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STRENGTHENING THE COMMITMENTS IN ARTICLE 4.2(A) AND (B)

QUANTIFIED EMISSION LIMITATION AND REDUCTION OBJECTIVES WITHIN SPECIFIED TIME-FRAMES

Review of possible indicators to define criteria for differentiation among Annex I Parties

Note by the secretariat

CONTENTS

GE.96-62579

I. INTRODUCTION

A. Mandate

1. The Ad Hoc Group on the Berlin Mandate (AGBM), at its second session, requested the secretariat to prepare, for consideration at its fourth session, a document reviewing possible indicators that could be used to define criteria for differentiation among Annex I Parties (FCCC/AGBM/1995/7, para. 39).

B. Scope of the note

2. This note is an initial presentation of ideas on possible indicators for differentiation. Differentiation in this note has, in the absence of an agreed definition, been taken to mean that some Annex I Parties or groups of Parties would have commitments that are different from those of other Annex I Parties or groups of Parties.

3. The note does not consider the question of whether or not differentiation is necessary or desirable. In the absence of any specific discussion in the AGBM or guidance from the AGBM on the question of differentiation, it does not seek to develop such indicators for differentiation nor to recommend any particular options. While differentiation could apply to policies and measures as well as to quantified emission limitation and reduction objectives (QELROs), this initial note focuses upon the latter.

4. The note is divided into four sections. Section II discusses a number of background issues. Section III outlines the basic understandings on which, in the absence of explicit guidance, this note is based. These two sections are designed to set the stage for a discussion of indicators. Section IV then provides an overview of some possible indicators for differentiation. The first annex to the note gives selected extracts of proposals made in relation to differentiation; the second annex lists most Annex I Parties, their 1990 greenhouse gas emissions, and carbon dioxide (CO_2) emissions, according to three different indicators.

5. A number of Parties have referred to related concepts such as "equitable burden sharing", collective objectives, or an "emissions bubble". This note has been prepared on the understanding that indicators for differentiation could contribute to implementing these and similar concepts.

C. Possible action by the Ad Hoc Group on the Berlin Mandate

6. The AGBM may wish to consider the following issues:

(a) Should the protocol or another legal instrument to be adopted by the Conference of the Parties at its third session (COP 3) include provision for differentiation among Annex I Parties?

(b) If so, what might be the nature of this differentiation?

(c) How would different categories of Parties be determined and what would be the role of indicators in this regard?

As a means to narrow the scope of future deliberations, the AGBM may wish to invite interested Parties to develop a concrete proposal on differentiation, possibly including indicators, that would help to focus the discussion. In addition, it could be possible to arrange an informal workshop on the issue. However, further work on indicators by the secretariat, in the absence of guidance on the nature of the differentiation to be pursued, may not be productive. On this basis, the AGBM may wish to clarify how it wishes to approach its next discussion of the issue.

II. BACKGROUND

A. Differentiation in the Convention

7. Differentiation is reflected in the Convention in several ways. First, there is a clear differentiation between Annex I and non-Annex I Parties, and between Annex II and other Parties. There is also some differentiation among Annex I Parties. Article 4.6 provides that a certain degree of flexibility shall be allowed by the COP to the Annex I Parties undergoing the process of transition to a market economy, and is an example of "contextual" differentiation as discussed in paragraph 18 below.

8. Further contextual differentiation is found in Article 3.1 which refers to "common but differentiated responsibilities and respective capabilities" and provides that developed country Parties should take the lead in combating climate change and the adverse effects thereof. Contextual differentiation is again present in Article 4.2(a), which refers to Annex I Party commitments while also "taking into account the differences in these Parties' starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these Parties to the global effort regarding that objective". Article 4.2(a) is also reflected in paragraph 2 (a) of the Berlin Mandate (decision 1/CP. 1).

