



AD HOC GROUP ON THE BERLIN MANDATE
Third session
Geneva, 5-8 March 1996
Items 4 and 5 of the provisional agenda

**STRENGTHENING THE COMMITMENTS IN ARTICLE 4.2(A) AND (B)
CONTINUING TO ADVANCE THE IMPLEMENTATION OF EXISTING
COMMITMENTS IN ARTICLE 4.1**

Annotated compilation of information relevant to the Berlin Mandate process
Note by the secretariat

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I. INTRODUCTION

1. At its first session, the Ad Hoc Group on the Berlin Mandate (AGBM) pointed to the wide array of currently available information relevant to the Berlin Mandate process and to the analysis and assessment in particular. The entities responsible for such information were invited to make this information available to the AGBM to assist in the process (FCCC/AGBM/1995/2, para. 19 (g) and (h)). The AGBM requested the secretariat to prepare for the second session an annotated compilation of information relevant to the Berlin Mandate process; this was issued as document FCCC/AGBM/1995/5. The present document is a continuation of the earlier annotated compilation and should be read in conjunction with both that compilation and document A/AC.237/83 (prepared for the eleventh session of the Intergovernmental Negotiating Committee).

II. SCOPE OF THE NOTE AND ACTION BY THE AD HOC GROUP ON THE BERLIN MANDATE

2. The annotations consist of descriptions of the contents of compiled documents: they are not intended to summarize the information provided in the document but to give an indication of the issues addressed. In some cases, the annotations were provided by the submitting organization; in others, they were prepared by the secretariat. In no case should they be interpreted as representing the views of the secretariat.

3. The compilations should not be seen as an exhaustive listing of relevant documents but as an initial attempt to assist the AGBM in identifying and considering the wide range of information relevant to the Berlin Mandate process that is currently available.

4. The AGBM is invited to make use of the compilations at its third session as background information to the discussion under items 4 and 5 of the provisional agenda.

Annex
COMPILATION OF RELEVANT LITERATURE
A.I. REPORTS BY SPECIALIZED AGENCIES AND OTHER
BODIES IN THE UNITED NATIONS SYSTEM

A. Global Environment Facility (GEF)

Jan Fuglestvedt, Ted Hanisch, Ivar Isaksen, Rolf Selrod and Asbjorn Torvanger, **A review of country case studies on climate change**, 1994. GEF Working Paper No. 7, Report No. 12752.

1. This paper is the fourth of a series of GEF working papers dealing with the Program for Measuring Incremental Costs for the Environment (PRINCE). It provides an overview of the status of country studies on climate change and covers methodological issues, field tests, and dissemination related to the technical issues of measuring incremental cost. The paper also looks at the extent to which the studies are meeting, or plan to meet, the obligations of the Parties under the UNFCCC. Areas covered include inventories of sources and sinks of greenhouse gases, impacts and vulnerability assessments, response strategies and their cost-effectiveness, the implications of country projects that have transnational benefits, and the usefulness of country studies for government policy makers.

B. International Civil Aviation Organization (ICAO)

Civil aviation and the environment, ICAO Assembly Working Paper A31-WP/39, 1995.

2. This report from the ICAO Council to the thirty-first session of the ICAO Assembly discusses the progress being made by the Committee on Aviation Environmental Protection (CAEP) and its subsidiary bodies with regard to aircraft engine emissions. The paper also draws attention to the decision of the Conference of the Parties regarding allocation and control of international aviation emissions and refers to the need for ICAO to contribute where appropriate to the UNFCCC process, while seeking to ensure that insofar as the control of emissions is concerned, the UNFCCC process does not duplicate the work of CAEP.

Report of the Executive Committee, Thirty-first Session of the Assembly, September/October 1995.

3. This report discusses the need for the ICAO to maintain its leadership role with regard to environmental issues and requests the ICAO Council to consider various proposals put forward on environmental charges and taxes and to examine all aspects of the relationship of the ICAO with other United Nations policy-making bodies in the environmental field that have expressed an interest in civil aviation, notably the UNFCCC.

Policies on taxation in the field of international air transport, ICAO Doc. 8632-C/968, second

edition, January 1994.

4. This document reviews the policies of ICAO member States aimed at ensuring that various forms of taxation, including taxes on the sale and use of air transport, do not become major obstacles to the further development of international air transport. Non-observance of the principle of reciprocal exemption envisaged in these policies was also seen as risking retaliatory action with adverse repercussions on international air transport. Section IV includes a resolution calling on States to reduce or eliminate such taxes levied to raise revenue for general or specific public (that is, non-aviation) purposes.

Statements by the Council to Contracting States on charges for airports and air navigation services, Doc. 9082/4, fourth edition, 1992.

5. This document contains recommendations and conclusions of the ICAO Council with regard to charges and is intended for the guidance of States. The document addresses noise-related charges; no specific guidance is given regarding emissions-related charges. The Council expresses concern over the proliferation of charges on air traffic and recommends that States impose charges only for services and functions which are required for international civil aviation and should refrain from imposing charges which discriminate against international civil aviation in relation to other modes of international transport.

Background information in connection with an environmental tax/charge on air transport, paper presented by the ICAO secretariat to the Commission on Sustainable Development, Working Group on Finance, March 1995.

6. This paper provides background information in connection with a suggested tax or environmental user charge on air transport. It considers some of the issues raised by such a tax or charge and provides information on the policies that States have adopted within ICAO regarding taxation and international air transport; the distinction between "taxes" and "charges"; policy questions that would need to be addressed; and practical problems that would need to be overcome.

ICAO engine exhaust emissions data bank, Doc. 9646-AN/943, ICAO, Montreal, 1995.

7. This data bank compares the gaseous emissions from different aircraft engines, and notably those emissions for which ICAO established Standards such as smoke, unburnt hydrocarbons, carbon monoxide, and oxides of nitrogen. One of the limitations of the data bank is that, like the ICAO Standards, it is based on the landing and take-off cycle and only considers emissions below 915m (3000 ft). It may not therefore be a good guide for comparing the emissions of different engines in other flight modes.

C. International Maritime Organization (IMO)

Prevention of air pollution from ships. Resolution A.719(17), adopted on 6 November 1991 (agenda item 10).

