GREENHOUSE GAS MARKET PERSPECTIVES

TRADE AND INVESTMENT IMPLICATIONS OF THE CLIMATE CHANGE REGIME

Recent Research on Institutional and Economic Aspects of Carbon Trading

United Nations
New York and Geneva 2001

Publication support given by:
United Nations Foundation
Project A006 TAD GLO 98 025

UNCTAD/DITC/TED/Misc.9

Note

Symbols of the United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations.

UNCTAD/DITC/TED/Misc.9

GREENHOUSE GAS MARKET PERSPECTIVES

TRADE AND INVESTMENT IMPLICATIONS OF THE CLIMATE CHANGE REGIME

Recent Research on Institutional and Economic Aspects of Carbon Trading

Prepared by
Malik Amin Aslam
Jos Cozijnsen
Svetlana Morozova and Mark Stuart
Richard B. Stewart and Philippe Sands

With commentaries by
Lucas Assunção and Bernhard Raberger
Youba Sokona
Farhana Yamin
ZhongXiang Zhang

Table of Contents

Foreword
by the Secretary-General of UNCTAD

We live in an age when the calls for responsible environmental management intensify with more and more frequent discoveries of new injuries that society is inflicting on our global commons: biodiversity, the atmosphere and the oceans. These common resources extend beyond the exclusive economic zones of each country, but as stewards of our natural resources, we must work together to sustain them. Unfortunately, the policies and measures proposed to forestall environmental degradation are not without a cost. Compliance costs are, understandably, of great concern to negotiators in their task of reaching international agreement on environmental issues. They have the responsibility of carefully balancing overarching economic, social and environmental goals while drawing up multilateral treaties that are acceptable to all.

Even as we focus on the science and the politics of emerging environmental threats, we cannot lose sight of the principal lesson of economic instruments envisaged in climate change policies: international cooperation generates greater welfare when compared with unilateralism and confrontation, while creating at the same time mutually beneficial outcomes for Parties to the United Nations Framework Convention on Climate Change with diverse interests. To this end, the political deal struck at Kyoto in 1997 established three market-based mechanisms with equal standing, namely Joint Implementation (JI), the Clean Development Mechanism (CDM) and International Emissions Trading (IET), contained in articles 6.1, 12.2 and 17 respectively. These mechanisms make use of trading principles to enable countries to reach their common goal of climate protection, while at the same time minimizing the costs of achieving that goal. In applying the logic that large trading areas facilitate greater cost reductions than smaller ones, the flexibility of the mechanisms and their potential for benefiting both industrialized and developing countries offer a practical way to begin reducing global emissions. That is a compelling virtue.

In particular, the combination within emissions trading of incentives for international cooperation with opportunities for minimizing cost augurs well for its use as part of a strategy to address diverse pollution problems. Since the natural trading areas for issues such as reducing tropospheric ozone, preventing stratospheric ozone depletion and increasing acid rain control are very large indeed, emissions trading could be an efficient and cost-effective mechanism to address these environmental problems. Emissions trading in such cases would also encourage technology transfer and flows of financial resources from industrialized to developing countries and to countries with economies in transition. These arguments are equally valid in the case of climate change. Moreover, the combination of CDM, JI and IET, as well as domestic climate policies, contributes to sounder management of the global commons and sustainable development, under the principle of common but differentiated responsibilities embedded in the Convention on Climate Change.

UNCTAD's extensive research efforts regarding tradable emission permits began in 1991, with the aim of shaping global carbon markets to enable them to fulfil their promise of increased and shared economic and environmental benefits. Following the adoption of the Kyoto Protocol, the concept of emissions trading was enlarged to encompass at once internationally tradable emission allowances (or the IET mechanism) and trading of emission credits or units produced from CDM and JI. If CDM manages to capture 35 per cent of carbon markets, the potential CDM market size alone is estimated in this publication to be worth USD 18 billion per annum. With respect to development assistance and net private capital flows, CDM investments could therefore be substantial if employed with an integrated approach to the other Protocol mechanisms. While the implementation of a fully operational global emissions trading market still faces important political and technical problems, there is a belief on UNCTAD and among several of its UN and non-UN partners in the international field of climate change in the soundness of the principles underlying the Kyoto Protocol mechanisms.

In the present publication, UNCTAD investigates the central issue of a climate policy architecture: the structure and design details that must be confronted in order to implement a feasible plurilateral greenhouse gas emissions trading programme. The authors address technical as well as policy issues concerned with maximizing the performance of the Kyoto Protocol’s international trading mechanisms. The issues addressed cover:

- The operational architecture of carbon trading, including where to assign property rights for carbon and how to distribute permits;
- The estimation of emissions permit prices to provide a better understanding of the actual costs of meeting the Kyoto Protocol’s policy targets;
- The challenge represented in translating to the international context the accumulated national experience with emissions trading such as legal standards and rules of accountability; and
- The challenge of finding incentives to motivate countries with diverse interests to move voluntarily towards the collective goal of reducing greenhouse gas emissions.

The challenge that lies ahead is to ensure that global climate change solutions recognize developing countries’ need to develop while simultaneously pursuing their trade and sustainable development objectives. We cannot isolate trade or environmental policy from the impacts of international debt, the need to alleviate poverty, the equitable imperative to transfer technology and the need to assist developing countries in enhancing their capacities to face the challenges of development. In this regard, UNCTAD is committed to working closely with its member States in the creative search for solutions to the challenges of our time and to exercising leadership in capacity building, sound research, and analysis for addressing trade mechanisms considered in the area of climate regime.

The authors in the present publication are accompanied by commentators who, in the period between the suspended sixth session of the Conference of the Parties to the Convention on Climate Change in The Hague in November 2000 and its resumption in Bonn, scheduled for 16 to 27 July 2001, present their critique of the most recent and inherent procedural problems that hamper the implementation of the Kyoto Protocol. These commentators also examine the prospects for overcoming weaknesses in our treaty-making processes and institutions – an exemplary exercise which has greatly benefited from the timely interaction between a great many scholars, diplomats, policymakers, non-governmental organizations, and other negotiation practitioners.

Rubens Ricupero
Secretary-General of UNCTAD
Geneva, April 2001

Introduction[1]

In late 1990, UNCTAD began research into the design and application of market and trade mechanisms, namely tradable entitlements (on which nine volumes have been published since 1992), and to contribute to the climate negotiations in the framework of the United Nations Conference on Environment and Development (the Earth Summit). This pioneering effort led to the design and development of a global greenhouse gas (GHG) emissions trading system that is reflected in the architecture of the United Nations Framework Convention on Climate Change and its Kyoto Protocol.

Creating markets for GHG emissions and allowing the trading of emission credits and allowances, taking advantage of differences in the marginal cost of reducing emissions in different countries, are now considered by both Governments and the private sector as enduring principles to address the climate change challenge. Significantly, the Kyoto flexibility mechanisms offer a way to involve developing countries in the efforts to control GHG emissions without constraining their development prospects. The market- and project-based mechanisms aim at hastening development by generating additional investment in the developing countries, accelerating technology transfer and enabling countries to advance to cleaner technologies, while helping developed countries achieve their emissions reduction commitments at a lower cost.

The Convention on Climate Change has already been ratified by 187 Parties. This virtually universal group of countries has the task of making the Kyoto Protocol and its mechanisms operational. In response, UNCTAD, since 1999 with the valuable support of the United Nations Foundation/United Nations Fund for International Partnerships, has been developing its programme to respond to the research, capacity-building, information dissemination and policy discussion needs of member States. Moreover, it has increasingly developed expertise in the trade and investment aspects of climate change and its potential synergy and conflict with the multilateral trade regime.

Developed and developing countries are currently negotiating the details for both GHG trading among the Annex I countries, through International Emissions Trading (IET) and Joint Implementation (JI), and trading with developing countries through the Clean Development Mechanism (CDM). Under CDM, non-Annex I countries, which do not have caps on their emissions, can generate emission reduction credits to allow Annex I countries to meet their agreed targets. On the other hand, IET among Annex I countries may involve linking together domestic emissions trading systems. Annex I countries can also opt for a project-level approach whereby participants can generate emissions credits from emission-reducing actions in other Annex I countries through JI. The Kyoto mechanisms have triggered substantial interest from Annex I countries, international investors, developing country Parties and their own companies, as well as from a myriad of other actors in the finance, insurance, certification, brokerage and trading sectors.

[1] UNCTAD's GHG Emissions Trading Programme is now evolving into a wider-scope programme addressing trade- and investment-related aspects of the climate change regime as part of its mandate to examine the economic and developmental implications of multilateral environment agreements and identification of ways to promote the effective implementation of measures to achieve global environmental objectives (see the Plan of Action adopted at UNCTAD X, Bangkok, February 2000, paragraph 147).

In this book, we explore a new set of issues related to the proper functioning of trading in GHG credits and allowances. It complements the UNCTAD series on carbon trading.[2] The papers and post-Hague commentaries contained in this volume are addressed to international climate negotiators and decision makers concerned with establishing an environment for the effective participation of all countries in the climate change regime.

UNCTAD is committed to giving support to those who share responsibility in setting the stage for international trading of credits and allowances originating from GHG emissions abatement in Annex 1 countries through IET and JI, and from CDM projects in developing countries.

UNCTAD's programme has developed networks in both developing and developed countries involving negotiators, researchers, the private sector, non-governmental organizations and other national and international initiatives. It intends to further develop research, capacity-building, information dissemination and policy discussion activities with a view to enable member States to assess risks and use the opportunities arising in the climate change regime.

On the GHG Emissions Trading Programme, UNCTAD has greatly benefited from collaboration with the Earth Council Institute of Canada (Toronto), the International Centre for Trade and Sustainable Development (Geneva) and the International Emissions Trading Association (Geneva). The staff working in UNCTAD's GHG Emissions Trading Programme are: Lucas Assunção, Sálvano Briceño (Coordinator), Ali Dehlavi, Dianna Dinevski, Lorena Jaramillo, Lalen Lleander, Gao Pronove and Vivian Raksakulthai. While all of the staff have made contributions to this publication, we wish to extend special thanks to Ali Dehlavi, who took on the demanding task of coordinating all the contributions from authors and commentators.

[2] Information on other titles can be found at www.unctad.org/en/subsites/etrade. A new website with all relevant UNCTAD publications and links is being developed.

Chapter I

The Legal and Institutional Framework for a Plurilateral Greenhouse Gas Emissions Trading System

Richard B. Stewart[*] and Philippe Sands[+]

INTRODUCTION

This paper discusses the legal and institutional issues presented by the development of a plurilateral greenhouse gas (GHG) emissions trading system in which participating countries that have adopted domestic trading systems mutually recognize emissions allowances or credits generated by each other's domestic systems, providing the basis for the emergence of an international trading system. This plurilateral approach deserves serious consideration. The Kyoto process for reaching agreement on a single set of global arrangements for international GHG emissions trading is encountering difficulties. Denmark has already adopted a limited domestic CO_2 emissions trading system and other countries, including the United Kingdom, Australia, Sweden, and Argentina are either in the process of adopting domestic CO_2 or GHG emissions trading system or are seriously considering their adoption. The European Commission has endorsed a proposal to commence emissions trading within the European Union beginning in 2005 as a part of the European Climate Change Programme. While effective controls on GHG will eventually require comprehensive global arrangements, the plurilateral approach can represent an important step in building such arrangements. Part II of the paper summarizes the advantages of emissions trading systems at both the domestic and the international levels, including the advantages of their use to limit GHG emissions. Part III discusses the concept and potential evolution of a plurilateral GHG emissions trading system. Part IV reviews experience to with domestic emissions trading systems. Part V analyses the essential legal and institutional elements of a successful international emissions trading system. Part VI analyses how the designs of the domestic trading systems of countries participating in a plurilateral GHG emissions trading system might be coordinated or harmonized in order to support the successful development of such a system while allowing for appropriate variations to address national circumstances. Part VII briefly reviews issues of the compatibility of a plurilateral trading system with international law. A brief conclusion follows.

ADVANTAGES OF USING EMISSIONS TRADING SYSTEMS TO ADDRESS GREENHOUSE GAS EMISSIONS

Emissions trading systems to control air pollutants have been developed in recent years to address some important limitations of traditional command and control environmental

[*] Emily Kempin Professor of Law, Director, Center on Environmental & Land Use Law, New York University, New York, USA.
[+] Reader in International Law at the University of London, School of Oriental and African Studies, London, UK, and Global Professor of Law at New York University Law School, New York, USA.

regulation.[1] As confirmed by experience in the United States, which has the greatest experience with use of emissions trading systems, properly designed and implemented emissions trading systems have a number of important advantages over traditional command regulation. They can achieve emissions limitations at far less cost than traditional regulation. They afford sources wide flexibility in the means of limiting emissions, and at the same time provide continuing incentives for innovation and investment in less polluting, resource efficient products and processes. Further, the trading mechanism can provide infusions of capital and technology to upgrade existing industrial and commercial infrastructure or to build new, state-of-the-art plants and facilities. Emissions trading systems also enjoy administrative advantages. Under command regulations, government administrators must make detailed economic and engineering decisions about the required level and also often the means of control by particular sources. Under emissions trading systems, regulators must determine the appropriate overall level of emissions, but the decisions about each source's level of emissions and means of emissions control are made by the managers of sources in response to market prices and incentives.[2]

These several advantages of emissions trading are especially pronounced as applied to GHG limitations. There are many different types of facilities and activities in different economic sectors that generate different GHGs, with wide variations in the costs of limiting GHGs among different sources and sectors and in sequestering GHGs in different kinds of sinks. There are generally even larger differences in the costs of controlling net GHG emissions among different nations because of differences in the current state of capital plant and technology, economic structure, geographical and ecological factors, stage of development, and available substitutes. The potential costs of limiting net GHG emissions are very large .It is therefore extraordinarily important that limitations be achieved in the most cost effective fashion, through market mechanisms that provide incentives and business opportunities for private entities. Reducing the costs of achieving limitations can also promote the likelihood of successful international agreement on and implementation of limitations measures. Emissions trading systems can further these objectives by capitalizing on differences in the costs of limiting emissions or enhancing sinks in different sectors and nations, and steering private sector investments to the lowest cost GHG-reducing opportunities. Emissions trading can attract consent by nations to participate in arrangements to limit GHG emissions with fewer distortionary side effects than command regulation or emissions taxes.[3]

Command regulation imposes limits on emissions by each source. In order to make this task manageable, regulators typically establish uniform limitations for categories of sources, such as power plants and steel mills, based on widely available control technologies. In practice, however, the sources in a given category and their means and costs of emissions control vary, often substantially. The use in these circumstances of uniform "one-size fits all"

---

[1]For an overview of emission trading systems and other economic incentive systems and their advantages over command regulation, see Richard B. Stewart, Economic Incentives for Environmental Protection, in Richard Revesz, Philippe Sands, and Richard B. Stewart, Environmental Law, The Economy, and Sustainable Development (Cambridge University Press, 2000). For discussion of the lessons of the experience with emissions trading in the United States and elsewhere for the design of international GHG emissions trading systems, see Richard B. Stewart and Philippe Sands, Institutional and Legal Issues of Emissions Trading, in Luis Gomez-Echeverri, Climate Change and Development (Yale School of Forestry and Environmental Studies and UNDP, 2000)
[2]See United Nations Conference on Trade and Development, Combating Global Warming: Study on a Global System of Tradeable Carbon Entitlements (1992).
[3]See Jonathan Baert Wiener, Global Environmental Regulation, Instrument Choice in a Legal Context, 108 Yale L. J. 677 (1999).

requirements leads to serious inefficiencies and economic waste. Sources are precluded from using alterative methods, such as source-specific process changes and pollution prevention measures that limit emissions far more cheaply than generic control technologies. Also, where the costs of control vary widely among sources, the same aggregate level of emissions limitations could be achieved far much more cheaply if sources with low control costs did more control and high cost sources less control than the uniform requirement. And, by mandating specific emissions control technologies or otherwise limiting sources' choices among control methods, command regulation tends to stifle the development and application of innovative abatement methods.

Emissions trading systems can address the serious inefficiencies of command systems of centralized planning and promote cost-effectiveness by introducing flexibility and providing incentives for sources with lower control costs to undertake more of the control burden. Under a *tradable allowance* system, a governmental authority issues a certain number of pollution quotas. Each allowances entitles the holder to emit a given amount, such as a tonne, of a pollutant. A source may not emit pollution in excess of the number of allowances that it holds. Total emissions by all sources are thus capped. Allowances are allocated to individual sources by auction or by administrative allocation. Allowances may be traded, bought, and sold, and held by anyone. Because allowances are scarce, they will be worth money. A source incurs a cost for each unit of pollution that it generates; it must either purchase an additional allowance or incur the opportunity cost of foregoing potential sale of an allowance that it holds and that would become surplus if its emissions were lower. Thus a tradable allowance system imposes a price on each unit of pollution emitted; this price is set by market supply and demand. The price of allowances gives every source the incentive to innovate and adopt less costly ways to reduce emissions.

Tradable allowance systems are designed to allow individual sources flexibility in deciding what level of emissions levels to achieve and how to achieve it. Sources are no longer locked into uniform "one size fits all" requirements and can use whatever means they choose to limit emissions.[4] Tradable allowance systems also provide strong incentives for sources to reduce their emissions, since sources must pay for each unit of pollution that they emit. Each source will tend to reduce its emissions to the point where its marginal costs of limiting emissions equals the price of allowances. Sources with lower control costs will tend to control their pollution more, and sell or transfer their excess allowances to sources for which it is more costly to control. Since all sources face the same allowance price, the marginal costs of emissions limitations will tend to be the same for all sources, producing a least-cost allocation of emissions limitations. The resulting cost savings over a command system can be enormous, cutting total emissions limitations costs by 20 to 50 per cent or more. These savings are likely to be especially large in an international GHG emissions trading system because of wide variations in the marginal costs of emissions limitation in different countries. Moreover, tradable allowance systems give all sources a long-run incentive to develop new, more resource-efficient less-polluting methods of production that reduce emissions more cheaply because sources can thereby save money and make pollution control a source of profit. Society will benefit because pollution will remain limited even as economic development moves forward, and the savings due to the lower costs of limiting emissions can

[4]Tradable allowance systems can also provide intertemporal flexibility. Sources can be allowed to bank surplus allowances obtained as a result of emissions reductions in one time period to cover increased emissions at a later time period. The development of allowances options and futures markets can also allow sources to obtain allowances for use today based on reductions to be achieved in the future. The appropriate nature and extent of such flexibility is a question of regulatory policy.

be invested in other societal objectives. By contrast, traditional command regulation allows sources to discharge pollutants within regulatory limits for free, and sources have no incentive to reduce such emissions. Further, allowance-trading systems provide not only the incentives but also the resources to upgrade older, inefficient plants and facilities or build new ones. Owners of older, inefficient plants often lack the capital and technological know-how to upgrade them. Upgrading, however, can result in significantly reduced pollution, creating valuable surplus allowances. Firms with the needed capital and know-how will accordingly have an economic incentive to invest, through allowance purchases or even joint ventures, in upgrading these plants in return for a portion of the surplus allowances generated. Tradable allowances systems similarly create financial incentives to build new, resource-efficient plants to replace outdated ones.

A somewhat different form of emissions trading system relies on *emission reduction credits*. In a credit trading system, a source, entity, or sector that reduces pollution below the levels fixed by regulatory requirements or other relevant baseline obtains a credit which it can bank for future use or transfer or sell to other sources to help meet their emissions limitation obligations. Like tradable allowance systems, tradable credit systems provide sources with flexibility and incentives to reduce emissions, and reallocate control efforts from high-cost sources (who will purchase credits) to low-cost sources (who will generate and sell credits) thereby producing a cost-effective allocation of control efforts. A credit trading system does not establish an initial set of allowances for all sources (although the level of abatement required by regulation implicitly sets an overall allowed level of emissions). Instead, credits are established on the basis of achieved reductions in emissions below the levels required by regulation. These required levels may be established, and credits awarded, on a source-by-source basis. Alternatively, a level could be established for an entire firm or an industrial sector. The baseline represents a form of emissions "budget". Reductions in emissions below the baseline create an emissions budget "surplus" that can be used, in the form of credits, to offset emissions elsewhere or in the future.

In this paper, tradable emissions units (TEUs) will be the generic term used to encompass both tradable emissions allowances and tradable emissions reduction credits.

Tradable allowance and credit systems have different advantages and disadvantages in terms of administrative and transaction costs. The initial start-up costs of an allowance trading system are higher than those of a credit system. Allowances must be issued to all sources covered by the system, and a comprehensive bookkeeping system established. Once established, however, the transaction costs associated with trading are relatively low. Trades need no advance approval, and can simply be reported to a central bookkeeping system. Under a credit trading system, start-up costs are lower because the system builds on existing regulatory requirements or other baselines. Only those sources, firms, or sectors that reduce emissions below their required levels can claim credits; the number of sources involved in the trading system is less, reducing administrative costs. However, some credit programmes have required that a regulatory authority certify the achievement of credits before they can be recognized, introducing transactions costs, uncertainty, and delay. Also, the scope of the market tends to be smaller than under a system of allowance trading.

Emissions trading systems are emphatically not a form of deregulatory laissez-faire. They require the imposition of limitations on emissions in order to achieve environmental objectives and create scarce commodities, in the form of tradable GHG allowances or credits, as the basis for a trading market. Government plays a vital role by establishing the system and prohibiting sources from emitting pollution in excess of the allowances or credits that they hold. Violations of these requirements, like violation of command requirements, must be subject to administrative, civil, and possibly, criminal sanctions.

Emissions trading systems are not well suited for dealing with localized pollutants that will cause disproportionate harm if too many sources are sited in a given location or if their emissions are too high. In such cases, the flexibility provided by emissions trading systems may be a disadvantage, and limitations on allowance purchases in some locations or even use of command regulation may be needed to ensure that localized pollutant concentrations are not excessive. Emissions trading systems are better suited for widespread pollutants that are emitted by large numbers of sources and that mix on a regional or global scale and accordingly do not threaten local pollution “hot spots”. Because GHG emissions come from widespread sources and mix globally, emissions trading systems are especially well suited for regulating such emissions.

THE CONCEPT OF A PLURILATERAL GREENHOUSE GAS EMISSIONS TRADING SYSTEM – BUILDING FROM DOMESTIC TO INTERNATIONAL TRADING

It is envisaged that an international GHG emissions trading system could emerge out of the adoption of domestic trading systems by various countries and agreements or arrangements among these countries for mutual recognition of the tradable emissions units (TEUs) established by their respective domestic trading systems. A number of countries have already initiated steps to establish or have expressed serious interest in establishing domestic systems. They are likewise interested in possibly participating in international trading with other countries adopting similar domestic systems in order to expand the scope of and hence the economic and environmental advantages of the GHG emissions trading market.

After the adoption of domestic emissions trading system by countries, emissions allowances or credits in one domestic system could be recognized, and accorded credit for domestic regulatory purposes, by other domestic systems through a series of bilateral or plurilateral agreements among the states in question. Eventually an umbrella international agreement might be established to harmonize the various domestic arrangements into a unified international trading system with an international governance structure. In order for this scenario to be realized, efforts must be made to promote consistency and potential for coordination among the domestic systems as they are initially developed with respect to the essential common elements that must be established in order to support successful international trading. As explained below, these essential elements are relatively few in number, and can be achieved while still allowing scope for considerable differences in the design of domestic trading systems, in accordance with the different traditions and policies of the different countries participating in the plurilateral trading system.

These efforts must build on analysis of experience with domestic emissions trading systems and their key “building blocks”, and on precedent in private and public international frameworks to promote consistency and coordination with respect to common regulatory and financial objectives, all with a view towards the structure of an international trading system that would eventually emerge. This work must also be coordinated with - and presumably be consistent with - the development of ground rules for international trading under the Kyoto Protocol to the United Nations Framework Convention on Climate Change (FCCC), and the possibility of banking credits established prior to 2008 under domestic or plurilateral systems for recognition during the first commitment period pursuant to the Protocol. Thus the development of a plurilateral trading system could provide invaluable experience with international GHG emissions trading and form a basis for the adoption pursuant to Kyoto Protocol Art. 17 of an international trading system for assigned amount units of Annex I/Annex B Parties. The provisions of Art. 4 regarding Annex I Party umbrellas, of Art. 6 regarding Annex I project-based Joint Implementation (JI) credit trading or emission reduction units (ERU), and of Art. 12 regarding the Clean Development Mechanism (CDM) and trading of certified emissions reductions (CERs) could provide additional FCCC bases for international TEU trading. Eventually TEUs generated under all of these provisions and under correlative domestic trading systems could trade in a single global market.

Thus the development of a plurilateral trading system would build on experience with, and analysis of the key elements of domestic trading systems, including:

- the creation of a fungible, homogenous TEU commodity with appropriate property right, ownership, and transfer rules;
- the use of allowance or credit systems in conjunction with the adoption of emissions caps and their relation with traditional regulation and fiscal instruments;
- arrangements for the allocation of allowances or the recognition of credits (including "upstream" and "downstream" or hybrid allocation strategies);
- requirements for international free trade in allowances or credits and avoidance of market distortions such as tariffs, non-tariff trade barriers, monopoly power, and expropriation;
- monitoring, record keeping, reporting and verification requirements; liability rules and sanctions for non-compliance;
- registration and bookkeeping of allowance or credit transfer and holdings;
- requirements for exchanges;
- possible government "market-maker" roles, including auctions; and
- dispute resolution procedures.

It is unlikely, as noted above, that all countries will choose exactly the same model for a domestic GHG emissions trading system. Regulatory policies and the rules and institutional structures for implementing will naturally vary depending on local conditions and circumstances. Further, a degree of experimentation is desirable. At the same time, for reasons already noted, there is an overriding interest in building consistency and potential for coordination among the various domestic systems with respect to the legal and institutional elements that are essential for successful international trading.

In these circumstances, one approach would be by way of a *first stage* to develop several model domestic trading systems, with different selections and arrangements of the key "building blocks", but designed in such a way as to maximize appropriate consistency and the potential for coordination among the various models on key elements necessary for successful international trading markets in order to foster the emergence of a plurilateral and, eventually, a fully integrated international trading system compatible with the FCCC/Kyoto Protocol.

At the *second stage* of evolution, bilateral or plurilateral arrangements for mutual recognition of allowances and credits would develop. These arrangements would presumably have to be authorized by domestic legislation in order to provide for recognition within one country of

TEUs generated by another country but could otherwise be characterized but by a degree of informality, established by working agreements and arrangements among relevant officials from the participating countries. Formal treaties would not be required at this stage. These cooperative arrangements will require consideration of methods for harmonizing the commodities recognized by different domestic trading systems, and harmonizing them in turn with JI ERU credits and CDM CERs including possible arrangements to register and account for such credits as part of the international emissions trading system and recognize such credits in determining the net emissions of participating countries and their sources. Careful consideration will have to be given to the development of suitable coordination arrangements, liability rules and dispute resolution procedures, and other legal and institutional assurances of mutual compliance that will provide private entities, including foreign investors and CER allowance/credit holders, with the requisite security for investments in allowances or credits established by a given domestic system, as well as to provide domestic regulators with assurance that trading with other countries does not become a means for circumventing emissions limitation obligations.

At the *third stage* of evolution, it might be necessary or appropriate to develop a comprehensive multilateral international agreement establishing a unified international trading system. Such an agreement would have to provide legal and institutional arrangements establishing the basic features of a trading system, including: a governance structure; the identity, roles, and rights and obligations of the participants, including Parties, non-Party states, legal entities, and operational entities; the emissions limitation obligations assumed by the Parties and their relation to those established in the Kyoto Protocol; the definition of the tradable emissions unit (TEU), whether allowances, budget credits, etc., and how TEUs would be established, allocated, and certified; the role of operational entities; arrangements for monitoring and reporting of net emissions; registration, tracking, and validation of TEU trades and holdings; certification of Parties' net emissions, TEU holdings, and compliance or non-compliance; compliance enforcement and liability rules; dispute resolution, including the special issues of international dispute resolution procedures involving States, international organizations, and private entities; and free trade and avoidance of market distortions.

The arrangements at early stages in this evolutionary process should, insofar as possible, anticipate the requisites of an international trading system and facilitate its development. They must also take full account of, and be consistent with, developments as to arrangements likely to emerge under the Kyoto Protocol. These arrangements should anticipate the integration of domestic trading systems into an evolving and increasingly integrated and comprehensive international system. Such integration would have to address matters that cross cut domestic and international regimes; these include certification of TEUs and reporting, registering and tracking of trades and holdings, monitoring and reporting of emissions and compliance, and enforcement issues. As previously noted, steps should be taken at each stage of the evolution to promote the fungibility of the TEUs established within this system with credits generated by CDM and JI projects. Transitional arrangements for the recognition of permanent international governance and dispute resolution procedures and the accreditation and functioning of transnational operational entities will have to be anticipated in the evolutionary design.

To be sure, the evolution of a plurilateral emissions trading regime will confront certain difficulties. The most obvious is the emergence of markedly heterogeneous or inconsistent approaches by different countries, frustrating subsequent integration. Another difficulty is that early emissions control systems in only a few countries could induce "leakage" of emissions-intensive economic activities to countries not yet controlling their emissions. Such leakage highlights the critical importance of designing a plurilateral trading system to accommodate and affirmatively attract new members, especially those with significant net emissions.

EXPERIENCE WITH AND LESSONS FROM DOMESTIC EMISSIONS TRADING SYSTEMS

The United States has the most extensive domestic experience with emissions trading systems.[5] Most of this experience has been in the context of air pollution control. Two programmes have been especially successful: the programme for phase-out of lead additives in gasoline during the 1980s, and the programme adopted in 1990 to reduce sulphur emissions by 50 per cent over a ten year period. Both of these programmes successfully spawned the development of full-fledged trading markets and achieved very substantial cost savings in meeting environmental objectives. These cost savings and the flexibility afforded by the programmes in turn promoted agreement on more ambitious environmental protection objectives than would have been possible under a traditional command system. Other trading programmes, most notably the offset and bubble programmes initiated by the U.S. Environmental Protection Agency (EPA), have not lead to the development of well-functioning emissions trading markets and instead have resulted only in scattered informal or "spot" trades. While the latter trading programmes have provided a welcome degree of flexibility and achieved some cost savings, they have been relatively less successful than the lead and sulphur trading programmes.

The U.S. Trading Programme for Lead Additives in Gasoline

The U.S. EPA began reducing the lead content in gasoline in 1973. When the EPA decided that much deeper reductions in the lead content were needed in 1982, it opted to institute an emissions trading programme. Given the severity of the reduction (90 per cent of the lead-additive was to be removed by 1987), there was concern that some refiners, particularly smaller ones, would have difficulty complying. Refiners were required to reduce the lead content in their gasoline from 1.1 grams per gallon of gasoline to 0.1 gram per gallon of gasoline from 1982 to 1987. The added flexibility provided by the trading programme helped ease industry concerns about the costs and timing of compliance, allowing the EPA to pursue further reductions than it would have been able to otherwise.

All refiners participated in the programme, and were granted limited rights to add specific quantities of lead to their gasoline. The number of rights to add lead given to refineries was based on the amount of leaded gasoline produced by the firm previously and the EPA standard for each specific year. Firms that used less then their allotted amount of lead could trade those unused rights, both internally and externally. Banking was permitted beginning in 1985, with most large refineries depositing rights. There was extensive use of the intertemporal flexibility afforded by banking, and markets in lead credit futures and options also developed. Vigorous trading was reported throughout the programme's history, with participation peaking in its last years. An essential contributor to the programme's success

[5]See Richard B. Stewart and Philippe Sands, supra note 1.Experience with trading systems in other countries as well as the U.S. is reviewed in Daniel Dudek, Richard Stewart, and Jonathan Wiener, Environmental Policy for Eastern Europe: Technology-Based Versus Market-Based Approaches, 17 Colum. J. Envir. L. 1 (1992).

was the low transaction costs associated with trading. The EPA relied on self-monitoring by refineries to verify lead content of gasoline. Refineries submitted a report to the EPA each quarter on their gasoline production and lead content. If refineries participated in trading, they had to report this information as well. This information was readily available to all firms, imposing a minimal administrative cost. The traditional arms to ensure regulatory compliance -- verification, record keeping, and enforcement backed by strong sanctions -- were in place as well.

The lead trading programme flourished in large part due to the lack of restrictions placed on the market. With minimal restrictions, firms could confidently enter the market without fearing a sudden change in the status of their rights. Given the severity of the reductions in lead content, and the varying marginal costs faced by different refineries in reducing their lead levels (as illustrated by the vigorous trading), firms had a strong incentive to enter the market, and faced few hindrances in participating.

It is estimated that the lead trading programme saved the refinery industry hundreds of millions of dollars; over two-thirds of these savings have been attributed to the banking feature. And while a trading programme does not inherently produce lower emission rates than a command and control regime, the advantages provided by a trading programme in the form of increased flexibility in the means and timing of compliance allowed the EPA to mandate lower reductions in lead content then it could have utilizing a traditional command and control regime.

The U.S. Sulphur Dioxide Allowance Trading Programme

Title IV of the U.S. Clean Air Act Amendments (CAAA) of 1990 instituted an emissions trading programme for sulphur dioxide (SO_2) on of the pollutants thought to be responsible for acid rain. The programme applies to electric utilities plants that burn coal and oil. The first phase of reductions were met in 1995, with deeper cuts that were planned for 2000. The number of allowances is to be restricted to achieve a reduction of 10 million tonne of emissions from 1985 levels by the year 2010. The programme applies to all fossil fuel burning electric utilities larger than 25 megawatts. Utilities are granted allowances to emit one tonne of SO_2. Allowances were allocated based on historical fuel usage. A source must hold or surrender to the EPA an allowance for every tonne of SO_2 that it emits in a given year.