9. Articles 4.1, 4.3 and 4.10 also reflect some degree of differentiation *vis-à-vis* the implementation of commitments by Annex I Parties. The Convention also provides for differentiation among non-Annex I Parties, including Article 12.5 which allows Parties that are least developed countries to make their initial national communication at their discretion.

B. Current situation in the Ad Hoc Group on the Berlin Mandate

10. The limited discussions in the AGBM to date would suggest that there are two general approaches to the question of whether there should be differentiation among Annex I Parties in the protocol or another legal instrument to be adopted at COP 3. Some Parties have spoken in favour of a "flat rate reduction" objective, because of the difficulty they perceive in negotiating a differentiated regime. They also see such an approach as equitable, by virtue of the fact that progress is measured against a Party's own national emissions in the base year.

11. Other Parties see deficiencies in the "flat rate" approach and have advocated a differentiated approach. In their view, this would better respond to differing national circumstances, particularly with regard to costs of abatement and levels of economic development and growth. They also see differentiation as more equitable and efficient and argue that it would enhance the cost-effectiveness of the emission reduction effort.

12. In their submissions, some Parties have suggested a number of indicators for differentiation, to be employed either individually or in combination. Where there were several similar proposals, these have in the following list been grouped as a single item to reduce repetition. Annex I to this note gives fuller citations from which the following proposals have been extracted:

(a) Emissions per square kilometre of a country's territory (see annex I, items a, f);

(b) Availability of sinks (annex I, item f);

(c) "Critical economic loads" (annex I, item e);

(d) Per capita emissions (annex I, items a, f, g, i, j);

(e) Per unit of gross domestic product (GDP) or gross national product (GNP) emissions (annex I, items a, f, g, i, j);

(f) Share of global emissions (annex I, item g);

(g) Share of respective Party to global warming (annex I, item i);

(h) Carbon intensity of primary energy use (annex I, item g);

(i) Marginal costs of abatement per unit of reduction (annex I, items g, h, j); and

(j) Levels of production and consumption of energy per capita (annex I, item f).

This list is not exhaustive of all possible indicators for differentiation; in addition, many of the indicators listed here could be further refined.

13. Parties have also proposed a number of approaches to implementing differentiation, including the following (annex I to this note again gives fuller citations from which these proposals have been extracted):

(a) Countries in a given category or across categories could choose to form clusters, combining their emission reduction objectives and sharing the costs and benefits of achieving them (annex I, items c, g);

(b) A protocol could be drawn up with different provisions for different groups of countries (annex I, item c);

(c) A system of "dual commitments" could be devised (countries accepting separate domestic and "international" commitments) (annex I, item b);

(d) A system of market mechanisms could be introduced, for example a progressive tax on CO_2 at coordinated rates; an equal price on emissions wherever they occur, and enabling market transactions to lead toward this efficient allocation; an economic instrument which equates the size of the incentive to mitigate emissions (annex I, items h, j); and

(e) Countries with relatively high domestic costs of measures might do more internationally (assuming this is cheaper) and countries with relatively low domestic costs would do more at home (annex I, items b, j).

Again, this list is intended to identify proposals mentioned so far by Parties. It is not meant to exhaust all possible approaches to differentiation. In particular, concepts of emissions permits and emissions trading, emissions caps, and banking or crediting of emissions reductions could be added.

C. Work on indicators in other forums

14. A number of international organizations, and some Parties, are working on, or have developed, environmental indicators. However, indicators tend to be specific to the task for which they have been designed. Thus, environmental, sustainable development, or economic indicators, for example, while enriching the discussion of indicators for differentiation among Annex I Parties, may not readily meet the needs of the AGBM in this context.

