amendment: all FCCC parties, or just parties to the amendment? If it were to be decided that only parties to the amendment should finance such activities then some arrangements would appear to be necessary to establish separate trust funds and financial procedures for them.

(ii) **Subsidiary Bodies:** Parties may decide that the outcomes of the AGBM will require technical input and ongoing review in order for implementation of those outcomes to be effective. Should parties so decide, consideration would need to be given by parties as to how such services would be provided.

These functions are provided for the FCCC by the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation. On the basis of FCCC/AGBM/1996/4 (paragraphs 12 - 14) the FCCC articles pertaining to the two subsidiary bodies and the COP (article 9.3, article 7.2 and article 10) would appear to ensure that there is no impediment to use of these subsidiary bodies for purposes of either a protocol or an amendment, should the COP decide it wishes to utilise them.

In respect of both bodies, it would appear to be necessary for parties to reach some decision as to funding issues that may arise in respect of servicing of meetings of the SBI and SBSTA as they relate to a protocol or an amendment (see also section (vi) below). More importantly parties would also need to reflect on and reach decisions as to any additional work programs that may need to be undertaken by the SBI and SBSTA to service the new legal instrument. For instance additional work may be required of subsidiary bodies in terms of receiving and processing communications from parties (see section (iv) below) and in reviewing progress in implementing the outcomes of the AGBM. There may be some difference in the work programs depending on whether a protocol or amendment route is chosen by the parties.

Other issues flagged by the FCCC/AGBM/1996/4 include membership, election of officers, Bureaus, and decision-making procedures. These issues could however be dealt with on the basis that the subsidiary bodies are not reconstituted by providing advice in respect of either a protocol or an amendment: they are merely given additional functions under the existing legal arrangements.

(iii) Financial Mechanism: The FCCC establishes a mechanism to provide new and additional financial resources on a grant or concessional basis to provide the resources needed by the developing country Parties to meet the agreed full incremental costs of implementing measures under article 4.1 of the Convention and the agreed full costs of compliance with article 12.1 (articles 4.3 and 11) . The FCCC has assigned interim operational responsibility for provision of these resources to an outside agency (the Global Environment Facility). The FCCC also provides however that this agency operates under the guidance of the COP in various respects including ensuring that projects are in conformity with the policies, program priorities and eligibility criteria established by the COP.

The Berlin Mandate is clear in its stipulation that the AGBM process will not introduce any new commitments for Parties not included in Annex I, but reaffirm existing commitments in article 4.1 and continue to advance the implementation of these commitments in order to achieve sustainable development, taking into account article 4.3, 4.5 and 4.7. Parties may wish to consider if there are likely to be any impacts from the AGBM outcome on the financial mechanism of the Convention in light of the fact that the FCCC already provides a mechanism for meeting the agreed full incremental costs of implementing measures under article 4.1.

(iv) Communication of Information: Communication and review of information under the FCCC falls into three categories in terms of the issues raised by the choice between a protocol or an amendment:

- a Information required under article 12.1(a) and (c): This information (required from all parties) is a national inventory of anthropogenic emissions and any other information that a party considers relevant to the achievement of the objective of the FCCC.

It would appear that this information could be provided in respect of either a protocol or an amendment without difficulty under these existing FCCC provisions.

- b. Information under article 12.1 (b): This information (also required of all parties) is a general description of steps taken or envisaged to implement the FCCC.

It seems likely that article 12.1(b) would operate so that this information would automatically also have to be provided in the case of an amendment to the FCCC. Information may have to be collected separately in respect of a protocol under separate information requirements in the protocol itself.

- c. Information under article 12.2: This information (which applies only to Annex I parties) consists of a detailed description of policies and measures adopted to implement FCCC article 4.2(a) and (b) and a specific estimate of the effects of these policies and measures on anthropogenic emissions in the period to the year 2000.

Parties would need to consider whether the new commitments generated for Annex I parties by the AGBM process would require a specific communication process analogous to FCCC article 12.2 to ensure transparency and enable monitoring of performance.

In the case of an amendment these additional requirements could be achieved by amending article 12 itself, were parties to decide this course of action to be appropriate. In the case of a protocol, the parties may need to consider the creation of an additional reporting requirement within the protocol itself. An issue that parties would also need to address in the case of a protocol is the decision making forum to which any

communication is to be delivered. As the meeting of the parties under a protocol is likely to be the relevant decision making authority, any communication containing additional information may need to be provided to the meeting of the parties under the protocol (in addition, perhaps, to also being provided to the Conference of the Parties under the FCCC).

(v) **Multilateral Consultative Process:** Parties would benefit from obtaining a clearer idea of the outcomes of current deliberations by the Ad Hoc Group on Article 13 as to its necessity for the FCCC and the general nature of the multilateral consultative process, in order to facilitate consideration on the possible applicability of that process to the outcomes of the AGBM. Parties may then wish to consider how the outcomes of article 13 deliberation should be related to the AGBM outcomes.

In this respect it is noteworthy that the process provided for in article 13 is explicitly limited to "questions regarding the implementation of the Convention". In the case of a protocol some consideration would need to be given to how to extend this limit. Options might include a parallel provision in a protocol. In the case of an amendment however this difficulty would not appear to arise.

(vi) **Settlement of Disputes:** Article 14 which provides for settlement of disputes allows its provisions to be applied to any related legal instrument (unless provided otherwise in that instrument). At first instance then article 14 would appear to apply both to an amendment or a protocol. Parties may wish to consider whether there is any need to vary this applicability.