8. This resolution requests, *inter alia*, the Marine Environment Protection Committee to collect and assess available information on machinery exhaust and cargo emissions in order to establish a reference level for air pollution levels from ships and develop an implementation plan to reduce the shipboard use and consumption of ozone-depleting chlorofluorocarbons (CFCs). Furthermore, the resolution urges Governments to prohibit the use of CFCs in fixed refrigeration and air conditioning plants and the use of halons in fire-extinguishing systems on board newly built ships.

Draft protocol of 1997 to the protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973. Marine Environment Protection Committee (MEPC), 20 October 1995, MEPC 38/9.

9. Annex VI of the new draft protocol outlines 19 new regulations aimed at preventing air pollution from ships. In chapter II, "Survey, certification and means of control", the draft protocol envisages surveys and inspection of ships (regulation 5), the issue of international air pollution prevention certificates (regulation 6), and duration and validity of such certificates (regulation 9). Deliberate emissions or new installations of equipment using halons, CFCs, nitrogen oxides, sulphur oxides, and volatile organic compounds are prohibited in a number of regulations.

D. United Nations Conference on Trade and Development (UNCTAD)

Newly emerging environmental policies with a possible trade impact: a preliminary discussion (TD/B/WG.6/9), 1995.

10. The report seeks to identify emerging environmental policy instruments and provides a conceptual analysis of the possible trade effects of such instruments. Emerging product-specific environmental policy instruments are discussed, including policies touching on energy, climate change, ozone depletion, and forestry. The report highlights some of the uncertainties surrounding the implementation of newly emerging environmental policies, with developing countries taking a "wait and see" stance on whether the industrial sector in developed countries will adopt these policies and whether these policies may restrict or promote their exports. The instruments or environmental policies that are most likely to affect trade are "process and production methods" and "life-cycle approaches".

Environment, international competitiveness and development: lessons from empirical

studies (TD/B/WG.6/10), 1995.

11. This report analyses the linkages between environmental policies and competitiveness and presents empirical research showing that the competitiveness effects of such policies have not been significant in developed countries. However, developing countries are concerned that the competitiveness effects of environmental standards are emerging in sectors where comparative advantage is shifting from developed to developing nations and could become significant in sectors such as textiles, footwear, electronics, and furniture.

12. Multilateral environmental agreements have made important contributions to improving environmental management and have affected trade and competitiveness. However, they need to be considered against the less positive aspects that such agreements may have. Moreover, the trade and competitiveness effects of these agreements may be higher for developing countries than developed countries in relative, but also in absolute, terms.

E. World Bank

Kulsum Ahmed, **Renewable energy technologies: a review of the status and costs of selected technologies**. Report No. WTP 240, 1994.

13. This paper examines evidence on the historical and projected costs of selected renewable energy technologies and assesses developments. It reviews estimates from more than 50 studies and expresses the costs on a common basis for photovoltaics, solar-thermal technologies, and biomass for liquid fuels and electricity production.

14. The findings presented in this paper show that: (1) there has been a decline in the cost of ethanol production since the 1970s, attributable to technology improvements and a shift towards cheaper crops; (2) the costs of electricity from biomass are site-specific and vary with raw material costs but still compare well with the costs of fossil-fired generation and even hydro generation in favourable situations; (3) costs of electricity from solar-thermal technologies show much variability; and (4) costs of photovoltaic modules have decreased by a factor of 50 since the early 1970s and the possibilities for further cost reduction are far from being exhausted.

Denis Anderson, **Cost effectiveness in addressing the "CO₂ problem", with special reference to the investments of the Global Environment Facility**. Environment Department Working Paper, Climate Series No. 005.

15. This paper describes the investment criteria and ground rules used by the Global Environment Facility (GEF) to provide financial support and develop practices, technologies, and policies that could appreciably restrict carbon accumulations. The problems linked to

identifying cost-effective investments, costs, and portfolio choice are discussed, as well as the

advantages or otherwise of supporting projects that are aimed at energy efficiency, backstop technologies, and type I and type II projects. Some of the ground rules as to what comprises a satisfactory portfolio of projects that meet the criterion of cost-effectiveness are discussed. The paper identifies five types of cost-effective investment projects:

- *Placing a cost (or a shadow price) on carbon emissions.* This cost should be the marginal cost of turning to the backstop technologies. At the present time, the most promising of these technologies are those using renewable energy, principally solar and biomass;
- *Innovations and costs in the backstop technologies.* The GEF can help to reduce costs further by expanding applications as small investments in such projects result in innovation and reduced total costs in the long term;
- *Type I and type II projects.* The GEF will need to give priority to the development of type II projects if developing countries and the international community are to be well placed to respond to the global warming problem if circumstances warrant it;
- *Demonstration projects and transaction costs.* Notwithstanding the transaction costs and uncertainties linked to type II projects, demonstration projects are considered to be important and should be introduced under certain conditions, notably in countries whose institutional arrangements and energy pricing policies are well suited to the success of GEF projects;
- *Continuity of GEF operations.* Costs can be expected to decline only if there is a long-term commitment to develop the markets and applications of the more promising technologies. Future GEF projects will therefore support the principle of replicability by financing follow-up projects.

Robin W. Bates and Edwin A. Moore, **Commercial energy efficiency and the environment.** Report No. WPS 0972, 1992.

16. This report argues in favour of greater energy efficiency in developing countries and countries with economies in transition as a means of mitigating the harm to the environment arising from growing energy consumption. Developed countries have an indispensable role to play in improving energy efficiency in developing countries, and the report suggests that the introduction of market mechanisms could help to meet such objectives, including:

- More domestic and external competition
- The gradual elimination of energy pricing distortions

- The reduction of macroeconomic and sectoral distortions
- Reducing state interference and giving a greater role to the private sector in energy supply enterprises
- Consumer incentives to select more efficient lighting, and space heating

Robert T. Deacon, **Controlling tropical deforestation: an analysis of alternative policies.** Report No. WPS 1029, 1992.