15. Chapter 40 of Agenda 21 called for the development of indicators of sustainable development to be used at the national level. The Commission for Sustainable Development, through the Department for Policy Coordination and Sustainable Development, has been coordinating this work, which is being performed by a number of international agencies. A major element of this work has been the drafting of methodology sheets describing the

significance, methodology and data availability for approximately 135 sustainable development indicators. Some of these indicators relevant to climate change include:

(a) Emissions of greenhouse gases;

(b) Annual energy consumption per capita;

(c) De- and re-forestation rate;

(d) Share of natural-resource-intensive industries in manufacturing value added; and

(e) Ratio of consumption of renewable to that of non-renewable energy resources.[1]

16. This work remains at a relatively formative stage. It is unlikely that results will be available in time to meet the schedule of the AGBM. Moreover, while some of these indicators may be relevant to climate change policy making or as measures of progress, their relevance to differentiation of commitments among Annex I Parties may be somewhat limited.

III. DIFFERENTIATION AND INDICATORS

17. In preparing this note, the secretariat based its work on the following understandings.

18. Differentiation among Annex I Parties could take one of two forms:

(a) The differentiation could be "concrete", whereby different Parties or different groups of Parties would have different commitments. For example, Parties could be divided into two or more groups, with each group having different QELROs or different base or target years; or

(b) The differentiation could be "contextual", in that Annex I Parties would share the same commitment or commitments, but the achievement of such commitments would depend upon, or take account of, the national contexts.[2]

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[1]Implementation plan for the Commission for Sustainable Development work programme on indicators for sustainable development, November 1995.

[2]Relevant examples from other conventions are outlined in section IV of document FCCC/AGBM/1996/6 on the possible features of a protocol or another legal instrument.

19. The secretariat prepared this note on the understanding that "indicators for differentiation" are a means to help Parties take decisions on how the commitments adopted by Annex I Parties or groups of Parties might differ. Indicators for differentiation thus have a specific purpose that distinguishes them from other indicators, such as indicators for sustainable development or other environmental indicators.

20. Simple indicators would be easier to negotiate, compile and use. More complex indicators, or compilations of indicators, may be more sensitive to national differences, may better clarify the forces which drive emissions, and may also have the potential to result in more efficient and equitable outcomes. Complex indicators, or compilations of indicators, would, however, take some time to be developed and agreed. Likewise, indicators for factors that can be directly observed may be more readily adopted than indicators which have to be estimated.

21. If differentiation is to be pursued, the AGBM may wish to consider whether this might be considered on an incremental basis, beginning with a "knowledge building" phase. Alternatively, or in addition, the outline of a differentiated approach could be adopted, and the details subsequently negotiated.

22. A system for differentiation could be implemented with or without the use of indicators. Though the former case is the subject of this note, the AGBM may wish to observe that there are several possibilities for the latter case. For example:

(a) Parties could "self-select" into one of several "commitment categories" that the AGBM had established. For example, the AGBM could adopt several QELROs, and invite Parties to subscribe to the commitment which is most suited their national circumstances. In this way, different groups of Parties would be constituted. Parties could be invited to outline the reasons for their choice, to help clarify those factors most relevant to differentiation;

(b) The AGBM could decide to allocate commitments based upon economic or other differentiation formulae which, for example, attempt to define a set of actions that would minimize the overall international cost of abatement. While this may be a long-range possibility, in the absence of a relevant internationally accepted model, and as the numerous existing models vary significantly in their estimates of costs and prescriptions for action, it may be premature for the AGBM to consider adopting such an approach to differentiation at this time; or

(c) The flat rate and differentiated approaches, discussed in paragraphs 10 and 11 above, could potentially be combined. Under this possibility, all Parties could agree to a flat rate of emissions reductions for a portion of their burden, and further reductions could be negotiated according to differentiated formulae.

IV. OVERVIEW OF SOME POSSIBLE INDICATORS FOR DIFFERENTIATION

23. For the purposes of this paper the secretariat has identified three clusters of indicators for differentiation among Annex I Parties. These indicators are based on:

(a) National emissions;
(b) National circumstances; and
(c) Costs of action.