(vii) **Financial procedures:** Parties may also wish to consider the issue of financial procedures. It would appear that financial procedures would be more simple in the case of an amendment rather than a protocol. However the additional requirements in respect of a protocol in terms of legal structures can be easily satisfied (as done in the case of the Montreal Protocol). The actual additional funds required in either case of an amendment or a protocol are unlikely to be dramatically different if the approach of minimising duplication of institutions is taken. It seems likely that the primary additional cost would be generated by the additional work program associated with the implementation of the AGBM outcome. This cost would need to be met whether a protocol or amendment is pursued.

G. Changes to the FCCC

Parties may also need to consider consequential changes to the FCCC. An issue flagged by FCCC/AGBM/1996/4 (Annex) is the possibility that an amendment as opposed to a protocol will require such "consequential changes". This is likely to be the case for an amendment, but is also likely to be of minor significance unless parties were to decide otherwise.

The important issue flagged by this observation which parties will need to address would be the potential consequences if amending the FCCC led to parties, or groups of parties, seeking amendments to areas outside the scope of the Berlin Mandate. Such attempts could equally be pursued in the context of negotiating a protocol.

H. Parties to the Instrument

An issue which parties may also wish to consider which is not flagged by FCCC/AGBM/1996/4 is the question of the possible parties to a protocol or amendment.

In the case of a protocol it does not appear to be a requirement that all parties to the Convention have a right to be a party to the protocol. (FCCC article 17 provides that: *Only*

Parties to the Convention may be Parties to a protocol - it does not appear to rule out a protocol only intended for ratification by a sub-group of the parties: e.g. Annex I parties). Depending on the nature of the AGBM outcome, parties may find they wish to consider the option of a restricted group of parties to the FCCC as possible parties to such a protocol.

In the case of an amendment however, the Vienna Convention on the Law of Treaties (article 40) provides: *Every State entitled to become a party to the treaty shall also be entitled to become a party to the treaty as amended*. In the case of an amendment therefore an amendment would have to be open to all parties.

The concept of a "modification" to a treaty, available under article 41 of the Vienna Convention, may also be pertinent. Whether this is an appropriate course of action for the AGBM process could be a matter for parties to consider.

I. Reservations

Another point of possible difference between a protocol and an amendment relates to the making of reservations. FCCC article 24 prohibits reservations to the Convention itself. Parties would need to decide whether or not reservations should be allowed to the outcomes of the AGBM if they are embodied in a protocol. FCCC article 24 would automatically apply, and prevent reservations, in the event of an amendment being adopted unless parties were to explicitly decide that article 24 should have no application to an amendment made by the AGBM process.

Characteristics	Protocol	Amendment
<i>A. Majority for Adoption</i>	Draft rules of procedure provide for protocol to be adopted by [consensus], [2/3][3/4] majority vote of the parties present and voting. <i>In effect the current rule, while the rules of procedure remain in draft form, is consensus.</i>	May be adopted by consensus, last resort 3/4 majority vote of Parties present and voting (article 15.4)
<i>B. Entry into Force</i>	Entry into force requirement to be established by Protocol (article 17.3) Only Parties to the Convention may be Parties to the Protocol (article 17.4)	Entry into force 90 days after 3/4 of parties to Convention have deposited instruments of ratification. Amendment enters into force only for those Parties having accepted it (article 15.4)
<i>C. Relationship with FCCC</i>	Protocol creates a separate regime	Amendment does not create a separate regime, even if all parties to the FCCC do not ratify.
<i>D. Rules of Procedure</i>	Protocol may require separate rules of procedure	Rules of Procedure may need to be amended to govern amendment regime.
<i>E. Decision making</i>	Parties to a Protocol would form a separate decision making forum (art 17.5)	Existing COP would be entitled to serve amended regime.
<i>F. Separate Institutions</i>	A Protocol may need to establish some separate institutions and subsidiary bodies. This is unlikely however in most cases.	Convention institutions could accommodate amendment regime.
<i>G. Changes to FCCC</i>	A Protocol could change the FCCC implicitly by altering the balance of rights and obligations between parties.	An amended regime could require consequential changes to other provisions of the FCCC.
<i>H. Parties to the instrument</i>	A Protocol could limit its parties to a subset of the parties to the Convention	An amendment would be open to ratification by all parties (art 40.3 Vienna Convention on the Law of Treaties)
<i>I. Reservations</i>	The Protocol would determine whether reservations could be made or not.	Unless explicitly stated otherwise by the amending instrument, it is likely that no reservations would be permitted (given article 24)

**Ad Hoc Group on the Berlin Mandate (AGBM)
Fourth session, Geneva**

Possible features of a protocol or another legal instrument

In response to the call at the third session of the Ad Hoc Group on the Berlin Mandate for comments concerning the possible features of a protocol or another legal instrument for consideration at the fourth session, Switzerland presents the following views.

Switzerland has already stated its preference for a protocol during the second session of the AGBM and indicated some priority areas in which policies and measures should be taken. Since then, other Parties have brought interesting elements to the discussion. It is Switzerland's view that AGBM has progressed enough in order to, putting together all these ideas, reach a consensus on the form that the legal instrument should have. The present comments collect elements which should be taken into account for the establishment of such a legal instrument.