17. This report discusses some of the difficulties of finding and adopting simple and direct solutions to deforestation and other environmental problems in developing countries. While recognizing the importance of property rights in correcting certain inefficiencies, the report stresses that the sheer size of tropical forests, the communal nature of their service flows, and the pervasiveness of individual access to them makes monitoring and enforcement very costly in some situations and virtually unimaginable in others.

18. A model is presented as providing a systematic way of thinking about the environmental and welfare effects of government policy, for example, by considering patterns of substitution among inputs and outputs in cases where an environmental resource is exploited under conditions of free access. The report argues that detailed knowledge of patterns of substitution and complementarity among ordinary inputs and environmental resources, and information on the use of various environmental resources in the production of specific goods and services, are important and allow policy makers to pursue policy goals in situations where first-best instruments are unavailable.

Willem Floor and Robert van der Plas, **CO₂ emissions by the residential sector: environmental implications of inter-fuel substitution.** Report No. WPS 0978, 1992.

19. This paper examines the efforts of Governments, non-governmental organizations and staff of international development agencies to link deforestation with biomass fuel use. Based on the evidence of CO₂ emissions from household stoves - the major end-use for biomass fuels - and taking into account the complete CO₂ cycle for all the fuels used, the paper finds that the incremental net volume use of CO₂ will usually be higher if hydrocarbon fuels are substituted for biomass fuels. It proposes a household energy strategy in sub-Saharan countries consisting of management of wood-fuels supply, inter-fuel substitution, energy demand management, fuel pricing policies, and appropriate institutional arrangements.

Arnulf Grubler and Nebojsa Nakicenovic, **International burden sharing in greenhouse gas reduction.** Report No. ENV 0055, 1992.

20. This report provides an overview of current and historical greenhouse gas (GHG) emissions; it examines alternative formulations on how emission reduction efforts could be shared among regions/countries and evaluates quantitatively the implications of alternative

GHG allocation/reduction criteria, particularly from the "North/South" perspective. Finally, it describes a combined GHG emission database and software tool developed for the analysis of GHG allocation regimes: the "parametric framework".

21. The main conclusions and findings of the report are as follows: (1) the definition of two generic classes of allocation criteria: *distributive* - the allocation of emission rights - and *reductive* - the allocation of emission *reduction* requirements; (2) differences between each of the two classes were smaller; (3) the basic principle of the allocation was more important than the inclusion of different GHGs; (4) the smallest variations in emission distribution resulted from altering the reference year against which the achievement of emission reduction should be measured.

David O. Hall, **Biomass**. Report No. WPS 0968, 1992.

22. This report discusses the enormous untapped potential for biomass and bioenergy systems which may be less irreversibly damaging to the environment than conventional fuels. However, the economic, social and technological barriers to long-term planning and development of biomass energy systems makes implementation more difficult than for other more centralized energy resources. The report favours the use of both traditional and modernized biomass systems to produce preferred forms such as heat, electricity, and liquids. A series of case studies are presented showing that local involvement and control of biomass energy programmes and projects is a prerequisite for the success of such programmes.

John Homer, **Natural gas in developing countries: evaluating the benefits to the environment**. Report No. WDP 190, 1993.

23. This report argues that there are significant opportunities for sustainable economic growth to be gained from exploiting the reserves of natural gas in developing countries and presents three factors that would favour such a development: (1) the existence of substantial reserves of gas in most developing countries; (2) the availability of large-scale, highly efficient gas-fired power generation technology in the electricity industry in those countries; and (3) the fact that natural gas emits less carbon dioxide than coal or oil and therefore contributes less to global warming. The report goes on to describe how three countries, the Republic of Korea, Poland, and the United Kingdom have dealt with severe air pollution. Lastly, it evaluates the benefits of the use of natural gas in quantitative as opposed to qualitative terms.

Bjorn Larsen and Anwar Shah, **Global tradeable carbon permits, participation incentives, and transfers**. Report No. WPS 1315, 1994.

24. This report evaluates alternative tradeable permit allocations in a global permit regime for the stabilization of world carbon CO₂ at 1987 levels by the year 2000. Allocation by population or GDP, or a combination of the two, is likely to be unacceptable to most middle income countries, as well as to the countries with economies in transition, because they argue that current GHG concentration levels are primarily due to historical emissions from OECD countries and the former Soviet Union and those countries should bear the cost of the abatement policies envisaged.

25. The report proposes an alternative allocation scheme under which non-OECD countries would be allocated permits equal to their projected emissions, and OECD countries would be allocated permits equal to the world emissions target minus the permit allocations to the non-OECD countries. Under this permit allocation, non-OECD countries would benefit from participation, and the net costs to the OECD countries would be only half the costs of unilateral OECD reductions. The cost savings would be even greater if marginal costs of reductions in the non-OECD countries were lower than in the OECD countries.

Bjorn Larsen and Anwar Shah, **Carbon taxes, the greenhouse effect, and developing countries**. Report No. WPS 0957, 1992.

26. This report considers the case for carbon taxes in terms of national interests and concludes that: (1) a global carbon tax involves issues of international resource transfers and would be difficult to administer and enforce; (2) national carbon taxes can raise significant revenues cost effectively in developing nations and are not likely to be regressive as commonly perceived; (3) a carbon tax can significantly reduce local pollution and CO₂ emissions; (4) a carbon tax of US\$10 a ton leads to very little output loss for the Pakistani industries analysed in this paper, and any such loss is offset by the health benefits from reduced emissions of local pollutants; and (5) tradeable permits are preferable to a carbon tax when the critical threshold of the stock of carbon emissions beyond which temperatures would rise exponentially is known. However, a carbon tax appears to be a better and more flexible instrument for avoiding large unexpected costs given the current ignorance about the costs of reducing carbon emissions and the threshold effect.

Bjorn Larsen and Anwar Shah, **World fossil fuel subsidies and global carbon emissions**. Report No. WPS 1002, 1992.