Parties may wish to propose additional clusters. Possible indicators falling within each of these clusters are discussed below, including issues related to how they might function in differentiating among Annex I Parties.

A. National emissions

24. Three basic indicators are commonly identified as potentially useful in differentiating among Annex I Parties:

(a) Emissions per Party;
(b) Emissions per capita; and
(c) Emissions per unit of GDP.

"Emissions" could be taken as pertaining to individual greenhouse gases, or to all greenhouse gases aggregated using global warming potentials, and could also be taken to include removals by sinks. Annex II to this note contains a list, presented for illustrative purposes only, of those Annex I Parties for which data were available from national communications, their total greenhouse gas emissions, and CO_2 emissions, for each of these three indicators for 1990. In addition, a perspective on the use of two of these indicators is provided in the second compilation and synthesis of national communications from Annex I Parties (FCCC/CP/12/Add.1, para. 29).

25. The level of emissions per Party is the most straightforward indicator. The relevant 1990 information is readily available in the national communications for most greenhouse gases, although it is not always directly comparable. Variations on both this and the following two indicators would include the capacity to reflect changes over time by adopting different base and benchmark years, or to calculate average annual emissions over a multi-year period. It might also be possible to reflect in some way the concept of historical emissions, or a Party's share of global emissions.

26. The emissions per Party indicator would allow for differentiation according to the absolute level of emissions, or the rate of change of emissions over time. For example, particular commitments could be applied to Parties or groups of Parties, based on their emissions levels in a particular year or years. This indicator would not reflect the different

circumstances of populous countries, energy-inefficient economies, energy-intensive primary or secondary industry economies, or fossil-fuel dependent countries. All have high levels of emissions, although the reasons in each case are very different. Nor would this indicator reflect the cost of emission reductions.

27. The indicator of emissions per capita is one of the most commonly used indicators. It is readily calculated by dividing national emissions by national population. It is a more refined indicator than emissions per Party as it reflects a Party's emissions per individual.

28. Differentiation according to emissions per capita could take the form of different commitments for Parties whose per capita emissions fall above or below a certain level. Unlike emissions per country, emissions per capita is an indicator which can over time distinguish between rising emissions due to rising population, and rising emissions for a given population. It would not reveal the reasons for differences in per capita emissions, which include the factors mentioned above in the discussion of emissions per Party. It would also not reveal the cost of emission reductions, or identify relevant national circumstances, for example as discussed in paragraph 31.

29. Emissions per unit of GDP is the third basic measure. It is calculated by dividing national emissions by national GDP (and could be refined by calculating emissions per GDP adjusted, for example, for purchasing power parity).

30. Emissions per unit of GDP could permit differentiation on the basis of whether Parties fall above or below a certain level of emissions per GDP. A more sophisticated application of this indicator would disaggregate national emissions per unit of GDP on a sectoral basis (agriculture, industry, transport, and so on, or yet more detailed breakdowns). The measure is dependent on calculations of GDP, methodologies for which vary between countries. As emissions per unit of GDP vary according to national energy sources and energy efficiency, type of economic production, consumption of energy per unit of GDP, and so on, it can disguise a variety of national circumstances. It is thus not a direct measure of economic efficiency. The indicator would also not reveal the cost of emission reductions. Like emissions per capita, it is a more revealing indicator than emissions per Party, as it measures a Party's emissions per unit of GDP.

B. National circumstances

31. Differences in national circumstances are at the centre of the discussion of QELROs as they influence each Party's scope for action and the associated costs and benefits. The national communications from Annex I Parties mention a wide range of national circumstances that affect emissions profiles and response capabilities. These include:

(a) Physical characteristics such as land area, sinks, and climatic conditions;

(b) Demographic characteristics such as population density, growth and distribution;

(c) Energy profile, including the extent of, and potential for, renewable and non-fossil energy generation; degree of implementation of, and potential for, energy efficiency and conservation programmes; and the replacement cycle of infrastructure; and

(d) Socio-economic characteristics such as the energy intensity of economic activity, dependence on primary production and/or on export of energy-intensive goods, patterns of consumption, waste generation, population of ruminant animals, and economic structure and infrastructure.