1. Switzerland's preference is for a protocol. This protocol should be adopted according to article 17 of the FCCC and following the final decision of the Conference of the Parties at their first session. No new body or bureaucratic structure should be created for the protocol. The Conference of the Parties for the FCCC should also be the responsible body for the protocol.
2. The central component of the protocol must be both policies and measures (P&M) as well as quantified limitations and reduction objectives (QELROs) within specified time frames. Switzerland supports the proposal made by the EU at AGBM 2 containing QELROs and a list of P&M.
3. The list of the proposed P&M should have a certain flexibility in order to take into account new scientific and technological progress. It should address all GHGs and all sectors of emissions. For the P&M, priority should be given to common measures identified by OECD/IEA Annex I Expert Group on the FCCC.
4. Although the protocol should be binding for the Annex I Parties, non Annex I Parties are invited to apply voluntarily P&M of the protocol or join the protocol as a whole.

REGIONAL ASSESSMENT OF THE VULNERABILITY AND RESILIENCE OF
PACIFIC ISLANDS TO THE IMPACTS OF GLOBAL CLIMATE CHANGE AND
ACCELERATED SEA-LEVEL RISE

A SUMMARY FOR POLICY MAKERS

Background

This report was initiated by the South Pacific Regional Environment Programme (SPREP) to assess the regional vulnerability and resilience of Pacific islands to the impacts of global climate change and accelerated sea-level rise. It reflects the continuing and growing concern of the small island developing states (SIDS) of the Pacific with respect to the regional and national manifestations of global climate change and accelerated sea-level rise. The regional synthesis presented here is intended to assist the SPREP Secretariat to continue its support of its members in international negotiations related to global climate change and accelerated sea-level rise.

The findings of the study are summarized below. The full report is available from SPREP.

Findings

There is now a consensus that there is a discernible human influence on global climate. The form these global changes will take in the Pacific is far less certain, but the most significant and more immediate consequences are likely to be related to changes in rainfall regimes and soil moisture budgets, prevailing winds (both speed and direction) and in regional and local sea levels and patterns of wave action.

A second finding is arguably of even greater and immediate importance. Pacific island countries are highly vulnerable to changes in both mean and extreme atmospheric and oceanic conditions. This applies to natural as well as socio-economic systems. In some instances the vulnerability is partially offset by the intrinsic resilience of natural systems and by decisions to manage systems in a way which increases their ability to withstand the adverse impacts of variations in climatic and oceanic conditions. Notwithstanding such characteristics and interventions, Pacific island environments - both natural and human - are undeniably susceptible to extreme and anomalous persistent events occurring under present day conditions. Vulnerability and actual harm are enhanced by increased human pressure on natural systems. This sensitivity, and the consequences, leave little doubt that should the changes predicted in the IPCC Second Assessment Report manifest themselves in the future, the repercussions will threaten the life-supporting capacity of natural systems and the sustainability of human habitation.

Climate change and sea-level rise are two of numerous environmental concerns for island nations and territories of the Pacific. These issues are accorded high government priority in all Pacific Island countries, for it is generally recognised that they would exacerbate most other environmental problems and many social, cultural and economic issues currently facing these countries.

Vulnerability assessments have revealed that it is not only the low islands of the Pacific which are susceptible to the adverse effects of sea level rise. Human population, economic activity and infrastructural development are concentrated in the coastal areas of

high islands. There are few effective opportunities for retreat in face of inundation consequent upon rising sea levels or increased frequency and magnitude of storm waves and surges. These characteristics mean that vulnerabilities are very high in such cases. Few land masses in the Pacific are tectonically stable - systematic changes in sea level may be significantly offset or exacerbated by local uplift or subsidence of the land.

Imperative for Action

There are areas of uncertainty associated with the preceding findings. But many of the anticipated changes may well be irreversible by the time there is certainty of outcome. Moreover, the momentum of change in the combined atmosphere-ocean system is such that the modifications of atmospheric composition taking place as a result of current human activity are already committing our children and their children to living in a world substantially different to the one we know today. From the Pacific island perspective, dangerous anthropogenic interference is already occurring to the climate system.

Basic Response Strategies

There are two main categories of active response to climate change: mitigation and adaptation. The need for both has been recognized in the United Nations Framework Convention for Climate Change (UNFCCC) as well as other agreements and strategies. Mitigation refers to those activities which seek to reduce the build up of greenhouse gas and other climate modifying constituents and thereby reduce the rate and magnitude of climate change. Many countries in the Pacific have done little to cause changes in atmospheric composition and hence in the global climate. Moreover, few are in a position, by themselves, to directly influence mitigation. But collectively Pacific island countries can have an influence on mitigation, as has been amply illustrated by the negotiations leading to the UNFCCC. Consistent with the Convention, Pacific island countries are also active in reporting on and implementing mitigation strategies. For all these reasons, adaptation rather than mitigation strategies were emphasised in the study.

Adaptation is used in the present context to refer to those activities which enable communities, now or in the future, to cope with changes resulting from global warming. It therefore includes activities which seek to offset the costs and increase the benefits that may accrue from climate change. Adaptive responses can be many and varied, reflecting differences in existing social, economic, cultural and environmental conditions and the likely stresses induced by climate change, both within and between countries.

International effort has tended to focus on gaining agreement to limit climate change. Significantly, even if an agreement to totally halt human-induced changes in atmospheric composition could be reached today, there would be residual effects far into the future. These would be due to lags in the response of the climate system to changes in atmospheric composition that resulted from human activity over the preceding decade or more. In the event that significant reductions in anthropogenic greenhouse gas emissions are not achieved for some time, adaptive action becomes even more necessary. Many

adaptation strategies are effectively the same as those which constitute sound environmental management, wise resource use and appropriate responses to present-day climate variability. Often the strategies are found in policies and plans for sustainable development. Thus, adaptive responses may well be beneficial even if the climate does not change as anticipated.