The EPA set up an allowance tracking system and requires on-line continuous emissions monitors at plants participating in the programme. Utilities that have emissions exceeding their allowances must pay a fine of USD 2000 per tonne (approximately 10 times the market price of an allowance) and forfeit the corresponding number of tonnes the following year. A strong monitoring and enforcement programme has ensured full compliance by sources with their emissions limits.

Allowances are fully tradable. There are no limits on the number of trades allowed or on the amount of allowances to be purchased or sold. Allowances are issued annually in "vintage" years, i.e., a utility may be granted a 1996 allowance, which can be used in 1996 and after. The CAAA includes two government "market-maker" programmes. The first, and more important, is an allowances auction held by the EPA. The EPA reserves 2.8 per cent of the allowances granted each year for the auction, and offers for sale both present and future vintages. The EPA also sells 25,000 allowances per year through the "Direct Sales Reserve".

However, since allowance market prices have been below EPA's price throughout the length of the programme, the allowances have been auctioned off after remaining unsold for a year. A substantial market in allowances have developed, including a Chicago Board of Trade futures market in allowances that plants will receive in future years or will make available in the future through banking of unused allowances.[6]

The SO_2 trading programme has been a considerable success. It is ahead of schedule, and its costs are far below those of a comparable command system. As of 1996, emissions were more than 30 per cent below the reduction schedule target. Control costs are less than 50 per cent of the command regulatory alternative, resulting in more than USD 5 billion in savings over the life of the programme. Almost no restrictions were placed on trading, though a few state regulators attempted to impose state-specific restrictions. Though trading prices and trading rates have been lower than expected, this development was not due to restraints on the market, but to independent changes in the cost of low sulphur coal as well as reductions in the costs of low-emissions technology (i.e., scrubbers) and the flexibility that emissions trading systems give to sources in determining the means for limiting their emissions.

Like the lead trading programme, the SO_2 trading programmes has produced environmental as well as economic benefits. The adoption of emissions trading to address acid rain in lieu of command measures broke a 15-year political stalemate over dealing with the problem and enabled agreement to be reached on an ambitious 50 per cent emissions reduction target.

The RECLAIM Programme

Another allowance trading system for air pollution control is the California RECLAIM programme to reduce emissions of nitrogen oxides and sulphur dioxide in the heavily polluted Los Angeles Basin. The RECLAIM programme was adopted with the support of regulators, environmental groups, and industry, all of which concluded that traditional command regulation had reached its limits in dealing with the problems of Los Angeles. Allowances are issued to existing sources based on the amount that they are permitted to emit under current regulatory requirements. The allowances' emissions value is reduced over time. There have been numerous trades. While trading has been impaired by regulatory limitations on and review of trades, the programme is expected to save hundreds of millions of dollars compared to the command alternative.

Allowance Trading for Ozone Depleting Chemicals

The U.S. EPA has successfully instituted an emissions trading system to provide firms with flexibility in the phase-out of CFCs and other ozone-depleting substances as required by the Montreal Protocol and subsequent international agreements. Because the number of producers is small, the number of trades has been limited, but it appears that the programme has yielded appreciable cost savings and provided firms with needed flexibility in complying with the phase out schedule.

[6]The futures market along with the banking feature creates significant intertemporal flexibility. A plant that reduces its emissions faster than the schedule can bank its extra allowances for its own future use or sell the extra allowances to others for present or future use. A plant that plans to make its reduction investments later and accordingly has excess emissions in the near term can buy surplus allowances from others for the current year or can buy allowances for use in subsequent years through the futures market.

Generic EPA Emissions Trading Programmes Under the U.S. Clean Air Act

The U.S. EPA has adopted a variety of emissions credit systems designed to give firms greater flexibility to comply with the command regulatory requirements Clean Air Act. The programme has three components, offsets, bubbles, and netting. Offsetting allowed firms to enter non-attainment areas, i.e., areas where air quality was worse than required by ambient standards, by purchasing credits that more than "offset" the increased emissions from the new source from a current source's expansion. One form of bubbling places an imaginary "bubble" over a multi-source plant-creating version of internal trading. Levels of emissions control can vary within the bubble, so long as the total emissions emitted is within the statutory limit. Another form of bubbling places a bubble over a number of existing emitters. Netting allows a modified source to increase its emissions through the modification, so long as it decreases emissions elsewhere in the plant. Netting is hence, an internal trading programme.

Of the three, the netting programme has seen by far the greatest level of participation. The cost saving from netting is estimated to be between USD 525 million to USD 12 billion. Bubbling, primarily through internal trades among different sources, has saved some USD 300 million. Offsetting required vigorous external trading to be successful and the market never developed to the extent anticipated.

Transaction costs for external trades, including the costs of locating appropriate buyers or sellers, have been higher than for internal trades. Also, such trades are reviewed by regulatory agencies, creating a layer of regulatory overhang. Regulatory review was much more intensive for external trading than internal trading. The result of this regulatory oversight is not surprising: internal trading dwarfs external trading. Though significant savings have been realized, greater savings still could have been realized.

The most successful U.S. trading programmes have been the lead credit and the SO_2 allowance trading programmes. Their success is due to a number of factors, First and foremost, each established a uniform, homogeneous commodity -- pounds of lead additives and tonnes of SO_2 emissions -- which facilitated the development of trading markets as well as intra-firm transfers. Second, both programmes used a pure performance b-based measure of compliance -- lead content in gasoline or sulphur emissions -- allowing firms complete flexibility in selecting the means and levels of limiting lead content or sulphur emissions. These features ensured cost-effectiveness in achieving of aggregate programme goals. Third, the allocations and baseline issues were resolved on a generic rather than case-by-case basis. In the lead programme allowances were allocated to firms based on the historical amount of leaded gasoline produced by each firm. In the sulphur programme, allowances were allocated to existing power plants based principally on their historical energy input. Fourth, in both programmes trades and other transfers were accomplished by voluntary actions by private entities without the need for governmental review or approval before the trade or transfer became effective. These entities reported trades and transfers to EPA, which recorded them and kept track of current holdings. This elimination of regulatory overhang helped to promote the development of well-functioning markets. Fifth, the liability for the seller's failure to comply with programme requirements was placed on sellers, not on purchasers or holders of credits or allowances. Under the lead phase-down programme, if a refiner sold lead credits but failed to reduce the lead content in its gasoline in an amount sufficient to match the credit sold, the government took enforcement action against the seller; the buyer holding the credit could still claim the full value of the credit. Similarly, under the sulphur programme, sellers of allowances who fail to reduce their emissions sufficiently to equal the amount of allowances sold face enforcement action and sanctions; the buyer who holds the allowances can continue to claim their full value. By providing security to buyers, this approach promotes trading. Placing the risk of non-performance on buyers or holders of credits or allowances through a rule of buyer liability under which the value on allowances or credits is reduced based on the seller's non-compliance is likely to chill trading. Sixth, both programmes mandated large cuts in existing emissions, which helped to drive the trading programmes. In part these large reductions were made politically palatable by the lower costs of compliance obtained through use of emissions trading.

There has been limited experience with emissions trading in a number of countries other than the United States. Germany, for example, has adopted an offset programme whereby new or modified sources can locate in areas not in compliance with ambient standards by securing offsetting reductions of the same or functionally equivalent pollutants from other sources in the vicinity. As in the case of the U.S. offset programme, the German programme involved a high degree of regulatory review of individual offsets and an offset trading market did not develop. Chile adopted a trading programme for emissions of particulate matter from industrial sources in the Santiago region. However, the programme was hastily designed and implemented and has not been regarded as successful.

BASIC LEGAL AND INSTITUTIONAL CHOICES IN THE DESIGN OF DOMESTIC GREENHOUSE GAS EMISSIONS TRADING SYSTEMS

The threshold issue in the design of a domestic GHG emissions trading system is the choice between an allowance system and a credit system. This section of the memorandum first describes the various elements of an allowance system and its relation to other GHG regulatory systems, and then conducts a similar analysis of credit systems. As previously noted, an allowance system involves higher start-up costs, but if successful will have relatively low trading transaction costs. Credit systems often involve lower start-up costs but higher trading transaction costs.

Recall that under an allowance system, the government must establish a limited total number of allowances (which may change over time) and allocate them to all relevant sources. Allowances may then be transferred, sold and bought. This is known as a "cap and trade" system. In order to promote market liquidity and efficiency, it is desirable that the right to hold allowances not be limited to sources but be extended to anyone, including brokers, speculators, and environmental groups. Trading can be internal to a source (between different GHG emissions streams of the same facility), internal to a firm (among different facilities of the same business or other entity) or external among firms.

Allowances are defined in terms of a right to emit a given amount of one or more pollutants: for example, the right to emit one metric tonne of CO_2 or its equivalent in other GHGs in terms of radiative forcing and atmospheric residence time.[7] Thus trading will occur to the extent that certain sources have reduced their emissions below their allowance holdings and have surplus allowances to transfer or sell to other.

[7] Equivalency values for different gases were agreed for the first commitment period by the third Conference of the Parties to the FCCC, decision 2/CP.3. These values should presumably be adopted by countries participating in a plurilateral trading system prior to the first commitment period for use in that system.

An important question is which GHG gases and sinks and which sectors should be included. In principle, all GHG gases and sinks and all sectors should be included in order to provide the maximum opportunity for achieving limitations in the most cost-effective way and to prevent leakage of economic activity and emissions from gases/sectors that are covered to those that are not. There are, however, substantial differences in the quality of emissions monitoring for different gases and sinks and for different sectors, due to the differences in uncertainties in determining both emissions factors for different activities and the level of activities generating emissions. Thus, monitoring of CO_2 emissions from energy uses and some large industrial sources is generally subject to low levels of uncertainty, whereas monitoring of net CO_2 emissions from forestry and land use changes is subject to substantially greater uncertainties. Uncertainties in determining emissions of methane and N_2O are generally greater than for CO_2, but the uncertainty varies by sector, and for particular sectors is less than the uncertainty in measuring CO_2 from forestry and land use changes. N_2O from large industrial sources and methane from gas distribution and landfills is not subject to the same degree of uncertainty as emissions from more complex sources and sectors, including from diffuse sources of methane (especially enteric fermentation and manure management), transport sector N_2O, and N_2O from agricultural soils.

This situation gives rise to a concern that firms or countries will report reductions in uncertain gases and sectors that are greater than those that have actually been achieved, and thereby purposefully or inadvertently under report net emissions, thereby compromising the environmental and economic integrity of the trading system. It has been argued that, from a compliance perspective, this problem justifies a limitation of the trading programme, at least initially, to those gases and sectors where uncertainty is low, subject to possible later expansion. If, however, the sectors not covered by the trading systems are unregulated, or are regulated at a less stringent level than the sectors covered by the trading system, there will be a leakage of investment into the uncovered sectors, which in turn will resist expansion of the trading system to include them. Moreover, the problem of uncertainty in emissions monitoring is not unique to emissions trading programmes. It must be addressed, in one way or another, by whatever type of regulatory system is used.

To the extent feasible, the preferable policy response to the problems of greater uncertainty regarding determinations of emissions for particular gases and sectors is to use conservative default assumptions about net emissions in order to reflect the uncertainty. The conservatism of these assumptions can be relaxed on a showing by sources or countries of improved methods for determining emissions. In contrast to an approach that leaves such gases and sectors out of the trading system entirely, this approach provides desirable incentives for such improvements to be undertaken.

Another consideration is administrative feasibility. It would be desirable to limit the coverage of a trading system to gases and sectors involving a relatively small number of relatively large sources or sinks. On the other hand, as more gases and sectors are left out of the system, its economic and environmental advantages are reduced.

The scope of an allowance trading systems, in terms of gases and sectors to be covered, must be determined by balancing the increasing administrative costs and problems of monitoring and enforcement of a broader system against its economic and environmental advantages. The development of an allowance trading system could be limited initially to those gases/sinks and sectors that can be monitored with greater certainty and administered more easily. Its scope could then be expanded, in a phased fashion, based on experience and the development of administrative capacity and of improvements in monitoring techniques. As noted above, however, those sectors that benefit economically and competitively from their exclusion from an initial, limited trading system will resist such expansion. Thus, there are powerful arguments for making the trading system as comprehensive as is feasible from the beginning.[8]

Under an allowance system, sources must hold sufficient allowances to cover their emissions for the relevant time period. This requirement may be enforced by requiring sources to surrender allowances in an amount equal to their emissions for a given time period, or simply by requiring sources to report emissions and allowance holdings for the relevant time period. If sinks are included, extra allowances can be allocated to them equal to GHGs sequestered, or the sequestered GHGs can be deducted from gross emissions in determining net emissions. In order to facilitate tracking of allowance holdings and trades, allowances should be issued in serial form, and a central registry for tracking should be established. Holders, transferors, and transferees of allowances should be required to report holdings and transfers to the registry. It should be provided that failure to report may result in non-recognition of claims to allowances.

Allowances are issued for a given time period. For example, in the U.S. SO_2 trading programmes, allowances, which confer the right to emit one tonne of SO_2, are issued annually in vintages. An allowance may be used in the year of issuance or in any subsequent year. This banking feature allows inter-temporal flexibility. Another means of providing such flexibility is to allow trading markets to offer options or future contracts for allowances to be issued in future years. An alternative to a system of annual allowances that may allow even greater intertemporal flexibility is to issue allowances for a given period, such as five years, and allow sources to use them in any pattern they wish within the five-year period.

In order to ensure the integrity of the allowance regulatory system, the government must provide for effective monitoring, recording, and reporting of net emissions and of allowance holdings. Monitoring, record keeping and reporting should be carried out by sources in the first instance, subject to government review and enforcement action for failure to carry out these functions, for false reporting, and for failure to hold allowances at least equal to emissions. At the end of each relevant allowance accounting period B such as a year B there can be a “true up” period during which sources with excess emissions can purchase sufficient allowances to cover them. There must be an effective system of enforcement and sanctions in order to ensure compliance with these requirements.

The government may use various means to allocate allowances. They may be auctioned. If the auction revenues are used to reduce existing taxes on labour and capital, productivity gains could significantly reduce the net social costs of the GHG regulatory system. However, an auction will competitively disadvantage firms and sectors with high GHG emissions. Alternatively, as has typically been the practice with emissions trading systems in the United States and elsewhere, allowances may be given by the government to existing sources gratis based on actual prior or existing emissions, emissions allowed by applicable regulations, or by the use of other criteria. New sources typically have to buy allowances from existing sources. This arrangement results in a transfer of wealth to existing sources, which are given

[8] See Richard B. Stewart and Jonathan B. Wiener, The Comprehensive Approach to Global Climate Policy: Issues of Design and Practicality, Arizona, Journal of International and Comparative Law 83 (1992).

valuable property rights.[9] This approach has made emissions trading systems more acceptable politically to industry than emission taxes and can be used to compensate obsolescent facilities and their workers. So long as there is a workably efficient market in allowances, this "grandfathering" strategy for allocating allowances should not pose an entry barrier to new sources or prevent the trading system from achieving aggregate emissions limitations in a cost-effective manner. A third method of allocation is one based on output; this may have the perverse effect of causing an increase in output from sources with high GHG emissions.

Another basic issue in the design of allowance systems is whether they should be "downstream," "upstream," or "hybrid." Under a downstream system, allowances must be held by the sources or entities that actually emit GHGs. Sources must hold allowances equal to their emissions. Under an upstream system, allowances must be held by producers or importers of fuels and other substances that will generate emissions when combusted or used; these may be regarded as indirect sources. These indirect sources upstream must hold allowances based on an assumed emissions factor based on the characteristics of their product; in the case of fossil fuel, for example, the assumed emissions can be based on its carbon content.

A *downstream system* is compatible with existing command environmental regulatory systems, including monitoring and compliance systems, which are focused on direct sources of emissions. The U.S. SO_2 trading programme is an example of a downstream system. However, a downstream system might have to be limited to larger sources. Smaller sources, such as individual motor vehicles, households, and small industrial and commercial facilities, might be so costly to monitor that they would need to be excluded from the allowance trading system and addressed through command regulation or other measures. Thus, a downstream trading system might not be comprehensive in its coverage. A downstream trading system could be phased in over time; it might initially be limited to the largest sources and gradually extended to smaller ones.

The advantage of an *upstream system* is that, for at least some gases and sectors, it is both comprehensive and involves many fewer regulated entities than a downstream system, greatly easing problems of administration, monitoring, and enforcement, lowering transactions costs, and enhancing environmental effectiveness and economic efficiency because all emission sources are indirectly covered. For example, the carbon content of fossil fuels can readily be determined. Producers and importers of such fuels can be required to hold allowances based on the CO_2 emissions that will be generated when the fuel is combusted. In effect, they are treated as indirect sources with emissions equal to projected emissions of the downstream sources that combust the fuel. The U.S. lead trading programme is an example of a successful upstream system. An upstream trading system would raise the price, for example, of fuels, sending a price signal to ultimate users.[10] This approach, however, is not practical for other GHG, such as non-fossil CO_2 and agricultural methane, nor for sinks. An upstream system can not be phased in, unlike a downstream system; it has to be adopted for all indirect sources of a given gas/sector Further, it would require development of a new regulatory, accounting, and monitoring system for upstream indirect sources distinct from existing regulatory programmes, which are focused on emitters. This new system would have to account

[9] Command regulation also confers valuable property rights on sources by allowing them to use the atmosphere for disposal of residuals without paying a fee. Unlike the case with an emissions trading system, however, these property rights cannot be sold to others.
[10] Because of market imperfections, it is possible that the price signal sent to emitters will be less effective in reducing emissions than a downstream system that imposes a quantitative limit on aggregate emissions.

separately for imports and exports. The U.S. lead trading programme, however, indicates that the difficulties involved may not be great. Also, one would have to determine exactly at what point upstream of actual emissions the system would be targeted-- whether at the point of extraction, processing, or transportation and distribution. Rules and procedures would have to be developed to ensure that all upstream products were counted once and only once.

Further, an upstream allowance allocation based, for example, on the carbon content of fuels would not reflect actual emissions. Such a system would fail to recognize, for example, difference in downstream combustion methods or improved scrubber technologies that could result in higher or lower emissions per until of fuel combusted, and would thereby fail to create incentives for use of more efficient downstream combustion methods. This problem, however, might be addressed (albeit at the cost of considerable administrative complexity) by providing allowance rebates to the extent that the upstream producer of fossil fuel provided documentation that its fuel was being combusted by the downstream direct sources that used its product in such a way as to emit fewer GHG emissions than assumed by the emissions factor used to determine the amount of allowance holdings required of upstream sources. The system could also be refined to deal with carbon-based products, such as asphalt produced by oil refineries that do not result in emissions. But the more detailed and extensive these adjustments, the more an upstream system might come to resemble a downstream systems, but in patchwork form.

A third alternative is a *hybrid system* under which a downstream system is used for large direct sources, and an upstream system is used in situations where there are many direct sources and many fewer indirect sources whose product is used by the direct sources. Thus, fossil fuel combustion by power plants and major industrial users could be covered by a downstream system and automobile emissions by an upstream system. The hybrid system would rely on price signals to alter behaviour on the part of smaller downstream sources not subject to the downstream allowance system. This mixed approach would introduce greater administrative complexity than either a pure upstream or a pure downstream system. A system of upstream accounting would have to be established that would, among other matters, distinguish those products, such as fuels, destined for downstream sources covered by downstream cap-and-trade regulation (which would not require upstream allowances) from those destined for downstream sources not covered by such a system (which would require upstream allowances). A system of downstream missions monitoring for the relevant sources would also have to be established.

Those gases and sectors not covered by an allowance trading system may be addressed by other regulatory measures, including credit trading systems (discussed below), traditional command regulations, emissions taxes, voluntary agreements by industry and government, public information campaigns, and other policies and measures. Because GHG generally mix globally and do not present local pollution “hot spot” problems, there is no need to supplement an allowance trading system for those gases as such with regulatory constraints to prevent such hot spots, unlike for example the trading system for VOCs in the Los Angles RECLAIM programme, which is constrained geographically to address the hot spot problem. It may be, however, that certain GHGs may in practice be constrained by regulatory requirements aimed at associated pollutants. For example, command regulatory controls designed to reduce local concentrations of sulphur dioxide or particulate matter may have the effect of leading electricity generators to switch to use of natural gas in lieu of coal, with the incidental effect of reducing CO_2 emissions as well. Further, a country might adopt policies and measures in addition to an allowance cap and trade system to address GHGs, including taxes, command regulation and voluntary agreements, although the need for such measures is questionable if an effective allowance trading systems is adopted. Such measures might impair the trading market and create distortions if they target some gases and sectors more heavily than others, reducing the efficiency advantages of the trading system. If allowances could not be used as credits against command regulatory obligations, the scope for trading would be reduced and the advantages of trading impaired. However, to the extent that the price signals to downstream sources created by an upstream allowance system do not work efficiently because of market imperfections, there may be a role for additional policies and measures directed at downstream sources not covered by a downstream allowance system.

As in any regulatory system, including in any type of emissions trading system, there must be an effective governmental system of monitoring, implementation, enforcement, and sanctioning in order to ensure compliance with emissions limitations obligations. In the case of allowance trading, the obligation is that of a source to surrender or hold allowances equal to its emissions. Cheating results in excess emissions. It also undermines the trading market because sources that successfully cheat will not buy allowances to cover their excess emissions or will sell allowances that they already hold and no longer need because of cheating. In this way, cheating reduces the demand for or increases the supply of allowances, reducing their price and the incentive of sources to invest in emissions limitations.

In designing an allowance trading system, a country will have to decide on the liability rule that will govern in cases where it is discovered that a source that has sold some of its allowances has emissions in excess of the remaining allowances that it holds. As previously discussed in the review of the U.S. emissions trading experience, under a rule of seller liability, the value of the allowances sold is not reduced by virtue of the seller's non-compliance, and the buyer is protected. Instead, the government proceeds against the seller to sanction its non-compliance and require it to purchase sufficient allowances in the market to cover its allowance deficit. This rule promotes trading but depends on strong enforcement capacity. The use of a seller liability rule has been successful in the U.S. because monitoring is continuous and comprehensive; the U.S. EPA enforces programme requirements vigorously; and non-complying sources are subject to an automatic fine of USD 2,000 per tonne of excess emissions (approximately ten times the current market price for an allowance) as well as the obligation to obtain allowances to cover their allowance deficit. A rule of buyer liability may inhibit trading. On the other hand, it creates market incentives for compliance because buyers will wish to purchase allowances from sellers with a good reputation and record of compliance. This rule may accordingly be appropriate where government enforcement and sanctioning capabilities are more limited, although it, like the seller liability rule, depends on the existence of reliable, adequately enforcement monitoring and reporting arrangements in order to detect non-compliance. It is also possible to develop various mixed liability rules in which the seller and the buyer both bear some liability for the seller's non-compliance.

As previously discussed, an emissions credit trading system provides for TEUs only to the extent that sources reduce their emissions below some required regulatory level and wish to qualify the resulting reductions as credits for trading. The total stock of TEUs under a credit system is thus likely to be substantially less than under an allowance system, which may impair the efficiency advantages of emissions trading. Credit systems require the definition of a base level, which may create political controversy and administrative complexity depending on the baseline chosen. Base levels could include, for example, historical emissions or emissions allowed by applicable regulations now or in the future. The base level can be defined in terms of emissions by a particular source, by a business or other entity, or by an entire industrial or other economic sector. The corresponding credits for emissions below base levels would accrue to a source, an entity, or a sector, respectively. Credits would also be issued to sinks based on GHGs sequestered.

A crucial question in the design of an emissions credit trading system is whether credits must be verified ex ante by a government authority before they are issued or traded, or whether transferors can claim and transfer credits without prior government review and approval, subject to requirements that they report emissions and credit transfers ex post and are subject to appropriate enforcement sanctions for cheating. Most of the credit trading systems in the United States and in other countries have required ex ante government certification of credits; such a requirement introduces considerable risk and delay and high transactions costs, impeding trading and the efficiency advantages of the system. The gasoline lead additive trading programme in the United, however, states demonstrates that ex ante certification of credits is not a necessary feature of a credit trading system. But, a credit trading systems based on ex post review and enforcement depends on reliable monitoring techniques and effective administrative and enforcement capacities.

In other respects, the issues presented by the design of a credit trading system are quite similar to those presented by an allowance system. These include the need to define credits in homogenous terms (such as a metric tonne of CO_2 or its equivalent); the time period for which credits are issued; whether they can be banked for future use and whether options or futures markets in credits are permissible; which gases, sinks, sources, and sectors will be included in the system; the choice among upstream, downstream, or mixed regulatory strategies; and the relation between the trading systems and other policies and measures, including command regulation, for addressing GHG.[11] As in an allowance system, there must be an effective system of monitoring, implementation, and enforcement, and a choice must be made among alternative liability rules.

LEGAL AND INSTITUTIONAL DESIGN AND IMPLEMENTATION OF A PLURILATERAL TRADING SYSTEM

Essential legal and institutional elements for a successful international trading market

A plurilateral GHG trading system should include the core essential requisites of a successful international emissions trading market, compatible with the different choices made by the different participating countries regarding the design of their domestic emissions trading systems, as discussed above. Fortunately, the core requisites are relatively few in number, and can accommodate substantial diversity in domestic trading system design.

The key requisites of an international GHG emissions trading system are the same as for a domestic system: to establish enforceable limitations on net emissions by domestic sources covered by the system; to establish a homogenous and fungible TEU commodity defined and protected by well-established property rights and by ownership rules that allow anyone to acquire or hold TEUs; to provide for free transferability of TEUs without prior regulatory review or approval; to accord recognition in each participating country of TEUs from the

[11] In a credit trading systems these choices are likely to depend on the design of existing or new command regulatory systems, since credit systems are often adopted as a supplement to command regulation in order to provide flexibility.

other participating countries for purposes of determining compliance by domestic sources with domestic limitations on their emissions; to establish an integrated system for tracking TEU trades and holdings; and to provide adequate assurances that net emissions are accurately determined and reported and that sources comply with their emissions limitation obligations. Securing these requisites will, of course, be somewhat more difficult in an international context involving several countries than in a purely domestic situation, but the difficulties are far from insurmountable.

Emissions caps

Countries participating in a plurilateral trading regime must establish enforceable domestic caps on emissions of gases from sources and sectors participating in the regime. These caps can be established either through an allowance system, or through a command regulatory system under which reductions by sources of emissions below the levels required by regulation are recognized as credits that can be traded to other sources to help them meet their regulatory requirements. As discussed more fully below, a plurilateral trading system is compatible with substantial variations in the design of the different domestic systems of the participating countries. Concerns over equity and competitiveness, however, will likely generate demands by each participating country that the other participants adopt caps of roughly equivalent stringency in order to have the TEUs generated by their system recognized in the domestic regulatory system of the participating country. Competitiveness concerns may also lead to demands that the domestic sectors covered by the participating countries' domestic systems be roughly the same. In principle, however, a plurilateral emissions trading system could work effectively and produce significant economic and environmental benefits even if the stringency of domestic systems varied and the sectors covered were different. Thus, resolution of these issues is a contingent policy matter that will have to be resolved politically among the participating countries.

Homogeneous and fungible, mutually recognized TEU commodity

It is essential for the successful operation of the plurilateral trading market that the TEUs generated in all of the participating country be defined in the same way: tonnes of CO_2 or their equivalent, determined through the equivalency values endorsed by the COP for the first commitment period. TEUs should be fungible for purposes of regulatory compliance. Each country must agree to recognize TEUs issued by other participating countries, regardless of gas/sink or sector that generates them, and authorize its domestic sources to hold and use such TEUs on the same basis as domestically-issued TEUs for purposes of determining compliance with domestic regulatory requirements.

Property rights and ownership and transfer rules

The domestic laws of each participating country should establish TEUs generated by its domestic laws as legally protected property right, protected both against third parties and against government expropriation (subject to the right of the government to adjust the aggregate number of TEUs in response to changes in conditions). This protection must be extended to TEUs generated by other participating countries. Since domestic trading systems will necessarily provide for holding and trading by non-government entities, and a plurilateral system will develop out of those domestic systems, it is logical that the latter system provide for holding and trading of TEUs by non-government entities. The inclusion of those entities will promote the functioning and efficiency of the plurilateral market.[12] There may be some sentiment to limit ownership to nationals or entities sited in the participating countries. However, allowing universal ownership, including ownership by brokers and speculators and environmental groups who are not nationals or entities sited in a participating country, will enhance the functioning and efficiency of the trading market. There must also be assurances of free, undistorted trade in TEUs. Participating countries should provide that TEUs may be transferred both domestically and internationally without prior regulatory or other government approval or restrictions or tariffs or charges on same (except for registry fees, as discussed below). Participating countries should also provide that trade in TEUs should be subject to antitrust/competition laws in order to prevent the development of undue market power or other distortions.

TEU Registry

It will be necessary to establish an integrated or single registry of TEU holdings and transfers. Each participating country could establish its own registry for TEUs issued pursuant to its domestic programme. Arrangements could then be made to integrate these registries, for example, through a single on-line umbrella system listing all TEUs (by country) and transfers and holdings. Alternatively, a single registry for all participating countries could be established. Registrations should be electronically available to the public worldwide.

Mutual compliance assurances

In order to ensure the economic and environmental integrity of TEUs in a plurilateral trading system, it will be necessary to establish and secure mutual assurances on the part of all participating countries that net emissions from covered sources in each country are accurately monitored and reported. This will require the development of common procedures and criteria for monitoring emissions and sequestration, including the use of common default values for emissions and activity rates for sectors subject to greater measurement uncertainty, as discussed above. It will also be necessary to establish and implement mutual assurances that the respective domestic implementation and enforcement regimes will ensure that the respective domestic sources comply with their domestic emissions limitation obligations. These arrangements would, of course, be necessary in any international arrangement for joint emissions limitations, regardless of whether or not it provides for trading. If a participating country has an allowance trading system, it must ensure that sources hold TEUs equal to their emissions for the relevant accounting period. If it has a tradable credit system, it must ensure that sources comply with applicable emissions limitations requirements, crediting any TEUs that a source acquires and debiting any TEUs that it has transferred. Unless there are such mutual assurances, there would be an unacceptable risk that source would not comply with their limitations and that TEUs that were transferred lacked integrity because, in the case of allowances, they were not surplus, and, in the case of credits, that they were not valid. Without adequate assurances of compliance by sources with applicable emissions limitations, demand for and hence the value of TEUs will be diminished, and those sources that wish to transfer TEUs that have integrity will find their market position undermined by TEUs that lack integrity. These problems would threaten the viability of the entire system. Developing and implementing adequate mutual compliance assurances will be the most difficult problem

[12] There is, however, an issue, discussed further below, that only governments might be authorized to make initial transfers of credits for sectors not covered by a domestic TEU system but subject to other regulatory limitations.

in the design and operation of a plurilateral GHG trading system, or of any international systems providing for emissions limitations, with or without trading.

Scope for differences in the design of domestic regulatory and trading systems within a plurilateral GHG trading system

The essential elements of a plurilateral trading system, as described above, are compatible with substantial variations in the design of domestic regulatory and emissions trading regimes.

There appears to be no reason why some countries participating in the plurilateral system could not adopt an allowance system for purposes of domestic regulation, others a credit system, and still others a combination of allowance and a credit systems, provided that all of the requisites set forth above are met. Subject to the same condition, there appears to be no reason why different participating countries might not cover somewhat different gases and sectors in their domestic trading systems. It is to be expected that all domestic systems will include fossil fuel CO_2 emissions from the energy sector and perhaps certain industrial emissions because these are major emissions sources and emissions can be monitored with considerable certainty. Beyond this core, there is room, as a technical matter, for national variation and experimentation, provided that requirements of homogeneity, fungibility, and adequate monitoring and compliance assurances are met. As noted above, however, due to competitiveness and other concerns, participating countries may as a matter of policy insist on at least a rough similarity of coverage in the domestic systems of the participating countries, at least insofar as the TEUs generated by those systems are entitled to mutual recognition. This would allow a given participating country to have a domestic trading system with much broader coverage than the others, but only TEUs generated by sectors equivalent to those covered by the other domestic systems would be entitled to recognition for regulatory credit in those systems.

An issue that presents great complexity is the compatibility among upstream, downstream, and hybrid trading systems in different countries. At a conceptual level, if TEUs under all three different systems are homogeneous and fungible, then there should be no impediment to trading and mutual recognition across different types of systems. But there may be questions about, for example, the functional equivalency of TEUs under, for example, a downstream system, which is based on actual emissions, and an upstream system, which is based on projected emissions based on certain default assumptions and values. There would need to be agreement on common upstream default assumptions to ensure functional equivalency across different types of system. The different types of entities subject to regulation and the different types of monitoring data to be collected under upstream and downstream system could also introduce complexities in ensuring integration of the different systems in a plurilateral regime.

Another important question is the extent to which governments might be authorized to offer credit TEUs for sectors not covered by a domestic trading system but subject to other forms of regulatory limitations. If regulations establish an enforceable emissions budget for such a sector, and if a government can establish that emissions for that sector are below the budget, then in principle TEUs might be recognized equal to the excess reductions. Since the sources within the sector would not be part of a domestic trading system, any such credits would have to be held and transferred in the first instance by the government of the country in question; thereafter they could be held and traded by anyone. Of course, the government could choose to distribute such TEUs to firms in the regulated sector in some fashion. This issue requires further study and would in any event be a matter of policy for the participating countries to resolve.