27. This report presents evidence on the level of fossil fuel subsidies which are currently evaluated at more than US\$230 billion, or 20 to 25 per cent of the value of world fossil fuel consumption at world prices. Removing such subsidies would substantially reduce national CO₂ emissions in some countries and cut back global CO₂ emissions by 9 per cent, on the assumption that prices would not change, and by 5 per cent, if changes in world prices were taken into account. Welfare gains from subsidy removal worldwide would be more than

US\$30 billion assuming no change in world prices, or 15 per cent of total subsidies, even if the benefits from the curtailment of greenhouse gases and abatement of local pollution were not taken into account. However, the report concludes that neither subsidy removal nor an equivalent carbon tax would be sufficient to stabilize global carbon emissions at 1990 levels.

Bjorn Larsen, World fossil fuel subsidies and global carbon emissions in a model with interfuel substitution. Report No. WPS 1256, 1994.

28. This study presents a simple empirical framework for estimating the level of world fossil fuel subsidies and analysing their implications for CO₂ emissions. It builds on previous work by Larsen and Shah (1992) by providing a more detailed sectoral data set that includes energy prices and consumption for an expanded sample of countries. The study concludes that substantial fossil fuel subsidies prevail in a handful of large carbon-emitting countries and that the fiscal implications of these subsidies are significant in some countries. The author estimates that removing such subsidies would reduce CO₂ emissions by 20 per cent in some of the countries relative to baseline emissions and reduce global CO₂ emissions by 7 per cent.

World Bank, Energy efficiency and conservation in the developing world. The World Bank's role. Report No. 11987, 1993.

29. A comparison of the performance of developing and developed countries in energy efficiency has highlighted four critical factors that directly correlate with differences in the efficiency of energy production and end-use. These factors relate to: (1) differences in energy pricing policies; (2) mechanisms for controlling and regulating energy-supplying enterprises; (3) the extent to which energy-using industries are protected from competition; (4) other legal, institutional, and information barriers to the efficient functioning of markets.

30. The following four-point programme is aimed at taking advantage of the increased receptivity of many developing countries to efficiency issues: (1) better integration of energy efficiency issues into country policy dialogues so that they can be addressed at an earlier stage; (2) greater selectivity in lending to energy-supplying enterprises; (3) higher level in-country visibility to be given to demand-side management and end-use intermediation issues; and (4) greater attention to be paid to the transfer of more energy-efficient and pollution-reducing technologies in sector and project work.

A.II. REPORTS BY OTHER INTERGOVERNMENTAL ORGANIZATIONS

A. European Conference of Ministers of Transport

Urban travel and sustainable development. The European Conference of Ministers of Transport (ECMT), 1995.

31. This report identifies current land use and transport policies in OECD/ECMT countries as leading to excessive travel by car in cities and surrounding areas which in turn results in congestion, air pollution, noise, acid rain, and the risk of global warming. The three main strands of the integrated policy approach recommended in the study with a view to reducing car travel, especially in cities, involve:

- *Best practice* - raising the effectiveness of current land-use planning and traffic management to the level of those in the best managed cities
- *Innovations* - bringing demand for car travel into balance with road capacity by shaping new policies to ensure that urban developments assume less car-dependent forms and to apply congestion pricing to traffic management
- *Sustainable development* - promoting more economical vehicles, shorter fewer car trips, a shift away from solo driving, and greater use of more environmentally-friendly modes of travel by means of repeated annual increases in motor fuel taxation **d**

Transport and the greenhouse effect: interim report on country plans (CEMT/CM(94)3), 1994.

32. In the light of findings that transport emissions per capita in the OECD countries were very high compared with the rest of the world, and continued to grow, as opposed to emissions from non-transport sectors, which have decreased since the 1980s, the Council of Ministers requested further information from member countries on the breakdown of CO₂ emissions in 1990, the measures being taken to limit growth in emissions, and forecasts for the year 2000 for a reference case and for a "measures" case.

33. Figures for the 1990 emissions were for the most part known, but projections for 2000 were not always available. However, forecasts show that there would be a continuous progression of emissions. The measures proposed to limit the growth in emissions fell into three separate categories: (1) measures with uncertain results such as the promotion of modes with low CO₂ emissions; (2) measures with promising results which, at present, only exist as studies, projects or intentions; and (3) effective measures aimed at CO₂ reduction, towards which initial steps have been taken and firm commitments made.

34. A comparison of the measures already implemented with road traffic predictions shows that transport emissions will not be stabilized in most countries, and that, with the exception of increases in fuel taxation in several countries, other recommendations aimed at reducing transport's contribution to global warming have not resulted in concrete measures.

Taking account of transport's external costs (CEMT/CM(94)16), 1994.

35. This document, submitted to the 1994 session of the Council of Ministers, summarizes the work of a joint OECD/ECMT seminar in the autumn of 1993 on the external costs of transport. The seminar found that, *inter alia*, there were positive and negative benefits or "externalities" associated with the transport sector. Estimates of the external effects of accidents, noise, air pollution and congestion are prone to large variations due to different methodologies and assumptions; however, all studies show that road transport generates the greatest share of the costs, which are calculated as a percentage of GDP. In recent years, significant advances have been achieved in valuation methodologies for quantifying externalities.

Task force on social costs of transport: draft terms of reference and work programme (CEMT/CM(95)19), 1995.

36. At their June 1994 meeting, European Ministers of Transport decided to constitute an ad hoc task force on "Internalizing the social costs of transport". The principal objectives of this ad hoc task force, which is expected to conclude its work in June 1997, are, *inter alia*, (1) to define the differences between what is meant by "social" and "external" costs; (2) to provide an overview of available external cost estimates; (3) to give an overview of existing and proposed policies at the national or international level; (4) to report on special problems facing economies in transition, international competitiveness/trade harmonization issues and the impact of individual perceptions on behaviour; and (5) to formulate policy recommendations.

B. International Organization for Standardization (ISO)

Environmental management systems - Specification with guidance for use. Draft International Standard ISO/DIS 14001.

37. This draft International Standard specifies requirements for an environmental management system to enable an organization to formulate a policy and objectives, taking into account legislative requirements and information about significant environmental impacts. It applies to those environmental aspects which the organization can control and over which it can be expected to have an influence.

Environmental management systems - General guidelines on principles, systems and supporting techniques. Draft International Standard ISO/DIS 14004.