Resource and environmental management strategies which are beneficial for reasons other than climate change, and which can be justified by current evaluation criteria and decision rules, may well be the measures to select first in developing responses to climate change. This approach is referred to as the "no regrets" strategy.

Proposed Policy Responses for Pacific Island Countries

The fundamental motives of protecting environmental and human health and welfare should inspire all island countries in the Pacific to do everything in their power to limit climate change and to plan appropriate adaptations for changes that are anticipated to occur despite international attempts at mitigation. In addition, such planning and policy initiatives must be taken if Parties to the UNFCCC are to meet their obligations.

It is important to realise that there is significant uncertainty surrounding our present information and understanding. For this reason, it is premature to be prescriptive regarding regional response strategies and priorities for addressing the impacts of climate change on Pacific island countries. Much remains to be accomplished in terms of both information gathering and methodology development before the procedures for assessing regional climate impacts and identifying optimal response options (be they mitigation, adaptation or simply no regrets) can be implemented in a comprehensive and rigorous manner for the entire region. Indeed, the study notes that meeting these prerequisites is a high priority in response formulation.

There are several regional responses which would facilitate adaptation to climate change. Priority is given to no regrets policies and plans for, as also noted earlier, these form the basis of sound environmental and resource management regardless of climate and related changes. The following policy responses, some of which are already being coordinated by SPREP, may be worthy of further consideration:

A Policy of Regional Cooperation and Coordination

A Policy of Owning the Issue of Climate Variability and Change

A Policy of Maximizing the Benefits of Climate Change

A Policy to Base Plans and Actions on Factual Understanding of Climate Change

A Policy of Main streaming Climate Change Responses in National Planning

A Policy of Enhancing Capacities to Respond to the Consequences of Anticipated Changes in Climate

A Policy of Enhancing Regional Security

Priority Policies

The policies outlined above are mutually supportive, rather than conflicting or competing. As such they could well be accorded equal and high priority with respect to implementation. However, securing the capacity to implement the policies could be accorded some overall priority. This would help ensure that the remaining policies are implemented in a favourable milieu and in a sustainable manner.

Proposed Regional Action Strategies of High Priority

The study confirmed the need for urgent action at the regional level in order to alleviate the adverse impacts of climate change on human, environmental and economic sectors of Pacific island countries. The strategies are developed in the context of the previously articulated policies. The priority ascribed to them is a reflection of the study's findings related to assessment of the vulnerability and resilience of Pacific island countries to climate and related changes.

A Strategy for Capacity Building

A Strategy for Development and Application of Appropriate Assessment Methodologies and Information Sources

A Strategy to Identify, Assess and Implement Technologies Relevant to Adaptation

A Strategy to Identify, Assess and Implement Investment Instruments Relevant to Adaptation

A Strategy to Support Optimal Management Responses to Climate Change at the National Level

A Strategy for Regional Support for Integrated Coastal Zone Management

Implementation

In keeping with international understanding and priorities, Pacific island countries are committed, individually and collectively, to developing sustainably. Thus the intimate linkages between economic development, environmental, cultural and resource conservation and social progress are recognized. Development must involve achieving an equitable balance between the foregoing goals, rather than seeing them as distinct or differing in priority. For these reasons environmental management cannot be, and typically is not considered in isolation.

If policy development and the ensuing actions to address the anticipated impacts of climate change and accelerated sea-level rise are to be effective they must be mainstreamed in both development planning and disaster management, with core initiatives being identified and implemented within an integrated environmental management framework. This is a current and continuing challenge for Pacific island countries where limitations on resources (human, financial, technical and information) and institutional capacities mean responses that, on occasions, fall short of the optimum approach. The cost is further stress on systems already under pressure.

Further Background to the Study

The review is based, in part, on a synthesis of the findings of preparatory missions conducted under the auspices of SPREP. These involved the Pacific island countries and territories of Tonga, Kiribati, Tuvalu, Cook Islands, Guam, Palau, the Federated States of Micronesia, Western Samoa and Tokelau. Two similar studies were also undertaken in the Marshall Islands.

While each island country or territory in the Pacific faces its own specific mix of environmental problems which will be caused or exacerbated by changes in climate or sea level, or both, it is possible to identify features that are held in common. Despite their diversity, the island nations and territories of the Pacific do have many common environmental concerns, as was demonstrated so forcefully at the United Nations Conference on Environment and Development.

Current Understanding of Climate Change and its Implications for the Pacific

The recent findings of the Scientific Assessment Working Group of the Intergovernmental Panel on Climate Change (IPCC) and other investigations reveal that continuing increases in greenhouse gas concentrations are tending to warm the surface and to produce other changes of climate. These changes are largely attributed to human activities, mostly fossil fuel use, land-use change and agriculture. The warming is being offset, in part, by tropospheric aerosols resulting from combustion of fossil fuels, biomass burning and other sources.

Analyses of meteorological and other data over large areas and over periods of decades or more have provided evidence for some important systematic changes in climate over the past century. Global mean surface temperature has increased by between about 0.3 and 0.6 C since the late 19th century. Recent years have been among the warmest since 1860, i.e., in the period of instrumental record, despite the cooling effect of the 1991 Mt. Pinatubo volcanic eruption. Assessments of the statistical significance of the observed global-mean temperature trend over the last century suggest a significant change and show that the observed warming trend is unlikely to be entirely natural in origin.