Each country will probably have somewhat different institutional arrangements for monitoring, enforcement, and other measures to assure compliance by sources with the emissions limitation obligations established by domestic law, subject, however, to adequate mutual assurances of compliance as discussed below. An important question in this regard is whether adoption by different countries of different liability rules for non-compliance would be compatible with a well-functioning plurilateral trading market. Recall that under a rule of seller liability, adopted for example under the US SO_2 and lead trading programmes, a TEU remains valid even though it is determined, after it has been transferred by a source to another holder, that the allowance was not surplus or the credit was not valid because the source was not in compliance with emissions limitation requirements. Under seller liability, the TEU remains valid and the buyer is protected. Enforcement action is taken against the selling source to come into compliance and correct the violation, including by purchasing additional TEUs. While this rule promotes trading, there may be difficulty in securing adequate mutual assurances of effective enforcement and compliance in a plurilateral system involving different governments. Under a rule of buyer liability, the buyer bears risk of seller non-compliance; the TEUs are invalidated or discounted, depending on the nature of the buyer liability rule. This risk may inhibit the development of trading markets, but does create incentives on buyers to obtain credits from reliable sellers, which in turn provides compliance incentives for sellers. Suppose, however, that some countries adopt a seller liability rule and others a buyer liability rule. Is that compatible with successful operation of an integrated trading market? This issue requires further study; it is discussed further below.

Arrangements for harmonizing the design and operation of domestic trading systems to secure the essential elements of a plurilateral trading system

As discussed above, there are certain essential elements of a well-functioning plurilateral trading system that are compatible with substantial variations in the design and operation of the domestic trading systems of the participating countries. It will, however, be necessary to ensure that these essential elements are satisfied by all participants. It would obviously be highly desirable to design, from the outset, the domestic trading systems of countries potentially interested in participating in international trading to assure these essential elements. To that end, such countries should cooperate in the design of their respective domestic systems, which is an important objective of the current project.

Before a plurilateral trading system can be established, not only must the domestic trading systems of the participants be consistent with and incorporate its essential elements as described above, but there must be arrangements to provide for the mutual recognition of TEUs generated by the domestic regulatory systems of other participants. Mutual recognition might be provided by domestic legislation in each country that delegates to its administrative or executive authorities the power, subject to criteria and procedures established in the legislation, to determine whether TEUs from other countries should be accorded recognition for purposes of domestic regulatory compliance. Such legislation, which could be part of the basic legislation establishing a domestic trading system, could then form the basis for informal or formal agreements among such administrative or executive authorities to grant mutual recognition to TEUs generated in each other's domestic systems. Alternatively, there could be treaties among the participating countries providing for mutual recognition under defined terms and conditions. The treaty method, however, would be slow and cumbersome, and there should be room for flexibility and rapid adjustment in the development and evolution of a plurilateral trading system. Accordingly, a system of mutual recognition based on parallel domestic regulatory arrangements and working arrangements or agreements among domestic administrative or executive authorities may be preferable, pending the development of a more inclusive international treaty providing for emissions trading.

There are many analogies to such an approach in the international harmonization of domestic regulatory systems in other areas. These include:

- Pharmaceuticals and medical devices
- Aircraft and pilots
- Maritime safety, environmental protection and liability
- Intellectual property
- Securities regulation/stock registration on multiple exchanges in different countries
- Insurance regulation
- Commodities trading
- Chemicals regulation, including labelling
- Banking
- Basel standards for capital adequacy
- National accountancy standards/multinationals
- Product safety
- International electricity markets
- International fisheries management
- Currencies trading
- Broadcast frequencies
- Internet domain names.
- Satellite orbit locations

In addition, the EU experience for mutual recognition of domestic member state approvals of pharmaceuticals, approval of the labelling and/or sale of chemicals and other products, professional accreditation, and other regulatory determinations provides other analogies that would be useful in the development of a plurilateral trading system.

Legislative and administrative arrangements for mutual recognition of TEUs and working agreements among relevant officials of the participating countries should assure that the essential elements of a plurilateral trading system, described above, are met by all participants. There will also have to be agreement on issues of policy regarding the scope (gases and sectors included) and stringency (tightness of emissions caps) of the domestic trading systems (or portions thereof) that will participate in the plurilateral trading system under a rule of mutual recognition of TEUs generated by the domestic trading systems of other participating countries. Thus, the governments of the participating countries will have to negotiate such issues as how equivalent in stringency the participating domestic systems must be, whether they must all cover the same or similar sectors or whether substantial divergences in coverage will be permitted; and whether all domestic systems must use the same design (allowance versus credit system; upstream, downstream or hybrid system) or whether differently designed domestic systems are operational compatible and acceptable as a matter of policy.

There will have to be working arrangements to develop agreement on and ensure the mutual adoption and implementation of common tonne/CO_2 equivalency values for different gases, sectors and sinks (as previously suggested, the equivalency values endorsed by the COP could appropriately be used); of appropriate common rules regarding property rights in TEUs, ownership of TEUs, and free transfer of TEUs including unrestricted import and export of TEUs without tariffs or other market distortions; and of appropriate common rules of mutual recognition of TEUs generated by other systems. In addition, the participating countries will have to provide for the establishment of an integrated registry to track all holdings and transfers of TEUs in the plurilateral system. A private entity could be used to establish and operate this registry. Such an arrangement would be faster and easier to establish than establishing a new, formal intergovernmental body.

One of the most difficult and potentially most contentious issues will be the establishment of adequate mutual assurances of effective domestic implementation and enforcement of monitoring, reporting, and compliance obligations. Again, this is an issue that would have to be addressed in any plurilateral system of emissions trading, with or without trading. Both governments and sources will be rightly concerned about the risk of non-compliance, which would undermine the environmental and economic integrity of the plurilateral trading system. Each government will be especially concerned about non-compliance by sources in the other participating countries because it has no competence or capacity to bring enforcement actions against such sources and because it may fear that other governments, due to competitiveness pressures, the desire to export TEUs, or for other reasons, will not adequately implement their domestic compliance and enforcement systems.

Working agreements among the relevant officials of the participating agreements should be able to establish agreement on common monitoring and reporting procedures, protocols, and criteria, including default values for determining emissions for gases/sinks and sectors subject to greater uncertainty in determining emissions and procedures for revising those default values as monitoring capabilities are improved. It may also be possible to reach agreement on common or adequately harmonized legal and institutional systems for implementation and enforcement, including sanctions for non-compliance by domestic sources, although this task will be made difficult by differences in the legal, political, institutional, and procedural structures of different countries.

One possible response to this problem is to establish a multilateral non-compliance procedure in which concerns may be raised by one or more participating states about inadequate enforcement by another government and non-compliance by its sources with applicable emissions limitations. Possible models include the non-compliance procedures under the Montreal Protocol and the procedures available under the North American Free Trade Agreement under which a government or a private entity can raise claims of non-enforcement by a Party of its domestic environmental laws before a body composed of representatives of all Parties. Sanctions for persistent, uncorrected under enforcement and domestic source non-compliance on the part of a country participating in the plurilateral emissions limitations system (with or without trading) could include excluding the country or its non-complying sources (if non-compliance were limited to certain sectors) from participating in the trading system; discounting the credit accorded to TEUs generated by that government's domestic system in the domestic system of the other participants; and (as discussed further below) adoption of a buyer liability rule for TEUs generated by that government's domestic system.

Under such a system, how would adequate, accurate information about the adequacy of enforcement in other countries and the extent of their sources' compliance be developed? One option would be to require that the governments of the participating countries report monitoring data and information about compliance and enforcement to a multilateral body established by the countries participating in the plurilateral trading system. That body might have authority to conduct its own investigations, including on-site visits, to verify these reports and determine enforcement adequacy and the extent of compliance. This information could be publicized and used in a non-compliance procedure such as that described above. Possible analogies to such an approach include the European Commission's role in reviewing member state implementation of Community law and the role of the U.S. EPA in determining whether states that have been delegated the responsibility to implement and enforce the pollution and waste control requirements established by federal law are adequately discharging their responsibilities. There might, however, be political and institutional obstacles to establishing, in the context of an evolving and relatively informal plurilateral trading system, a multilateral institution with the resources and authority necessary to carry out these tasks.

A potential alternative is to rely on private sector institutions to audit and certify the adequacy of participating country implementation and enforcement systems or the extent of compliance by their domestic sources. Private auditing and certification bodies are involved in a variety of similar functions, including the application by private certifying agencies of the ISO 14,000 environmental management systems guidelines adopted by the International Standards Organization; certification by private entities of forestry companies' compliance with sustainable forestry management systems criteria established by the Forest Stewardship Council; eco-labelling certification systems for products, international arrangements for private certification for the design, construction, maintenance, and safety management systems for ships. Similar arrangements to audit compliance systems for GHG emissions limitation obligations established by domestic trading systems could be deployed and adjusted relatively quickly; the participating entities would presumably be accredited by and report to the working group of participating country representatives. The participating countries might, however, be concerned, from the viewpoint of sovereignty, to have their compliance and enforcement systems reviewed by a private entity, or to have a private entity exercise responsibility for determining compliance by other private entities with regulatory requirements established by government. In many countries, however, private entities often take on the latter role. In the United States, for example, private certifying bodies determine compliance with government requirements for fire safety and equipment and for water filters for drinking water supplies. Governments that are willing to use market-based arrangements to limit GHGs may be receptive to using private sector approaches to determining compliance as well. One option in this respect is to limit the role of private certifiers to determining compliance by sources that wish to sell TEUs or credits internationally. This arrangement, analogous to that envisaged for certification of emissions reductions under the CDM defined by Article 12 of the Kyoto Protocol, would limit the extent of the certifiers' role so as not to intrude on purely domestic matters. Such an arrangement fails, however, to address the risk of systematic non-compliance by sources in sectors that do no participate in plurilateral trades, which could undermine the environmental objectives of a plurilateral system and also undermine trading.

The various options for providing mutual compliance assurances discussed above are consonant with a rule of seller liability; their focus is to ensure adequate measures by governments to ensure that sources comply with applicable regulatory requirements and thereby ensure the integrity of any allowances or credits that they sell. Another option to deal with concerns about non-enforcement and non-compliance is to adopt a rule of buyer liability for the plurilateral trading system. As previously discussed, this could create market pressures on sources and their countries for compliance; those countries and firms that established a record of or reputation for non-compliance would find their TEUs trading at a discount. But, as previously noted, a buyer liability rule could impede the development of a robust trading market. Also, its effectiveness depends on the ability to detect non-compliance, which in turn requires accurate monitoring and reporting, which in turn reintroduces many of the issues previously discussed. Another option, noted above, is to adopt a seller liability rule for the plurilateral trading system but to have a non-compliance or other multi-lateral body provides that TEUs issued by a participating country or by sources with a poor compliance record are subject to a buyer liability rule.

There is also the issue of whether the countries participating in a plurilateral trading systems would need to make any special provision for resolution of disputes that arise in relation to the operation of the system. Apart from procedures relating to non-compliance, discussed above, it would probably not be necessary, at least in the initial stages, to make any special provision for resolution of disputes, which could probably be adequately handled through domestic tribunals, international arbitration, or specialized tribunals such as ICSIT. This question, however, requires further analysis.

Finally, the countries that initially participate in a plurilateral trading system should develop informal working arrangements for the admission of new participants, which will widen the scope and hence the benefits of the common trading market. New entrants would, of course, be required to satisfy the essential requirements of a plurilateral trading system, as operationalised. There will also be negotiations over matters such as relative stringency of emissions caps, coverage, and other matters. It may be necessary to add new participants in groups to avoid destabilizing the market for TEUs. New additions may also require renegotiation of the emissions limitations commitments of the participants. These matters also need to be analysed more thoroughly.

COMPATIBILITY OF A PLURILATERAL TRADING SYSTEM WITH INTERNATIONAL LAW

Whichever of the models or approaches outlined above is chosen, it is evident that its development and application will not take place in a legal vacuum. In general terms a plurilateral GHG emissions trading system will need to be developed in the context of the relevant or applicable rules of international law, taking account both of global and regional (e.g. European Union, NAFTA) requirements. The principal sources of international legal obligation at the global level are likely to include (1) the 1992 UN Framework Convention on Climate Change and its 1997 Kyoto Protocol, (2) the rules of the World Trade Organisation, and (3) subsidiary sources of obligation relating to *inter alia* anti-trust (competition) law, energy law, and foreign investment law.

The 1992 UN Framework Convention on Climate Change (FCCC) and its 1997 Kyoto Protocol

The principal catalyst for the proposed trading system is the 1992 Convention and its 1997 Protocol, which have the effect of imposing limitations on emissions of GHGs on Annex 1

Parties. The Protocol, once it enters into force, will impose emission reduction obligations on developed country Parties and Parties "undergoing the process of transition to a market economy," mainly in Eastern Europe. We assume that any plurilateral treading system will need to be compatible with the 1997 Protocol in order that the benefits achieved through a trading system may be taken into account in meeting a Party's obligations under the Protocol. This means account will need to be taken of the rules and guidelines adopted under the Protocol as they emerge.

The key obligation of the Protocol is set out in Article 3(1), which provides that Annex I Parties "shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions" of specified GHGs "do not exceed their assigned amounts." The "assigned amounts" are the quantified emission limitation and reduction commitments inscribed for each Annex I Party, with a view to reducing the overall emissions of Annex I Parties "by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012." Article 3(7) provides *inter alia* that in the first quantified emission limitation and reduction commitment period (2008 to 2012), the "assigned amount" for each Annex I Party shall be equal to the percentage inscribed for it in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the listed GHGs in 1990, multiplied by five. The list in Annex B provides differentiated targets for individual Parties: the European Community and its Member States have agreed to a limitation on emissions of 92 per cent of the 1990 base year, or an 8 per cent reduction in the first commitment period of 2008-2012; the US has agreed to a 7 per cent reduction; Japan and Canada have accepted a 6 per cent reduction; while Australia has agreed to an 8 per cent increase. Commitments for subsequent periods will be established by amending Annex B in accordance with the amendment procedure provided for in Article 20(7).

Recognising that these targets may impose significant burdens, the Protocol envisages a number of means for their achievement by flexible means ("flexibility mechanisms"). Article 4 provides for the joint fulfilment of emission reduction obligations. Article 6 provides for the "joint implementation" of the emission reduction obligations of the Protocol, whereby any Annex I Party may transfer to, or acquire from, any other Annex I Party "emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of GHGs in any sector of the economy." Any such project must have the approval of the Parties involved, and must provide "a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur." And Article 12 provides for a "clean development mechanism", whereby non-Annex I Parties "will benefit from project activities resulting in certified emission reductions," while Annex I Parties "may use the certified emission reductions accruing from such project activities to contribute to compliance" with part of their Article 3 commitments. The mechanism will be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to the Protocol.

Articles 4, 6 and 12 each establish arrangements in respect of which a plurilateral GHG emissions trading system may make a contribution. The development of any plurilateral arrangements will therefore need to take account of the framework of rules established to give effect to these provisions. The most pertinent provision of the Kyoto Protocol is Article 16bis, which provides that

> "The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for

> emissions trading. The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3 of this Protocol. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article."

This provides the impetus for a plurilateral trading system. However, the Conference of the Parties has not yet defined the relevant "principles, modalities, rules and guidelines", and is not expected to do so in the immediate future. Certainly the "principles, modalities, rules and guidelines" will address many of the issues identified in this paper, including:

- The relationship between allowance or credit systems and emission caps;
- Requirements for international trade;
- Minimum standards for monitoring, record-keeping, reporting and verification, as well as provisions on liability and sanctions for non-compliance;
- Registration and bookkeeping of allowance or credit transfer and holdings;
- Rules governing exchanges; and
- Dispute resolution procedures.

Our assumption is that a plurilateral trading system is more likely to be attractive to states and provide entities if the benefits it provides may contribute to states' obligations under the 1997 Protocol. To that extent that the design and implementation of national and plurilateral systems will need to take account of discussion within the framework of the 1992 Convention and the 1997 Protocol. This applies even if the trading system is entirely operated within the private sector.

The Rules of the World Trade Organization (WTO)

A second set of rules likely to impact upon a plurilateral trading system are those of the WTO. Since the rules governing trading under the Kyoto Protocol and any plurilateral systems have not yet been agreed it is not clear what precisely will be the impact of WTO rules. Similarly, significant proportions of the WTO rules have themselves not been in force beyond five years, and their precise effect in practice remains to be seen.

The WTO rules are intended to liberalize markets in trade in goods and services between its members. This is to be achieved through the imposition of relative and absolute standards of treatment of goods and services in international and national market places. The WTO's relative standards prohibit WTO Members from the discriminatory treatment of like goods, services and service suppliers on the basis of country of origin. The WTO's absolute standards prohibit or discourage Members from putting in place certain types of measures that directly or indirectly interfere with trade in products and services. These rules may have impacts upon international emissions trading involving private entities, including where the transfers involve government issued permits or "allowances". The characterization of emissions allowances is a matter needing further scrutiny. Are they products or services within the meaning of WTO rules? If not, then the rules governing the transfer and mutual recognition of allowances would appear not to be covered by WTO requirements. Countries could set such rules unilaterally, or by two or more countries, or by the FCCC COP. Moreover, rules accepted voluntarily (e.g. by private entities acting outside the framework of mandatory governmental requirements) would also appear not to be covered.

On the other hand, design choices regarding the means of regulation and the allocation of allowances could affect the competitive relationship between products and services that are governed by WTO requirements. Many energy and energy-related products and services are covered by the rules of the General Agreement on Tariffs and Trade (GATT) and/or the General Agreement on Trade in Services (GATS) guaranteeing non-discrimination and market access. There may be circumstances in which rules for the allocation and trade of emission allowances may act to constrain or promote the import or export of energy or energy-related products or services. For example, allowances required for the distribution or sale of energy products or services within the domestic market place may raise GATT or GATS concerns, particularly if they are allocated on a basis that is either directly or indirectly discriminatory against or between products, services or service suppliers originating from third states.

Measures implementing an emissions trading system may nevertheless be found to fall within the permissible exceptions provided under the GATT or GATS. Further analysis will be need of recent WTO case law addressing the application of these exceptions, for example the 1998 WTO Appellate Body decision in the Shrimp Turtles case. If an emissions trading systems can be designed in a manner, which is not arbitrary or unjustifiable and is not a disguised restriction on trade it may well have a greater chance of passing WTO scrutiny. Further, the application of any exceptions will be related to the question of whether the trading system is adopted under the framework of – or in accordance with – a multilateral environmental agreement (such as the 1997 Protocol)

Subsidiary sources of obligation relating to *inter alia* energy law, foreign investment law, and anti-trust (competition) law.

Beyond the multilateral climate change and international trading rules there are various other international rules, which are likely to be relevant, both at the regional and global levels. These will require further consideration in the design and implementation of a plurilateral GHG trading system. Particularly relevant are likely to be the rules on energy law, foreign investment protection requirements, and anti-trust rules. By way of example, to the extent that the acquisition of an emission trading allowance by a foreign private entity amounts to a “foreign investment” within the meaning of bilateral investment treaties or other agreements, care will be needed to ensure that the rules governing regulation of trade in allowances will not be applied so as to amount to an interference with the rights of foreign investors. Thus, the 1991 Energy Charter Treaty obliges Contracting Parties to endeavour to accord non-discriminatory treatment to investors of other Contracting Parties as regards the making of investments.[13] This obligation is relevant for the 38 Contracting Parties who have ratified the Treaty and for the five Signatories applying the Treaty provisionally. Similarly, although there are no global agreements establishing rules on competition and anti-trust, regional arrangements (in particular in the EU context) establish restrictions on anti-competitive agreements and abuses of dominant position. These often mirror arrangements at the national level. The implications of these regional and national rules for a plurilateral GHG trading

[13] The standard of non-discrimination is broadly agreed to be defined as: "Each Contracting Party shall accord to Investors of other Contracting Parties and their Investments in its Area, as regards the Making of Investments in its Area, treatment no less favourable than that which it accord to their own Investors or their Investments, or to Investors of any other Contracting Party or any third state or their Investments, whichever is the most favourable:" Art. 10.

system, and the possible need to modify them to accommodate and regulate such a system, must be considered.

CONCLUSION

The Kyoto process envisages a single comprehensive international set of arrangements for GHG emissions trading. The difficulties currently encountered in reaching agreement on a single international system under Kyoto suggest that the "top down" approach should be reconsidered. A number of nations and the EU are taking steps towards the adoption of GHG trading systems independent of the Kyoto process. Several major multinational corporations, including BP, du Pont, and Shell, have adopted internal GHG cap and trade systems. If these initiatives could be linked through international trading under a plurilateral strategy, a decentralized, "bottom up" approach to international GHG emissions trading could well prove feasible and desirable. Such an approach would provide for a degree of flexibility, experimentation, and diverse "learning by doing" that would not be possible through a single international agreement. Further, the "top down" and "bottom up" approaches need not be regarded as mutually exclusive. Instead, they may function as complements. The experience gained thorough plurilateral approaches can inform and promote the development and adoption of more comprehensive arrangements, which will ultimately be required to effectively address the risks of climate change. On the other hand, selective forms of plurilateral cooperation can be used by specific nations and private entities to implement international trading within the context of a global international agreement.

****

Post-COP-6 Perspectives:

Lucas Assunção[*] and Bernhard Raberger[+]

It would be misleading to suggest that the November 2000 meeting of the Sixth Conference of Parties (COP-6) to the United Nations Framework Convention on Climate Change (FCCC) delivered the breakthrough most stakeholders in the climate change negotiations had expected. There is no doubt today that – partly due to the weak preparatory efforts by key negotiators – it was perhaps an impossible mission to seek an agreement at The Hague among the 186 Parties to the Convention and 84 Signatories to the 1997 Kyoto Protocol on issues as diverse as capacity building in developing countries and economies in transition, technology transfer, Global Environment Facility (GEF) financing, how to deal with carbon sinks in the emerging regime, agreeing upon the detailed specification of the market based mechanisms to efficiently reduce emissions, and general issues related to monitoring, verification and compliance. Experienced insiders to international negotiations refer to the evolving climate change regime as the most difficult international regulatory regime outside the areas of security, non-proliferation of weapons or world trade.

While several commentators suggest that a deal was closer than ever, the failure to clinch this deal is evident. As disappointing as it sounds, this failure however is more indicative of the complexity and serious economic implications of the upcoming post-Kyoto climate regime than an outright discarding of the climate change problem. COP-6 is scheduled to reconvene in Bonn from 16 to 27 July 2001 (COP-6 Part II) to seek a compromise that will allow for early entry into force of the Kyoto Protocol to the FCCC.

Stewart, and Sands' paper highlights the advantages of emission trading systems as a mechanism to achieve GHG emission reductions. It further discusses the fact that existing national experiences can become solid building blocks towards the launching of a successful international trading system, provided efforts are made to promote consistency and coordination between such domestic trading systems. Section IV of their paper discusses real world experiences with emissions trading, although these refer exclusively to US experiences such as the Reclaim Programme, the allowance-trading scheme for Ozone Depleting Chemicals, the US Clean Air Act scheme, Lead Additives trading program and the SO_2 allowance-trading program. In the climate change context, it may be relevant to discuss ongoing experiences in countries such as Denmark, the United Kingdom and Norway.

Section V and VI provide an insightful discussion of all the basic legal and institutional elements for the design of GHG emissions trading systems at the national and at the plurilateral levels. These two sections offer the reader a useful list of all the key elements currently under discussion, between both private sector companies and among Annex I countries interested in an early participation in a future international emissions trading system.

Finally, Section VII points out that whichever model or approach is chosen for a plurilateral trading system, "it is evident that its development and application will not take place in a legal vacuum." Any attempt by the private sector or an individual country to set up its own trading system will need to take into account rules and guidelines adopted under the Protocol

[*] Greenhouse Gas Emissions Trading Project, UNCTAD
[+] Institut für Wirtschaft und Ökologie, University of St. Gallen

as they emerge at COP 6 Part II or thereafter. Even though an emission trading mechanism would make economic sense in its own right, it is clear that it will be more attractive to states and entice a larger number of private entities if it is compatible to and supportive of "principles, modalities, rules and guidelines" under negotiation at the intergovernmental level. In that sense, the authors underline that the Kyoto Protocol to the FCCC is the *principal catalyst* for their proposed plurilateral trading system. After COP-6 Part I, it is reasonable to assume that success in the establishment of such a plurilateral emissions trading system will largely depend upon entry into force of the Protocol and its overall emission targets for the developed world.

While a few national trading schemes are already up and running (or at least in the pipeline, see Jos Cozijnsen's paper in this publication) their fate will likely depend on whether the underlying international obligations also become binding for other key emitters and trade partners in competing economies. Increasingly, emitting firms and economic sectors that adopt mitigation measures or engage in emissions trading will require similar actions from their trade partners. The more liberalized and competitive the emitting firm or industry the more relevant would be to consider the potential for loss in trade competitiveness.

In this connection, Stewart and Sands conclude the paper by calling attention to the need to ensure compatibility of a plurilateral trading system with other relevant sets of international law such as the WTO rules, the 1991 Energy Charter Treaty, foreign investment law and anti-trust and competition law.

Recent data presented by the Intergovernmental Panel on Climate Change (IPCC) in February 2001 clearly indicate that the global community needs to speed up its efforts to design an institutional and regulatory framework that addresses ever-growing emissions and their adverse economic effects. Earlier figures relating to rises in global mean temperatures were corrected to twice the levels predicted in 1996, and the negative effects of climate change – especially in the poorer regions of the world – are already far worse than previously estimated.

Next Steps

One of the key outstanding question arising from The Hague is whether the failure to make Kyoto ratifyable at COP-6 Part I should be interpreted as a final curtain for the Kyoto flexibility mechanisms and, in particular, the plurilateral GHG emissions trading regime discussed in detail by Stewart and Sands. Clearly, the answer to that question is no!

Taking a step back, it is certainly possible to be optimistic about the introduction of such a system. A comparable deadlock in the negotiations held within the framework of the Biodiversity Convention led to the adoption of the Biosafety Protocol by an extraordinary session of the Conference of Parties in Montreal, which had been the only notable outcome provided for by a deeply divided set of negotiators at the preceding high-level meeting in Cartagena.

In addition, while binding decisions on the key hurdles listed above were not agreed upon at COP-6 Part I, the main negotiating groups nevertheless came forward with more specific proposals and demands, which can now be assessed by their relevant counterparts. In fact, there were signals that the US and EU seemed closer than ever to agree on a compromise on carbon sinks on the last day of negotiations in The Hague. Such a compromise seems necessary to overcome the hotly debated issue of supplementarity. Furthermore, the Clean Development Mechanism has basically received a green light for an early start and it seems clear after The Hague that any compliance system to be eventually adopted would establish rather tough standards in comparison to other international regimes.

Also at The Hague, one observed that unusual suspects positioned themselves to prepare for struggles over *how* to implement the Kyoto Protocol, rather than *whether* to do so. As an example, Senator Hagel, previously the leading opponent to the Kyoto Protocol in the US Senate, acknowledged the notion of human-induced climate change and said that he would advise President Bush to work *with* the Kyoto Protocol, rather than *against* it. It also seems that important private sector players such as DuPont, Enron and Ford backed Senator Hagel, indicating a potentially major shift towards acceptance of the IPCC's findings in the global business community. In Europe, immediately after The Hague, the European Commission declared that it still expects to see the entry into force of the Protocol by 2002 and to stick to 2005 as a start date for an EU-wide emissions trading system.

COP-6 Part-II can and should put the international climate regime back on track. While any compromise emerging is likely to be criticised from various sides, the learning-by-doing example of the Montreal Protocol shows how a regime initially based on rather modest goals can evolve in terms of environmental credibility, social responsibility and economic efficiency. The expected benefits of a sensibly drafted plurilateral GHG emissions trading system, as outlined by Stewart and Sands, could no doubt help to address climate change more effectively.

In the meantime, private sector companies in developed, but also increasingly in developing countries are moving ahead, showing that they are not shying away from the climate change challenge.

****

Chapter II

The Size of the Carbon Market Study

Svetlana Morozova* and Mark Stuart+

EXECUTIVE SUMMARY

This report draws on the findings from over a dozen recent studies that have estimated the cost of meeting the Kyoto Protocol objectives. From this, average estimates of the size and gross market value of the future carbon dioxide emissions reduction market are provided. These estimates are undertaken for four different scenarios of institutional arrangements that are possible under the Protocol including:

- Domestic only emissions abatement (*narrow pool of participants*);
- The trading of emission quotas among Annex I countries alone (*wider pool of participants*);
- The expansion of the allowed pool of emissions via Certified Emissions Reduction (CERs) and the Clean Development Mechanism (CDM) in developing countries (*an even wider pool of participants*);
- A global tradable permit market involving all countries (*the widest possible pool of participants*).

The findings are presented in the context of these varied institutional frameworks and are used to help explain potential capital flows that are derived from such arrangements. The main findings are:

1. When greenhouse gases are only allowed to be abated domestically (in Annex I countries) the marginal price of a ton of carbon dioxide in 2010 at the net present value is approximately USD 77 (USD 1998) — with a total market value of about USD 92 billion;
2. When emissions reductions can be met through Joint Implementation or in a tradable permit market among Annex I countries, the price declines to just over USD 37 per ton — with a total market value estimated at USD 44.5 billion. With 'hot-air.' approximately USD 9 billion in capital goes to the Former Soviet Union (FSU). Under Annex I trade, Japan, UK, US, and several other countries spend approximately 50 per cent less as compared to the no-trade scenario;
3. When non-Annex I countries participate in a global permit market, it is anticipated that the value reaches approximately USD 30-35 billion annually as the per ton average cost declines nearly 20 per cent — to less than USD 30. Nearly half the capital flows to China (USD 9.85 billion), FSU (USD 5.47 billion), India (USD 2.62 billion);
4. If the CDM captures at least 35 per cent of an international market, the estimated value to those countries is approximately USD 18 billion per annum. China gains USD 8 billion, FSU USD 4.5 billion, India USD 2.1 billion, with most of the remaining USD 3.2 billion going to Latin America, Africa and other non-Annex I countries.

* Associate, Ecosecurities Ltd., Los Angeles, USA.
+ Director, Ecosecurities Ltd., Los Angeles, USA.

One of the difficulties of this type of analysis remains use of differing structural assumptions in the modelling regimes used by researchers[1]. One of the key components of this shortcoming is that most of the analysis regarding marginal costs requires penalties — i.e. tax burdens — to achieve particular degrees of emissions. While it is likely that taxes will be used to some degree in some sectors and some countries to help achieve Kyoto Protocol targets, there is very strong political momentum, both internationally and at various domestic levels towards emissions trading, which is a substantially different dynamic. Comparatively few analyses have focused directly on the economic ramifications of trading, as opposed to taxation penalties, and therefore the discussions about marginal abatement costs are often difficult to specifically parse.

INTRODUCTION: CLIMATE PROTECTION, POLICY, AND PECUNIARY IMPLICATIONS

As the international community continues towards adopting the principles of the Kyoto Protocol, policy implementation debates have centred on the institutional-market structure that will influence the economic costs, positive resource distributions and environmental effectiveness of future compliance regimes. All debates regarding institutional frameworks are fundamentally framed within that context.

Perhaps the most important issue regards the gross total of tradable emissions rights that may be available for spending by emitters under different policy parameters. Economic theory clearly informs us that a larger supply pool of emission rights will consequently lower overall costs, the stated goal of most participants to the Kyoto Protocol. However, it is also recognized at the Protocol level that economic efficiency should not be paramount to environmental effectiveness and social equity concerns. Therefore, there is a strong and necessary bias to ensure that emissions reductions are real, credible and long-term.

For developing emissions compliance frameworks, there is the general sense that while a widening pool of participants will potentially lower costs, such expansion also incurs greater risks of lowered environmental efficiency, if improperly managed. When considering the options for developing emissions compliance, a matrix emerges that details a converse relationship between likely cost profiles and performance risks:

- Through 'domestic only' abatement in Annex I countries (*narrow pool of participants)*;
- Through emissions trading and project level joint implementation among Annex I countries (*wider pool of participants)*;
- Utilizing Certified Emissions Reductions in developing countries (CERs) via the Clean Development Mechanism (CDM) (an even *wider pool of participants*);

[1] It should be noted that most of the models examined in this paper are top-down economic models as opposed to bottom-up engineering ones. The former allow abatement costs to be calculated in terms of welfare loss for various reduction levels. By contrast, engineering approaches plot the potentials for emission reduction for different marginal cost levels or use energy system optimization models, which derive the marginal costs from imposing an emissions constraint.

- Under the theoretical construct of a global tradable permit system involving all nations (*the widest possible pool of participants*).

There are several non-trivial reasons — beyond the simple political reality of the current status of negotiations between developing and developed countries — why the CDM will be an operative modality for a substantial period of time before a global tradable permit system is established. Most researchers regard developing country emission participation to be essential if Kyoto Protocol commitments are to be met within a reasonable cost frame, yet recognizing that the political reality is that there is virtually no possibility of a global permit market being established before the end of 2008. The CDM represents the only way to accumulate early creditable emission reductions, with a corresponding incentive for initial financial investments.