38. The general purpose of these guidelines is to provide assistance to organizations implementing or improving an environmental management system (EMS). The guidelines outline the elements of an EMS and provide advice on how to effectively initiate, improve or sustain such a system, as well as on how to allow organizations to address environmental concerns through the allocation of resources, assignment of responsibilities, and ongoing evaluation of practices, procedures, and processes.

C. Organisation for Economic Co-operation and Development (OECD)

Scott Barrett, **Convention on climate change: economic aspects of negotiations**, OECD, Paris, 1992. (Also available in French)

39. This volume contains three papers by Dr. Barrett that address different economic aspects of the negotiation process that has led to the United Nations Framework Convention on Climate Change. Although economic efficiency was seen as an important factor influencing the global warming negotiations, other objectives such as social equity and environmental effectiveness were perceived as having important roles to play in determining the eventual policy response.

40. Chapter 1 considers how the choice of a policy instrument might determine which countries would wish to join an international agreement. Chapter 2 examines how the number of participating countries could be increased by using so-called "side payments" without sacrificing overall economic efficiency objectives. Lastly, chapter 3 analyses how to deter "free riding" in an international agreement. All three chapters take a "simulation" approach, coupled with a "games theory" perspective to illustrate their conclusions.

Jean-Marc Burniaux and Joaquim Oliveria-Martins, **Carbon leakages, trade and energy supply: evidence from a simplified maquette**, OECD Department of Economics and Statistics, OECD, Paris, 1994.

41. This paper assesses the reliability of the simulation results of the size of the carbon leakages concerned using the OECD GREEN model. Comparisons between this model and other applied general equilibrium (AGE) models show that there is no general agreement on the size and time pattern for the leakage effects. The paper investigates the underlying causes of these differences by identifying the key parameters and carrying out an extensive sensitivity analysis, using a two-country, four-good "maquette". This maquette reproduces a wide range of alternative assumptions and parameters that would otherwise be difficult to simulate with a large AGE model like GREEN.

Jean-Marc Burniaux, Joaquim Oliveria-Martins and Dominique van der Mensbrugghe, **Carbon abatement, transfers and energy efficiency**, in **The Economics of Sustainable Development**, eds., Ian Golding and L. Alan Winters, Cambridge University Press, 1995.

42. This article explores the impact of direct transfer mechanisms between OECD and non-OECD countries, and uses the GREEN model to simulate and assess the potential scope for curbing CO₂ emissions via such technology transfers. The main conclusions are: (1) that the autonomous energy efficiency improvement parameter plays a key role in determining baseline levels of emissions; (2) implementing a transfer scheme under which OECD carbon tax revenues are recycled towards investment in the non-OECD area is likely to have only a moderate impact on both energy efficiency and emissions; (3) a scenario in which a global carbon tax is combined with a transfer mechanism tied to an energy efficiency mechanism could achieve a sizeable reduction of world emissions without imposing an undue burden on the real income of the non-OECD regions participating in the agreement.

G.F. van den Born, A.F. Bouwman and R. Leemans, **Contribution of agriculture to global change, an analysis of the future role of sustainable land use**, Global Change Department, National Institute of Public Health and Environmental Protection, Bilthoven, Netherlands.

43. This draft paper submitted during an OECD workshop on sustainable agriculture held in February 1992 presents a model indicating that the total contribution of land-use-related emissions of GHG under the "business-as-usual" scenario will not increase significantly, but that the contribution of the different gases will change. Under the "accelerated policies" scenario - a scenario closely related to the concept of sustainable agriculture - there is a significant decrease of about 35 per cent in the total contribution from land use.

44. The authors conclude that sustainable agriculture can play a major role in reducing the emissions of greenhouse gases from land-use-related sources as a result of its emphasis on good land-use planning, management and greater protection of forests, and encouragement of sound animal husbandry practices. Further soil erosion and consequent loss of soil carbon, as well as human-induced soil degradations such as water and wind erosion and chemical and physical deterioration, could be reduced by implementing sustainable agriculture.

William R. Cline, **Global warming: the benefits of emission abatement**, OECD, Paris, 1992. (Also available in French).

45. This report makes two contributions in estimating the benefits of global warming response policies. The first consists of a comprehensive framework which seeks not only to evaluate the direct economic consequences of global warming but also the indirect economic impact (for example price effect) and environmental impacts. The second consists in the provision of rough estimates of values for the most significant cells of the conceptual framework. The preliminary conclusions of this report are that the benefits of responding to

climate change may be of the same order of magnitude as most currently available estimates of the economic costs of policy action, and that greater abatement of greenhouse gas emissions may be justified than was previously accepted in much of the literature.

Jean-Marc Burniaux, John P. Martin and Joaquim Oliveria-Martins, **The effects of existing distortions in energy markets on the costs of policies to reduce CO₂ emissions: evidence from GREEN**, *OECD Economic Studies*, Special Issue on the Economic Costs of Reducing CO₂ Emissions, No. 19, Winter 1992, pp. 141-164.

46. This paper shows that existing distortions resulting from energy taxes and subsidies are important considerations in designing an effective strategy to curb emissions. The existence of energy subsidies in many non-OECD countries has several implications. Firstly, it would entail eliminating subsidies as part of a "no regrets" approach to curbing emissions. Secondly, the economic costs of curbing global emissions are overestimated when the energy subsidies in non-OECD countries are not treated as explicit distortions. Thirdly, an international agreement involving the elimination of existing subsidies before phasing in carbon taxes could be achieved at virtually no cost for the non-OECD countries as a whole so long as carbon reductions are allocated cost-effectively across countries.

Jean-Marc Burniaux, Giuseppe Nicoletti and Joaquim Oliveria-Martins, **GREEN - A global model for quantifying the cost of policies to curb CO₂ emissions**, *OECD Economic Studies*, Special Issue on the Economic Costs of Reducing CO₂ Emissions, No. 19, Winter 1992, pp. 50-91.

47. This paper presents the general specifications and structure of GREEN, a multi-regional dynamic general equilibrium model developed by the OECD secretariat. It also describes the database underlying the model and the choice of key parameter values used in calibrating the model to the base year (1985) data set.