32. There does not appear to be a simple indicator, or package of simple indicators, which could adequately reflect differing national circumstances. However, it may be that a series of such indicators could be developed over time if this were desired. Options relevant to taking account of national circumstances would include:

(a) Indicators derived from national circumstances (such as those listed in paragraph 31 above);

(b) Indicators reflecting circumstances in different sectors (e.g., the concept as proposed by some Parties of "heating degree days");

(c) Indicators to reflect factors that are within the control of Parties (e.g., degree of implementation of energy efficiency measures) or factors beyond their control (e.g., the existence of climatic extremes or the availability of potential sinks).

Moreover, it is conceivable that a series of indicators could be aggregated into some form of index. As noted in paragraph 20 above, this would take some time to develop.

C. Cost-based differentiation

33. Cost is one of the basic determinants by which to consider emissions reductions. There are a number of methods by which the consideration of costs may lead to indicators for differentiation, some of which are discussed below. It should be noted, however, that cost-based differentiation could also be derived from economic or other differentiation formulae. Further, the Intergovernmental Panel on Climate Change has identified "no regrets" actions that can be undertaken in many areas at little or no cost.

GDP

34. GDP has been mentioned by several Parties as one factor relevant to differentiation. An indicator based on GDP might involve Parties whose GDP is above a certain level undertaking more extensive commitments than other Parties.

35. To the extent that GDP correlates to national emissions levels, the use of GDP as an indicator imposes burdens upon those who have both contributed to, and benefited from, past emissions. In this respect, it takes account of the respective capabilities of Parties.

36. If GDP were to be developed as an indicator for differentiation, several important issues would have to be clarified. It would need to be determined whether GDP was the best measure to be adopted, or per capita GDP, purchasing power parity, or another similar measure. It would need further to be agreed whether those Parties with high GDP but low emissions should bear a burden equal to those with high GDP and high emissions.

Equalizing the costs of action

37. Some Parties have proposed that differentiation should be based on "equalizing the costs of mitigation", or the marginal costs of emissions abatement efforts, across countries. Absolute costs or some other formula could also be possible. Such an approach could also be characterized as one in which Parties would expend similar levels of effort to achieve different commitments.

38. It has been suggested that "net national economic cost", measured by GDP forgone, and adjusted for a country's capacity to pay, could be used as the indicator of a Party's emission abatement efforts. Capacity to pay could, under this proposal, be derived from measures of per capita GDP. This proposal aims to ensure that Parties face broadly equivalent economic costs on a per capita basis for emission reductions.

39. In addition to the need to decide on the measure of costs to be used, the methodology for defining and calculating costs and benefits would also need to be agreed; in this way the costs faced by different Parties could be compared. A means would also need to be determined to ensure that the costs accounted for were calculated at the level of the least cost per unit of greenhouse gas abatement. Such an approach would be based on projected costs derived from economic models, rather than actual costs, as it looks to the future and to anticipated costs avoided. Thus, the use of common models, or transparency in modelling, would need to be discussed. These methodological issues may not be readily resolved.

40. Such an indicator by itself would, to some extent, reflect differing national circumstances. It would reflect purely economic considerations to the exclusion of non-economic factors such as per capita emissions.