There are inadequate data to determine whether consistent global changes in climate variability or weather extremes have occurred over the 20th Century. On regional scales there is clear evidence of changes in some extremes and climate variability indicators. The 1990 to mid-1995 persistent warm-phase of the El Niño - Southern Oscillation (ENSO) (which causes droughts and floods in many areas of the world) was unusual in the context of the last 120 years, as has been the dominance of the warm phase since the mid 1970s.

The climate is expected to continue to change in the future. For the mid-range IPCC scenario of greenhouse gas and aerosol precursor emissions, assuming the "best estimate" value of climate sensitivity, 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, due primarily to lower emission scenarios (particularly for CO₂ and the CFCs), the inclusion of the cooling effect of sulphate aerosols, and improvements in the treatment of the carbon cycle. Despite these reduced estimates of the magnitude of global warming, the Alliance of Small Island States (AOSIS) and others have noted that large reductions in greenhouse gas emissions are required to stabilize atmospheric concentrations at safe levels.

Moreover, future unexpected, large and rapid climate system changes (as have occurred in the past) are difficult to predict. This implies that future climate changes may also involve "surprises".

Studies carried out under the auspices of IPCC indicate that the biases in simulations of regional climate change and the inter-model variability in the simulated regional changes are still too large to yield a high level of confidence in simulated change scenarios.

The IPCC emphasises that regional temperature changes could differ substantially from the global mean value. Confidence is higher in the hemispheric-to-continental scale projections of coupled atmosphere-ocean climate models than in the regional projections, where confidence remains low. There is more confidence in temperature projections than hydrological changes. The cooling effect of aerosols is not a simple offset to the warming effect of greenhouse gases, but significantly affects some of the continental scale patterns of climate change, most noticeably in the summer hemisphere. The spatial and temporal distribution of aerosols greatly influence regional projections, which are therefore more uncertain.

Despite the serious constraints on the current use of global climate models for prediction of changes in regional climate, some benefits arise from studying the results of recent efforts. In general, temperatures in the Pacific exhibit minor sensitivity to an effective doubling of CO₂, though the sensitivity increases with latitude and in winter relative to summer. Changes in seasonal rainfall produce somewhat complex patterns, but mean annual rainfall is generally higher, except for mid latitude areas.

These results suggest that, for lower latitude areas of the Pacific, systematic increases in local temperatures will not be an important consequence of an enhanced greenhouse effect. However, recent calculations which include oceanic heat transfers more consistent with observations suggest that the Southern Hemisphere oceans would warm at twice the rate predicted by other models. Greater rates of warming in the tropical atmosphere than has been indicated in recent studies are also suggested by the recent finding that increasing water vapour resulting from higher temperatures is unlikely to form thicker and hence more reflective clouds. Instead it is likely to remain dispersed in the atmosphere, where it can act as a greenhouse gas, increasing the rate of warming, or increasing the amount of rainfall. Recent satellite studies suggest that clouds actually become thinner as warming increases. The findings are consistent with the predictions of many global climate models that the warming effect of increased water vapour would

predominate over the cooling effect of increased cloud formation. Such results are consistent with recent studies of the geologic record which show that during the last ice age tropical temperatures varied more than previously thought.

A general warming is expected to lead to an increase in the occurrence of extremely hot days and a decrease in the occurrence of extremely cold days. Warmer temperatures will lead to a more vigorous hydrological cycle; this translates into prospects for more severe droughts and/or floods in some places and less severe droughts and/or floods in other places. Several models indicate an increase in precipitation intensity, suggesting a possibility for more extreme rainfall events.

Studies also show that it is necessary to consider climate elements other than temperature, including rainfall and wind and extreme events such as tropical cyclones. The naturally large interannual variability in these elements, and their poor characterization by climate models, severely restrict the ability to make reliable estimates of changes in such variables as a result of greenhouse warming.

The IPCC notes that the behaviour of the ENSO has been unusual since the mid-1970s and especially since 1989. Since the mid-1970s warm episodes (El Nino) have been relatively more frequent or persistent than the opposite phase (La Nina). The recent ENSO behaviour, and especially the consistent negative values of the Southern Oscillation Index since 1989, appears unusual in the context of the instrumental record that spans the past 120 years. However, evidence suggests that such unusual patterns have occurred prior to the period of instrumental record.

Several coupled ocean-atmosphere general circulation models are able to simulate ENSO-like sea surface temperature variability for present day climate, and also for climates associated with increased greenhouse gas concentrations. However, it is not at all clear whether global warming will affect the characteristics of ENSO and the climate patterns with which it is related.

The IPCC warns against overly simplistic conclusions that, since sea surface temperatures are likely to increase, so too will the occurrence of tropical cyclones. Although some models now represent tropical storms with some realism for present day climate, the state of the science does not allow predictions of future changes.