Analysts have arrived at differing conclusions about the combination of policies that will enable most efficient, effective, and equitable means for achieving climate stabilization. These conclusions assume a range of built-in economic and institutional variables, including:

- Baseline assumptions/projections about population, economic growth, size of the country, carbon-intensity of energy consumption and production, level of technology and other secondary economic factors;

- Assumptions concerning the extent to which industrial country emission commitments — as specified in Kyoto — can theoretically be met through international tradable permits and Clean Development Mechanism (CDM) transfers;

- Assumptions concerning the extent to which sequestration (through forestry management and protection or new plantations) may be used to meet commitments; and,

- Assumptions on the size of the benefits generated from emerging economies of scale in the alternative energy sector; as well as their impact in countering the anticipated fall in technological innovation in conventional energy efficiency.

Depending on the relative strengths of these, and other, assumptions in economic models, policy findings range from modest gains for the global economy from investment in mitigation activities to severe downturns due to economic dislocation. Instead of serving to inform policy makers and potential investors in the emission reduction market, this divergence in results has often served to obscure important economic and policy issues. Rather than establishing a new model, this paper attempts to collectively review many of the foremost economic models, which analyse the impacts of emission restrictions on the global economy. The aim is to describe the means by which emissions trading under the Kyoto protocol would help create substantial cost savings for participants to meet their commitment objectives, while concurrently providing new streams of revenue for developing countries. To enable this discussion, the paper is specifically focused on the potential market dynamics of the emerging emissions trading regime, including:

- Estimates of the overall size of the emissions reductions market, its dollar value under several of the most probable institutional scenarios; and
- The relative distribution of capital flows to various countries and regions under these alternative institutional frameworks.

After a brief review of the literature, the findings from a number of key studies are synthesized into a mean to estimate average market volume and values. The findings are presented in the context of potential market constraints and are used to help delineate possible capital flows to various regions.

GENERAL DISCUSSION ON MODELS/LITERATURE

This section provides a general discussion on some of the primary literature that was reviewed for this study. It does not offer a comprehensive list of research that could, in one way or another, be related to the topic at hand because the research literature discussed in this section covers models, which appeared prior to November 1999 while focusing on the most significant findings. In sum, these models present two important general points:

- There are a wide range of assumptions that may be included or excluded in any one analysis; and
- The possible implementation alternatives, as discussed in the Kyoto Protocol, are usually used as a broad framework for approximating the institutions that will be used to assist in GHG emissions reductions.

We begin with a brief discussion on the implications of the assumptions and the effects they can have on policy analysis. This is followed by a review of studies/models used for the analysis that is carried out in this paper.

What Can Go Into An Analysis: Assumptions

While several variables can be included in any one study on the economic and environmental implications of climate change and related policy, the outputs from any particular model will vary greatly depending on the weighting and, ultimately, the accuracy of the underlying assumptions[2]. Making projections about if, how, or why the policy variables might change can be partially attributable to differing assumptions about 'secondary' factors in the baseline models. These factors can include such aspects as:

- differences in population growth projections;
- economic growth rates, including varying assumptions regarding labor productivity, employment levels, income effects and non-energy price interaction effects;
- capital substitution elasticity between energy-intensive and energy-saving sectors of production;
- fluctuations in exchange rates;
- diffusion of technological innovation, including end-use energy efficiency;
- resource base (what specific resources will be/can be used in the model – the degree of resource endowment);
- environmental costs of energy production (if any);
- number of forecast periods.

[2] See J. P. Weyant (1993) for an excellent discussion on the significance of baseline input assumptions.

It should be pointed out, however, that the matrix of assumptions that make up a model is principally based on historical information. Without a crystal ball that provides a perfect picture of the future, the best that can be done is to carry out rigorous analyses using reasonably accurate information on past trends with extrapolation to future projections. However, even this may prove to be particularly difficult when applied to the issue of greenhouse gas mitigation, since the "business as usual" case that underlies many of the core tenets of the main models, is already being impacted by the Kyoto accords. That is, governments and companies are already shifting to less carbon intensive policies and assets, despite the lack of formal Kyoto ratification.[3]

The impacts of secondary factors are illustrated in a recent special edition of *The Energy Journal* (1999). In this edition of the journal, thirteen modelling teams with their own respective models assessed several Kyoto scenarios and cost minimizing strategies, among other things. The editors write in the introduction that there is a "wide range of projected carbon emissions" among the models that are evident as early as in the first commitment period (2008-2012). Moreover, these disparities increase with time.[4]

A related phenomenon is manifested in the estimates of the costs of emissions reductions. For example, the estimated carbon tax required to impact emissions to the point of compliance in Japan from these models ranges — under the no-trading scenario — from over USD 1,000 to less than USD 100 (USD 1990) per metric ton.[5] Such differences, like those for projected emissions, are the result of varying baseline assumptions about economic growth, fuel costs and technology substitution possibilities, capital stock depreciation and investment, and so on.

The treatment of economic growth rates provides another example of how assumptions can influence projections. For example, the MIT Emissions Prediction and Policy Assessment model (EPPA) is designed to take into account the possibility that the volume of the global emissions trading market is partially contingent upon overall economic growth.[6] Depending on the growth rates, the volume of GHG reductions are estimated to fluctuate up to ± 120 megatons. As in the previous example, the implications of such variations are manifested not only in emissions reductions, or lack thereof, but also in the market price of a ton of GHG in the resultant marketplace.

Variables such as economic growth and the availability of alternative technology can be lumped into the category of exogenous factors existing independently of the emissions trading systems. However, the scope and utility of trading systems will also be largely impacted by political decisions regarding the market mechanisms. For example, the imposition of limits on the import of emission allowances and/or reductions credits (as has been suggested by the European Union) will clearly influence:

- the gross volume of the tradable emissions reductions market,
- the anticipated market clearing price of a ton of GHG; and
- the distribution of economic gains and losses among countries from implementing Kyoto.

[3] See Manne A. and R. Richels "CO_2 hedging strategies: the impact of uncertainty upon emissions" *The Economics of Climate Change*, OECD 1994
[4] See Weyant et al. (1999).
[5] Ibid. p. xxxi
[6] See Ellerman et al. (1998)

As should be evident, there are a myriad of secondary factors (or assumptions) that can go into any one analysis, some with greater or less effect on the findings.[7] One of the downfalls of this state of affairs is that the subtleties of every potential impact can overwhelm policy analyses. If the objective is to synthesize the research that has been done in this area so as to make a more informed decision about global climate protection, the emissions reduction market and resultant capital flows, effects of secondary factors have to be controlled for to the extent possible. The remainder of this section focuses on the key characteristics and findings of the main studies/models that are drawn on in this report. This is followed by our analysis on the emissions reductions markets and the potential distribution of capital.

Approaches, Models, and Findings

This section introduces some of broader implications of the approaches used in modelling and then discusses specific models and findings. Several of the main differences in the structure of the models that were reviewed for this study stem from the approach (or theoretical framework) that is employed to help explain economic activity. Three basic approaches come across in most economic models[8]:

1) General Equilibrium;
2) Macro econometric; and
3) Aggregate Production/Cost Function.

Models that utilize the *general equilibrium* (GE) framework are premised upon an understanding that an ideal competitive market can and does work as the theoretical ideal would have it. The GE approach attempts to account for the effects of the interaction of demand and supply between consumers and firms (producers) — aggregated to the sectoral level — in a perfectly competitive market. It holds that policy goal can be achieved most efficiently in a competitive market as compared to any regime of command and control regulations or a 'revenue-neutral tax' based, for example, on a products-embedded carbon. Several precursors to the ideal GE market situation include, but are not limited to, the establishment of credible property rights, full and widely shared information, and the possibility to exchange freely throughout the world.[9] GE models further allow for inter-

[7] Another example comes from a thorough analysis carried out by the World Resources Institute (WRI). Using statistical regression analysis, WRI predicted the impact of carbon abatement on the U.S. economy as a function of nine salient factors that determine 83 per cent of the variance in predicted future GDP relative to the baseline CO_2: the percentage reduction in CO_2 emissions, the number of years available to meet the abatement target, non-carbon backstop fuel availability, revenue recycling of carbon taxes, benefits from avoiding climate change damages, benefits from avoiding non-climate change environmental damages, availability of joint implementation, allowance of product substitution, and whether there is allowance of inter-fuel substitution.

[8] This delineation of the models is drawn from John P. Weyant et al. (1999). The pioneering work on the dynamic integrated climate-economy model was done by Nordhaus in the Yale Cowles Foundation discussion paper entitled "Rolling the "DICE": an Optimal Transition Path for Controlling Greenhouse Gases". This paper was later published in *Resource and Energy Economics* (1993), where it represents a dynamic integrated climate-economy (DICE) model, which was put to investigate alternative approaches to slowing climate change. Evaluations of five possible policies suggested that a modest carbon tax would have been an efficient approach to slow global warming, while rigid emissions stabilization approaches would have imposed substantial economic costs. Nordhaus expanded the application of this model in his 1994 work: " Managing the Global Commons: The Economics of Climate Change" (published by MIT Press). His latest well-known revision of climate change models is found in the co-published work with Yang, Zili: " A Regional Dynamic General-Equilibrium Model of Alternative Climate Change Strategies", American Economic Review, Vol. 86(4), p. 741-65.

[9] Of course, no market is completely free of costs associated, for example, with such things as searching, transacting, monitoring, and enforcement. Nevertheless, the increased cost burden of JI or the CDM as

industry interactions and international trade in non-energy goods. Within the framework of GE models, energy prices are driven by changes in the relative production costs of different types of energy (coal, oil, gas). These costs ultimately influence consumption of the amount (or quantity demanded) and type of energy goods relative to the prices in non-energy sectors and budgets constraints. Explicit energy sector capital stock dynamics are conventionally omitted from these models, which also ignore unemployment and financial market effects, such as effects of interest rates fluctuations. In this case, the goal of GE models (or CGE, which stands for *Computable General Equilibrium* models) is to scrutinize the *key* economic sensitivities that could potentially affect results for both the core and other types of Kyoto scenarios. MIT's EPPA model and World Scan model, as discussed below, are based upon the general equilibrium approach.

The *Macroeconometric approach* accounts for the interaction between the supply, demand, and price, and macroeconomic variables such as international capital flows. This type of approach produces models that can also include the dynamics of unemployment, financial markets, international capital flows and monetary policy. Unlike GE, this approach allows for some imperfections in market activity that may occur due to such things as mild forms of information asymmetry. Macro econometric models, unlike the GE approach, are subjected to statistical verification and are more capable of *explaining* accurately historical data, on which current researchers base their projections. Most importantly, relative to GE models, macro econometric forecasts carefully consider monetary policy reactions to economic shocks, resulting from introduction of Kyoto regulations. The primary example of the application of the macroeconomic approach is Oxford's Global Macroeconomic and Energy Model.[10]

The *Aggregate Production/Cost Function* (APCF) models are based upon optimal economic growth theory. This approach is structured on the premise that investments reducing the output of a harmful product (or an associated externality, which is carbon emissions in our case) are motivated by the desire to reduce the negative effects of product consumption, while increasing aggregate consumption possibilities in the future. This cluster of forecasts is called 'aggregate production' models because it aggregates all industries within the state borders, while GDP is determined by an aggregate production function, where capital, labor and carbon are the key inputs into the economy. Thus, models based on this approach tend to control for the effects of capital utilization and employment and focus on the costs of reducing carbon emissions from unconstrained baselines via an aggregate cost function within each economy. Though this approach generally omits all inter-industry interactions, it includes trade in carbon and carbon emissions rights (but not in other goods and services). The APCF model always assumes full employment of capital and labor. Though more distant from empirical reality relative to both macro econometric and GE models, APCF approach allows for a long-term aggregate approximation of carbon abatement benefits. The goal of these models is to help in structuring *long-term* objectives of climate policy, such as stabilization of the concentration of CO_2 in the atmosphere. The best example of this approach is the Regional Integrated model of climate and the Economy (RICE) used at Yale University. A variation on the APCF theme is Stanford University's MERGE model.[11]

---

compared to world trade in carbon permits predicted in models based upon GE may not adequately account for what might ultimately be necessary to establish emissions reductions, i.e., firms and/or public agency involvement sufficient to establish a credible market.

[10] See A. Cooper et al. (1999).

[11] See, Manne, A. S., Mendelsohn R. and R.G. Richels, "MERGE - A model for evaluating Regional and Global Effects of GHG Reduction Policy", *Energy Policy*, 1995, 23, 17-34.

The above list of models cannot possibly embrace the richness of theoretical and empirical work done with respect to assessing the effects of Kyoto implementation. As the focus of this analysis is on the most encompassing models existing in the field, this study will not provide a detailed analysis of theoretical model structures outside the GE, macro econometric and APCF approaches.

REVIEWING THE MODELS: THE COSTS OF IMPLEMENTING THE KYOTO PROTOCOL – A MULTI-MODEL EVALUATION

Adrian Cooper et al. (1999) in "A Cross-Country Quantitative Investigation using the Oxford Global Macroeconomic and Energy Model" capture the interactions between macroeconomic dynamics and the supply, demand, and energy prices. The critical contribution of Oxford model is the inclusion of a large number of variables of importance to policy-makers including GDP, inflation, the trade balance, employment/unemployment rates, exchange rates, etc. This study takes an integrated approach to analysing over twenty-two economies and in general tends to usually include more variables than models based on GE. Fuel types are disaggregated and the energy demand is examined on a sectoral basis – residential, industrial, transportation, and the electricity generation.[12] With a tax of USD 100/tC, the model predicts a net reduction in CO_2 emissions and positive indirect capital flows (as relative production prices change) to China and FSU from US, Japan, and EU. In terms of meeting Kyoto objectives, the model anticipates for the Annex I trading regime a permit price of USD 222 at constant 1997 prices, with Russia being the primary seller of permits and US and Japan getting the largest cost savings.[13] Unfortunately, the authors did not provide clear-cut market size estimates beyond sporadic predictions of the number of permits traded under three scenarios:

Table 1.1. Permit trade, Kyoto targets (per cent changes from base projections)

1. Annex I permits trading including Russia (scenario 1);[14]
2. Double bubble[15] (scenario 2).

Country	Permits bought(+)/sold(-) (mmt), scenario 1	Permits bought(+)/sold(-) (mmt), scenario 2 (double bubble)
US	114	156
Canada	33	33
Japan	52	53
Germany	37	.
France	19	.
Italy	18	.
UK	11	.
EU total	94	.
China	0	.
Russia	-293	-242

Source: Cooper et. al., 1999

[12] See A. Cooper et al. (1999), p. 335.
[13] Ibid., p. 354.
[14] Since permit trading is expressed as percentage change from the base projections, it remains impossible to calculate the total value of trading under any scenario. See Nordhaus W. D. and J. G. Boyer, "Requiem for Kyoto: An Economic Analysis of the Kyoto Protocol", *The Energy Journal*, Special Issue: The Costs of the Kyoto Protocol, 1999, 93-130.
[15] The term "double bubble" refers to the scenario, where the EU is assumed not to enter in the international permit trading (preferring to implement its own internal burden sharing agreement), while permit trading occurs among other Annex I members.

The Regional Integrated Model of Climate and the Economy (RICE-98)[16] is an updated version of several models that William Nordhaus has employed in his extensive past work in the area.[17] As its name suggests, RICE-98 takes into consideration the climactic and economic impacts at the regional level, within a global context. Based upon optimal economic growth theory, RICE-98 holds that investment in capital that results in reductions of GHG is motivated by the desire to reduce the negative effects of climate change and increase consumption possibilities in the future. The central contribution of the model is its ability to shed light on costs associated with the implementation of the Kyoto Protocol. It offers few substantive facts on the size of the emissions trading market. As with the aforementioned Oxford study, Nordhaus' model does not address plausible effects of the CDM. The model predicts the net global cost of Kyoto (approximately USD 700 billion (1990 USD) will mostly be borne by the US (two-thirds). The prices of permits to emit CO_2 in this study range from USD 21/tC in the trade scenario to USD 154 without any trade.[18] These permit prices in the trading scenario refer to the global (unrestricted) trade. Overall, the projected benefits from emissions reductions from the Protocol implementation are expected to be within the range of USD 0.12 trillion (1990 USD).

As a word of caution, it should be noted that optimal economic growth models tend to overestimate the costs of Kyoto compliance due to the attribution of very high abatement costs to the U.S. In reality, it may be expected that higher abatement costs would be experienced by the nations already heavily invested in energy conservation, while the U.S. would have a larger basket of opportunities for abating carbon emissions. On the other hand, it is plausible that all models based on growth optimization may underestimate carbon abatement costs because they assume complete availability of complete information to decision-makers, ignore short-term macro-shocks and presume efficiency of policies.

Alan Manne from Stanford University in California and Richard G. Richels from EPRI (formerly known as the Electric Power Research Institute) recently used the 3.0 version of the Model for Evaluating Regional and Global Effects of Greenhouse Gas Reduction Policies (MERGE) to evaluate the impacts of emission reductions under different institutional constraints. MERGE is a market equilibrium model that can combine, for example, the dynamics of the energy supply sector and ancillary domestic economy considerations that could influence demand and prices in an emission reduction market over time, i.e. the value of a region's human and natural capital, labour, and its share of carbon emission rights. [19] One of the interesting features of the way the MERGE was employed in this analysis is the inclusion of 'endogenous trade diffusion'. This analysis assumes that the initial adoption of

---

[17] The pioneering work on the dynamic integrated climate-economy model was undertaken by W. D. Nordhaus in the Yale Cowles Foundation discussion paper entitled "Rolling the "DICE": an Optimal Transition Path for Controlling Greenhouse Gases". This paper was later published in *Resource and Energy Economics* (1993), where it represents a dynamic integrated climate-economy (DICE) model, which was put to investigate alternative approaches to slowing climate change. Evaluations of five possible policies suggested that a modest carbon tax would have been an efficient approach to slow global warming, while rigid emissions stabilization approaches would have imposed substantial economic costs. Nordhaus expanded the application of this model in his 1994 work: " Managing the Global Commons: The Economics of Climate Change" (published by MIT Press). His latest well-known revision of climate change models is found in the co-published work with Yang, Zili: " A Regional Dynamic General-Equilibrium Model of Alternative Climate Change Strategies", American Economic Review, Vol. 86(4), p. 741-65.

[18] See Nordhaus W. D. and J. G. Boyer, "Requiem for Kyoto: An Economic Analysis of the Kyoto Protocol", *The Energy Journal*, Special Issue: The Costs of the Kyoto Protocol, 1999, 93-130.

[19] Alan S. Manne and Richard G. Richels, "The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives?", *The Energy Journal*, Special Issue, 1999

high-cost carbon-free technologies leads to lower cost approaches. Of course, this process is subject to diminishing margins of return as the 'lowest' cost solutions are eventually developed, prompting the marginal rate of return to decline.

Using MERGE, Manne and Richels (1999)[20] explored three scenarios: the scenario of no trading, Annex I trading plus CDM and full global trading. The model estimated that, given a requirement for commitments to be met only within the geographical boundaries of the respective countries, the approximate cost in the US would be about USD 240 per ton of carbon; about USD 100/tC with Annex I trade and CDM; and roughly USD 70/tC with global trade [21]. The MERGE model focuses on estimating domestic abatement costs and does not provide us with any kind of estimate of the benefits of international carbon emissions trading and the resulting size of the trading market.

Mckibben et al. (1999)[22] employ the G-Cubed model to estimate the potential economic effects of the Kyoto Protocol. G-Cubed is multi-sector intertemporal general equilibrium model of the world economy. The model consists of a set of eight regional general equilibrium models linked by international flows of products and assets. In each region, production sectors are assumed to maximize investments and inputs in an effort to maximize their stock value. Like several of the other models that are considered in this section, capital, labor, energy, and 'other' materials are considered to be substitutable at a constant rate. In a manner that is similar to tax shifting, the model assumes that the revenue generated is recycled back into the economy and thus market distortions are kept to a minimum.[23] In the unilateral compliance scenario the model predicts that emissions reduction will be achieved at the price of USD 170 (USD 95) per ton of carbon with international cooperation/trading the average permit price drops to about USD 23/tC.

The Dutch National Research Program of Global Air Pollution and Climate Change (DNR) did a study on "flexibility" instruments under the Kyoto Protocol. DNR's study simulated the price of a carbon permit under a hypothetical trading market, taking into account only the costs of carbon and assuming optimal trade without market imperfections. This study is an example of a set of models that derive permit prices under different trade scenarios and the CDM. Several of the main findings coming out of the DNR research are: 1) Trade/CDM could result in a price of permits as low as USD 15/tC; 2) The average permit price from a *range* of estimates is actually USD 40/tC.

DNR calculations were based on prices ranging from USD 10/ton for carbon (ICARUS 3, 1998) — assuming European (only) trading and a 10 per cent carbon emissions reduction by 2020 with 1990 as a base year — to an estimated USD 175/ton of carbon (Kosobud et. al., 1994), assuming worldwide trading and a reduction of 20 per cent carbon emissions reduction by 2010 at the 1990 levels. The methodological approach used in this study is similar to that used in the DNR study, though more emphasis is given to controlling variations in emission

[20] See Alan S. Manne and Richard Richels "The Kyoto Protocol: A Cost Effective Strategy for meeting Environmental Objectives?" , *The Energy Journal*, Special Issue: The Costs of the Kyoto Protocol, 1999, 1-24.

[21] See *The Energy Journal*, Special Issue: The Costs of the Kyoto Protocol, 1999, p. 7.

[22] See, Mckibbin W., Ross M., Shakleton R. and P. Wilcoxen, "Emission trading, Capital Flows and the Kyoto Protocol, *The Energy Journal*, Special Issue: The Costs of the Kyoto Protocol, 1999, 287-334; also see Mckibbin W. and P. Wilcoxen, 1992," G-cubed: A Dynamic Multilateral Model of the Global Economy, Brookings Discussion Paper in *International Economics*, no.128, Brookings Institute, Washington DC.

[23] See: Roodman, D. "Get the Signals Right" World Watch Institute (Washington, DC: WorldWatch, 1997). Durning, Alan and Bauman, Yoram, *Tax Shift: How to Help the Economy, Improve the Environment, and Get the Tax Man off Our Backs*, (Northwest Environmental Watch: 1999).

reductions, for example, in a consistent manner under different possible institutional/market alternatives.

Table 1.2. CO_2 Permit Price Simulation from Dutch National Research (1998)

Permit Price (USD/tCO_2)	Trading Scale	Targets (2010 on 1990 levels)	Model or Author
USD 10	EU/CEE	-10%	ICARUS 3 (1998)
USD 15	World-wide	0.0%	Kosbud et al. (1994)
USD 20	EU	-10%	PRIMES (1998)
USD 28	World-wide	-15%	Rose and Stevens (1993)
USD 34	EU/CEE	-20%	Bohm and Larsen (1994)
USD 40	Annex I	-5.2%	CEA (1998)
USD 58	World-Wide	0%	Larsen and Shah (1994)
USD 109	Annex I	-20% in2020	ECON (1997)
USD 154	World-wide	-20%	GREEN (1992)
USD 175	World-wide	-20%	Kosobud et al. (1994)

***Source*: Dutch National Research Program of Global Air Pollution and Climate Change, 1998**

The Center for International Climate and Environmental Research in Oslo (CICERO) has recently produced some interesting work on GHG emission reductions markets, notably 'Achieving Commitments by Trading' (ACT). ACT is a numerical model developed in-house by CICERO, which uses global fossil fuel market and price information, including a North American gas market where the U.S. and Canada produce gas with a net gas export from to Canada to the U.S, a Russia/Europe gas market and an East-Asian/Pacific regional gas market. The ACT model specifies the dependent variable, a national income indicator, as a welfare function of the following causal variables: oil, coal and gas consumption in the country (related to carbon content of the fuels), indigenous oil, coal and gas production in the country, emissions of methane and industrial gases, prices in oil, coal and gas markets (ignoring the differences in prices in each market), the quota price, the emissions of greenhouse gases, the quota size, the marginal excess burden of taxes, and the total amount of public revenue generated by carbon taxes plus the revenue generated by quota sales, minus the public expenditure related to the quota purchase. This measures value-added and consumer surplus from use of fossil fuels and emissions of greenhouse gases. The model predicts that under the quota trading, the price of carbon permits in the international market would be USD 21.60/ton of CO_2 in 2010.

The Clinton Administration's Interagency Analytical Team Study found that if the US had to reduce carbon emissions through entirely domestic mechanisms, then the implicit price of carbon would increase by about USD 100/ton, or a USD 52.52 per ton price increase for coal. This study projects GDP losses, as a result of higher energy costs, at between 0.01 to 0.02 per cent of GDP. Using the Stanford Energy Modelling Forum's results and Battelle's Second Generation Model, the White House produced a separate study, giving an estimate of Kyoto-related costs of between USD 7 billion to USD 12 billion annually and an annual energy price increase of USD 70 and USD 110 per household. According to the White House study, the CDM would cut costs by 20 to 25 per cent. The report predicts the price of carbon to be between USD 14 to USD 23/ton, and increased energy prices from 2008 to 2012 to be between 3 and 5 per cent, for an increase in fuel prices of 5 to 9 per cent, natural gas prices of

3 to 5 per cent, gasoline prices of 3 to 4 per cent (or 4 to 6 cents per gallon) and electricity prices of 3 to 4 per cent.

The Energy Information Administration (EIA) estimates that under the strictest program of reductions, the price of carbon will be approximately USD 348/ton in 2010, or a 66-cent increase per gallon of gasoline over the predicted USD 1.25/gallon price without reductions. The least cost scenario predicts carbon prices of USD 67/ton, or a 14 cent/gallon increase in gasoline. The EIA study uses a different model from that of the White House study; the latter indicates the cumulative effects in later years.

This concludes the review of the models and findings examining the costs of compliance with Kyoto. We turn now to an analysis of the carbon reductions market, its value, and the potential capital flows under several different institutional scenarios.

REVIEWING THE MODELS: THE BASES OF THE MIT-EPPA MODEL AND THE POTENTIAL SIZE OF THE INTERNATIONAL CARBON ABATEMENT MARKET

Some of the most widely referred to work on emissions reduction markets comes out of Massachusetts Institute of Technology. At MIT the Emissions Prediction and Policy Assessment (EPPA) model is used to generate projected marginal abatement cost curves under different emissions reduction scenarios. EPPA provides estimates of the costs of carbon emission reductions at different levels throughout the economy using a general equilibrium model of global economic activity, energy use and carbon emissions. Since this model is the most encompassing and representative of all forecasts existing in the carbon trading/CDM market literature, we will show the substantive components of the model and then proceed to the findings specific to this study.

The current version of the model covers the period 1985 to 2100 in five-year steps. The world is divided into the 12 regions shown in table 2.1, which are linked by bilateral trade. The economic structure in each region consists of eight production sectors and four consumption sectors (shown below) plus one government and one investment sector. In addition to these production sectors, there are two future energy supply or “backstop” sectors that produce perfect substitutes for refined oil and electricity.

Table 2.1. Key dimensions of the MIT/EPPA model. [24]

Production sectors, ***i*** Non-Energy 1.Agriculture 2. Energy-intensive industries 3. Auto, truck and air transport Energy, ***e*** 4. Crude oil 5. Natural gas 6. Refined oil 7. Coal 8. Electricity, gas and water Future Supply Technology,***b*** 9. Carbon liquids backstop[1] 10. Carbon-free electric backstop[2]	**Consumer sectors**, ***c*** 1. Food and beverages 2. Fuel and power 3. Transport and communication 4.Other goods and services **Primary Factors of Production** 1. Labor 2. Capital (by vintage) 3. Sector-specific fixed factors for each fuel 4. Land in agricultural
Regions (Abbreviation) 1. United States (**USA**) 2. Japan (**JPN**) 3. European Community (**EEC**) 4. Other OECD[3] (**OOE**) 5. Central and Eastern Europe[4] (**EET**) 6. The former Soviet Union (**FSU**) 7. Energy-exporting LDCs[5] (**EEX**) 8. China (**CHN**) 9. India (**IND**) 10. Dynamic Asian Economies[6] (**DAE**) 11. Brazil (**BRA**) 12. Rest of the World (**ROW**)	**Gases** (chemical formuli of gases considered)[25] 1. Carbon Dioxide (CO_2) 2. Methane (CH_4) 3. Nitrous Oxide (N_2O) 4. Chlorofluorocarbons (CFC) 5. Nitrogen Oxides (NO_x) 6. Carbon Monoxide (CO) 7. Sulfur Oxides (SO_x)
[1] Liquid fuel derived from shale [2] Carbon-free electricity derived from advanced nuclear-, solar power or wind [3] Australia, Canada, New Zealand, EFTA (excluding Switzerland and Iceland), and Turkey [4] Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and Yugoslavia [5] OPEC countries as well as other oil-exporting, gas-exporting, and coal-exporting countries (see Burniaux *et al*., 1992) [6]Hong Kong, Philippines, Singapore, South Korea, Taiwan, and Thailand	

[24] The model representation is taken from MIT, Joint Program on the Science and Policy of Global Change, Report 6: "The MIT Emissions Prediction and Policy Analysis (EPPA) Model", May 1996.

[25] Estimates of emissions of greenhouse gases and other gases that produce scattering aerosols or otherwise influence the atmospheric chemistry, are driven by various activity levels within the model. With the exception of emissions from deforestation and some components of biomass burning, CO_2 emissions are calculated directly from the period-to-period levels of energy sector activities. The base-level emissions are set for 1985, and the emissions in subsequent periods are related to changing levels of energy and non-energy activities using various energy substitution elasticity factors. Emissions from deforestation are exogenously determined, and are added to the emissions driven by the activity levels generated by the EPPA model. In the results shown below, these emissions are assumed constant at estimated 1985 values from 1985 to 2000, and thereafter to decline linearly to zero in 2050.

The model is myopic (covering only a short-term timespan); as it emphasizes periods closer to the time of permits trade rather then the long-term, looking into the future. It solves for a sequence of new equilibria for future periods, based on assumptions about exogenous (external to the model) trends in the rate of population and labour productivity growth and technology change, as well as endogenous (embedded into the model) changes in capital stocks and fixed factor supplies.

Three basic cases are used to illustrate the effects of Kyoto implementation. The first case is an autarkic one in which Annex B parties meet their Kyoto commitments without any emissions trading. As a result, the FSU and non-Annex B regions are affected only through the prices and quantities of goods traded with the Kyoto-constrained regions. In the second case, Annex B parties (including the FSU) trade emission permits among themselves. Emissions trading within Annex B countries reduces the costs of the Kyoto commitment for the constrained regions, and the FSU finds a new source of export revenue; but non-Annex B countries continue to be affected only through conventional trade linkages. The third case examines emissions trading on a global scale in which non-Annex B countries join the FSU in earning export revenue from supplying permits to Annex B countries. The majority of models outside of the MIT study adhere to the same conventional format of listing the three central scenarios expressed above. Lastly, one unique characteristic of the MIT study is consideration of three scenarios of economic growth outlined below.

As mentioned above, MIT forecasts are modeled by calculating Marginal Abatement Curves (MACs) for each region under consideration.[1] What is the economic theory behind the MACs and how might it help us to model effects of international trade in emissions permits? If several regions commit to achieving emission reductions at the same time and there is some empirical prediction of what emissions would be without the commitment, the abatement required can be represented as a point on each region's marginal abatement curve. Moreover, if the marginal costs associated with those reductions are different across regions, the aggregate cost of meeting the commitments will be less to the extent that a region with higher marginal costs can induce a region with lower marginal costs to abate more on its behalf. By abating more, the lower cost region produces "rights to emit," or emission permits, which it can sell to the higher cost region which would thereby avoid a like amount of higher cost domestic abatement. Thus, the difference in the marginal costs associated with each region's commitment in the absence of trade creates a potential gain to be shared in some manner between them. The aggregate emission reduction will be achieved at least cost when the two regions trade until their marginal abatement costs are equal at what will then be the market clearing price for the "right to emit" carbon.

Figure 2.1 below presents the MACs and the costs associated with the carbon emission reductions required of each of the Kyoto-constrained regions (excluding the FSU) when there is no emissions trading. The diamond symbols on the MACs indicate, on the horizontal axis, the quantity of abatement required of each region, and, on the vertical axis, the shadow price of carbon for the region. *The shadow price is the marginal cost for the last ton abated*. The autarkic marginal cost of abatement for Japan (USD 584/ton) is much higher than the marginal costs for the European Community (USD 273), the OOE (Australia, Canada, New Zealand, EFTA, excluding Switzerland and Iceland) and Turkey (USD 233), the USA (USD 186), or the Central and Eastern Europe (USD 116). The areas under the curves represent the total costs of abatement for each region, which sum to USD 120 billion:

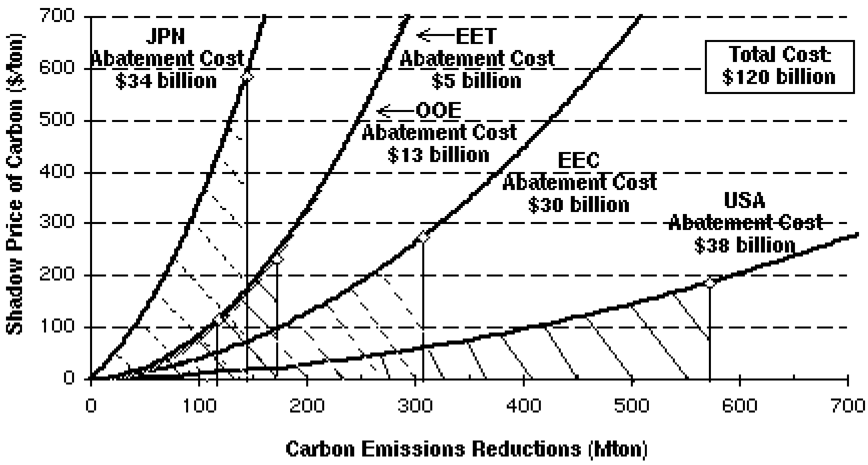


Figure 2. 1. Annex B Regions Meeting their Kyoto Commitment, No Trading.[26]
Source:* MIT, *Global Change Joint Program Report No. 41, 1998

Next, figure 2.2 below shows the effect of Annex B trading on the Kyoto-constrained regions. At the market clearing price of USD 127/ton, the OECD regions are importers of carbon trading permits and the Central Eastern Europe and FSU are permit exporters. As an unconstrained Annex B party, the FSU accounts for practically all of the exports (98 per cent). According to the calculations of the model, about a third of these permit exports consist of "hot air", with a cost of zero; but the remaining exports are generated by domestic abatement undertaken to earn additional export profits up to the point where marginal abatement cost equals the market price. In this scenario, the FSY is the largest party gaining the most out of international permit trading scheme: it costs the FSU USD 10 billion to abate 234 megatons, but the permits can be sold for USD 30 billion for a net gain of USD 20 billion. When added to the USD 14 billion earned for exporting 111 Mton of the unused Kyoto entitlement, the FSU's total gain from emissions trading is USD 34 billion.