Annex I

LIST OF PROPOSALS ON DIFFERENTIATION MADE TO THE AD HOC GROUP ON THE BERLIN MANDATE

Although there has been no detailed discussion of indicators for differentiation in the AGBM, some Parties have made proposals relating to differentiation by Annex I Parties. Relevant issues were also discussed at the workshop on QELROs held during the third session of the AGBM. Some proposals made in submissions* include:

(a) Analysing "anthropogenic GHG emissions by calculating them on a per capita, per GNP unit and per square kilometre of a country's territory basis" (A/AC.237/MISC.43/Add.1, p. 3 - proposed by the Russian Federation);

(b) Translating "the required emission reductions into regional and/or national 'tasks', taking into account a fair sharing of the costs, a cost-effective approach and transboundary effects of national measures. In searching for a fair distribution mechanism a system of 'dual commitments' (countries accept separate domestic and 'international' commitments) might be able to increase flexibility. Countries with relatively high domestic costs of measures might do more internationally (supposed this is cheaper) and countries with relatively low domestic costs would do more at home" (FCCC/CP/1995/MISC.1, pp. 39-40 - Netherlands);

(c) Adopting "a protocol with different provisions for different groups of countries, as in the case of the Montreal Protocol. Developing binding targets and timetables for the industrialized countries, based on the principle of fair burden sharing, will require other solutions than just setting equal targets for all countries concerned. In concrete terms, we would advocate an approach whereby a joint target is set for the OECD countries, and that mechanisms for its implementation be developed based on the principle of equitable burden sharing between the countries. This approach could result in differentiated targets for individual countries ... Recognizing that establishing principles for fair burden sharing may be complicated, considerable efforts may need to be undertaken in studying and developing adequate methodologies which can enable us to agree on such principles " (FCCC/CP/1995/MISC.1, p. 55 - Norway);

(d) Using "collective targets, such as for the group of Annex-I countries ... would allow a least cost strategy to be followed, that could drastically reduce the costs for all Parties involved. That is, if the accompanying issue of a fair distribution of the costs can be resolved" (FCCC/AGBM/1995/MISC.1/Add.1, p. 39 - Netherlands);

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* The following extracts from submissions by Parties are reproduced as received and without formal editing.

(e) Setting "a common emission target for a group of Parties, such as the OECD, which is to be achieved through 'equitable and appropriate contributions by each of these Parties'. In practical terms this would mean that the emission targets for each of the Parties would be differentiated on the basis of their 'differences in starting points and approaches, economic structures and resource bases'. ... the idea of a fair distribution of costs suggests that the 'critical economic loads' would be an appropriate point of departure. In other words, commitments under a Protocol or other legal instrument should be differentiated among the Parties in emission terms. In terms of total economic loads, however, there should be no differentiation among the Parties which are part of the common emission target.
Thus an important task of the analysis and assessment phase will be to elaborate further the concept of *equitable and appropriate contributions* (or *fair distribution of costs* or *burden sharing* or whatever label one chooses to address this pivotal issue)"
(FCCC/AGBM/1995/MISC.1/Add.1, pp. 40-41 - Norway);

(f) Defining "the principle of common but differentiated responsibilities, and [adopting] certain criteria for its practical implementation. The criteria should reflect social, economic and some climatic parameters relevant in the context of sustainable development ... Among these criteria one could mention:

- GDP per capita;
- amount of anthropogenic emissions, first of all of carbon dioxide and methane, per capita and per unit of territory;
- amount of sinks and net emissions per capita and per unit of territory;
- levels of production and consumption of energy per capita.

"To take into account the cumulative effect of these criteria for the purpose of determining differentiated commitments of individual countries it is proposed to evaluate specific indicators according to each criterion by summing up their reverse values. ... The principle of common but differentiated responsibilities in the context of the Convention is proposed to be formulated as follows:

> *"The common responsibility of the Parties to the Convention means common actions aimed at protection of the climate system to attain the ultimate goal of the Convention. The differentiated responsibility means individual responsibilities of the Parties to the Convention related to their commitments determined to taking into account their economic capabilities and stipulated in a protocol or another legal instrument* "
> (FCCC/AGBM/1995/MISC.1/Add.1, pp. 55-56 - Poland and the Russian Federation);