In the south Pacific the number of tropical cyclones appears to have increased and in the latter case this may be related to the increased frequency of El Nino events. But such conclusions must be qualified in light of the quality (especially the lack of consistency) of the long term cyclone data base. Knowledge is currently insufficient to say whether there will be any changes in the occurrence or geographical distribution of severe storms, e.g., tropical cyclones. The formation of tropical cyclones depends not only on sea surface temperatures, but also on a number of atmospheric factors including the vertical lapse rate of temperature and vertical wind shear. Although some models now represent tropical storms with a degree of realism for present day climate, the state of science does

not allow conclusive assessment of future changes. Some research suggests that there are in fact no compelling reasons for expecting a major change in *global* tropical cyclone frequency, although substantial regional changes may occur. At present models are incapable of predicting the direction of such changes. But other researchers claim it is highly probable that the increasing temperature differences between the tropical atmosphere and oceans as a result of global warming would be accompanied by an increase in the maximum intensity of actual tropical cyclones. Meanwhile, another investigation indicates that there is unlikely to be more intense tropical cyclones than the worst that occur at present, though there is some propensity for changes in cyclone frequency in regions where sea surface temperatures are between 26 and 29 C at present. Another study found that for an enhanced greenhouse scenario the geographical distribution of tropical cyclones was unchanged but the number decreased, especially in the Southern Hemisphere.

The IPCC concludes that it is very much open as to whether the frequency, area of occurrence, time of occurrence, mean intensity or maximum intensity of tropical cyclones will change as a consequence of global warming.

Global sea level has risen by between 10 and 25 cm over the past 100 years and much of the rise may be attributed to the increase in global mean temperature. The "best estimate" of the effect of global warming is an increase in sea level of about 50 cm from the present to 2100. This estimate is approximately 25% lower than the "best estimate" in 1990 due to the lower temperature projection, but also reflects improvements in the climate and ice melt models.

Sea level would continue to rise at a similar rate in future centuries beyond 2100, even if concentrations of greenhouse gases are stabilised by that time, and would continue to do so even beyond the time of stabilisation of global mean temperature. Regional sea level changes may differ from the global mean value owing to land movement and ocean current changes.

Additional Information on Common Findings in the Country Studies

Based on the findings of country and more detailed studies, the following are the common themes, issues and findings relating to variations in, and changes to climate and/or sea level.

Physical changes to the Environment

The relevant factors leading to physical changes to the coastal environment include not only sea-level rise, but also significant variations in the characteristics of storm surges, wind velocity, near shore currents and wave energy. Possible consequences depend on a range of factors - island size, elevation and shape; exposure to wind and waves; length of shoreline and its composition; vegetation cover and the nature of any adjacent reef and lagoon features.

For example, studies for Majuro Atoll (Marshall Islands) indicate that, even for a

25 cm increase in sea level, the shoreline would retreat by as much as 5 m. Nearly 10% of the dry land area would be lost as a consequence of such a higher sea level. Flooding would impact a further 30% of the land area. At one site, with a 25 cm increase in sea level, flooding frequencies would increase from the present 1 year in five to 10 times per year.

Flooding of land, or at least excessive levels of soil water or salt, may result from a rising water table which is in turn a natural consequence of higher sea levels. In lowland areas, ground water can also lead to increased surface flooding or land can become swampy and springs more prevalent should rain storms be heavier or of longer duration. On steep uplands excessive soil loss can be expected with such changes, or with modification of surface land cover and use as a consequence of changes in the climate. The resulting sediment will likely have detrimental effects on lagoon and near shore ecosystems. Soil can be also be degraded through a loss of moisture due to decreased precipitation or enhanced evaporation, changes that are anticipated for some other areas of the Pacific.

Under storm conditions, strong winds are capable of carrying sea salt inland for considerable distance, with detrimental impacts on natural vegetation and crops, physical infrastructure and potable water supplies.

The effect of sea level on ground water conditions can be increased further by dredging and quarry operations increasing the coupling of the ocean and ground water. Similarly, projects such as channel development or causeway construction may modify lagoon circulation characteristics, and hence the factors controlling water level differences between lagoon and ocean.

A major issue is how coral reefs will respond to the projected rises in sea level. Their response may well be conditioned, in part, by higher ocean temperatures since above a certain temperature corals typically eject their symbiotic algae. This results in "bleaching" and possible widespread death of corals. As this response is also associated with other excessive stresses on the ecosystem, a healthy reef ecosystem is more resilient to rising sea-surface temperatures. In the past healthy reef systems have survived 1000 years or longer periods where sea level has risen by 20 mm y^{-1} . A "best guess" of maximum vertical coral accretion under ideal conditions is 10 mm y^{-1} , but modal rates for shallow lagoonal reefs is 0.6 mm y^{-1} , for coral reef flats 3 mm y^{-1} and for coral thickets 7 mm y^{-1} . On the other hand a "best guess" for sea-level rise is around 4 mm y^{-1} . Thus healthy reefs may be able to adapt to sea-level rise, the response being helped by fewer exposures at low tide and by enhanced water circulation. But such responses will be severely hampered by coral bleaching, sedimentation effects, physical reef damage, freshwater inputs, pH, sunlight, resource exploitation and other human induced impacts.

Where reef fronts do not keep pace with sea-level rise there will be greater opportunity for storms and cyclones to damage exposed and degraded parts of lagoons, such as by burying corals and other animals in sediments and eroding shorelines.

Particularly in the case of nursery areas for vertebrate and invertebrate species, destruction of these habitats could have a serious impact on the near shore environment and resources, and hence on the lifestyles of the people who depend on them.

b. Physical Resources

Here emphasis is placed on the potential of climate change to impact adversely on water resources and materials availability. Considerable concern exists with respect to issues of water quality, quantity and security of supply.