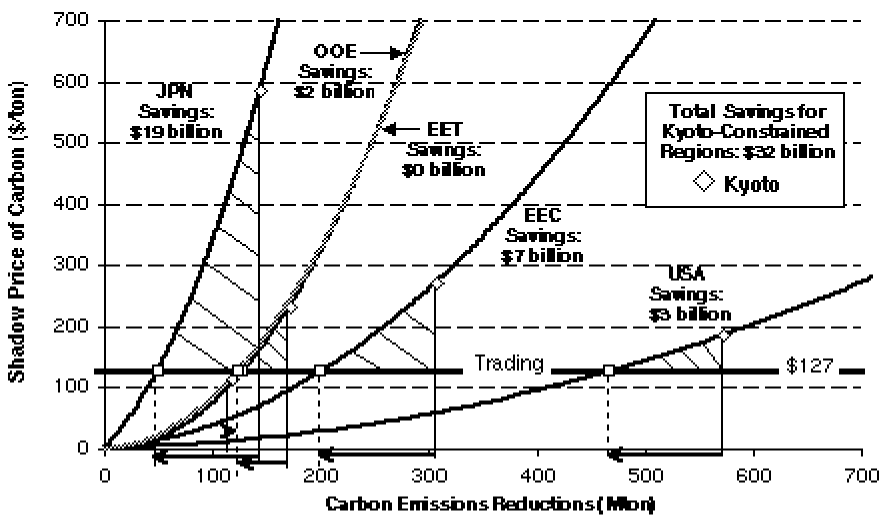


Figure 2. 2. Annex B Meeting their Kyoto Commitment, No Trading/Trading (MIT Study No. 41, 1998)
Source:* MIT, *Global Change Joint Program Report No. 41, 1998

For the five Kyoto-constrained regions depicted in figure 2.2, the cost of meeting the Kyoto commitment is reduced by USD 32 billion. The total gains from emissions trading are USD

[26] The table is reproduced from MIT EPPA study No. 41 (November, 1998).

66 billion, split about evenly between the FSU (USD 34 billion) and the OECD plus EET (USD 32 billion).

Within the second trading scenario, the distribution of the reduction in costs (that is, the gains from emissions trading for the Kyoto-constrained regions) is distributed roughly in proportion to autarkic marginal cost. The two regions with the highest autarkic marginal costs, Japan and the EEC, benefit the most from traded permits:

ANNEX I TRADING SCENARIO in the MIT/EPPA Model
– WHO BENEFITS THE MOST?
Japan -- imports = 66 per cent of its reduction requirement, cost reduction = USD 19 billion.
The EEC – imports = 35 per cent of its reduction requirement, cost reduction = USD 7 billion.

The other three regions are characterized by autarkic marginal costs much closer to the Annex B market price so that they consequently trade much less.

To illustrate full global trading, EPPA study relied on global aggregate supply and demand curves for emissions permits (*not* abatement curves). These curves indicate the *total quantities of permits* that would be supplied or demanded at various price levels in a given market. In figure 2.3, there is only one permits demand curve because the Kyoto-constrained regions are the same in both the Annex B and the global markets. However, the global supply curve shifts to the right after introduction of global trading, reflecting the large amount of low-cost carbon abatement that becomes potentially available due to large-scale participation of developing countries. The large-scale supply of permits from non-Annex B regions results in a market price that is much lower (USD 24/ton) than in the Annex B trading case. The total cost of reducing global CO_2 emissions to achieve the Kyoto goals is reduced dramatically: USD 11 billion *vs*. USD 54 billion or USD 120 billion in the other two cases.

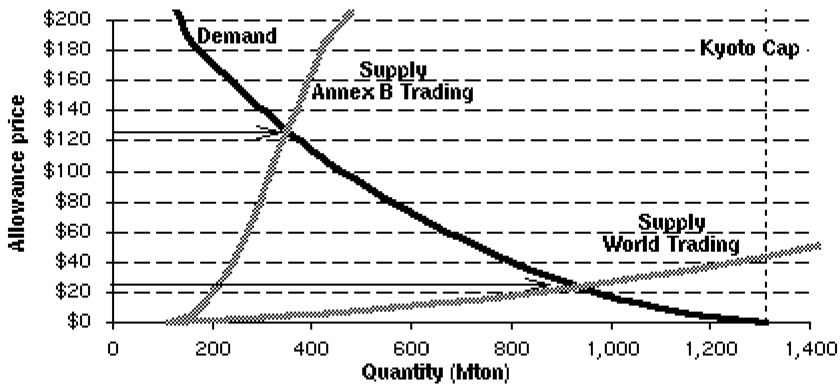


Figure 2.3. Aggregated Supply and Demand Curves for 2010 under Kyoto Constraints. Annex B Trading versus World Trading. [27] ***Source:*** **MIT,** ***Global Change Joint Program Report No. 41, 1998***

With full global trading, the gains from emissions trading are much greater for the Kyoto-constrained regions (USD 94 billion *vs*. USD 32 billion with Annex B trading). The Former Soviet Union is the only party that is made worse off by the widening of the market because

[27] At this price, the Kyoto-constrained regions depend far more on imports than when trading was restricted to Annex B regions only. In the aggregate, 71per cent of OECD + EET commitments are met by importing emission permits from non-constrained regions; and the percentage reliance upon imports reflects autarkic marginal cost: Japan, 92per cent; EEC, 76per cent; USA, 68per cent; OOE, 66per cent and EET, 56per cent. On the suppliers' side, three countries account for the bulk of exports: China (47per cent), the FSU (23per cent) and India (11per cent), hence 81per cent altogether. Whether because of relatively small size or high relative abatement costs, the remaining four non-Annex B regions are small suppliers of emission permits to the Annex B regions. (MIT EPPA study No. 41, 1998, p. 5)

the hot air is worth much less. As a result, the FSU's net gain (USD 4 billion) in the global market is much less than its USD 34 billion gain when it does not compete with the non-Annex B regions.

The distribution of the gains from emissions trading in the global market again illustrates the central feature of global emissions trading: regions whose autarkic marginal abatement cost is further from the equilibrium price benefit more than regions whose domestic marginal cost is closer to that price.

The MIT model examines what would happen to the global carbon trading system when the projected rate of economic growth is 10per cent higher and 10per cent lower than in the reference EPPA projection for all regions. Figure 2.4 shows the effect of higher and lower growth rates for illustrative Kyoto-constrained regions (Japan, European Community and USA), and figure 2.5 shows the effects on aggregate supply and demand for permits in the Annex B and full global markets:

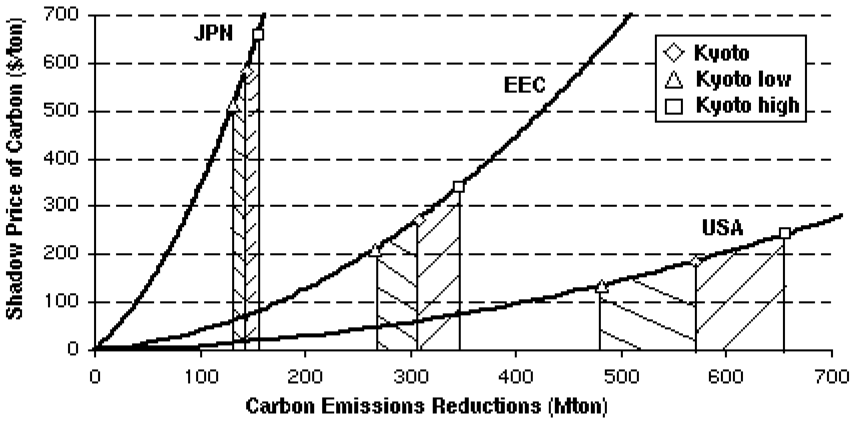


Figure 2.4. Effect of Lower and Higher Growth Rates (+/- 10per cent) on the Kyoto Commitment for JPN, EEC, USA
Source:* MIT, *Global Change Joint Program Report No. 41, 1998

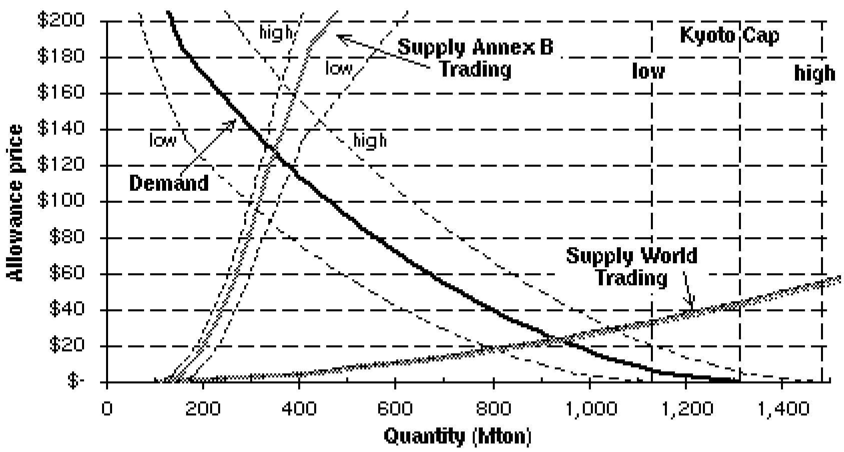


Figure 2.5. World Supply and Demand in 2010 under Kyoto Constraints. Annex B Trading / World Trading: Low and High Scenarios
Source:* MIT, *Global Change Joint Program Report No. 41, 1998

The effects of higher or lower growth on emissions is typically fairly small, always less than 5 per cent, but the Kyoto emissions reduction commitment is fixed so that the effect on the required reduction is *amplified*. For instance, for the Kyoto-constrained regions, the variation in total required emission is 13 to 14 per cent. Finally, the change in total costs, without trading, is even greater (31-36 per cent), because the most expensive abatement — that on the margin through domestic efforts — represented by the hatched area in figure 2.4, is what is being increased or decreased by the variation in economic growth.

When aggregated into two-scenario demand and supply curves for permits (for global trading and Annex B trading), the variation in economic growth has a large effect on demand, but not much on supply since most of the supply comes from unconstrained regions, the FSU or the non-Annex B countries. The main effect upon supply within the relevant price range is through the influence on hot air. Higher growth reduces hot air and shifts the supply curve inward; and conversely, for lower economic growth.

The effect of higher or lower economic growth on the price and quantities of traded permits is very different in the Annex B and full global trading markets. In the case of Annex B trading, the volumes traded change very slightly (12 Mton), but the price varies greatly (USD 40). In a market limited to Annex B regions, most of the incremental effort stipulated by higher or lower economic growth translates into more or less domestic abatement. In contrast, for full global trading, the aggregate supply curve is flatter, so that the variation in the volume of traded permits is greater (120 Mton) but the variation in price much less (USD 6).

In sum, the model estimates that without trading, the marginal cost of abatement is USD 584/ton for Japan, USD 233/ton for Australia and New Zealand and USD 186/ton for the U.S. With trading among the Annex I nations constrained by Kyoto, the price would be USD 127/ton for the United States and Australia/New Zealand under a trading scheme where the former Soviet Union sells their abatement of 234 megatons for a USD 34 billion gain. A full global trading scheme reduces the cost of abatement significantly — to USD 24/ton globally — if an ample supply of permits from developing countries increases the volume of trading— highlighting the importance of having developing countries participate in carbon abatement sales. The total cost is cut from USD 54 billion in the Annex I trading case and USD 120 billion without trading to only USD 11 billion with global emissions trading.

The benefits from trade (both within Annex B and from global trading) can be represented as follows:

Table 2.2. Annex B trading

	USA	JPN	EEC	OOE	EET	oecd+ eet	FSU	World
Reductions / ref 2010 (Mton)	466	49	201	128	124	968	234	1202
'Hot air' (Mton)	\	\	\	\	\	0	111	111
Permits Market Price (USD/ton)	**127**	**127**	**127**	**127**	**127**	**127**	**127**	**127**
Cost of Abatement (USD billion)	21.16	2.82	9.51	5.16	5.36	44.01	9.95	53.96
Permits exp(-)/imp(+) (Mton)	106	95	106	43	-6	345	-345	0
i.e. per cent of commitment (import)	*19%*	*66%*	*35%*	*25%*	\	*26%*	\	\
Flows exp(-)/imp(+) (USD billion)	13.44	12.06	13.51	5.49	-0.73	43.77	-43.77	0.00
Total Cost (USD billion)	34.60	14.88	23.02	10.64	4.64	87.78	-33.82	**53.96**
Gains from trade (USD billion)	**3.03**	**19.49**	**7.27**	**2.17**	**0.03**	**31.99**	**33.82**	**65.81**

Source: **MIT, *Global Change Joint Program Report No. 41*, 1998.**

Table 2.3. World trading

	USA	JPN	EEC	OOE	EET	Oecd + eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	ROW
Reductions / ref 2010 (Mton)	182	12	73	59	52	378	101	723	1202	51	437	102	42	2	89
'Hot air' (Mton)	\	\	\	\	\	0	111	0	111	\	\	\	\	\	\
Permits Market Price (USD/ton)	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**
Cost of Abatement (USD billion)	1.66	0.14	0.71	0.41	0.43	3.36	0.81	6.99	11.15	0.54	4.22	0.95	0.44	0.03	0.81
Permits exp(-)/imp(+) (Mton)	390	132	234	112	66	935	-211	-723	0	-51	-437	-102	-42	-2	-89
i.e. % of commitment (import)	*68*	*92*	*76*	*66*	*56*	*71*	\	\	\	\	\	\	\	\	\
Flows exp(-)/imp(+) (USD billion)	9.27	3.15	5.57	2.67	1.57	22.24	-5.03	-17.21	0.00	-1.21	-10.40	-2.44	-0.99	-0.06	-2.12
Total Cost (USD billion)	10.94	3.29	6.29	3.09	2.01	25.60	-4.22	-10.22	**11.15**	-0.68	-6.17	-1.49	-0.55	-0.03	-1.31
Gains from trade (USD billion)	26.69	31.08	24.00	9.73	2.66	94.16	4.22	10.22	**108.61**	0.68	6.17	1.49	0.55	0.03	1.31

Where:

ANNEX B REGIONS	**NON-ANNEX B REGIONS**
USA: USA	EEX: Energy Exporting Countries
JPN: Japan	CHN: China
EEC: European Union (EC-12 as of 1992)	IND: India
OOE: Other OECD Countries	DAE: Dynamic Asian Economies
EET: Eastern Europe	BRA: Brazil
FSU: Former Soviet Union	ROW: Rest of World

***Source:* MIT, *Global Change Joint Program Report No. 41*, 1998.**

Finally, the EPPA study examines cases in which there is a limited supply of emissions permits. A scenario of this sort can emerge if there is a strict requirement to adhere to 50 per cent domestic carbon abatement before resorting to the international trade in permits. This sort of scenario is examined extensively in the study by Zhong Xiang Zhang (1999).

The EPPA model considers several possibilities for less than fully efficient supply in which it is assumed that 5 per cent, 10 per cent, 15 per cent, 25 per cent, and 50 per cent of the supplies from the FSU and non-Annex B regions are available at every price. The lowest line, corresponding to 100 per cent (unrestricted supply), is fully efficient global trading:

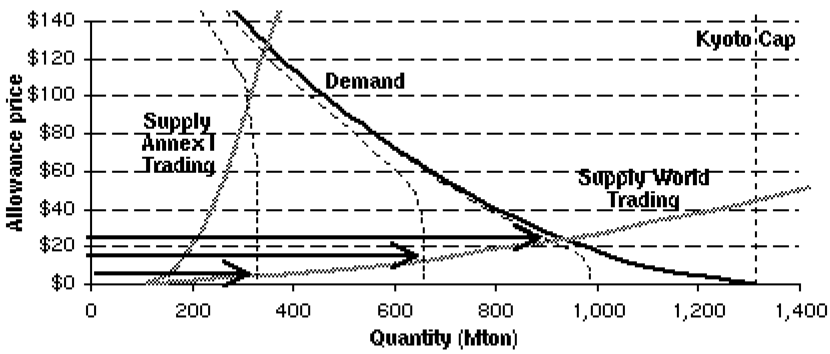


Figure 2.6. World Permit Supply and Demand in 2010 under Kyoto Constraints. Limitation on Supply: Supply = 50, 25, 15, 10, and 5 per cent of Total Supply Potential

***Source:* MIT, *Global Change Joint Program Report No. 41*, 1999.**

Note: the dotted vertical lines denote the supply caps/limits, clearly visible for 50, 25 and 15 per cent limits.

The model calculated that if the supplies from the global market are very small initially, say at 5 per cent of the full global market potential, then the market price for permits is estimated to be relatively high (USD 181) and the quantities traded small (170 Mton). As experience is gained and supplies grow, the quantities traded would increase and prices would fall. The gains from emissions trading increase with improved efficiency of supply and they become quite large well before attaining 100 per cent efficiency.

In a manner that is typical of the majority of existing models, the MIT study views the CDM as a *constraint* on the global trading of carbon emissions permits. Specifically, the EPPA model views the CDM as an increase in transaction costs, which would result in a wedge between the price paid by consumers and that received by producers. Figure 2.7 illustrates prices and quantities traded for the CDM institutional surcharges of 25 per cent, 50 per cent and 100 per cent of the marginal cost of supply. Table 2.4 provides details concerning prices, quantities and regional gains. Institutional surcharges of 50 per cent or 100 per cent are beyond any level being discussed currently in international negotiations, but they do illustrate the effects of inelastic permit demand. Since FSU exports would not be surcharged, the model treats the FSU as a competitive supplier in all these cases.

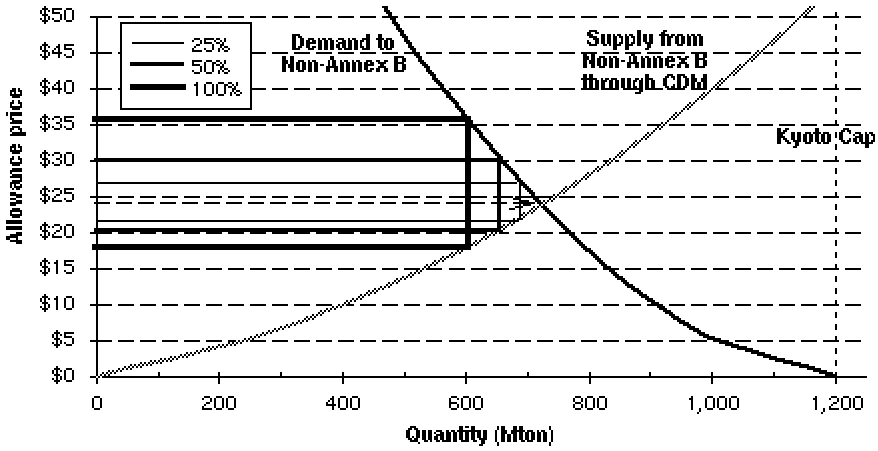


Figure 2.7. CDM Surcharges: 25per cent, 50per cent and 100per cent

Table 2.4. Prices, Flows and Gains with a CDM Surcharge

Level of CDM Surcharge	None	25%	50%	100%
Market Price (1985 USD)	USD 23.8	USD 27.4	USD 30.6	USD35.9
CDM Net profit (billion USD)	**USD 10.2**	**USD 12.6**	**USD 14.4**	**USD17.0**
Profit to producers	USD 10.2	USD 8.9	USD 7.9	USD 6.3
Surcharge Proceeds	USD 0	USD 3.7	USD 6.6	USD10.7
CDM Exports (MtonC)	723	687	654	602
FSU Exports (MtonC)	211	219	225	235
FSU Gains (billion USD)	USD 4.2	USD 5.0	USD 5.7	USD 6.9
OECD+EET Cost (billion USD)	USD 25.6	USD 28.9	USD 31.7	USD 36.3
World Cost (billion USD)	**USD 11.2**	**USD 15.0**	**USD 18.2**	**USD 23.0**

Source: **MIT, *Global Change Joint Program Report No. 41*, 1998**

According to the MIT model, the single biggest beneficiary from CDM surcharges is the FSU. Under the CDM, as a competitive supplier, the FSU benefits directly from the increase of the market price and the increase of its exports.

"It is able to benefit doubly because, having accepted an Annex B limit on emissions, its exports are not surcharged. The example will be compelling for many non-Annex B producers, who will come to see Annex B accession as a way to by-pass the CDM. Proponents of the CDM will not be pleased, but such action is essential both to the creation of a more efficient global trading system and to achieving the stabilization of atmospheric concentrations of GHGs. Accession logically implies a transitional role for the CDM. So long as the CDM provides an essential service — i.e., recordation, certification and verification — for converting non-Annex B emission reductions into tradable emission permits, a reasonable fee can be charged. But that service, and the attendant role for the CDM, would no longer be needed as non-Annex B parties accept limits and arrange for their own certification and verification as part of the global emissions trading regime." (MIT, *Global Change Joint Program Report No. 41*, 1998, p.12)

THE BENEFITS OF IMPLEMENTING THE KYOTO PROTOCOL: MODELS OF INTERNATIONAL TRADING AND CDM

In the realm of economic and environmental forecasts, models specifically and solely addressing the scale of potential carbon emissions trading would be an impossibility because any predictions of the scale of trading, leave alone the price of permits and flow of CDM, are derived from the initial estimates of domestic abatement costs. We do not lack econometric work elucidating the *costs* of Kyoto Protocol. Forecasts of deliberate *benefits* of implementing Kyoto are more rare since such work would presume a political will to take the first steps towards, actually, enacting the agreement into reality instead of debating the *plausibility* of its implementation. However, a number of models do include deliberate estimates of the potential market size, similar to the MIT's EPPA model. These forecasts are very similar to the MIT approach in terms of scenarios considered and approaches to modeling CDM, but they still vary along the specific model assumptions, especially with respect to the representation of new technologies, incorporation of macroeconomic predictors, inclusion of various carbon-based gases, time frame of forecasts, etc.

Having discussed cost estimates, we now turn to analyzing the existing forecasts of trading benefits, CDM market-size, limitations on the international trading due to the Kyoto's supplementarity condition, etc. In this section we omit a discussion of the assumptions[28] of each specific model since most of the crucial economic assumptions have already been scrutinized in the in the preceding discussion of the MIT study.

The CICERO partial-equilibrium model[29] is one of the most recent market size estimates.

[28] By default, all market size forecasts do not examine any of the political variables, which will inevitably influence the actual scope of carbon emissions trading — such as, the governmental capacity to raise carbon taxes, political stability (which is especially essential for the implementation of the CDM), transparency of financial markets, etc. The omission of crucial "soft" political variables is a convention of economic modeling because these factors are not easily measurable. Still, it should be noted that a successful launch of the CDM is especially vulnerable to a number of political factors within the host economy, and these variables will be considered in a conventional investment risk analysis by the potential project investors. Unfortunately, they cannot be taken into consideration in this report, which represents a significant simplification of economic reality.

[29] Key model assumptions:

- ACT includes all the gases listed in the Kyoto Protocol;
- The Annex B countries maximize country-specific welfare functions subject to national GHG- emissions constraints and public budget constraints;
- The different national fossil fuel consumption patterns together with the size of fossil fuel taxes in 1990 are the main factors behind the estimated abatement cost functions for CO2 in different countries and regions. The higher was the share of coal in countries' fossil fuel consumption in 1990, the lower are (broadly speaking) the estimated abatement costs.
- The governments are assumed to use the fossil fuel consumption taxes as their climate policy instrument.
- In the cases where emissions trading is allowed a competitive quota market is also included. The quota price is endogenous and requires equilibrium in the market. If emission rights could be achieved through the CDM, this could constitute a ceiling for the quota price.
- The assumptions about the countries BAU emissions in 2010 are based on emission scenarios presented in national communications when it is possible. The starting point for the model is June 1998.
- The model assumes that there is no hot air from the Eastern European emissions, and the amount of Russian hot air is equal to 167 million tons.

The model projects that for the Annex II trade the price of quota is USD 30.4/CO_2 ton equivalent, and or the scenario of free (global) trade – it is USD 21.6/CO_2 ton equivalent. Given that the model forecasts the number of permits traded between Annex II countries, with these prices we can estimate the market size as follows:

Table 3.1. Market Size Estimation/Capital Flows, based on CICERO'99 (calculated for 2010)[30]:

Country	Annex II trade Quota Import (in million tons of carbon equivalent)	Market size, Annex II trading, @ USD 30.4 per unit/q	Quota import (in million tons carbon equivalent)	Market size, Annex II with global trading, @ USD 21.6 per unit/q (in million tons of carbon equivalent)
USA	293.0	8.9072 billion USD	652.6	13.513 billion USD
Canada	17.0	516.8 million	50.5	1.091 billion
EU12	-307.4	- 9.34496 billion	-107.7	-2.326 billion
Denmark	12.8	389.12 million	15.9	343.44 million
Finland	-0.8	-24.32 million	2.4	51.84 million
Sweden	1.5	45.6 million	3.4	73.44 million
Norway	7.0	212.8 million	8.6	185.76 million
Other OECD	-2.6	-79.04 million	-1.2	-25.29 million
Russia	0.0	0	-488.8	-10.558 billion
Other EIT	0.0	0	-203.2	-4.389 billion
Australia/N.Z.	-82.2	2.49888 billion	-48.2	-1041 billion
Japan	61.7	1.87568 billion	115.6	2497 billion
Non-Annex B	-	-	-	
Sum	0.0	**USD 16.432 billion**	**0.0**	**USD 17.654 billion**

An alternative market size estimate is provided by McKibbin, Shakleton and Wilcoxen (1999).

The authors use econometrically estimated multi-region, multi-sector general equilibrium model of the world economy to examine the effects of using the system of internationally tradable emissions permits to control world carbon dioxide emissions. The most interesting contribution of this article is that under certain circumstances, the United States appears to be the permit *seller*, which is the opposite of conventional wisdom. [31]

[30] The numbers given in the table below are the *estimates* derived from CICERO's calculations.

[31] In order to explore the main issues in permit trading as a general proposition, the authors abstract from the actual regimes proposed in the Kyoto Protocol and instead examine three more transparent policies: 1) unilateral stabilization of U.S. carbon emissions at the 1990 level; 2) stabilization of the OECD emissions at 1990 levels on a country by country basis without international permit trading; 3) joint stabilization of OECD emissions with full international permit trading (that is, trading within OECD only). The OECD group in this analysis does not include Eastern Europe and the FSU, as would be the convention in the Annex I to the Kyoto Protocol. The reason for the exclusion of the FSU lies in the fact that the authors would like to examine gains from trade *not* influenced by the presence of hot air. If the FSU is included, the measurement of the gains from trade would be complicated by the fact that the total emissions standards would be relaxed by the addition of an extra 300

For the trading scenario, it is assumed that countries are given allocation of permits equal to their 1990 level of emissions. In contrast to independent (domestic) stabilization of emissions, international permit trading leads to a uniform OECD-wise permit price that rises from about USD 116 per ton in 2010 to USD 132 in 2020. Because the United States have the lowest abatement costs in this model, US emissions reductions are larger than in the no-trading scenario. This is because the United States finds it beneficial to sell permits on the world market while the permit price is above the marginal cost of reducing a unit of carbon in the domestic US economy. As a result, the US carbon emissions decline by about 35 per cent, significantly more than the 24.3 per cent per cent reduction needed to return US emissions to their 1990 levels. Annual permit sales exceed 189 million tones (USD 22 billion) in 2010 and reach over 430 million tones (USD 51,7 billion) in 2020. These numbers represent the market size for OECD in 2010 and 2020.

In the above model the overall GDP gains from emissions trading total about USD 28 billion in 2010 and around USD 50 billion in 2020. These gains reduce total OECD GDP losses from about USD 222 billion to about USD 193 billion in 2010, and from USD 336 billion to USD 286 billion in 2020. In percentage terms, trade reduces the GDP losses by 13 per cent in 2010 and 15 per cent in 2020. In contrast, the real GNP gains from trade are about USD 34 billion in 2010 and USD 55 billion in 2020.

Next, consistent with the CICERO's estimates, the GRAPE model by Kurosawa et.al.[32] (1999) provides the following range of emissions trading market value:

Table 3.2. Projections of the market size – 2010-2030: [33] approximation from the GRAPE graphs

Overall projections in USD	2010	2020	2030
Annex I trade scenario	USD 26.6 billion	USD18 billion	USD9.6 billion

Source: **Kurosawa et. al., *Energy Journal*, 1999**

GRAPE is an example of a model that relies foremost on modeling the energy sector while taking a more aggregate approach while representing the rest of the economy.[34] In the Annex

million tons of carbon, which is exactly the amount by which the FSU is below its carbon emissions level in 1990.

[32] See, Kurosawa .A, Yagita H, Zhou W and Tokimatsu K. (1999). "Analysis of Carbon Emission Stabilization Targets and Adaptation by Integrated Assessment Model", *The Energy Journal*, 1999,157-176

[33] The size of the market depends on the projected carbon trade price, which declines after 2020 with reduced emissions and a higher trading participation rate.

[34] The model depends on a non-linear dynamic intertemporal optimization methodology; shared variables include energy cost, energy trade, carbon emissions certificate trade, biomass energy potential, land use cost, food trade, carbon balance change from fossil fuel and deforestation/reforestation, and climate temperature. Resources included in the energy analysis module include natural gas, oil, coal, nuclear, biomass, hydropower, geothermal, solar and wind. Final energy demand is disaggregated into three categories: electricity, transportation and other demand. Carbon capture from coal and several isolation options are included in the module. Enhanced oil recovery, depleted gas wells, aquifers and oceans are treated as potential carbon sinks. Regional fossil fuel carbon emissions and carbon from land use change from ten regions are combined to represent carbon accumulation. Further, in international trade importers pay transaction costs proportional to the imported certificates. The unit transaction cost is set to USDUSD10 (in USDUSD1990) per ton of carbon throughout the simulation periods. This transaction cost applies both to acquisition and sales throughout the

I trade scenario, Eastern Europe and the FSU are modeled to be the only permit exporters, while in the global trade scenarios, where FSU becomes as importer of carbon emissions rights, all Annex I countries are modeled as emissions permits importers after 2030. In GRAPE, the size of the market depends on the projected carbon trade price, which declines after 2020 with reduced emissions and higher trading participation rate.

In the second scenario (the scenario of global trade) the price of permits increased until 2040 because of the gradual increased energy efficiency of production and also due to the initial increase in emissions from developing countries until they reach their emissions cups. Due to this fact, the value of the global trade market in 2030 is significantly higher than the value of Annex I market for the same period.

McKibbin *et. al*. (1999) make use of an econometrically estimated multi-sector GE model to compare four potential implementations of the Protocol involving various degrees of permit trading, focusing particularly on short-term dynamics and on the effects of the policies on the output, exchange rates and international flows of goods and financial capital.[35] The model only accounts for emissions of carbon dioxide while Kyoto protocol specifies targets for all gases. The former Soviet Union is treated exogenously because it has not been effectively integrated into global economy after the collapse of the country, and the study focuses on trade/capital flows.

According to the authors, under the Annex I trading scenario emissions reduction will be about 40 per cent lower relative to the no-trade scenario – at least, for the first budget period close to 2010. At the beginning of trading, before 2010, emissions permits purchases particularly benefit the rest of OECD (excluding the US, Australia and Japan), which uses internationally purchased allowances to meet 72 per cent of its obligations and thus achieves a 77 per cent reduction in its marginal abatement costs. Closer to 2010, when the economies of the former Soviet block begin to recover, their levels of emissions begin to grow: under these circumstances, the US becomes permit exporter/*seller*, supplying permits to Australia, Japan and the rest of the OECD. Permit trading reduces the OECD's overall GNP costs of meeting their commitments under the Kyoto protocol by about 63per cent in 2010, from USD 272 billion to USD 143 billion. The authors estimate that roughly 60 per cent of those benefits are due to the relaxation of *constraints* on trade, with the rest 40 per cent due to the

Annex I region. The carbon trade price is determined *endogenously* by balancing the regional abatement marginal cost and trade price.

[35] The model is run for the following scenarios:

1. The US attempts to meet the Kyoto Protocol obligations but no other nations do. This is a benchmark scenario, though it is not realistic politically.