(g) Assigning "different emission reduction objectives ... to different categories of countries. Such categories would be defined on the basis of appropriate and agreed criteria, which should be based on combined and appropriately weighted indicators such as per capita emissions, GDP, share of global emissions, carbon intensity of primary energy use, and marginal abatement costs. To illustrate this point, we can use as an example a simple categorisation based on per capita emissions of energy-related carbon dioxide: countries would be grouped in categories based on increments of, say, 5 tonnes of CO_2 per capita. To

each of these categories would be assigned different quantitative emission reduction objectives between 2000 and 2020 based on 1990 levels, starting, for the first category, with an emission cap (i.e. stabilization at 1990 levels beyond the year 2000) ... countries in a given category or across categories could choose to form clusters, combining their emission reduction objectives and sharing the costs and benefits of achieving them" (FCCC/AGBM/1995/MISC.1/Add.2, p. 13 - Switzerland);

(h) Applying a "fairness criterion, leading to an acceptable burden sharing between the Parties concerned ... The cost of the new measures which may well be implemented by the Annex I Parties after the year 2000 is very different from one country to another bearing in mind in particular the intensity of the efforts already accomplished and the results obtained in energy policy matters. ... These starting point differences between the Annex I Parties will have to be fully taken into account when determining new commitments, in accordance with the Berlin Mandate. ... the most efficient and also the most equitable manner of sharing the effort to reduce CO_2 emissions among developed nations is to get all the emission reductions whose cost is lower than a common reference level carried out in all these countries. The simplest way to achieve this result, the least ambiguous for all the actors involved and the least costly in terms of administrative management costs, is to institute in the tax regimes of all these countries a progressive tax on CO_2 at rates coordinated between them" (FCCC/AGBM/1995/MISC.1/Add.3, pp. 14-16 - France);

(i) Taking as "the main criterion for differentiation ... GDP per capita. The share of the respective Party to the global warming should also not be forgotten in the list of such criteria" (FCCC/AGBM/1996/MISC.1, p. 41 - Estonia);

(j) Placing "an equal price on emissions wherever they occur and enabling market transactions to lead toward 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 permit 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 ...

"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.

"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 ... 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...

"... 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 2000-2020) rather than measuring emissions in a specific year (eg 2005) ... 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 the first best solutions" (FCCC/AGBM/1996/MISC.1/Add.1, pp. 14-16 - New Zealand).

Annex II

TABLES OF ANNEX I PARTIES FOR WHICH DATA WERE AVAILABLE FROM NATIONAL COMMUNICATIONS, THEIR GREENHOUSE GAS EMISSIONS, AND CO_2 EMISSIONS, BY SEVERAL INDICATORS FOR 1990[a]

GHG emissions per Party[b]		CO_2 emissions per Party	
United States of America	5 842 371	United States of America	4 957 022
Russian Federation	3 078 892	Russian Federation	2 388 720
Germany	1 241 509	Japan	1 155 000
Japan	1 206 523	Germany	1 014 155
United Kingdom	724 754	United Kingdom	577 012
Poland	614 300	Canada	462 643
Canada	577 954	Italy	428 941
Italy	563 117	Poland	414 930
France	494 032	France	366 536
Australia	465 305	Australia	288 965
Spain	310 070	Spain	227 322
Romania	253 152	Romania	171 103
Netherlands	213 946	Netherlands	167 600
Czech Republic	196 551	Czech Republic	165 792
Bulgaria	123 755	Bulgaria	82 990
Greece	94 888	Greece	82 100
Hungary	88 674	Hungary	71 673
New Zealand	80 266	Sweden	61 256
Sweden	75 573	Austria	59 200
Austria	75 286	Slovakia	58 278
Slovakia	71 900	Finland	53 900
Finland	67 114	Denmark	52 025
Denmark	65 517	Switzerland	45 070
Ireland	63 757	Portugal	42 148
Switzerland	58 196	Estonia	37 797
Norway	52 235	Norway	35 514
Portugal	51 045	Ireland	30 719
Estonia	46 479	New Zealand	25 476
Latvia	27 640	Latvia	22 976
Luxembourg	12 123	Luxembourg	11 343
Iceland	3 227	Iceland	2 172

[a] Includes only Annex 1 Parties which have submitted national communications. All data are for 1990, unless otherwise noted. All emissions are given in tonnes of CO2 or CO2 equivalent, calculated using the IPCC 1994 global warming potentials, 100-year time-horizon.