Climatic factors are extremely important in determining the nature of small island surface- and ground-water supplies. While one of the initial effects of sea-level rise may be a slight increase in ground water resources - a consequence of the increased capacity of upper water-bearing units - in the longer term serious losses will likely occur. Two main causes are identified. Catastrophic flooding due to high storm tides may not have a permanent effect, but through salt water intrusion may well make the ground water resource unusable at a time when other water supplies are also disrupted. The second, and more insidious effect is a consequence of island area loss, either by frequent tidal inundation of low-lying areas or by erosional loss of shoreline. A 25 cm rise in sea level has been estimated to reduce the cross-sectional area of the fresh water lens on Laura (Marshall Islands) by some 10%.

Demand for natural materials arises from four major activities - new construction, reclamation, protection and upgrading of infrastructure. Material can be removed from the lagoon, other land areas or from offshore. In the absence of other readily accessible sources, on many atoll and reef islands material is taken from coastal sand deposits or rubble banks created by cyclonic storms. Since these formations are integral to the continuing existence of the island system their removal increases vulnerability to many of the likely manifestations of climate change. Dredging of lagoon sediments may also prove to be unsustainable under present conditions and increase vulnerability to future changes in climate and sea level by removing sediment from the natural system.

c. Living Natural Resources

Historically, living natural resources have been generally abundant throughout the Pacific. But this is changing rapidly as population increases and as modern and non-selective methods of exploitation replace more benign traditional practices. Organisms already under stress risk are likely to be further pressured by the consequences of climate change. For higher islands, living marine resources would be adversely affected by substantial increases in freshwater runoff and sediment input to lagoon and reef ecosystems. These would change salinity and light levels, as well as impair the physiology of many species. With the high degree of endism in terrestrial species in the Pacific native plants, animals and birds could be further threatened by land loss, inundation, flooding, drought and salinization.

d. Extreme Events

Natural hazards already have a disproportionate effect on the environment, resources and population of the Pacific islands. This is especially due to there being little excess natural or human capacity to absorb the additional stresses. Therefore island nations of the Pacific are particularly vulnerable to extreme events such as tropical cyclones, earthquakes, tsunami (seismic sea waves), storm surges and volcanic activity. Some 90% of all indigenous and plantation trees on the Samoan island of Savai'i were defoliated during Cyclone Val, while 40% of the indigenous and 47% of plantation trees were snapped in half or uprooted.

The current inability to predict any of these extreme events, but their substantial influence on human safety and well being and on environmental sustainability, provides a special challenge to planning and management.

e. Agriculture, Forestry and Food Security

Growth of some plants is expected to increase as a result of increased carbon dioxide concentration in the atmosphere, but this advantage may well be offset by increased heat and water stress, factors which are already prevalent in many countries by the end of the dry season. Prolonged droughts raise the likelihood of fires which destroy protective vegetation and agricultural crops, thus increasing the incidence of soil erosion and, in turn, reducing land productivity. On the other hand, excessive rainfall can threaten the viability of certain crops.

Salt water intrusion into pulaka and taro pits has traditionally been a problem, especially during droughts, and hence could be exacerbated by global warming since higher sea levels and waves are likely to cause more salt mixing in the freshwater lens. Storm wave over-wash and salt spray would also damage crops, while increases in the ground water level and the associated increased flooding of low-lying areas would reduce other opportunities for agriculture.

But there is evidence that people can respond quickly to climate related disasters. In Western Samoa after Cyclone Ofa (February, 1990) staple food crops were scarce and vegetables were not seen in normal quantities for ten months. By way of contrast, vegetables were soon available after Cyclone Val (December, 1991). In addition, the increased availability of taro and other "storm resistant" crops show that farmers responded quickly to the first cyclone. Farmers have also changed their planting schedules to avoid cyclone damage to crops. Adaptation of temperate forestry concepts to the higher temperature tropics has required the use of new tree planting and husbandry methods in order to protect seedlings and workers from the sun and from storm damage. These experiences will assist in identifying and responding to the additional changes required should global warming occur.

Very little has been done to model the complex circulation patterns in the Pacific at

large, and locally. Fish is a major source of protein for many Pacific islanders. Fish take is closely related to ocean currents, zones of upwelling, temperature and to tidal patterns. For many countries storm conditions bring fishing activities to a halt, or severely reduce catches. This again compromises food security given fish is often a major food source and cannot be stored for long time periods. Should the frequency of such weather conditions increase as a consequence of global warming this will place added burden on populations already facing protein deficiency and other food shortages. Access to imported foods can similarly be restricted by severe weather conditions which limit air and sea transport.

f. Human Health

The vulnerability of Pacific island people to health problems is a concern as is the inadequacy of facilities for treatment. While increases in thermal discomfort and heat stress may not be as great as those based on earlier estimates of global warming, higher water tables in some circumstances are likely to cause deterioration in human health. For example, longer periods of standing water could lead to an increase in mosquitoes which in the Pacific are vectors for dengue fever, malaria and elephantitis. The degree of contamination of surface, ground and lagoon water by human and domestic waste will also increase as the water table rises.

Higher temperatures would influence the ability to store food and medication while climate change in general has implications for healing of injuries and skin and other infections. The demand for mental health services may also be affected due to increased mental stress associated with the real and perceived personal consequences of climate change.

Many of the dispensaries and related health care facilities in the more remote areas of the Pacific are housed in buildings which are highly vulnerable to hurricane force winds. This, and possible damage to other structures such as radio transmission equipment, would greatly impair the ability to arrange for, and provide, emergency care during adverse weather conditions. There is also the possibility that underground reticulated systems (power, telephones), which provide for the basic needs of all people, will be adversely affected by rising and salt-contaminated ground water.

g. Commerce, Transport and Communications

In most countries there is a scarcity of raw materials and even the existing tenuous methods of supply are highly vulnerable to disruption by natural events. Many island nations have sea and air services run by single operators with limited or no reserve capacity. In-country inter island communications often make use of vulnerable high-frequency radio. Several countries are now totally reliant on satellite-based systems for international telecommunications. But to reduce the risk of damage to the antenna the usual procedure is to take it out of service and protect it when tropical cyclone or other potentially damaging conditions are forecast. This may well be the time when there is the greatest need to send messages overseas.