The other four scenarios are when all regions meet their commitments but the extent to which international trading is permitted varies:

2. No international permit trading between the regions;
3. International permit trading permitted among all Annex I countries;
4. International trading permitted for all the other OECD and among the other Annex I regions (US, Japan, Australia and the former Soviet block) but prohibited among all the other Annex I. This fourth scenario is called "double umbrella", whereby the EU/rest of OECD trades permits within itself while the rest of Annex I engage in permit trading independently from that block. The key difference between the previous scenario and the current one is that countries not included in the umbrella block, i.e. US, Japan, Australia and the FUSSR do not buy approximately 327 million tons worth of permits from the former Soviet Block. "Rest of OECD" includes all countries in that regime besides the U.S., Japan and Australia.
5. Global permit trading – where developing regions accept an emissions allocation consistent with their modeled baselines, and allow sales from their permit allocation to Annex I countries.

gains from trade. Following the estimates obtained by McKibbin *et. al.*, the market value of international carbon trading looks as follows:

Table 3.3. International Trading in the G-Cubed Multi-Regional Model (2010 to 2020)

2010	US	Japan	Australia	Other OECD
Permit price (USD95)	USD 32	USD 32	USD 32	USD 263
Annual permit sales (Bn USD 95)	-USD 11.4	-USD 1.6	-1.3	…
Total market (Bn USD 95)				**USD 14.3**
Total carbon reductions	-9.2%	-5.7%	-6.7%	-32.7%
2020				
Permit price (USD95)	USD 71	USD 71	USD 71	USD 318
Annual permit sales (Bn USD 95)	-USD 19.8	-USD 5.7	-USD 3.9	---
Total Carbon reductions	-18.6%	-10.4%	-11.0%	-39.9%
Total market (Bn USD 95)				**USD 29.4**

Source: **McKibbin et. al., *Energy Journal***

Please, note that the above market values represent the OECD estimates, not the global ones. These results project the market value of the magnitude three times larger than the GRAPE's model, but we would like to remind the reader that all estimates may significantly deviate from one another due to the model assumptions and the data employed in the forecasts.

In McKibbin *et. al.* full global trading cuts the permit costs to USD 23 per metric ton of carbon (MTC) in 2010 and to USD 37 per MTC in 2020, and has only small effects on the Annex I economies. China provides about 300 MMTC of these allowances, and the other LDCs provide about 195 MTCs. One of the greatest positive effects of global trading is the fact that it eliminates carbon leakage. Except for Australia, OECD regions experience GDP and GNP impacts of, at most, 0.4 per cent. Capital flows, exchange rate impacts and trade effects are considerably *lower* under the full global trade scenario relative to the Annex I trade.

Table 3.4. Annex I Commitments with Global Permit Sales

2010	US	Japan	Australia	Other OECD	China	LDCs
Permit Price (USD 95)	USD 23	USD 23	USD 23	USD 23	USD 23	USD 23
Annual Permit Sales (Bn USD95)	-USD 8.9	-USD 1.2	-USD 1.0	-USD 9.3	USD 7.0	USD 4.5
Carbon emissions	-7.4%	-4.2%	-4.9%	-3.4%	-19.1%	-7.9%
2020						
Permit price (USD 95)	USD 37	USD 37	USD 37	USD 37	USD 37	USD 37
Annual permit sales (Bn USD95)	-USD 21.1	-USD 3.9	-USD 2.5	-USD 25.2	USD 24.3	USD 17.1
Carbon Emissions	-11.4%	-6.1%	-6.5%	-4.6%	-24.9%	-11.1%

Total market value for 2010 is approximately 20.4 billion (95 USD);

Total market value for 2010 is approximately 52.7 billion (95 USD).

Source: **McKibbin et. al. ,** ***Energy Journal***

Finally, the reader should be reminded of detailed market value estimates for various economic growth scenarios provided by the MIT EPPA model. A number of studies address costs of imposing limitations on flexibility mechanisms since, due to the condition of *supplementarity*, the Annex B states will have to make individual efforts to meet Kyoto requirements on domestic bases, before resorting to international permit trading and CDM investments. The studies by Gusbin, Ger Klaassen and Kouvaritakis (1999) as well as an analytical piece by Zhang (1999) represent the most well known works in the domain of constrained/ceiled Kyoto flexibility. Ceiled flexibility implies quantitative limits on how much nations can meet their Kyoto commitments through international emissions trading versus domestic actions. In recent international negotiations the European Union called for such constraints on emissions trading.

One of the central observations made by Zhang is the fact that too many restrictions on one type of mechanism could shift carbon reduction efforts to another type of mechanism, e.g., from emissions trading towards the CDM. Unless the further Kyoto extensions impose the ceilings on each mechanism, the CDM and emissions trading appear to be directly substituting mechanisms.

Within the European Union, there are several scenarios limiting the purchase of emissions permits. The EU proposal calls for the limits on both buying and selling countries. The EU has developed two alternatives for trading caps:

- 5 per cent of [(its base year emissions multiplied by 5 + its assigned amount of reductions)/2], or
- 50 per cent of the difference between its annual actual emissions in any year between 1994 and 2002, multiplied by 5, and its assigned amount.

At the same time, Gusbin, Ger Klaassen and Kouvaritakis (1999) observe that if the Kyoto protocol did not allow any of the flexibility mechanisms, the overall effect of Kyoto targets would be the global reduction of CO_2 emissions in 2010 by 10 per cent (20 per cent for the Annex I) compared to the BAU scenario. This reduction is *higher* than the Kyoto commitment to decrease overall emissions by 5.2 per cent. This results from the fact that, in this scenario, some Annex I countries — in particular Russia and Ukraine — would not be able to trade the differences between their baseline emissions and their Kyoto targets.

Even if carbon trade is restricted to the Annex I countries only, Zhang (1999) observed that, relative to high carbon emitters (such as the US), EU members will be allowed to obtain high carbon acquisition rights. One of the main reasons for high European acquisitions is that the projections of baseline greenhouse gas emissions in 2010 by most EU members are very close to their targets. Put another way, there are very small discrepancies between the EU national emissions targets and the baseline emissions of European states. As a result, the allowed acquisitions are high relative to the gap between their projected baseline emissions and their targets in 2010.

Zhang's study considers four scenarios for emissions abatement, in terms of international mechanisms:

- The *no limits* scenario;
- 50 per cent reduction from BAU scenario: the maximum allowed acquisition from all three flexibility mechanisms are limited to 50 per cent of the difference between projected baseline emissions and the Kyoto targets in 2010;[36]
- The EU ceiling scenario: the scenario follows the EU proposal for concrete ceilings on the use of all three flexibility mechanisms;
- No hot air scenario – trading in hot air is not allowed, indicating that any trading in GHG emissions must represent the *real* emissions reduction.

When trading in hot air is not allowed, the international price of permits increases in comparison with the no-limits scenario. "As a result, the demand for permits abroad increases, and more and more domestic abatement is undertaken."[37] Under the 50 per cent reduction from *business as usual* scenario, domestic actions contribute to 50 per cent of the aggregate demand for permits in 2010. Under these restrictions, it becomes easier for the EU to abate carbon domestically instead of purchasing the emissions permits abroad.

[36] According to the 12-region marginal abatement cost model, which is derived and run by Zhang, even if *no* limits are imposed on the use of the flexibility mechanisms, not all emissions reduction required of Annex I countries will take place abroad. From the standpoint of conventional economics, any country would be interested in reducing its own emissions by its own efforts for as long as the domestic marginal abatement costs are *lower* than the international abatement costs (including international transaction costs). Based on the marginal costs of domestic abatement for the 12 regions, it is estimated that reduction of 171.7 MtC, or 27.7 per cent of the total needed emissions reductions in 2010 will be met through domestic actions of Annex I countries under the no-limits scenario. This is broadly in line with the findings of the IPCC (1996).

[37] See Zhang (1999) p. 29.

Table 3.5 Estimates of the Contributions of Three Flexibility Mechanisms under the Four Trading Scenarios in 2010 (MtC) – Aggregate Estimates for the Market as a Whole

Scenarios	Domestic Actions	Hot air	Emissions trading and JI	CDM	Total supply
No limits	171.7	105.0	51.8	292.1	620.6
50% of reduction from BAU scenario	310.3	105.0	36.1	169.2	620.6
EU ceilings	387.8	70.2	30.8	131.8	620.6
Not hot air	203.5	0	59.6	357.5	620.6

Source: **ZhongXiang Zhang (1999)**

Based on the author's calculations, the following is the autarkic marginal abatement costs in the no trading case, and domestic as well as international prices of permits under the four trading scenarios.

Table 3.6. Kyoto Restrictions Scenarios, Domestic Abatement Prices and International Trading Price Under Different Implementation Scenarios (at 1998 USD per Ton of Carbon), for 2010

Scenarios	US	Japan	EU	Other OECD	**International Price**
No emissions trading	160.1	311.8	9.1	33.4	-
No limits	9.6	9.6	9.6	9.6	9.6
50% of reduction from the BAU	45.5	124.7	6.0	6.0	4.7
EU ceilings	79.0	144.3	3.5	9.7	3.5
No hot air	12.6	12.6	12.6	12.6	12.6

***Source*: ZhongXiang Zhang (1999)**

Pursuing our own calculations of the overall market value, we obtain the following estimates of market size under different restrained/unrestrained scenarios:

Table 3.7. International Market value for four Kyoto limitation scenarios (at 1998 USD billion)

Scenarios	**International market value**
No limits on trading	5,957.76
50per cent of reduction from BAU emissions	2,916.82
EU ceilings	2,127.1
No hot air	7,819.56

Source: Own calculations based on Zhang's (1999) reported findings

From Zhang's findings, when there are no limits imposed on the use of flexibility mechanisms, the marginal cost of domestic abatement for each region equalize, and there is no distinction between the international price and domestic prices. The original price of USD 9.6 per ton is pushed to USD 12.6 per ton, when trading in hot air is not allowed. The increase in the international price is partly because the prevailing trading in hot air increases the OECD’s demand for certified CDM credits. When supplementary restrictions are imposed on the acquisitions, the purchase of permits is restricted, pushing down the market price. Thus, the international prices of permits under the two supplementary scenarios will be lower than under the open trade scenario. The smaller the amount a country is allowed to purchase abroad, the higher its expected domestic autarkic, i.e. the no-trade prices. Because the autarkic marginal abatement costs for Japan are the highest, the EU proposed restrictions lead to the highest ratio of the domestic price in Japan to the international price of permits.

The bottom line of Zhang’s analysis is that unrestricted international trade can significantly reduce the marginal abatement costs within the countries. Japan and the US benefit the most from the international trading relative to all the other countries. “Measured as percentage of total abatement costs in the no trading case, the abatement costs of Japan and the US are cut by 93.1 per cent and 85.2 per cent under the no limits on trade scenario, and 91.0 per cent and 81.0 per cent under no hot air scenario. By contrast, the EU achieves only very small gains from trading under the above two scenarios.”[38] Specific reductions in total abatement costs for several countries are represented below:

Table 3.8. Reductions in the Total Abatement Costs under the Four Trading Scenarios (per cent)

Scenarios	United States	Japan	European Union	Other OECD	OECD
No limits	85.2	93.1	0.2	45.3	86.5
50 per cent of reduction from BAU scenario	81.1	77.4	19.1	68.8	79.6
EU ceilings	63.7	71.9	39.2	70.8	66.0
No hot air	81.0	91.0	2.3	33.5	82.4

Source: ZhongXiang Zhang (1999)

Gusbin, Ger Klaassen and Kouvaritakis (1999) examine the scenario, where a 50 per cent limits is imposed on the potential market trade volume. Under this scenario, parties' acquisitions would represent less than 20 per cent of their required reductions in 2010, with the exception of Japan, where they are still expected to represent 35 per cent (see table 3.9). The argument is that reducing the trading volume by half would increase annual costs for the Annex I countries by 50 per cent (from 22.7 to 33.6 billion USD/year) — a total increase of nearly 11 billion USD/year compared to the full trade case. With the 50 per cent ceiling on both sellers and buyers, global CO_2 emissions would be 1 per cent lower (2 per cent for Annex I) since part of the “hot air” or surplus cannot be sold. Thus, the overall global emissions would be about 60 Mton C lower than under the Kyoto without restrictions. The authors do no provide any estimates of resulting global market value, and the validity of this

[38] See Zhang (1999) p. 31.

work is in its ability to show that unrestricted trade bears lower costs of Kyoto implementation.

In addition to various international trading scenarios, a number of researchers estimated the size of the CDM market and looked into the specifics of JI policies. In essence, the CDM and JI represent the extension of the permits trading market: because the three emissions reduction mechanisms are interchangeable[39] on the international market, we can safely assume one global emissions reduction market. We next look into the findings of the cluster of CDM/JI works.

Within the existing literature, there are only three sources, which examine the size of the CDM emissions reduction programs: Haites (1998), the aforementioned MIT (1998) and Austin (1998). Excellent review of their analysis in given in Vrolijk (1999). An in-depth review of Haites' work is delivered in Figueres (1999).[40]

The estimates given by Haites (1998) assume that Annex I reductions needed from business as usual is 1000 MtC. Haites prices the CDM credits at USD 36.70/tC. Without market limitations this could lead to a total CDM value of USD 21 billion. Two supplementary scenarios are explored, with CDM values of USD 9.50 billion (which constitutes 50 per cent from BAU) and USD 1.0 billion (50 per cent from the base year).

Austin et. al. (1998) derive their estimate from 4 different models (one of them is the MIT EPPA Model) The range of estimates for this model is given below in table 3.9.

Table 3.9. Estimates of the CDM Market: Austin, 1998

Model	Market share (%)	Market Size MtC)	Market Price (USD/tC)	Market Value (USD bn)
OECD	33	397	19	**7.5**
G-Cubed	38	400	13	**5.2**
Second Gener. M	48	503	26	**13**
EPPA	55	723	24	**17.4**

"According to these models credits from the CDM will satisfy between 33 and 55 per cent of the total market (including domestic action), which equals to between 397 and 723 MtC. With carbon prices in the range of USD 13-26 t/C, the total market value of the CDM credits is USD 5.2-17.4 billion." (See Austin, 1998, p. 2)

As mentioned before, most models simply assume the quota price within the CDM and from that assumption they derive the size of the market. Only two models have attempted to take into account the actual dynamics of the market. The US Administration (1998) studied the impact of the Kyoto Protocol on the US economy.[41]

[39] Interchangeability is applicable for the carbon value only.
[40] See Figueres, Christiana, 1999, "How Many Tons? Potential Flows Though the Clean Development Mechanism", CSDA Reports and Publications, 11/23/1999: Center for Sustainable Development of the Americas.
[41] The second study, carried out by ITEA, did not specifically model the CDM as a separate Kyoto institution. In that study the CDM is modeled within a tentative analysis, where a potential for CDM is depicted as the addition of an extra country in the international trading regime with a marginal cost curve similar to the non-CO2 greenhouse gases.

According to Vrolijk, who based his arguments on the findings of the U.S. Administration study, participation of the U.S. in global trading with the CDM will significantly reduce the overall Kyoto compliance costs for that country, where the costs of the U.S. CDM investment are estimated to range between 6.86 to 4.14 USD billion (it is worth noting here that the size of the CDM is given for one country):

Table 3.10. Results of the U.S. Administration Study for the US Compliance with the Kyoto Target

Scenario	Quota price (USD/tC)	Reductions (MtC) US	Other Annex B	CDM	Costs (USDbn) CDM	Total
Domestic Action Only	200	500	--	--	100	
Annex B trading	56	140-265	360-235	--	--	28
Trading and CDM	42	105-229	270-204	125-167	5.25-2.81	21
Trading with key DCs	24	60-173	154-154	286-173	6.86-4.14	12

***Source:* Vrolijk, 1999**

In sum, all models show that the CDM is likely to be a multi-billion dollar business.

The US Administration projects developing country income to be between USD 2.8 to USD 5.3 billion, this covering only the US involvement in the projects. To include the rest of Annex B, again half of this estimate should be added (USD 4.2-7.9 bn.), and this number could be even higher when some key developing countries take on commitments and join the trading scheme.[42]

Finally, expressed in absolute carbon value, four studies using the OECD GREEN model estimated the size of the CDM market for the early 2000s to be around 397 MtC (Van der Mensbrugghe, 1998); the other estimates with the EPPA model (Ellerman and Decaux, 1998) give the size of the CDM market being equivalent to 723 MtC.

Austin *et. al.* argue that such estimates derived from the global modelling exercises tend to *overestimate* the CDM flows because, in practice, political institutions and transaction costs will probably keep CDM activity at a *much lower* level of estimates. This concern was confirmed by the recent developments of CDM negotiations at COP-6.

A limited number of studies addressed what would happen to the size of the CDM market when numerical restrictions are imposed on international trading of carbon emission rights. ZhongXiang Zhang estimated the size of the CDM market under several supply–ceiling scenarios.[43] In this study the value of the CDM is derived by multiplying the international price of permits (under each one of the restricted scenarios) by the supply of certified CDM credits from each non-Annex I country. The size of the CDM market is estimated to be from

[42] Vrolijk, Christiaan. 1999. "The Potential Size of the CDM". Research paper by the Energy and Environment Program, Royal Institute for International Affairs, London. In particular, see p. 5

[43] See ZhongXiang Zhang. 1999, "Estimating the Size of the Potential Market for all Three Flexibility Mechanisms under the Kyoto Protocol", Asian Development Bank.

USD 456.9 million under the EU ceiling scenario[44] to USD 4512.8 million under the scenario, where no hot air trading is allowed for the OECD states. "Subtracting their own abatement costs, the net value of the CDM market in 2010 … is estimated to be in the range of USD 244.6 million under the EU ceilings scenario to USD 2559.1 million under the no-hot-air scenario."[45] The *'No hot air'* scenario also constitutes a limitation on the volume of international transactions in carbon sales – thus, the size of the CDM market under this scenario is much *lower* than in the no-constraints case, considered by Haites, OECD model, G-Cubed and MIT-EPPA study.

Table 3.11. Value of the CDM Market and Share of China and India in 2010 under the Four Trading Scenarios

	No Limits	50per cent of reduction from BAU emissions.	EU ceilings	No hot air
CDM market (millions of USD), of which:	2795.6	797.4	456.9	4512.8
China	60.3 per cent	59.9 per cent	59.6 per cent	60.4 per cent
India	15.1 per cent	15.7 per cent	15.9 per cent	14.9 per cent
Net CDM market (million USD), of which:	1565.0	432.4	244.6	2559.1
China	59.9per cent	59.4per cent	59.2per cent	60.1per cent
India	15.5per cent	16.1per cent	16.3per cent	15.3per cent

***Source:* ZhongXiang Zhang (1999)**

However, the key question for estimating the exact size of the CDM market is: how many projects will be carried out through the CDM?

Estimating the size of the CDM - example of the Dutch government:

With respect to implementing the CDM, an example has been set by the Dutch government, which indicated the CDM market size to be about USD10-15 billion. In the Netherlands most industries are covered by long-term voluntary agreements with the government, with targets of around 20 per cent energy efficiency improvement in ten years. Due to these voluntary agreements, the government does not want to subject these industries to emission caps. In all three mechanisms, public entities will be responsible for international trade to meet the Dutch target. In August 1998 the government decided to reserve around USD 250 million for these public entities for the CDM after the year 2000; other money is available for the Joint Implementation projects in the EITs. The Dutch development aid is only USD 1 billion and it will not be affected by this new budget.

[44] Recall that, the EU ceiling proposals call for caps both on purchase and sale of carbon emissions rights, and the proposals assume the limits within two alternatives:
5per cent of [(its base year emissions multiplied by 5 + its assigned amount of reductions)/2], or
50per cent of the difference between its annual actual emissions in any year between 1994 and 2002, multiplied by 5, and its assigned amount.

[45] See Vroljik, 1999, p.32.

The current trial stage of global emissions reduction efforts has been formalized in the form of Activities Implemented Jointly (AIJ). By June 30 1998, 95 projects were reported under the AIJ pilot phase. Over their lifespan these projects are expected to reduce emissions by 44.1 MtC. At the same time, as of the end of 1999, only 27 AIJ projects are expected to lead to investment under the CDM. This subset of projects, however, constitutes the largest share of all credits, which amount to the abatement of 1.2 MtC per year. Of all projects in the CDM-subset a third takes place within the forestry sector[46], but they make up two thirds of all the credits. In sum, the international debate on what types of projects have to be allowed under the CDM has not yet reached the conclusion.

Why has there not been a more steady progress towards designing an effective CDM regime? Haites (1998) and Vrolijk (1998) help us to understand the concerns about implementing the CDM.

One serious economic concern for the developing countries, which could potentially also become a concern during implementation of the CDM, is the issue of *surplus sharing***.** This issue arises from the fact that the value of participating in the CDM for the Annex I countries is much larger than simply the income of the developing countries from the CDM investment. As a result, developing countries would like to split the share of surplus received by the Annex I from CDM projects.

The total costs for the US economy to comply with only Annex B trading is USD 28 billion, based on the US Administration study… When including the possibility of trade with (L)DCs through the CDM, costs are reduced by USD 7 billion, while the costs of the CDM credits are only around half of these savings… [At the same time], "…assuming linearly raising marginal costs, the Haites study would lead to reduction costs of USD 91 billion without CDM. Compared with the USD 33 billion with an effective CDM, the savings are USD 58 billion, nearly triple the sales of the credits.[47]

Although, from a political standpoint, it appears perfectly appropriate to allow the developing countries to participate in splitting the surplus — *to create an economic incentive for them to participate* — economically there is no justification for such an action. Nor is there an appropriate baseline, which would allow one to calculate how the economic surpluses from carbon reduction should be shared. The key question is what is the base for calculating the percentage at which to split the surplus?

Setting a reliable baseline for CDM projects themselves is already considered a substantial problem. Another problem is that in some ways investors have to be convinced to pay for the benefits that are created by market mechanisms. So far this issue has not been solved and there is no economic mechanism for surplus sharing.

Further, there is one additional difficulty related to implementing the CDM regime: it is likely that Africa will be left out, at least temporarily, from the initial stage of CDM implementation on the grounds that the continent lacks the basic infrastructure for supporting this type of investment? The capacity to generate permits exists in the Asian NICs, China, India and many Latin American countries. So far, the progress with development of African CDM projects has been minimal.

[46] The single largest AIJ project reported, a forestry project in Latin America, accumulates a third of the total credits.
[47] See Vroljik (1999) p. 8.

From the projects that took place in DCs, the Latin American countries absorbed most projects (20 out of 27), the Asian Pacific hosted 6 projects, and Africa only 1. The high avoided emissions in Latin American countries are due, most of all, to few very large reforestation projects.

Some studies (such as Austin et. al.) estimate that out of all the developing countries, the highest number of credits will be produced in China, whose market is rapidly expanding and offers a large scope for what may be termed clean FDI. According to Zhang's (1999) calculations, 60per cent of CDM investment will go into China with 16 per cent of CDM going into India.

"Because of the relatively high abatement costs and relatively small size, the remaining four non-Annex I regions account for only 25 per cent of the total non-Annex I countries' exported permits to the Annex I regions."[48] Thus other non-Annex regions are concerned about this projected inequality of CDM project distribution. The mentioned study of Austin et. al. estimates that 228-437 MtC credits will come from China — ranging from 57 to 70 per cent of the total market. Such a large share of projects falling on one country should raise concerns over the *monopoly power*.

The solution to this concern would be to contribute to capacity building within African countries, focusing on infrastructure development. Another solution would be to provide low-interest capital from international funds to stimulate any developing country's preparation for projects, so as to lower the risks of CDM investment to potential interested parties.

Having reviewed forecasting studies on the Kyoto mechanisms, we now turn to the analysis of the market value for all types of global carbon abatement mechanisms.

ANALYSIS OF MARKET VALUE AND CAPITAL FLOWS

This section of the report summarizes the methodology used to estimate the value and size of the carbon dioxide emissions reduction market in four different institutional arrangements that are possible under the Kyoto Protocol. The findings are presented in the context of the institutions and used to help explain potential capital flows under the different institutional scenarios.

Methodology

To calculate the value of a ton of carbon dioxide, estimates from over a dozen studies were averaged, controlling for differing assumptions about 'secondary' factors in the baseline models. Secondary factors can include such things as differences in projections for population, economic growth rates, capital substitution elasticity, fluctuations in exchange rates, employment levels, technological innovation, and so on. The average market clearing price is multiplied by the volume to estimate the total market value under four institutional scenarios, as will be discussed in moment. This method, despite some acknowledged caveats,

[48] See ZhongXiang Zhang (1999), *Estimating the Size of the Potential Market for all Three Flexibility Mechanisms under the Kyoto Protocol.* Asian Development Bank, p. 34

is useful for estimating the potential value of an emissions reduction market and flow of capital under different institutional settings.[49]

Our study draws from a broad range of possible outcome in order to control for confounding variation across models that is in part caused by differences in secondary factors. That is, we have included secondary factors by accepting them *premia facie* and *defacto* averaging out the variance. This allows us to better account for the relationship between the primary variables of concern here. Although the precision of the estimates is marginally reduced, this procedure provides a reasonable estimate of the potential market value under different institutional arrangements that will be generated as both the public and private sectors continue to move toward climate protection.

There are four primary institutional arrangements that stem from Kyoto that are considered in this paper. These include meeting the Kyoto commitments (2008-2012) through: 1) Domestic action only; 2) Joint Implementation/Trade in Annex I countries; 3) Clean Development Mechanisms; and 4) Permit based global market.

Capital flow projections are derived from: estimates in the literature that conform to the institutional arrangements considered here, the market clearing prices estimated in this study, and standard trade theory — which assumes that in a well functioning global market, the policy objective will be achieved at the least cost, with revenue accruing in countries with a competitive advantage in emissions reductions.

Findings: Market Clearing Prices, Total Market Value, Savings, and Capital Flows

Table 4.1, below, provides figures for the market-clearing price of a ton of carbon dioxide under the aforementioned institutional alternatives. The 'domestic only' abatement cost of about USD 77 (USD 1998) per ton of carbon dioxide represents an average for Annex I countries when they achieve their commitments without using tradable permits or Joint Implementation.[50] The considerable differences in the slope of the respective Annex I countries marginal cost curves' is hidden by this estimate. For example, according to a recent study by MIT, Japan faces a cost of over USD 584 (USD 1985) while the US price is USD 186. This is also evident in the Annex I trade/JI scenario. Nevertheless, at the average price and a total volume of 1.2 billion tons (1.08 billion tons) of carbon dioxide the total market value is estimated to be approximately USD 92.4 billion (USD 98) in 2010. There are no direct transfers of capital between countries under this institutional arrangement.[51]

Table 6.1. Average Value of Emissions Reductions Per Ton of CO_2 (USD 1998)

Domestic Abatement	Annex I JI/Trade	CDM (15% avg. fee)	Permit Based Global Trade	Diversified Market*
USD 77.02	USD 37.14	USD 29.99	USD 26.08	USD 52.52

*Diversified market assumes that 50per cent of abatementoccurs domestically and the remainder is achieved through CDM or permits.

[49] See John P. Weyant, "Costs of Reducing Global Climate Emissions", *Journal of Economic Perspectives* (1993), for an excellent discussion on the significance of baseline input assumptions.
[50] Unless otherwise noted all figures are given in 1998 US dollars.
[51] "With no emission trading, there are no export earnings. None of these regions would have any incentive to abate in order to generate 'rights to emit for export, and, of course, the FSU would not be able to export its 'hot air". (A. Denny Ellerman, Henry D. Jacoby, and Annelene Decaux, "The Effects on Developing Countries of the Kyoto Protocol and Carbon Dioxide Emissions Trading", *Policy Research Working Paper* 2019 (The World Bank, December 1998), p 5.

When the first layer of institutional constraint is removed, which represents strictly domestic compliance, emissions reduction commitments can be met through Joint Implementation or in a tradable permits market among Annex I countries. In this case, the price of one forgone ton of carbon dioxide emissions drops as the costs of compliance are met mostly in the Annex I countries where it is less expensive to do so. Table 4.1 shows that the average cost among Annex I countries declines from about USD 77 to just over USD 37 per ton of carbon dioxide. Table 4.2 shows the total market value is estimated to be USD 44.5 billion. The Annex I trade scheme also allows for capital transfers to occur as dollars chase the lowest cost methods for meeting their respective commitments in Annex I countries. According to a recent study carried out at MIT, the US has both an absolute and competitive advantage in emission reductions capabilities among most of the major Annex I countries and thus could be a recipient of capital flows.[52] When the former Soviet Union (FSU) is allowed to trade its ‘hot-air’ — approximately 111 Mton — it becomes the largest net exporter of permits to other Annex I countries including the US and thus receives the largest capital transfers (approximately to USD 9.3 billion). Meanwhile, Japan, US, and several other countries import (or meet) a significant portion of their respective commitments for approximately 50 per cent less cost as compared to the no-trade scenario.[53]

Table 4.2 Estimated Value of Annual Emissions Reduction Market
(**Billions** of USD 1998)

Domestic Abatement	Annex I JI/Trade	Permit Based Global Trade	CDM*	Diversified Market
USD 92.4	USD 44.5	USD 31.2	USD 18	USD 63

*Assumes 50 per cent of total market shares of global trade scenario @ 15 per cent per ton average fee.

The cost declines further when the second layer of institutional constraints are removed by allowing non-Annex I countries to be included in the realm of possible policies where Annex I commitments can be achieved. In this scenario, the potential total market value reaches approximately USD 30-35 billion (USD 1998) annually as the per ton average cost declines nearly 20 per cent — from USD 37 to less than USD 30 — or 63 per cent from the domestic only scenario (See table 6.3.) As specified in the Protocol, this can occur in two ways: through the CDM and through tradable permits.

Taken in this order, in the CDM scenario Annex I countries can take advantage of lower cost emissions reductions by investing in certified projects that, for example, reduce the expected emissions or increase aggregate sequestration rates in non-Annex I countries. This occurs because the marginal cost curves for reducing/mitigating future emissions in non-Annex I countries is on average considerably lower than in Annex I countries. The CDM is especially lucrative in that it is the only way, as specified in Kyoto, that emission credits can be acquired *prior* to 2008.

---

[52] While, according to some observers, this may be difficult to conceptualize from a political standpoint, economic theory suggest that it is a possible Pareto improving move –that is, potential gains in efficiency can be made out of such situation. Cost curve information comes from: A. Denny Ellerman and Annelene Decaux, *Analysis of Post-Kyoto CO2 Emissions Trading Using marginal Abatement Curves*, Report no. 40, (MIT: October 1998), p 9.

[53] Nordhaus and Boyer in *EJ* (1999) as well as other studies support the finding that under Annex I trade benefits the FSU. A study done at MIT estimated that the total gain going to the FSU could be as high as USD34 billion (USD 1985). Ellerman and Decaux, (MIT, 1998).

A full blown global market for tradable carbon dioxide permits by end of 2008 is widely acknowledged as the least cost method of achieving emissions reductions. With the shift to global trade a significant amount of low-cost carbon abatement [in non-Annex I regions] becomes potentially available. One example of this is when "emissions trading makes it possible to substitute reduced coal use in non-Annex B regions for more expensive abatement that reduces oil and natural gas use in Annex B regions."[54] For the global market scenario, it is expected that non-Annex I countries will agree to reasonable targets so as to prevent future increases of emissions of the magnitude that Annex I countries have agreed to reduce.[55] Though this has been a point of contention in the past, given the large cost savings accruing to and revenue that could flow into non-Annex I countries, it is possible that a considerable share of the emissions reductions in the future will be achieved initially through CERs and later mature into a tradable permit system.

Table 4. 3 Total and Marginal Saving Under Idealized Institutional Constraints

	Annex I	CDM	Global Permit Market
Total Saving From Moving Beyond Domestic Only Case*	USD 47.8 bn (USD98) USD 39 per ton/CO_2 (51per cent)	USD 56 bn USD 47/t (61per cent)	USD 61 bn USD 50/t (66per cent)
Marginal Saving From Reducing Institutional Constraints**	USD 47.8 bn (USD98) USD 39 per ton/CO_2	USD 8.5 bn USD 7.15/t	USD 4.7 bn USD 3.91/t

*Total savings are estimated using the domestic only scenario as a baseline for emissions reductions.

**Marginal savings are estimated from next best scenario, for example, a move from Annex I to CDM

The capital flows in an international market for carbon reductions can be much more difficult to track in all non-Annex I countries due to such limitations as poor data availability. However, several studies based on the best available data have attempted to make such calculations. The most reasonable estimates come from a study conducted by Ellerman, Jacoby, and Decaux at the World Bank and Cooper, Livermore, Rossi, Willson, and Walker at Oxford University.[56] In this study it was estimated that Japan, the EU, the U.S. and most of the other OECD countries in the Annex I group would be able to significantly reduce the cost

[54] Ellerman et al. (World Bank1998), p 7/16. Though this may help meet the policy objective, it may also become a point of contention among politically active environmentalists.

[55] "In the absence of binding targets in developing countries it will be difficult to determine the net emission reduction effects due to specific CDM projects . . ." (Bjart J. Holtsmark and Knut H. Alfsen, *Coordination of Flexible Instruments in Climate Policy*, (Oslo: Center for International Climate and Environmental Research, 1998:4). On the other hand several authors contend that Annex I countries can "earn emission credits for certified reductions from investment in 'clean development' projects in [non-Annex I] countries that have not taken on binding targets" (Warwick McKibbin, Martin Ross, Robert Shackelton, and Peter Wilcoxen, Emission Trading, "Capital Flows and the Kyoto Protocol", *Energy Journal* special ed., (IAEE: 1999), p 288.