Andrew Dean and Peter Hoeller, **Cost of reducing CO₂ emissions: evidence from six global models**, *OECD Economic Studies*, Special Issue on the Economic Costs of Reducing CO₂ Emissions, No. 19, Winter 1992, pp. 16-47.

48. This paper summarizes the results of an exercise in comparing the properties and predictions of GREEN and five other global models that have been developed in major energy and applied economics research centres. The purpose of these comparative model runs was to examine how and why the models differ in baseline CO₂ emission paths and the taxes needed to bring about reductions in emissions and in their associated output losses.

Peter Hoeller and Jonathan Coppel, **Carbon taxes and current energy policies in OECD countries**, *OECD Economic Studies*, Special Issue on the Economic Costs of Reducing CO₂ Emissions, No. 19, Winter 1992, pp. 167-193.

49. This paper reviews the existing and evolving structure of fossil fuel prices and taxes and the relationship between energy prices and emissions in some 20 OECD countries. It also analyses the economic cost of superimposing carbon taxes on current energy taxes and simulating a tax reform system using a simple energy demand system. The authors propose restructuring present energy taxation by the average implicit carbon tax and a carbon *cum* energy tax similar to the European Community proposal.

John P. Martin, Jean-Marc Burniaux, Giuseppe Nicoletti and Joaquim Oliveria-Martins, **The cost of international agreements to reduce CO₂ emissions: evidence from GREEN**, *OECD Economic Studies*, Special Issue on the Economic Costs of Reducing CO₂ Emissions, No. 19, Winter 1992, pp. 93-120.

50. This paper reports the results of several simulations using the GREEN model designed to quantify the economy-wide and global costs of a range of international agreements to curb CO₂ emissions. The paper addresses two questions connected with such agreements, namely, "What are the effects of agreements that are more or less comprehensive in country coverage?", and "How large are the real income gains that could potentially be reaped from a cost-effective agreement relative to uniform percentage cuts in all regions?".

Joaquim Oliveria-Martins, Jean-Marc Burniaux and John P. Martin, **Trade and the effectiveness of unilateral CO₂-abatement policies: evidence from GREEN**, *OECD Economic Studies*, Special Issue on the Economic Costs of Reducing CO₂ Emissions, No. 19, Winter 1992, pp. 123-139.

51. This paper analyses the effects of unilateral action by one country/region to curb CO₂ emissions in the absence of a global agreement, and the possibility that this could give rise to "carbon leakages". The simulation results presented suggest that the leakage rate would be small, and further sensitivity analysis shows that the key parameter determining the size of the leakage rate is the price elasticity of coal.

Peter Hoeller, Andrew Dean and Jon Nicolaisen, **Macro-economic implications of reducing greenhouse gas emissions: a survey of empirical studies**, *OECD Economic Studies*, No. 16, Spring 1991, pp. 45-76.

52. This paper examines the key factors shaping baseline emission scenarios and the aggregate cost of emission reductions, as shown by both global and country-specific models, and also discusses the key determinants of the model outcomes. The paper briefly reviews other options for reducing greenhouse gas emissions and draws some more general lessons for

the policy response to the threat of climate change.

Jon Nicolaisen, Andrew Dean and Peter Hoeller, **Economics and the environment: a survey of issues and policy options**, *OECD Economic Studies*, No. 16, Spring 1991, pp. 8-38.

53. This paper reviews the main causes for excessive use of environmental resources in a market economy and discusses the merits of different policy instruments to counter environmental degradation, as well as surveying the information needed for the successful conduct of environmental policy. The paper also considers policy options to cope with the uncertainties surrounding cost benefit estimates.

Jean-Marc Burniaux, John P. Martin, Giuseppe Nicoletti and Joaquim Oliveria-Martins, **The cost of policies to reduce global emissions of CO₂: initial simulation results with GREEN**, OECD Department of Economics and Statistics, Working Paper No. 103, OECD, Paris, 1991.

54. This report presents the results of scenarios of alternative international agreements to quantify the economy-wide and global costs of policies to curb emissions of CO₂ using GREEN. The three scenarios project: (1) a "Toronto-type" agreement in which countries cut their emissions by 20 per cent below their 1990 levels by the year 2020; (2) a "Toronto-type" agreement with trade in emissions rights; and (3) the introduction of regulations to ensure that carbon emissions are only curbed in industrialized countries. The findings show that:

- Under the first scenario, the level of carbon tax across the six regions considered averages US\$215 per ton of carbon, with variations ranging from a low of US\$30 per ton in China to a high of \$950 in other countries of the Pacific region;
- The second scenario shows that any international agreement that sets uniform targets should include a provision for participating countries to trade emission rights. This scenario would lead to a fall in demand for coal, more drastic CO₂ emission cuts by China, and an increase in oil consumption in OECD countries;
- Under the third scenario, industrialized countries would find themselves ~~burdened~~ with an average tax level of US\$2,200 per ton of carbon in 2020. These tax levels would lead to large welfare losses and have implications for household income and energy-exporting LDCs.

Jean-Marc Burniaux, John P. Martin, Giuseppe Nicoletti and Joaquim Oliveria-Martins, **GREEN - A multi-region dynamic general equilibrium model for quantifying the costs of curbing CO₂**

emissions: a technical manual, OECD Department of Economics and Statistics, Working Paper No. 104, OECD, Paris, 1991.

55. The purpose of this paper is to present a full technical description of a multi-regional, multi-sector, dynamic applied general equilibrium (AGE) model, known as the GeneRal Equilibrium ENvironmental model (GREEN), as well as of its database and parametrization as of May 1991.

Andrew Dean and Peter Hoeller, **Cost of reducing CO₂ emissions: evidence from six global models**, OECD Department of Economics and Statistics, Working Paper No. 122, OECD, Paris, 1992.

56. This paper summarizes and analyses the results of the OECD's Model Comparisons Project, which attempts to standardize key inputs and reduction targets across different models so as to acquire a better understanding of the ways in which the various models work and the different results on baseline CO₂ emissions paths, carbon taxes, and economic costs. The major findings of the project are as follows:

- There is a wide range of "business-as-usual" emission paths;
- Carbon taxes and economic costs vary greatly across regions and models;
- Substitution policies between different fossil fuels, between fossil fuels and non-fossil fuels, and between energy and other production factors are shown to be important determinants of the differences in taxes and costs across models;
- The composition of primary energy demand and relative energy prices are also important in determining the amount of substitution that takes place and the taxes necessary to induce fuel switching;
- Emissions trading has the potential to greatly reduce both the global and the regional cost of emissions reductions in view of the wide dispersion of carbon taxes and abatement costs across regions.