Underground utility reticulation could be affected as water levels rise, especially if the water is saline. In many island countries these underground aquifers are the only source for the fresh water necessary to sustain human habitation.

Tourism is considered by most countries to be at least a partial remedy to depressed economics, but both operations and patronage can be impeded by adverse weather and climate conditions brought about by climate change.

h. Waste Management

The disposal of solid waste and waste water is having a serious detrimental environmental impact in most countries, thereby reducing the resilience of these systems to accommodate change. Land, land-based marine disposal and marine disposal are all implicated. The problem is exacerbated by a lack of planning and inadequate management of waste materials, including enforcement of existing regulations. Changed coastal current patterns could have the undesirable effect of preventing the anticipated dispersal of sewage from ocean outfalls. As water levels increase in-ground waste disposal facilities such as septic tanks and latrines could be affected adversely. The lack of appropriate waste management and planning can lead to increased methane production, thus contributing further to global warming.

i. Physical Infrastructure

Sea walls, breakwaters, groynes, wharves, slipways, causeways are all threatened by rising sea level and increased storm waves, as are port infrastructure, coastal tourism facilities, roads and other structures built at or near sea level.

Often infrastructure development in coastal areas involves clearance of mangroves, rendering shorelines more vulnerable to erosion and causing loss of important habitat for many marine organisms. This will in turn increase vulnerability to any further environmental changes.

Studies have highlighted difficulties associated with inadequate information resources to support assessments of the risk to infrastructure and humans that are undertaken using more advanced techniques such as those found in geographic information systems. While a contour interval no greater than 0.5 m is desirable, in many instances the interval is 10 or even 30 m. Land use maps are often outdated and scales inadequate for locating individual communities and buildings.

Moves away from traditional forms of housing has increased vulnerability to thermal stress and, in some countries, increased the use of air conditioning. Imported materials used in buildings are often difficult to replace after a storm or other damage causing events, and are prone to causing additional damage and personal injury relative to more harmless local materials.

A Wider View of Climate Change in the Pacific

Identifying and responding to the implications of climate change and sea-level rise requires improved regional coordination and integration of national and local concerns, needs and capacities. This suggests an acceleration of recent initiatives to heighten the influence of small island developing states in negotiations of international agreements and a strengthening of national level capacity. It also implies a balance between top down and bottom up policy formulation and implementation of response strategies. Importantly, in addition to the coordination roles of regional and international organisations, local people must be mobilized to regard climate change and its consequences as their problem. They must assume a role in deciding upon and implementing remedies. This approach requires participation of non governmental organizations, especially religious and village organizations.

There is also a need for increased awareness at the political level, and at the upper levels of the religious and social hierarchies. Such an awareness must be built on a firm foundation of understanding, resulting from additional scientific data and other information being made available in a way which is commensurate with requirements at both national and regional levels.

The spatial and temporal scales of climate change and sea-level rise, and the processes involved, are unfamiliar to all but a minority of well-educated Pacific islanders. There is also the "competition" with more immediate problems - changes occurring over decades or perhaps centuries can be worried about in the future. Change is also of less practical concern to those living in a naturally highly dynamic (variable) environment, leading to a feeling of powerlessness to modify nature. In addition, there is a prevalent attitude that the ability to cope with the devastating effects of tropical cyclones and other natural hazards is evidence of an aptitude to handle any future environmental threats. While this might have been the case in the past, many of today's natural systems have been degraded by human activity and are therefore more vulnerable to stress, be it natural or human-induced. Moreover, changes in construction materials, methods and styles have all reduced the ability to make rapid and locally sourced repairs to homes and other buildings.

Over and above these personal attitudes is the perception that global warming and rising sea levels may bring tangible benefits to the Pacific. For this reason, some argue that the changes should not be impeded - rather, the approach should be one of adapting to the detrimental consequences and maximizing any benefits. The latter include the increased productivity of tropical food crops being grown in areas where the climate is distinctively sub-tropical and improved navigation due to increased water depth over hazards to shipping. As noted by the IPCC, the potential negative impacts are likely to far outweigh any benefits.

The present study has highlighted the importance of climate change, accelerated sea-level rise and associated issues to Pacific island countries and territories. Their vulnerability to such changes has been recognized in a series of country studies and

recently confirmed by the IPCC in its recently completed Second Assessment.

The vulnerability is in some instances partially offset by the intrinsic resilience of many natural systems. But this in turn is under threat, from increasing human pressures and from the instabilities likely under a changed climate.

Many institutions and organizations - national, regional and international - are addressing the policy, planning and management issues that arise during consideration of the implications of climate change and accelerated sea-level rise. But their efforts are hampered by limited capacities, nationally and regionally, to identify, evaluate and implement appropriate response options.

Despite these shortcomings, and because of the seriousness and urgency of the problem, a number of appropriate policy responses may be identified. The most important and urgent is to address the capacity constraints. Within the framework provided by these policies a number of more detailed response strategies have been proposed. They all provide support at the regional level for responses that must ultimately be developed and implemented at the local and national levels.