[56] W. McKibben et al., in "Emissions Trading, Capital Flows and the Kyoto" in the *EJ*, find that in the full trading scenario China and other non-Annex I countries see an inflow of approximately 11.5 billion (USDUSD95), with China receiving approximately 60 per cent of the total (1999, p 315). Adrian Cooper et al. (1999) in the full trading scenario find that "Russia is the only seller of permits, exporting 293 mmt of emission by 2010. These exports generate income inflows equivalent to around 4 per cent of GDP for Russia in 2010. The biggest permit purchaser in the US, which buys 114 mmt of emissions permits in 2010. Canada is the largest purchaser relative to the size of its GDP…" (1999), p 354. Also see an earlier analysis carried out by Scott Barrett, "Transfers and the Gains from Trading Carbon Emission Entitlements in a Global Warming Treaty", *Combating Global Warming: Study on a Global System of Tradable Carbon Emission Entitlement*, (New York: Untied Nations 1992), p115-125.

of meeting their commitments with the help of non-Annex I countries. In fact, this represents significant cost savings for Annex I countries and considerable capital flows into non-Annex I regions. At approximately USD 30 dollars per ton of carbon dioxide, the figures presented here assume, that 70 per cent of the commitments by Annex I countries will occur via trade. Under a global permit trading system it is estimated that capital transfers to China will be about 45 per cent of the value of the total market shares; whereas the FSU and India will receive about 25 and 12 per cent respectively. The remaining 18 per cent is widely dispersed and indirectly could represent on outward limit on the variance of these estimates. Using this as a proxy, the estimated value of the transfers to developing countries is approximately USD 22 billion (USD 98) –with China getting nearly half (USD 9.85 billion), FSU USD 5.47 billion, India USD 2.62 billion, and the remaining 3.9 billion is 'efficiently' allocated elsewhere:

Table 4.4. Capital Flow Projections (billions of USD 98)

	Annex I/FSU 'hot-air'	Global Permit Market*	CDM**
Total Market Value	USD 44.5 billion	USD 31	USD 18
China	n/a	USD 9.85	USD 8
FSU	USD 9.3	USD 5.47	USD 4.5
India	n/a	USD 2.62	USD 2.1
Latin America/Africa and other non-Annex I	n/a	≈USD 3.9	≈USD 3.9

*Global Permit Market assumes 30 per cent domestic abatement/70 per cent international permit trading

**CDM based upon 50 per cent market share of global permit market (or 35 per cent of total market value).

Before discussing how this would work itself out in terms of market value and capital, it is useful to briefly consider several reasons why CERs are more likely to be utilized before a global emissions permit system is established. One factor that will probably come to play is that CERs, by definition, include participation by non-Annex I countries which is a formal precondition before ratification by significant Annex I countries, namely the U.S. Secondly, some researchers in the field regard CERs to be part of the basic approach that will be necessary if the Kyoto Protocol commitments are to be met, while others contend that the possibility of well functioning global permit market being established before the end of 2008 to be far less likely.[57] Finally, and more to the point, CERs represent the only way to bank early credits (and achieve early emission reductions), thus increasing the incentive for the initial financial investment that helps lay the foundation for a tradable permit market. We turn now to the analysis on CERs.

Given that CERs are used to 90 per cent of their full potential before the first commitment period begins and to their full potential shortly thereafter, the total value of the CDM market — at 50 per cent volume of the potential total tradable permit market and a service fee of 15

[57] Among several of the most probable scenarios, "Annex I trading plus the CDM is the most consistent with the Protocol a it currently stands [in mid-1998]" (Manne and Richels, 1998, p 5). In a special edition of *The Energy Journal* in which the leading modelers from around the world were asked to run analyses on emission reduction scenarios the editors write: "virtually all of the modeling teams were uncomfortable running the Full Global Trading scenarios as a realistic outcome of the current negotiating process; there is simply not enough time between now and the first budget period to agree on the design an trading regime involving all the participant in the UN Framework Convention on Climate Change" (John P. Weyant, A Special Issue of *The Energy Journal: The Cost of the Kyoto Protocol a Multi-Model Evaluation*, IAEE, 1999), p. xxx.

per cent of the total value of transactions — is estimated to be approximately USD 18 billion (USD 98) per annum with the average price per ton of carbon dioxide at about USD 30. If a pattern of distribution similar to the global trade scenario is assumed, China is expected to gain approximately USD 8 billion, FSU USD 4.5 billion, India USD 2.1 billion, with most of the remaining USD 3.2 billion going to Latin America and Africa.

Table 4.5. Range-Based Estimated Value of Emissions Reduction Market, Various Scenarios/CDM inclusive (Billions USD 1998)

Annex I Trade	Permit-Based Global Trade	CDM*	Year
USD20.1-USD4.5	USD17.28-USD34.2	USD9.5-USD18.0	2010
USD23.7-USD29.4	USD25.00-USD52.7	.	2020
USD 9.6	USD 38.0	.	2010

* Assumes 50 per cent of total market share of global trade at 15 per cent per ton average fee;

Net averaged value of CDM market in 2010 (across GE and macroeconometric models) is approximately equal to 10.775. However, this gross estimate does not take into the account the percentage of CDM surcharge

In general, our findings and a number of the most thorough analyses suggests that widespread trade, governed by well enforced property rights, will result in the largest reductions in CO_2 and other related climate changing gases at the lowest economic costs. A second best 'diversified approach' — for example based on an even division of: 1) reductions (imports) from tradable permits; 2) CERs; and 3) domestic abatement — may not have as significant impact in terms of environmental gains as compared to widespread trade, but may help make it possible to overcome some of the initial political and economic considerations that have hindered negotiations.

CONCLUSION: OPPORTUNITIES FOR CLIMATE PROTECTION

Annex I and non-Annex I countries both have incentives to cooperate in efforts aimed at reducing carbon dioxide emission and protecting the climate. Non-Annex I countries are likely to receive significant capital flows from CDM projects, for example, while Annex I countries can reduce the costs of meeting their environmental objectives by billion of dollars. Most industrialized countries have agreed to work together towards addressing global climate change. Years of negotiations have manifested an international agreement that can work.

The extent of developing countries' interest and participation in helping to reduce GHG emissions via trading is a critical element for the success of the emissions reduction market. Slowly rising to this occasion, developing countries that have traditionally opposed flexibility mechanisms such as those outlined the Protocol, are now no longer bound uniformly to that policy position.

Firms generating new reductions through sequestration or CDM projects, intermediaries who trade in carbon emissions reductions and facilitate trading for others and governments and non-governmental organizations purchasing allowances in order to retire them early, are all likely to be players in the future carbon market. Expanding the market for carbon and, thus, minimizing the transactions costs of carbon emissions trading and increasing the efficiency of trade depends on the development of experience and the expertise of independent third-party intermediaries facilitating and developing the supply of carbon credits. These trades of greenhouse gas emissions credits will remain speculative until a trading system is established internationally.

According to a background paper by the Australia Institute (1998), the costs of CDM-generated allowances will increase over time as cheaper credits (generated by lower-cost projects) are purchased first. Thus our finding, while perhaps holding for a decade, may be conservative over a longer period of time. In the long run, however, as technology increasingly allows businesses to lower abatement costs, the supply of surplus allowances will increase and demand for allowances and hence their price within the carbon market will drop. If the supply of allowances is too generous, the pressure for technological solutions to greenhouse gas emissions will be lessened (Clive Hamilton, The Australia Institute, 1998). The industry technological response to the sulfur dioxide emissions limitations indicate that technology has a possibly strong role in reducing the costs of compliance with abatement requirements.

Reducing the price or allowances in the carbon market has important implications in the negotiations on implementation of the Kyoto Protocol. Lowering the costs of compliance with emissions reductions requirements makes emissions reductions much more politically feasible, which, in turn, would generate greater demand for future emissions reductions. For those who already hold emissions reductions credits, these credits would become assets whose value appreciates over time, particularly near the end of the first commitment period, when firms realize they miscalculated and scramble to meet their emissions reductions requirement, drive the prices up, and make supplies more scarce.

While the global emissions trading market will not emerge overnight, the anticipated response to future policy shifts can be seen in emerging market activity. Clearly, the extent of the market for carbon will depend, to some degree, on top-down decisions still to be negotiated. Yet the market is emerging today, as the finance and development of carbon credits is already occurring. As the appropriate institutional arrangements are created, these markets are expected to expand. A limited trading project involving the Annex I countries will probably be the first trading mechanism developed, followed by a gradual global expansion. The financial gains will probably be shared by the first parties to enter the limited, Annex I-only trading scheme. Gradually, the rents will be dissipated as others follow, implying a significant competitive advantage to early entrants into the carbon trading market.

REFERENCES

Austin, D. and Faeth, P. (1999) "How Much Sustainable Development Can We Expect From the Clean Development Mechanism?" World Resource Institute, Climate Protection Initiative, November 1999: Washington, D.C.

Bohm, P. and Larsen, B. (1994). "Fairness in a Tradable-Permit Treaty for Carbon Emissions Reductions in Europe and the former Soviet Union". The Economics of Environmental Protection: Theory and Demand Revelation. Bohm,P.: New Horizons in Environmental Economics series. Cheltenham, U.K. and Lyne, N.H.: Elgar. Previously published in 1994.

Cooper, A., Livermore, S. and Rossi, V. (1999). "The Economic Implications of Reducing Carbon Emissions: A Cross-Country Quantitative Investigation Using the Oxford Global Macroeconomic and Energy Model." The Energy Journal, Special Issue: The Costs of the Kyoto Protocol: A Multi-Model Evaluation, Cleveland, Ohio: International Association for Energy Economics, pp: 335-367.

Ellerman, D., Jacoby H.D. and A. Decaux. (1998). "The Effects on Developing Countries of the Kyoto Protocol and Carbon Dioxide Emissions Trading", Policy Research Working Paper 2019, December 1998, World Bank, Washington, D.C.

Ellerman, D. and A. Decaux. (1998). "Analysis of Post-Kyoto CO_2 Emissions Trading Using Marginal Abatement Curves", Massachusetts Institute of Technology Joint Program on Science and Policy of Global Change, Report No. 40.

C. Figueres. (1999) "How Many Tons? Potential Flows Though the Clean Development Mechanism", CSDA Reports and Publications, 11/23/1999: Center for Sustainable Development of the Americas.

Gusbin, D.; Klaassen, G. and Kouvaritakis, N. (1998) "Costs of Ceiling on Kyoto Flexibility". Working paper of IIASA (Austria), IPTC, World Trade Center (Spain) and CoHerence, Belgium. Corresponding author: Klaassen, IIASA, Schlossplatz 1, 1-2361, Laxenburg, Austria;

Haites, E. (1998). "Estimate of the Potential Market for Cooperative Mechanisms 2010." Toronto: Margaree Consultants, September 1998.

Hamilton, C. (1998)."The Evolution of Global Market for Greenhouse Gas Emissions Allowances, August 1998, Australian Institute, Australia:.

Holtmark, B. and Alfsen, K. H. (1998). "Coordination of Flexible Instruments in Climate Policy", November 26, 1998, CICERO, Oslo, Norway.

Jepma, C. J., Van der Gaast W. and Woerdman, E. (1998), "The Compatibility of Flexible Instruments under the Kyoto Protocol", Dutch National Research Program on Global Air Pollution and Climate Change, Report no. 410 200 026, October 1998, Netherlands: Patersold.

Kosobud, R.F.; Daly, T.A.; Southe, D.W. and Quin, K.G.(1994). "Tradable Cumulative CO_2 Permits an Global Warming Control", *The Energy Journal*, International Association for Energy Economics, 1994 Cleveland, Ohio:, 1994.

Larsen, B, and Shah A., (1994)."Global Tradable Carbon Permits, Participation Incentives and Transfers" Oxford Economic Papers, No. 46, UK: Oxford, 1994.

Lile, R.; Powell, M. and Toman, M. (1998). Implementing Clean Development Mechanism: Lesson from US Private-Sector Participation in Activities Implemented Jointly. Resources for the Future, November 1998, Washington D.C.

Manne, A. S., and Richels, R. (1999). "The Kyoto Protocol: A Cost Effective Strategy for Meeting Environmental Objectives?" The Energy Journal, Special Issue: The Costs of the Kyoto Protocol: A Multi-Model Evaluation, Cleveland, Ohio: International Association for Energy Economics, pp:1-24.

McKibbin, W.; Ross, M.; Shackleton R. and Wilcoxen, P. (1999). " Emissions Trading, Capital Flows and the Kyoto Protocol", The Energy Journal, Special Issue: The Costs of the Kyoto Protocol: A Multi-Model Evaluation, Cleveland, Ohio: International Association for Energy Economics, pp: 287-335.

Nentjes, A. Verhandelbare "CO_2-emissierechten" , (1998). Verhandelbare Rechten Joint Implementation: de Institutionele Aspecten, TME, (In Dutch)

Reilly et.al. (1999). "Report No. 45: Multi-Gas Assessment of Kyoto Protocol". Massachusetts Institute of Technology, Joint Program on the Science and Policy of Global Change"

Repetto, R. and Austin, D. (1997). "The Costs of Climate Protection: A Guide for the Perplexed", World Resources Institute, 1997, Washington D.C.

Rose, A., and Stevens, B. (1997). "The Efficiency and Equity of Marketable Permits for CO_2 Emissions", Resource and Energy Economics. "The Economics of Global Warming", Tietenberg, T. (ed)Cheltenham, U.K. and Lyme, N.H.: Elgar, 1997 (previously published in 1993).

Vrolijk, Christiaan. 1999. "The Potential Size of the CDM". The Paper by the Energy and Environment Program, Royal Institute for International Affairs, London (research paper)

Weyant, J. P., (1993). "Costs of Reducing Global Carbon Emissions," Journal of Economic Perspectives, Vol. 7(4), p. 27-46, Fall 1993.

Weyant, J. P., Jacoby, H.; Edmonds, J.; Richels, R. (ed.), (1999). The Energy Journal: The Costs of the Kyoto Protocol a Multi-Model Evaluation, Special Issue, Cleveland, OH: International Association for Energy Economics, 1999.

Zhang, ZhongXiang. (1999) "Estimating the Size of the Potential Market for the Kyoto Flexibility Mechanisms" Working paper, Faculty of Law and Faculty of Economics, University of Groningen, P.O. Box 716, 9700 AS Gröningen, the Netherlands.

Post-COP-6 Perspectives:
ZhongXiang ZHANG*

The Morozova and Stuart paper attempts to gauge the potential size of carbon market in the first commitment period by means of examining recent studies. A reading of their paper suggests a number of issues for consideration in appropriately estimating the size of carbon markets. They include Annex 1 countries' baseline emissions; qualitative and quantitative assessments of the role of carbon sinks; and the difficulty from an economic and legal perspective of interpreting and inferring impacts in relation to specific provisions attached to each flexibility mechanism for regulating the extent of their use.

BASELINE EMISSIONS IN ANNEX 1 COUNTRIES

Once the Kyoto Protocol enters into force, the greenhouse gas (GHG) emissions targets will become legally binding. Because emissions in Annex 1 countries are expected to continue to rise under the business-as-usual (BAU) scenario and because the emissions targets will not become binding until the first commitment period, the real reductions must thus be measured against their projected BAU or baseline emissions levels over the commitment period. Accordingly, the mandated reductions from projected baseline emissions levels represent the potential demand in the GHG offset market. In practice, how the needed reductions will take place will depend on the relative differential between the marginal cost of domestic abatement in Annex 1 countries and the international price of emissions permits. But, in theory, the needed emissions reductions reflect the maximum size of the carbon market in physical terms. As potential demand is a starting point for any estimate of the size of carbon targets, the Morozova and Stuart paper should have provided readers a survey of existing estimates for baseline emissions in Annex 1 countries.

To a large extent, the baseline emissions determine the cost of meeting a given emissions target (Zhang, 1997). The larger the size of the gap between the baseline emissions and the Kyoto target, the higher the marginal abatement cost of meeting the target. When net emissions reductions required of the EU in 2010 rise from 27.9 million tons of carbon (MtC) in the case of the low official EU baseline projection to 234 MtC, the median value for the EU baseline emissions estimated by the four economic modelling studies, the autarkic marginal abatement cost in the EU sharply rises to USD 249.9 per ton of carbon from USD 9.1 per ton (Zhang, 2000b). This sharp increase in emissions reductions required of the EU drives up the total Annex 1 countries' demand for permits and hence the market price of permits. Thus, there is a significant increase in demand for the certified CDM (Clean Development Mechanism) credits. As a result, the size of the CDM market increases almost a half in the case of the high EU baseline in comparison with the case of the low official EU baseline projection. In the meantime, the value of the CDM market, that is, the product of the market price of permits and the supply of the certified CDM credits, increases almost one and a half as a result of the increase in both the price and the supply (see Table 1).

* Senior Fellow, Faculty of Economics and Faculty of Law, University of Groningen, The Netherlands.

Table 1: The size and value of the CDM market and the shares of China and India in 2010 under the two trading scenarios under two alternative EU emissions baselines[a]

	No limits	EU ceilings with the however clause
Size of the CDM market (MtC)	420.7 (292.1)	281.7 (195.4)
CDM market (million 1998 USD)	6685.0 (2795.6)	2565.9 (1103.4)
Net CDM market (million 1998 USD)	3831.5 (1565.0)	1433.2 (603.0)

[a] The figures in parentheses are calculated based on the low official EU baseline projection.
Source: Zhang (2000b).

THE ROLE OF SINKS

During climate change negotiations at the COP-6 which ended in November 2000, the Americans were keen on the broadest and most generous definitions of sinks absorbing greenhouse gases in the atmosphere, while the Europeans wanted sharp curbs on the use of sinks. In the end, it had become clear that the two sides no longer disagreed on whether additional land use change and forestry activities in the first commitment period should be included, rather they disagreed over the extent of usage of sinks to meet their emissions targets. This fact alone may have profound implications for the size of the carbon market. On the one hand, allowing domestic sinks to meet targets could have the effect of reducing Annex 1 countries' demand for permits abroad because sinks provide them with less costly abatement options at home. On the other hand, inclusion of sinks under the CDM opens up the possibility in comparison with domestic actions of obtaining even less costly abatement options from the developing countries. Although it is very difficult to indicate which counter-effects will prevail because of a lack of cost data at a macro level, the Morozova and Stuart paper would have enriched the policy relevance at least if a qualitative discussion of implications of the inclusion of sinks had been done.

IMPLICATIONS OF THE SUPPLEMENTARITY CLAUSE

Under the Kyoto Protocol, each of the Articles defining the three flexibility mechanisms carries wording to the effect that the use of the mechanism must be supplemental to domestic actions. Article 6 states that emission reduction units from joint implementation projects should be "supplemental to domestic actions" for the purpose of meeting quantified emission limitation or reduction commitments. Article 12 states that Annex I Parties may use the certified emission reductions from CDM projects to contribute to compliance with "part of their quantified emission limitation and reduction commitments", while Article 17 states that emissions trading shall be "supplemental to domestic actions" for the purpose of meeting quantified emission limitation or reduction commitments. The absence of a precise definition of the meaning of supplementarity within the text of the Protocol has lead to the existing differing interpretations of these provisions. At one extreme, the supplementarity clause could be interpreted simply to mean that domestic actions should provide the main means of meeting Annex 1 countries' commitments, so that any action abroad would be additional to domestic actions. At the other extreme, the clause could be interpreted to mean that any action abroad will be supplemental to whatever domestic actions are taken. This implies that any one Annex 1 country could use the flexibility mechanisms as much as it wished in order to meet its Kyoto commitments. Whether the supplementarity clauses will be translated into a concrete ceiling, and if so, how should a concrete ceiling on the use of the three flexible mechanisms be defined remain to be determined. In my view, the supplementarity clause is of significant policy relevance to the ongoing negotiations on the overall issue of flexibility mechanisms. While the Morozova and Stuart paper does cite results from Zhang (1999), the paper does not pay sufficient attention to this topic. As the topic is important, in that different interpretations of clauses may affect the size of the carbon market considerably, it will be useful to elaborate on the subject further.

To date, there have been many proposals calling for a restriction on the use of flexibility mechanisms. The most representative is the EU proposal. Documented as the Community Strategy on Climate Change (European Union, 1999), the EU proposal calls for limits on both buying and selling countries.

Under the EU proposal, "however, the ceiling on net acquisitions and on net transfers can be increased to the extent that an Annex B Party achieves emission reductions larger than the relevant ceiling in the commitment period through domestic action undertaken after 1993, if demonstrated by the Party in a verifiable manner and subject to the expert review process to be developed under Article 8 of the Kyoto Protocol." (European Union, 1999). This so-called "however" clause allows an importing (exporting) country to purchase (sell) more than the amount defined by the above alternatives if verifiable domestic abatement by that country can be demonstrated. Thus, the "however" clause effectively raises the importing ceiling and allows an importing country to purchase emission reductions from abroad up to 50 per cent of the emission reduction requirement, provided that the country can verify a similar volume of domestic abatement undertaken after 1993.

Using the global model based on the marginal abatement costs of 12 regions, papers by Zhang (1999, 2000a, 2001) have analysed the economic effects of the EU proposed concrete ceilings both on Annex 1 countries and on non-Annex 1 countries. These analyses have clearly shown that, although the US and Japan are firmly opposed to such a restriction, they tend to benefit more from it than the EU, which strongly advocates such ceilings (see Table 2). On the other hand, the EU benefits much more with such a restriction than without it; whereas the US, Japan and the former Soviet Union are made worse off in comparison with the no limits case. Moreover, Zhang's results have shown that the EU ceilings with the "however" clause have less stringent effects on the US, Japan and the former Soviet Union than the EU ceilings without such a clause.

Table 2: The gains in 2010 under the three trading scenarios (%)[a]

Scenarios	United States	Japan	Europea n Union	Other OECD	OECD	Former Soviet Union
No limits	85.2	93.1	0.2	45.3	86.5	100.0
EU ceilings	63.7	71.9	39.2	70.8	66.0	23.5
However clause	79.8	76.5	16.3	63.9	78.4	41.3

[a] The gains are measured relative to the total abatement costs in the absence of trading for the OECD countries or the total benefits under the no limits scenario for the former Soviet Union.
Sources: Zhang (1999, 2000a, 2001).

Furthermore, given that the EU proposal restricts the total demand for permits and thus reduces the market price of permits, it should come as no surprise that such restrictions on the use of flexibility mechanisms are not beneficial to developing countries either as they restrict the total financial flows to them under the CDM as a result of fewer permits sold and lower prices received (see Table 1). For the OECD as a whole the "however" clause is less restrictive than the EU ceilings, and thus allows a significant increase in demand for the certified CDM credits. As a result, the CDM flows under the "however" clause scenario are 1.4 times higher than under the EU ceilings scenario, although they are still less than half of that under the no limits scenario. With respect to the geographical distribution of the CDM flows, China and India are expected to emerge as the dominant host countries of CDM projects owing to the number of low-cost abatement opportunities available in their energy sectors, as well as the sheer size of their populations. This is confirmed in Table 3, which shows that approximately 60 per cent and 16 per cent of the total CDM flows go to China and India, respectively.

However, it should be pointed out that the importance of the clause depends crucially on how well a verification procedure would actually work. Simplifying assumptions are made in the aforementioned papers by Zhang on a cost less process of demonstrating the amount of domestic abatement to be verified. Consequently, the "however" clause relaxes the otherwise very restrictive limits on the use of flexibility mechanisms. In fact, since the counterfactual baseline emissions are never actually observed, verifying any domestic abatement that reduces emissions below the counterfactual baseline emissions will be subject to technical and political disputes. This would thus increase transaction costs. It seems likely that the verification procedure in practice will fall short of the ideal and could limit the extent to which the "however" clause can bring down the cost of meeting the Kyoto commitments. In the worst case, it could even make the "however" clause's promise of relief just illusive.

Table 3: The value of the CDM market and the shares of China and India in 2010 under the three trading scenarios

	No limits	EU ceilings without the however clause	EU ceilings with the however clause
CDM market (million 1998 USD) of which:	2795.6	456.9	1103.4
China	60.3%	59.6%	60.0%
India	15.1%	15.9%	15.5%
Net CDM market (million 1998 USD) of which:	1565.0	244.6	603.0
China	59.9%	59.2%	59.6%
India	15.5%	16.3%	16.0%

Sources: Zhang (1999, 2000a, 2001).

REFERENCES

1. European Union (1999), “Community Strategy on Climate Change: Council Conclusions, No. 8346/99,” 18 May, Brussels.
2. Zhang, Z.X. (1997), “The Economics of Energy Policy in China: Implications for Global Climate Change”, New Horizons in Environmental Economics Series, Edward Elgar Publishing Limited, Cheltenham, England.
3. Zhang, Z.X. (1999), “Estimating the Size of the Potential Market for All Three Flexibility Mechanisms under the Kyoto Protocol”, Report Prepared for the Asian Development Bank under Contract TA-5592-REG.
4. Zhang, Z.X. (2000a), “Estimating the Size of the Potential Market for the Kyoto Flexibility Mechanisms”, Weltwirtschaftliches Archiv - Review of World Economics, Vol. 136, No. 3, pp. 491-521.
5. Zhang, Z.X. (2000b), “The Economic Effects of An Alternative EU Emissions Baseline”, Faculty of Economics and Faculty of Law, University of Gröningen, The Netherlands.
6. Zhang, Z.X. (2001), “An Assessment of the EU Proposal for Ceilings on the Use of Kyoto Flexibility Mechanisms”, Ecological Economics, Vol. 37, No. 1, pp. 53-69.

****

Chapter III

The Development of Post-Kyoto Emissions Trading Schemes in Europe: An Analysis in the Context of the Kyoto Process

Jos Cozijnsen*

EXECUTIVE SUMMARY

In this report, the author discusses some of the ongoing and planned national and regional pilot projects and schemes on greenhouse emissions and reductions trading in Europe. Through this market instrument – one of the Kyoto Mechanisms[1] – Parties to the Kyoto Protocol (1997) can meet part of their greenhouse gas emissions reduction commitments for the period 2008 to 2012[2].

The objective of the discussion is to identify the building blocks of the domestic and regional domestic emissions trading schemes and to assess the consistency and coordination leading to eventually international emissions in the framework of the Kyoto Protocol.

The author examines the main conditions for an effective emissions trading scheme. In particular, the following conditions are assessed in relation to the Kyoto Protocol:

A. Environmental credibility: *does it ensure overall reductions, namely to meet the quantitative Kyoto greenhouse gas emissions limitation obligations?*
B. Compliance mechanism: *does it include rules for accountability and legal standards*?

Based on these conditions the author undertakes a streamlined analysis of the national systems, the market liquidity and linkages with the Kyoto Process.

The following national and regional schemes are discussed in this paper:

- *Denmark*: first CO_2 cap-and-trade scheme (for the energy sector) in the EU;
- *U.K.*: has comprehensive plans for domestic greenhouse gas emissions trading;
- *Norway*: has a plan for domestic emissions trading covering 90 per cent of the sources. Although not an EU member, Norway has major interest in emissions trading together with the EU;
- *Netherlands*: combining emissions trading with joint implementation; and
- *European Commission*: produced a Green Paper on internal EU trading, both as a regional scheme and as a multilateral scheme.

---

* Consulting Attorney, The Netherlands.

[1] The Kyoto Mechanisms are: International Emissions Trading (IET): cap-and-trade between sovereigns; Joint Implementation (JI): financing reductions projects in another industrialized country for credits and Clean Development Mechanism (CDM) financing projects in developing country for credits.

[2] The following greenhouse gases need to be reduced by industrialised countries together with 5 per cent in 2008-2012 compared to 1990: CO2 (in particular through the burning of fossil fuels for energy use), Methane, N2O, HFC, PFC and SF6. The EU as a whole will have to reduce 8 per cent, The US 7 per cent and Japan 6 per cent.

The author concludes that there have been numerous, recent developments in emissions trading schemes in Europe and that these are expected to culminate in real cap-and-trade schemes. In designing the trading regimes, governments and stakeholders are being confronted with the following dilemmas: whether to start with a national or international scheme, whether to prevent state aid cases and GATT/WTO conflicts, whether to adopt cap-and-trade or performance based standards, mandatory or opt-in arrangements.

Domestic schemes are tailor made and tend to meet national political considerations and circumstances. Therefore, cross border trading arrangements ask for an international framework to ensure cooperation on the elaboration of compatible schemes and the development of international arrangements in the framework of the Kyoto Protocol.

Further, the Sixth Conference of the Parties to the Climate Convention (COP-6, November, 2000) will have to take framework decisions on compliance and accountability rules, but will not have to go into details regarding practical designing elements of emissions trading.

INTRODUCTION

One of the objectives of UNCTAD’s Greenhouse Gas Emissions Trading Programme is to contribute to the development of a comprehensive international framework to support the international greenhouse gas emissions and reductions trading provisions of the Kyoto Protocol. Through these provisions – the Kyoto Mechanisms - the Parties of the Kyoto Protocol can make use of market instruments to meet their greenhouse gas emissions reduction commitments.

A number of domestic emissions/credits trading pilots, simulations and plans, some with governmental involvement, others primarily private have been tested since the Kyoto Summit in 1997. In tacking stock of such developments and their compatibility with the Kyoto process, UNCTAD would like to contribute to bilateral and multilateral emissions trading arrangements including mutual recognition of allowances and credits.

In this study, the author discusses selected European (national and regional) emissions and reductions trading pilots and schemes that are in progress. The objective of the discussion is to identify the apparent building blocks of the domestic and regional emissions trading schemes, to assess the consistency and coordination leading to eventually a fully integrated international emissions and credits trading system in support of the Kyoto Protocol’s trading provisions. Central criteria used to evaluate the schemes in terms of compatibility with the Kyoto process are:

- Environmental credibility: *whether schemes ensure overall reductions, namely whether they meet the quantitative Kyoto greenhouse gas emissions limitation obligations?*
- Compliance: *do schemes include rules for accountability and legal standards*?

The author presented the preliminary outcome of the work at the event of the Fourth Greenhouse Gas Emissions Trading Policy Forum, (July 31st – August, 1st, 2000, Denver Colorado).

The author appreciates the valuable comments of reviewers on previous drafts of this paper, including Annie Petsonk, Ali Dehlavi, Bernhard Raberger, Lucas Assunção, Fanny Missfeldt and others.

Nature and scope of the study

The scope of this paper is strategic. Its assessment is intended to be policy and negotiations-relevant. In order to best assist what is basically an iterative, learning process, emphasis in this paper will be on pragmatic factors and the identification of actual opportunities. Research has been short-term and has involved interviews with key actors in the process.

The paper focuses on five principal European emissions/reductions trading developments[3]:
- *Denmark*: first CO_2 cap-and-trade scheme (for the energy sector) in the EU;
- *U.K.*: has comprehensive plans for domestic greenhouse gas emissions trading;
- *Norway*: has plans for domestic emissions trading covering 90 per cent of the sources. Although not an EU member, Norway has major interest in emissions trading together with the EU;
- *Netherlands*: combining emissions trading with joint implementation; and
- *European Commission*: produced a Green Paper on internal EU trading, both as a regional scheme and as a multilateral scheme.

Only the bare minimum and essential elements needed to make emissions trading workable are discussed in this paper[4]. In particular, the paper covers the following aspects:
- Existence and level of the emissions cap;
- The allowance and allocation system, with a view to other climate measures and taxation (related to state aid and competitiveness). Where necessary, discussion will cover the choice between upstream allocation and downstream allocation. Upstream allocations occur mostly at the entry level of the grid, either as tax or as incentives to enhance the amount of renewable energy in the grid. Downstream, for larger or all sources, can lead to energy saving/efficiency, technology innovation.
- Coverage of the system (gases/sources/sector wise);
- Monitoring, reporting, verification, certification;
- Market environment (exchanges, brokers);
- Integration of trading in national policy or Governmental predictability and companies' expectations
- Taking advantage of opportunities and ancillary benefits (air quality, energy market, renewable energy policy, procurement, organised buyers, use of internet);
- Role of NGOs and civil society in general; and
- Accountability in the domestic context (nature of domestic compliance and enforcement systems).

Streamlined analysis

In order to make this analysis useful for negotiators and for the future, the author uses a streamlined analysis – comprising 'environmental credibility' and 'compliance' criteria -- to see how ongoing pilots and plans match with the ongoing Kyoto Process[5].

[3] Other European emissions/reductions trading developments in Europe: German plans for emissions trading between a small group of companies facilitated by the Frankfurt Stock Exchange; plans by the Industry Working Group of the French Interministerial Task Force on Climate Change and *Entreprises pour l'Environnement* for a domestic emissions credit trading scheme. Finland and Sweden launched a cooperation on Joint Implementation. Slovakia and Slovenia are interested in launching (SO_2/CO_2) trading programmes.

[4] Environmental Defense defined the following principles: measurement, transparency, fungibility, accountability, consistency: Cooperative Mechanisms under the Kyoto Protocol: The Path Forward, June 1998.

The analysis encompasses discussion of the following three key characteristics:

Characteristic	Comment
A) National system	***Can it work?*** What is needed in the national system according the Kyoto Process? In the current negotiations this includes so-called *eligibility*; it also includes examination of accountability at national levels, that is, how does the national system provide incentives for compliance as well as enforcement, and what are the related consequences.
B) Market liquidity	***Will it work?*** Will the market deliver the needed cost-effective reductions; is risk management included;
C)Kyoto linkage	***Will it work for the Kyoto Protocol?*** Are trading actors involved in Kyoto process, will the scheme deliver in Kyoto process.

National Systems: can they work?