Peter Hoeller, Andrew Dean and Masahiro Hayafuji, **New issues, new results: the OECD's second survey of the macroeconomic costs of reducing CO₂ emissions**, OECD Department of Economics and Statistics, Working Paper No. 123, OECD, Paris, 1992.

57. This survey updates estimates of the macroeconomic costs of reducing CO₂ emissions and reviews a variety of policy-related topics that have not been covered in previous surveys. The survey concludes that reference scenarios which project trends in the absence of control policies point to a growth in CO₂ emissions in the range of 1 or 2 per cent per annum in the long run, with larger increases in the period up to 2025. With emissions continuing to increase in reference scenarios, reductions from current levels imply very large decreases from the levels

projected to occur in the long run.

58. Simulations by different models show large differences for the required carbon taxes and for associated welfare losses. Such differences can mainly be explained by variations in assumptions about the degree of substitutability among the various energy sources, the availability of low-cost, low-carbon backstop technologies, capital formation, expected formation, trade flows, and fossil fuel supply.

Giuseppe Nicoletti and Joaquim Oliveria-Martins, **Global effects of the European carbon tax**, OECD Department of Economics and Statistics, Working Paper No. 125, OECD, Paris, 1992.

59. This paper analyses the implications of the European Commission proposal of a mixed energy *cum* carbon tax to curb CO₂ emissions from a global perspective. The effects of this proposal on emissions and welfare in both the European Community (EC) and the rest of the world are considered as regards three aspects: (1) the effectiveness of the proposed tax measures in terms of curbing EC and global CO₂ emissions; (2) the implied cost for the EC and the other countries/regions of the world; (3) the implications of the European Commission's proposal for the world distribution of emissions and the competitiveness of the EC economy.

Graciela Chichilnisky and Geoffrey Heal, **Markets for tradeable CO₂ emission quotas: principles and practice**, OECD Department of Economics and Statistics, Working Paper No. 153, OECD, Paris, 1995.

60. This paper reviews a range of issues related to tradeable CO₂ emission quotas. It considers the economic principles on which they are based, compares them with alternative carbon abatement policies, and reviews the way in which tradeable quotas would be implemented in practice. Section II of the paper explains why these issues are on the agenda and how they relate to current issues such as joint implementation. Section III compares salient aspects of the two policy approaches - tradeable quotas and carbon taxes - and analyses how they can be combined. Section IV considers how tradeable CO₂ emission quotas should be allocated among participating countries.

Harvey Yakovitz, **Developed countries' views concerning environmentally sound technology transfer and information**. Paper presented at a workshop on "The promotion of access to and dissemination of information on environmentally sound technologies" held at Seoul from 30 November to 2 December 1994.

61. This paper reports that by the year 2020 the industrial sector of developing countries is expected to provide 30 per cent of their GDP. With this development in mind, the author proposes that the key priorities should be capacity building, increasing information flows to those who can implement cleaner production techniques, and leveraging private sector

investments to favour cleaner technologies. At present, only a minority of OECD member countries are emphasizing cleaner technologies in their technology cooperation programmes. This proportion will need to increase in order to enhance the chances that developing countries can leapfrog the "end-of-pipe" pollution control phase in the industrial sector.

62. To achieve this, and other objectives, the author recommends that: (1) developed countries promoting cleaner technologies need to interact more closely with the private sector in their own and recipient countries; (2) donor agencies need to consider cleaner technologies as an integral part of their technology cooperation programmes; (3) recipient Governments need to set priorities for implementing cleaner technologies; (4) recipient countries ought to create a demand for cleaner technologies as a major step towards sustainable development.

Environmental taxes in OECD countries, OECD, Paris, 1995.

63. This compendium on environmental taxes in OECD countries is an expanded and updated version of an earlier survey (1993). It discusses and reviews the use of taxation as an instrument of environmental policy in a number of OECD countries. It covers a broad range of taxes that are explicitly recognized as having an environmental purpose (for example, to reduce environmental damage), but also covers a number of areas of the tax system where the structure of existing taxes may be seen as having a significant effect, but the taxes are not specifically targeted on the environment. The survey also covers topics such as the relative importance of ecotax revenues (chapter 2); new policy trends (chapter 3); the taxation of motor fuels and vehicle-related taxes (chapter 4); the taxation of energy sources (chapter 5); and environmental taxation of energy in different European countries (chapter 6).

Promoting cleaner production in developing countries: the role of development co-operation, OECD, Paris, 1995.

64. This publication provides a detailed overview of workshop discussions and the priority action areas involved in the question of how donors can best support cleaner industrial production in developing countries. The main conclusions of the workshop covered six topics: (1) developing country policies; (2) donor policies; (3) capacity development; (4) access to information; (5) the role of the private sector; and (6) finance mechanisms.

Technologies for cleaner production and products: towards technological transformation for sustainable development, OECD, Paris, 1995.

65. This report was prepared by the Pollution Prevention and Control Division of the OECD Environment Directorate as part of a three-year (1990-1993) Technology and Environment Programme. The Programme sought to promote the exchange of information on cleaner and safer technologies, analyse opportunities for, and impediments to, technology development, develop new insights for achieving environmental policy objectives and, lastly, to

develop policy options and instruments for use by Governments in evaluating, supporting and transferring technologies to promote sustainable development.

66. The Programme's accomplishments included heightening awareness of the need for, and capabilities of, cleaner technologies. It provided an insight into technology trajectories, and identified new analytical tools for measuring and evaluating progress as well as barriers. The responsibilities of central governments and their policy options were clarified and a network of experts from government, industry and other private sector institutions was created to support the long-term work of the OECD.

Towards sustainable agricultural production: cleaner technologies, OECD, Paris, 1994.