[b] Emissions figures based on information provided in national communications or information presented to the UNFCCC secretariat in the course of in-depth reviews.

GHG emissions per capita[c]		**CO_2 emissions per capita**	
Luxembourg	32.50	Luxembourg	30.41
Estonia	29.59	Estonia	24.06
Australia	27.23	United States of America	19.83
New Zealand	23.99	Canada	17.44
United States of America	23.37	Australia	16.91
Canada	21.79	Russian Federation	16.11
Russian Federation	20.77	Czech Republic	16.00
Czech Republic[d]	18.97	Germany	12.76
Ireland	18.20	Netherlands	11.22
Poland	16.09	Slovakia	11.00
Germany	15.62	Poland	10.87
Netherlands	14.32	Finland	10.81
Bulgaria	13.73	Denmark	10.12
Slovakia[e]	13.57	United Kingdom	10.08
Finland	13.46	Japan	9.35
Denmark	12.75	Bulgaria	9.21
United Kingdom	12.66	Ireland	8.77
Iceland	12.66	Latvia	8.56
Norway	12.31	Iceland	8.52
Romania	10.91	Norway	8.37
Latvia	10.30	Greece	8.17
Italy	9.87	Austria	7.68
Japan	9.77	New Zealand	7.61
Austria	9.76	Italy	7.52
Greece	9.44	Romania	7.38
Sweden	8.83	Sweden	7.16
France	8.75	Hungary	6.79
Switzerland	8.67	Switzerland	6.71
Hungary	8.40	France	6.49
Spain	7.96	Spain	5.83
Portugal	4.85	Portugal	4.00

[c] Population figures from *Statistical Yearbook, 38th Issue*, United Nations, New York, 1993.

[d] Population figure from the national communication.

[e] Population figure from the national communication; figure for 1992.

GHG emissions/$1,000 GDP[f]		CO_2 emissions/$1,000 GDP	
Poland	10.42	Poland	703.56
Romania	6.62	Czech Republic	524.67
Czech Republic	6.22	Estonia	504.63
Estonia	6.21	Romania	447.40
Bulgaria	5.97	Slovakia	406.94
Russian Federation	5.06	Bulgaria	400.41
Slovakia	5.02	Russian Federation	392.80
Hungary	2.68	Hungary	216.83
Latvia	2.30	Latvia	191.34
New Zealand	1.84	Luxembourg	109.59
Australia	1.58	Greece	100.32
Ireland	1.42	Australia	98.11
Luxembourg	1.17	United States of America	90.30
Greece	1.16	Canada	81.44
United States of America	1.06	Ireland	68.55
Canada	1.02	Portugal	62.68
Portugal	0.76	Germany	61.84
Germany	0.76	United Kingdom	59.15
Netherlands	0.75	Netherlands	59.08
United Kingdom	0.74	New Zealand	58.53
Spain	0.63	Spain	46.21
Iceland	0.52	Denmark	40.29
Italy	0.51	Finland	39.98
Denmark	0.51	Japan	39.39
Finland	0.50	Italy	39.17
Austria	0.48	Austria	37.37
Norway	0.45	Iceland	34.79
France	0.41	Norway	30.79
Japan	0.41	France	30.66
Sweden	0.33	Sweden	26.66
Switzerland	0.26	Switzerland	19.94

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[f] GDP figures provided by the Central Statistical Unit, United Nations Conference on Trade and Development.