67. This summary report of an OECD Workshop on Sustainable Agriculture and Technologies and Practices discusses the central notion that environmentally and economically viable alternative agriculture techniques can be, and have been, achieved. Workshop participants recognized the wide diversity of more environmentally sustainable agricultural systems, whether biological/organic or integrated/low-input agriculture, that are already in place or are gradually emerging.

68. The workshop sought to identify pathways and policy frameworks to make agriculture more sustainable and provided an opportunity to focus on technological opportunities. It also examined issues such as integrated systems, erosion control, fertilizers, landscape management, information as an input, barriers to the adoption of more sustainable agriculture technologies and practices and, lastly, significant policy opportunities.

Trade issues in the transfer of clean technologies (OECD/GD(92)93), OECD, Paris, 1992.

69. This report examines a number of cases in which trade in clean technologies is currently taking place in order to establish whether, and to what extent, trade-related policies, such as the protection of intellectual property, actually interfere with the transfer of these technologies. The evidence of the seven case studies presented in the report shows that there are no significant obstacles to trade in clean technology. Exporters and importers considered that other obstacles, such as the lack of access to financing and weak or inadequately-enforced environmental regulations in some countries were more important factors. The report concludes that government policies aimed at encouraging trade in environmentally friendly technologies should address these two areas, and that less attention should be devoted to trade-related policies and practices as obstacles to clean technology transfer.

Export promotion and environmental policies (OECD/GD(94)9), OECD, Paris, 1994.

70. This report is intended to clarify the relationship between government export promotion activities and the export of environmental technologies. Governments are increasingly interested in promoting the export of such technologies because of the trade benefits to be derived by OECD countries and the environmental benefits to be reaped by non-OECD countries. Some OECD Governments are starting to determine the amount of funding, in the form of export credits, that should be devoted to environmental technologies. Moreover, the export of environmental technologies and services is increasingly being supported by government-sponsored export promotion activities.

71. The report identifies a number of policy options that may be examined by Governments with a view to integrating further environmental considerations into their export credit and promotion programmes:

- Improving data and information on environmental technologies benefiting from export promotion
- Targeting export promotion activities to assist producers of environmental technologies
- Promoting more exports of clean technologies as opposed to pollution control technologies
- Conducting reviews of the environmental implications of both export credit and promotion activities
- Ensuring consistency in development assistance and export promotion policies regarding environmental technology transfer

Summary record on OECD workshop on development assistance and technology cooperation for cleaner industrial production in developing countries, held at Hanover, Germany, in September 1994 (OECD/GD(95)92), OECD, Paris, 1995.

72. The major aim of the workshop was to review and discuss how donors could help to promote cleaner industrial production in developing countries. In the opening plenary, experts noted that there had been a progressive strengthening of measures to protect the environment, notably in pollution control and remediation.

73. Practice in pollution prevention rather than pollution control is lagging behind conceptual progress, and there are powerful reasons to strengthen the national capacities of developing nations to manage technological change to achieve sustainable development. With industrial production in developing countries expected to expand rapidly over the next two decades, the need will be felt for these countries to move beyond pollution control and to integrate economic development and environmental protection if they wish to achieve sustainable

development.

Global warming: economic dimensions and policy responses, OECD, Paris, 1995.

74. The purpose of this paper is to inform the process of developing an appropriate policy response to the risk of climate change. The paper begins with a brief introduction to and interpretation of the UNFCCC, followed by a summary of the uncertainties surrounding the issue of climate change and an assessment of the line between geographical coverage of abatement efforts and costs.

75. Possible responses to the risk of global warming are reviewed in part 3. Three main generic classes of response measures are covered - *emissions curtailment* (preventive action), *GHG sequestration* (offsetting action), and *adaption* (adjustment action). The basic problems and possibilities for an efficient overall response, including the role of research and development, are discussed in part 4. Given the crucial role of a carbon tax in both the theoretical discussion as well as the actual policy debate concerning climate change, the fiscal implications of a carbon tax are discussed in some detail in part 5. In recognition of the global scope of the paper and the "public good" aspects of the problem, part 6 of the paper focuses on the need for international cooperation and discusses various key issues pertinent to joint implementation.

The economics of climate change: proceedings of an OECD/IEA International Conference on the Economics of Climate Change held in Paris in June 1993, OECD, Paris, 1994.

76. The specific objectives of this Conference were: (1) to provide a broad overview of the state of the art in the economics of climate change; (2) to provide a sense of where consensus is emerging and where differences of opinion still exist; (3) to suggest ways of reforming the linkage between economic studies and actual climate change response policies; (4) to suggest new directions for OECD and IEA activities related to the economics of climate change.

77. Wide-ranging discussions amongst the 250 experts who attended the Conference focused on such topics as: the economic costs and benefits of emissions mitigation strategies; the potential role of carbon taxes and other economic instruments in the policy mix; possibilities for technical development and diffusion, especially in the energy sector; and opportunities for joint abatement action by industrialized and developing nations.

Appendix

ADDITIONAL REPORTS BY INTERNATIONAL ORGANIZATIONS

A. International Organization for Standardization (ISO)

General guidelines for environmental auditing - General principles. Draft International Standard ISO/DIS 14010.

Guidelines for environmental auditing - Audit procedures - Audit of environmental management systems. Draft International Standard ISO/DIS 14011.

Guidelines for environmental auditing - Qualification criteria for environmental auditors. Draft International Standard ISO/DIS 14012.

B. Organisation for Economic Co-operation and Development (OECD)

Energy conservation policies and technologies in Japan - A survey (OECD/GD(94)32), OECD, Paris, 1994.

C. World Bank

Charles R. Blitzer, R.S. Eckaus, Supriya Lahiri and Alexander Meeraus, **How restricting carbon dioxide and methane emissions would affect the Indian economy**, Report No. WPS 0978, 1992.

Charles R. Blitzer, R.S. Eckaus, Supriya Lahiri and Alexander Meeraus, **Growth and welfare losses from carbon emissions restrictions: a general equilibrium analysis for Egypt**, Report No. WPS 0963, 1992.

Mohan Munasinghe and Peter Meier, **Incorporating environmental concerns into power sector decision making: a case study of Sri Lanka**, Report No. 12966, 1994.