Without anticipating the outcome of actual discussions in the Subsidiary Bodies and the Sixth Conference of the Parties to the Climate Convention (November, 2000) country opinions appear to concur that sound national systems are needed. With regard to the pre-conditions for participation in the Kyoto mechanisms, some Parties favour an obligatory pre-commitment period review of the national system (based on Articles 5 and 7 of the Kyoto Protocol), while others favour a voluntary technical check, and still others deny the need for such a check beforehand. National systems will have to enable governments to measure and track actual emissions, and to register transactions, including transfers of allowances rendered surplus through emissions reductions. All industrialised countries are obliged under the Kyoto Protocol to have the emissions measurement and reporting systems installed ultimately in 2007. Emissions measuring and reporting, together with systems for registering/tracking transactions in emissions allowances (including reductions), are needed both for a workable and credible emissions trading scheme and for a workable system to evaluate compliance with Kyoto Protocol obligations.

Measurement and reporting of emissions, and reporting of transactions, are the foundation of the systems as well as necessary elements for the integrity of any national system. In the event of failure to report, the national system should assume a maximum level of emissions and penalize the entity for failure to report. The penalty must be high enough that there is no incentive for companies to simply fall into a routine in which they systematically fail to report and instead pay penalties. If an entity fails to report transactions, participation in the mechanisms should be denied. Countries can require reporting of forward and options sales, as well as transfers of allowances from national branches of multinationals to foreign branches. Such reporting can assist countries in maintaining a watch over their assigned amounts, in the event that in the future, the national systems are "backed by" assigned amounts (i.e., the country decides to devolve).

[5] Various sources for this issue include: UNCTAD, "International Rules for Greenhouse Gas Emissions Trading", 1999; Environmental Defense, "Cooperative Mechanisms under the Kyoto Protocol: The Path Forward", June 1998; OECD Information Paper, "Key features of domestic monitoring systems under the Kyoto Protocol", October, 1999; Mechanisms Pursuant to Article 6, 12 and 17 of the Kyoto Protocol; Consolidated text on Principles, Modalities, Rules and Guidelines by the Chairman, October, 2000.

The report will discuss the main institutional arrangements that accompany schemes, in particular:

- *Emissions cap:* is it specific, absolute or relative, using baseline or credits, voluntary or obligatory?;
- *definition of exchange unit*; definition of the cap on total emissions (coverage, etc. – absolute or specific targets, etc);
- *participation of entities* (mandates, approvals and authorisation);
- *allowance system* in relation with other measures in the own (trading) sector and other sectors and instruments (Voluntary Agreements/permits/European IPPC Directive). This includes relation with taxation/levy, state aid and competitiveness;
- *monitoring, reporting, verification, certification, including registry and serialization of the units;*
- *transparency and reporting*. Do tracking systems for emissions include publicly available emissions reporting from entities and governments? Do tracking systems for allowance transfers include on-line real time information; comparability of assigned amount tracking, serial numbers*?*
- *Enforcement system, i.e.* systems for ensuring that entities do not emit more than their allowable levels. These should include legislated penalty systems. The compliance roles of banks, insurers, reserves and use of safety margins is also considered;
- *Role and participation of NGOs and civil society in general.*

Market Liquidity: will it work?

Liquidity of an emissions trading market can be promoted by focussing on:

- *Size of the market:* market of scale, number of actors, price levels, differences in the market, time dynamic (start of market may show large supply, little demand, or vice versa);
- *Coverage*: some or all gases, sources, sectors; role for small companies and multinationals;
- *fungibility of market instruments and stance on cross border trading;*
- *prevention of market power dominance;*
- *governmental predictability and companies' expectations*[6]*- the importance of consistency* (stability)*;*
- *incentives for business and making use of business opportunities:* credit for anticipatory action; relation with commitment to show progress in 2005; opportunities in the energy market, renewable energy policy other national or regional developments, general environmental financial markets;
- *phasing in of the system*: quick entry, early action; early crediting (including voluntary agreements);
- *method of exchange*: use of an exchange, over-the-counter, broker, automated with internet (emissions trade will be more and more automated, in line with environmental e-commerce developments);
- *use of capacity and institutions building* for using Kyoto Mechanisms;

[6] According to IPIECA (June, 2000) the main concerns of the private sector are: participation, ratification, parties' compliance confidence and fungibility of the mechanisms. A study for the Finnish Government listed the following concerns: lack of knowledge within private sector, international discussions not practical; allocation of cap unclear, competition problems, clear governmental role. See also Jos Cozijnsen, "Companies' Perspectives for JI and Emissions Trading under the Kyoto Protocol", Finnish Environment Ministry, July, 1999.

- *role of technology innovation;*
- *risk control*. What is done to prevent leakage, overselling, and how does this interact with similar concerns on the international level.

Link with Kyoto Process: will it work for the Kyoto Protocol?

This can be accomplished through:
- *collaboration* by emissions trading participants with international partners;
- *organisation* of actors;
- *communication* of experiences to FCCC/delegations/observers;
- *stressing the role of ET in implementation of Kyoto Protocol;*
- *relationship with emerging Kyoto liability and compliance systems* and national systems for emissions trading and any other national GHG program - e.g., seller and buyer liability systems at international levels (automatic deduction, automatic discount of tonnes sold by Parties that then go into non-compliance). That is, national systems should be designed to take into account the possibility that international systems will have these elements. That puts the burden on national systems to have good monitoring, registry, emissions tracking systems (ETS) and allowance tracking systems (ATS), as well as domestic enforcement.

ANALYSIS OF EMISSIONS TRADING PILOTS AND PLANS

Denmark: CO_2 quota for electricity sector with cap-and-trade

Key Elements

On May 29th, 2000, the European Commission approved the planned Danish CO_2 quota system for the electricity sector. Electricity contributes 40 per cent to Denmark's CO_2 emissions. The scheme is part of a regulatory reform agreement for the energy sector to implement the EU directives on liberalisation of the markets for electricity and gas[7]. Under the scheme, the state will allocate emissions permits based on average historical emissions (grandfathered) for the period of 2001-2003 to the electricity producers. New entrants will be allocated permits based on objective, non-discriminatory criteria. In order to do this, some portion of each year's quota will be withheld.

The European Commission has indicated that it considers allocation based on historical usage as State Aid under Art 87(1) of the EC Treaty[8]. The Commission further finds that it can approve the State Aid on the basis of Article 87(3)(c), since it will contribute to development of environmental protection. The Commission underlines freedom of establishment, although new entrants are not expected in large numbers owing to the fact that the majority are about 150 per cent over their required energy capacity.

---

[7] Danish Bill on CO2 quotas for electricity production: http://www.ens.dk/uk/energy_reform/bill_no_235.htm.

[8] Article 87 of the European Treaty (ex Article 92) "*1. Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the common market. 3. The following may be considered to be compatible with the common market … (c) aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest.*"

In the Danish electricity sector scheme, an emissions ceiling for the participants is levelled off from 22Mt in 2001, 21Mt in 2002 and 20 Mt. CO_2 in 2003. Emissions in 1997 amounted to 28.9Mt. The emissions quota for each producer will be adjusted, taking into account the national quota, transactions made and permits saved. The partial ceiling leads then to a reduction of actual emissions of the electricity sector with 70 per cent compared to 1997.

The fine for exceeding the quota is DKK 40/tonne (~ USD 5/tonne). Excess permits may be sold to other producers for whom purchase of permits is a cheaper option than paying the fine. Whether the fine has to be paid depends also on electricity prices. If the price of electricity on the energy market is higher than, say 0.18 DKK, electricity might be sold to prevent the fine. With this scheme Denmark intends to invite other member states to set-up similar systems and trade with Denmark.

Interestingly, the recent OECD Economic Survey[9] urges Denmark to speed up making use of cap-and-trade instruments. It says this because firstly, the existence of a widely-varying set of tax rates, with lower rates for heavy energy users, has led to the overall reduction costs increase. The OECD believes the CO_2/tonne abated became unnecessarily high. Secondly, linking cap-and-trade with renewable policy would also render energy subsidies to a "once infant industry that, with a major presence in world markets, has now grown up integrated with the new green certificate system for renewable energy Denmark introduced earlier this year".

Analysis

National System

Cap	23-30 per cent annual reduction of CO_2 emissions compared to 1997 during 2000-2003 for participants
Definition of exchange unit	Tonne CO_2
Participation of entities	Allowances issued to company or via branch organisation
Allowance system	-Annual quota, based on historical emissions ('94-'98), adjusted considering national quota, transactions and savings; -New entrants will be allocated permits based on objective, non-discriminatory criteria
Monitoring, reporting, verification, certification	-Companies have to report annually electricity, heat (special treatment CHP), CO_2 (according calculations). - no special public registry
Enforcement system	Fine, court and penalty system
Role civil society	No NGO involvement

[9] See: http://www.oecd.org/publications/Pol_brief/economic_surveys/denmark-e.pdf.

Market Liquidity

Size of market and coverage	- Electricity sector amounts to 40 per cent of CO_2. A de minimis threshold of the cap-and –trade lies at 100.000 tonnes of CO_2, meaning coverage of 10-15 per cent of the electricity producers, and 90 per cent of electricity related CO_2- emissions. - Excluded is much of CHP. On the other hand one need to admit that many other sectors contribute to CO_2 reductions under CO_2 taxation. - rules will be made for cross border transfers (depending COP-6 outcome) - rules for incorporating cross border transfers in CO_2 allowance will be made
Prevention of market power	- role for branch organisation. In practice, a few consolidated already companies dominate trading
Political environment	- government waits for EU policies, including EU emission trading which will give more opportunities. OECD asked to relax CO_2 taxation in favour of cap-and-trade. - governmental involvement is high
Incentives for business; use of opportunities	- Special treatment for CHP - avoiding small fine - learning cap-and-trade
Phasing in of system	2001; surplus bankable
Method of exchange	Between companies; companies were already trading electricity. Limited market. Against charges an agency may be set-up up. Link with Nord Pool Exchange or brokers expected when trading cross border.
Risk control	- not clear how other sectors will provide reductions and what cap-and-trade brings with regard to the Kyoto commitment.

Link with Kyoto Process

	- Close link to Kyoto ruling; one of the project purposes is to promote the development of a multinational system. - unclear whether rules that apply nationally also apply internationally.

Conclusion

This scheme's importance lies in the fact that it is a precursor among European emissions trading schemes. Its CO_2 quota system, which was agreed politically in March 1999, is intended to establish a platform for cost-effective CO_2 reductions as well as international trade in quotas and emissions reductions under the Kyoto Protocol's project-based mechanisms (Joint Implementation and the Clean Development Mechanism). As coverage and actors (with comparable marginal costs) are limited, the system does not constitute a real cap-and-trade arrangement. The fine too is small and looks more like a tax as it is not expected that reductions could be obtained more cheaply within the sector. Producers cannot buy permits or reductions from other sectors or from abroad. This form of trade would become possible later, as the Kyoto Process proceeds. There exist opportunities for Danish companies to link CO_2 trade with the Baltic or EU energy markets.

With regard to enforcement, the small penalty system embodies the risk that an economically rational emitter will continue to emit, and later pay the penalty of DK40/ton. Accountability for reductions is absent from the Danish scheme.

No use is being made of public registries. The trade is seen as a bilateral scheme between companies and government, with a dominant role for the government. NGO involvement is limited.

U.K.: Emissions Trading Group

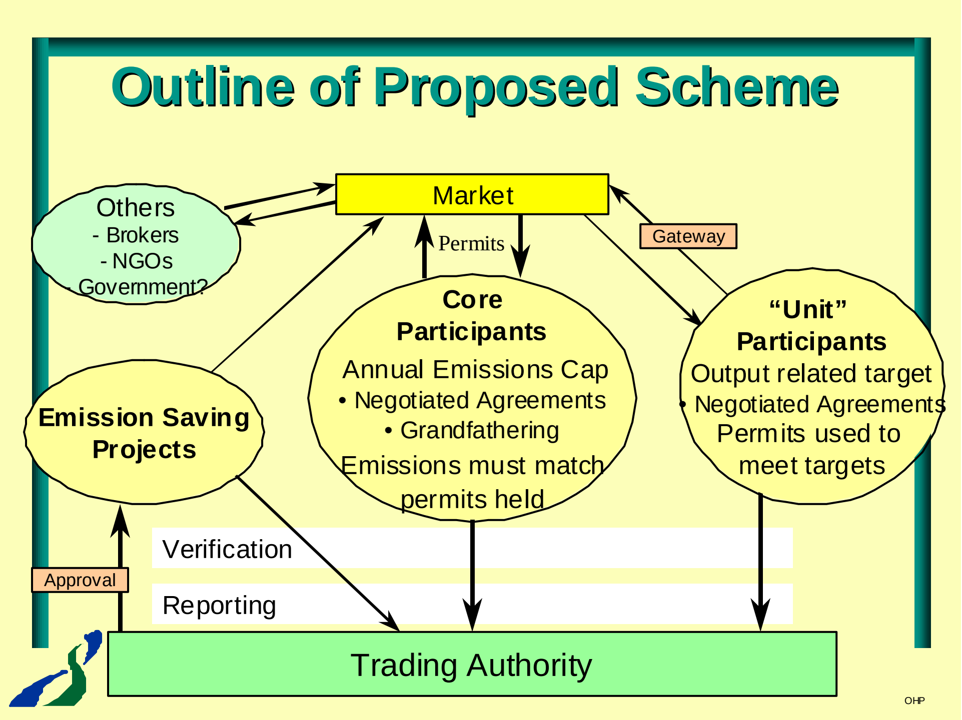
Key Elements

In March 1999, the UK Government announced a plan to introduce a Climate Change Levy (CCL) by April 1st, 2001. The plan includes a tax for industrial customers on electricity at a rate of 0.6 pence/kWh, and coal and gas at 0.21/kWh. Certain industrial sectors would be allowed a significantly lower tax rate in exchange for undertaking negotiated agreements between those sectors and the Government to improve their energy efficiency, including through carbon trading. The industrial sectors that are eligible for this reduced tax include: Steel, Aluminium, Chemical, Paper, Ceramic, Food and Drink, Glass, Cement, and Foundries. The CCL negotiated agreement will detail (a) the installations covered, (b) the savings target, (c) arrangements for monitoring, reporting and auditing, and (d) arrangements for the sectors covered by the agreement to share out the target. Trading will be allowed within and between sectors. Firms within a sector, with their trade association, will decide how to allocate the negotiated sector target between them.

In response to the Government's CCL proposal, the Confederation of British Industry (CBI) and the Advisory Committee on Business and the Environment (ACBE) launched an initiative to design an industry-wide pilot emissions trading scheme, which could be succeeded by an international emissions trading system. The CBI and CCL jointly launched the Emissions Trading Group (ETG) in June 1999, involving representatives from some 40 firms and trade associations. The ETG council comprises board-level representatives from all the firms involved plus environment, trade and treasury Ministers.

The ETG proposes the following:

- Firms agreeing to an absolute annual greenhouse gas emissions limit will receive permits to match that limit (‘absolute sector’).
- Firms with pre-existing Climate Change Levy agreements based on energy efficiency per unit of output (rather than on an absolute level of GHG emissions) would not receive permits, but would be allowed to participate in trading (‘unit sector’).
- Firms investing in projects to reduce GHG emissions would receive credits that could be sold in the market.
- Permits not needed to meet a firm’s target could be banked for use in future years. However, there would be a restriction on the amount of banked permits that could be used during the Kyoto commitment period of 2008-2012.
- Via a 'gateway' extra reduction units are brought into the system. The gateway is a mechanism to ensure that permits sold from the ‘unit’ sector do not swamp the ‘absolute’ sector.



Source: DETR, U.K.

In the March Budget Statement, the UK Government confirmed its support for the ETG's proposals, saying: "…the Government believes that emissions trading has a key role to play in reducing greenhouse gas emissions. The Government is keen to have an operational scheme up and running as soon as possible." Following this, in March 2000, the UK launched its draft climate change programme[10]. The draft programme sets out a substantial, integrated package of policies and measures, including: "the climate change levy; agreements with energy intensive sectors to meet challenging targets; and extra money for improving business energy efficiency and the use of low carbon technologies – up to USD 220 million in the first year and carbon trading. Companies that sign up for binding agreements with the government to reduce GHG will receive CCL rebate up to 80 per cent."

The Government's seriousness is proven by the fact that the government promised in July 2000 that it would provide 30 million pounds sterling to finance incentives for companies to cap carbon emissions. This was the amount requested by the ETG. Although the government has not decided what form the system would take, it is likely to be an auction mechanism in which companies will bid for funding in return for promised cuts in emissions. Once the caps have been set, companies that succeed in making more than their agreed cuts will be able to sell the surplus to companies that find it more difficult or expensive. A secondary market in financial derivatives is also likely to develop.

ETG is now considering issues like: form and scope of financial incentives; monitoring, reporting, verification and certification processes; how the electricity sector might best participate in a domestic trading scheme; the allocation procedure, and the treatment of new entrants; trading between the climate change levy agreements and a wider scheme; and, compliance, registry, and exchange practices.

[10] See: http://www.environment.detr.gov.uk/climatechange/draft/summary/index.htm. There is also a new web site providing information on the U.K.'s domestic emissions trading pilot: http://www.environment.detr.gov.uk/climateoffice/index.htm.

Analysis

National System

Cap	-To be negotiated; a hybrid system involving core group with caps is expected; other IPPC sectors with performance standards, also providing reduction units; - Officials expect a reduction of between 0.5m and 2m tonnes by 2010 through the scheme
Definition of exchange unit	Tonnes CO_2
Participation of entities	Entities are companies
Allowance system	- Part of negotiating agreement; annually issued. - Allowances for the following will be issues in July 1st, the year before
Monitoring, reporting, verification, certification	- Government will later specify rules for calculating CO_2 emissions and assigned amounts; in 2004 a formal review by the Government is foreseen. - ETG is still considering these aspects - independent verification foreseen
Enforcement system	To be developed
Role civil society	Not foreseen

Market Liquidity

Size of market and coverage	Large, and differentiated coverage;
Prevention of market power	In line with internal market rules
Political environment	- Government will introduce the climate levy. Trading works as a carrot. - Government is interested in full Annex I Countries emissions trading (vs. EU level), but wants full national experience first.
Incentives for business; use of opportunities	- Rebate of the clime levy - incentive for delivering reductions
Phasing in of system	Expected for April 2001
Method of exchange	The International Petroleum Exchange (IPE) is interested in launching a GHG exchange, including futures or derivate exchanges with registry, regulator, clearing mechanisms and compliance departments
Risk control	A 'gateway' brings in extra reduction units. Not clear how that influences the national cap.

Link with Kyoto Process

	ETG stresses the need for gaining early experience (starting 2001) with trading before agreeing on international rules. This could create unresolved questions as to which of the two caused the other. For the second pilot phase after 2003, rules will be set in 2001, taking into consideration the experience, status of renewables and the rules agreed at COP-6.

Conclusions

Factors that are critical to success include liquidity and the number of participants. The UK programme appears to be broad with large coverage and fungibility, but functional aspects are absent, there is also not much focus on CO_2 components or linkage with the domestic CO_2 target. Electricity generators are still excluded.

DETR expects a trade by 2010 of 500,000 to 2 million tones of CO_2. Although it is clear that the UK Government is focused on full Annex I Countries emissions trading, its activities underplay relations with EU emissions trading.

The author foresees a problem arising for the circulation of UK trading allowances outside of the EU, while the EU is not in compliance with its own commitment.

Norwegian plan for domestic GHG trading

Key Elements

A Parliamentary Commission has recently completed the report outlining a system for domestic emissions trading in greenhouse gases[11]. The Commission recommends a system that would cover as many sectors and sources as possible, and an obligation for those sectors that are not included to surrender quotas to the authorities starting in 2008. The system could include nearly 90 per cent of Norway's total emissions. The Commission could not reach agreement on the question of whether there should be ‘grandfathering.’ It is very likely that all sectors would have to pay the full market price for quotas. Should there be ‘grandfathering’, for instance, sectors exempted from a CO_2 tax of 11-44 USD per tonne CO_2, a base year should be chosen between 1990 and 1998. The allocation should be downstream where feasible - in line with the OECD’s Polluter Pays Principle (PPP) - and upstream for producers, importers or wholesale transactions. Other sectors should be made to reduce emissions, including the metallurgic industry, petrochemicals industry, oil refineries, and transport and processing installations for crude oil.

Coverage: the system should apply to all greenhouse gases listed in the Kyoto Protocol and for around 90 per cent of the Norwegian emission sources. New entrants will have to purchase quotas through a domestic trading system or the flexible mechanisms. Banking should be allowed. The domestic emissions trading system should be linked to an international emissions-trading system, joint implementation and the Clean Development Mechanism. In order to gain experience, the principal provisions of the system should be made binding as soon as possible. The possibility of extending a domestic scheme to Nordic Countries or EU remains open.

The Norwegian Pollution Control Authority (SFT) has backed these plans in May 2000. It urges introduction of the system "as soon as possible". The agency recommends that reasonably precise national targets be set for domestic emission reductions. The report's authors write that “in order to ensure cost-effectiveness, the quota system should include as many emission sources as possible.” Nevertheless, the authors also note that for sources such as nitrous oxide, methane from agriculture and landfills and HFCs, regulatory measures might be more appropriate “for the time being”. Quota obligations should be imposed as close to the “owner” of emissions as possible; but for carbon dioxide emissions from combustion “the quota obligation will generally have to be imposed on the sales or import chain”. Additional measures should include “voluntary quota obligations” for large transport companies, airlines, ferry companies and local authorities.

[11] Norwegian Ministry of the Environment: “A Quota System for Climatic Gases: An Instrument to Meet Norway’s Commitments Under the Kyoto Protocol”. NOU 2000:1, www.odin.dep.no

Efficient reporting and control and sanctions systems to secure compliance are essential. SFT says it is "prepared to take the responsibility for establishing and operating such a system". The importance of work on reporting and control is stressed by a recent publication. A report produced by the auditor general's office notes that in 1998, 252 industrial firms, representing 59 per cent of enterprises granted emissions licences by the SFT, reported that they had exceeded the terms of those licences. In routine spot checks, 41 per cent of companies visited by SFT inspectors were found to be committing violations. In the public sector, of 86 municipal sewage plants inspected, 49 were found to have exceeded pollution limits[12].

Analysis

National System

Cap	To be decided
Definition of exchange unit	Ton CO_2 equivalents
Participation of entities	Companies will participate
Allowance system	All sources or upstream
Monitoring, reporting, verification, certification	Strengthening the reporting and control routines should start early; objective is to have a high level of emissions control and data.
Enforcement system	To be enhanced to keep overall emissions within cap
Role civil society	Not foreseen

Market Liquidity

Size of market and coverage	- As large as possible, covering all GHGs (gearing at 90 per cent of the sources); - Cross border trade is necessary to provide the allowances needed; - Sources can make use of JI and CDM
Prevention of market power	
Political environment	Government feels the necessity for international emissions trading. Would like to join EU experiment for market liquidity purposes Norwegian Employers Organisation (NHO[13]) believe a trading scheme needs: voluntary commitments by companies, open for all, all gases, national legal framework, cross border trades, no tax or measures and banking from pre-commitment. Crediting for early action.
Incentives for business; use of opportunities	Tax rebate
Phasing in of system	Quota system is foreseen for 2008; earlier phase-in depends on international agreements.
Method of exchange	
Risk control	

Conclusions

Norway currently generates almost all its electricity from clean hydropower. But further hydro development is not popular because of its effects on the landscape. Importing electricity generated abroad by coal-fired or nuclear power plants are seen as even more environmentally unsound. This underlines the need for Norway to enter into a cross border-trading scheme and to find innovative solutions such as utilities compensation or GHG emissions by CO_2 storage.

[12] See Ends Daily News, June 23rd, 2000.
[13] NHO, Information Note, March 16th, 2000.

The author finds the option of downstream allocation preferable; and notes that negligence on monitoring the emissions could undermine thorough cap-and trade regime.

The Netherlands' Emission Reduction Unit Procurement Tender (ERUPT)

The Netherlands is planning to meet 50 per cent of the reduction commitment under the Protocol domestically and 50 per cent by making use of the Kyoto Mechanisms (total reductions due: 250 million tonnes of CO_2; current levels 17 per cent above 1990). In the pilot phase for Joint Implementation, a number of projects have been initiated; verifiers are now undertaking audits. At the moment energy intensive companies have through a covenant established agreements on energy efficiency benchmarking and the question of voluntary agreements from other companies. This fact and the JI experience have meant that the private sector is more interested in undertaking projects with credits than to accept emission caps with trade. The recently issued Emissions Reduction Tender is a follow up (see 'Elements' section below). Nevertheless, companies see the attractive side plus the attention the instrument receives from major players. The Dutch government realized that in the longer run the EU, and thus the Netherlands, would have to include emissions trading as instrument to churn out emissions reductions.

With regard to GHG emissions trade the following developments are of interest:

- The Netherlands will soon launch a *NOx reduction scheme* that would make companies pay a charge in a fund, while others install reductions units and receive financial compensation from that fund. There is no cap, but a NOx concentration level for the sector(s). The regulating body wants to ensure that cost-effective NOx reducing measures will be taken and that investment proposals reflect real prices. Because of this, the author believes that this guided market cannot be seen as a full cap-and-trade market instrument; however, it shows the first signs of the Netherlands' search for market instruments that fit in the national policy framework.
- Natsource together with RAND developed for The Ministry of Economic Affairs *tools for a* CO_2 *emissions trade scheme in the Netherlands*; the proposals were presented to the private sector in July 2000. A recently installed Commission of Stakeholders will provide advice on the feasibility of a CO_2 emissions trade scheme for the sheltered sector (due October, 2001).
- The Environment Ministry is preparing a CO_2 *reductions trade scheme:* consumers pay for reductions to be made by companies or for CO_2 sequestration; companies can buy these reductions. The consumers receive a rebate on the energy tax in return.
- The *Social Economic Council advised the government to participate in* CO_2 *emissions trading at EU level* instead of at national level, other than for testing, and not to start reductions trading, because of the monitoring aspects and higher costs.
- The *Emission Reduction Unit Procurement Tender (ERUPT*)[14] tender is set up to promote investments in CO_2 reduction projects by companies, from which the government can buy a share of the credits, the emissions reduction units (ERUs). Since these projects will be taken under an umbrella agreement with CEE governments, this tender has aspects of emissions trading. Parties to the Memorandum of Understanding (MoU) anticipate a surplus from the assigned amount the host country will have during the commitment period (2008-2012). (see figure 1)

[14] See: www.senter.nl/erupt

- December 99, *the Dutch Environment Ministry and the New Jersey (US) Environment Protection Department signed an 'Aide Memoire' for cooperation on climate change*. One of the topics is to identify GHG trading projects in both directions and to test an ERUPT or comparable project.

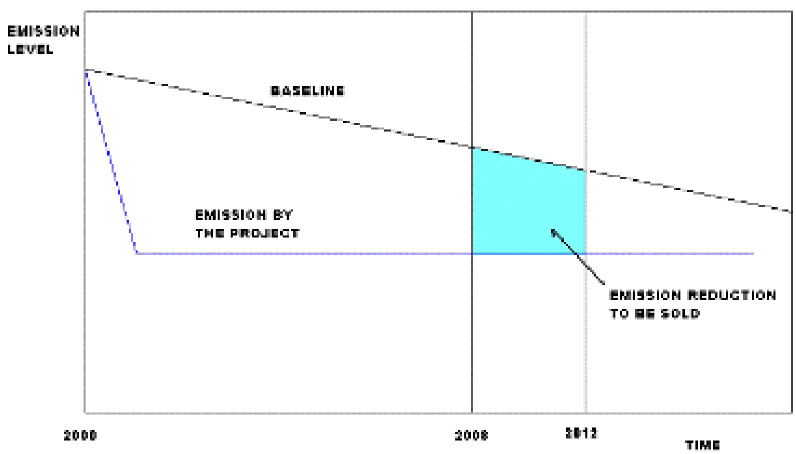
Elements of the Emission Reduction Unit Procurement Tender

An *ERU* has been defined as the reduction or sequestration of GHG emissions by 1,000 kilograms of CO_2 or CO_2- equivalent resulting from a project aimed at reducing man-made emissions during the commitment period (2008-2012). The Netherlands will not purchase emission reductions generated before 2008. The project must be in operation and generate ERUs during the period from 2008 to 2012.

The governments of Bulgaria, Romania and Slovakia have signed an MoU in which they agree to transfer amounts of future JI credits to the Netherlands. More MoUs are being prepared. No formal price limit will apply to Claims on ERUs. As it will be the first time ever for Claims on ERUs to be traded, market prices cannot easily be set. Senter International has estimated that the market price for an ERUs will come in a USD 4.5 - 9 range. The size of a project offer should be at least 500,000 ERUs. Guidelines for determining the baseline are available for the estimation of the GHG emissions in the period from 2008 to 2012. A baseline study must be validated in advance by one of recognised independent verification organisations. DNV, KEMA, KPMG, PriceWaterhouseCoopers, SGS Agro Control have been accredited for that exercise.

After consultations with the European Commission, The Netherlands decided to give ERUPT the format of a European Procurement Tender and to buy only the credits, instead of financing projects. The government expects that this approach will not create a state aid issue.

The Netherlands Government is probably correct in its assessment, although WTO's MFN principle (Most Favoured Nation) prohibits members from discriminating between like goods from different WTO members. It can be the case that by creating the umbrella agreements with some governments, including precise guidelines for projects, others are discriminated against and prevented from bringing forward ERUs from other host countries or meeting other guidelines.



(source: Senter, Netherlands)

ERUPT presents an interesting *capacity building challenge* for CEE countries. The countries participating in the program must have national capacity to allocate assigned amount units (AAUs) to baseline emissions of projects, since, even if the projects are successful and the ERUs (i.e., surplus AAUs) are transferred, the host countries will need to hold sufficient AAUs to cover the remaining emissions of the projects if the host countries are to be in compliance with their Kyoto Protocol emissions limitation obligations, according to Articles 3.10 and 3.11 of the Kyoto Protocol. (That is, in the diagram above, host country must allocate AAUs to cover all “emissions by the project” for the period 2008-2012. If the project is successful, the host country may transfer AAUs thereby rendered surplus (blue shaded area). However, a host country will need to hold onto AAUs sufficiently long to cover the rectangular area below the blue shaded area). This implies that host countries will need, more than simply a project pipeline, a national AAU allocation system, so as to ensure their compliance with Kyoto Protocol. Host countries are beginning to realize this, and will welcome further support to develop applicable national capacities. The Netherlands intends to support institutional set up, staff and capacity building and organised seminars on JI and ERUPT in Bucharest and Sofia in the Autumn of 2000.

Analysis

National System

Cap	- There is no CO_2 cap for sectors/companies yet; government favours energy efficiency targets and no specific cap on industries; - The NOx scheme uses an overall NOx concentration level as target.
Definition of exchange unit	1 ERU is 1,000 kilogram of CO_2 or CO_2- equivalent, which should ultimately be subtracted from host country's AAUs.
Participation of entities	Indirect: government acquires ERUs from other countries; entities invest/install projects
Allowance system	Under discussion (by Member State or EU system).
Monitoring, reporting, verification, certification	- Dutch Guidelines will follow the FCCC; verifying companies have been accredited. Verification, methods used for evaluating Dutch AIJ projects are used as example for World Bank PCF
Enforcement system	Based on voluntary agreements between government and branches; no penalties.
Role civil society	Not yet foreseen, although NGOs were involved in the AIJ pilot phase

Market Liquidity

Size of market and coverage	NOx scheme will cover most sectors
Prevention of market power	Regulator in NOx scheme will approve price and ensure cost-effective technology investment, explicitly to prevent dominance by the few larger participating companies.
Political environment	Government and business are locked in on the energy efficiency avenue. This can only be opened on the event of an EU CO_2 tax or EU emissions trading scheme.
Incentives for business; use of opportunities	- ERUPT provides incentive for reduction investments - NL energy sector interested in participating in EU emissions trading - government neglects opportunity links between energy market and market instruments for CO_2 reductions
Phasing in of system	First ERUPT tender must be finalised in this cabinet period.
Method of exchange	Governing body approves price and ensure reduction investments
Risk control	- voluntary nature of companies' commitments risk under-compliance and over-selling; - ERUPT risk is that projects credits are being sold and devaluated later, when the host country's emissions are out sizing the assigned amount emissions.

Link with Kyoto Process

	- ERUPT is meant to contribute to the Kyoto target and to prepare the use of Kyoto Mechanisms. Government will report; - Companies are only called upon their financial interest not upon Kyoto contribution and without a link with an emissions cap; this can make cross-border trades problematic and can distort level playing field.

Conclusion

The Netherlands ERUPT reflects the Dutch experience with JI/AIJ and the general preference, also within the private sector for project-based options. Nevertheless, in the rush towards more ERUs, larger projects and less transaction costs, one can see emissions trading elements slipping into the Dutch scheme. Considering the small scale of the country, its open economy, plus the Social Economic Advisory Council's preference for EU-wide emissions trading, one can expect the Netherlands to be among the first interested Member States to join an EU-wide emissions trading scheme, especially when it starts with CO_2 and energy players. The positive Dutch experience with voluntary agreements, monitoring and verifying by accredited auditors might help. The Netherlands to monitor and register carefully the emissions and transfers once they are evolving

Green Paper on Greenhouse Gas Emissions Trade within the European Union

Key Elements

The European Commission published in March 2000 a climate action plan (ECCP) and a Green Paper to consult on greenhouse gas emissions trading within the European Union[15]. The European Commission plans to commence emission trading within the Community by

[15] Green Paper on GHG emissions trading within the EU, COM (2000)87, http://europa.eu.int/comm/environment/docum/0087_en.htm.

2005 in order to gain experience before full international emissions trading starts in 2008. Both the ECCP and a Green Paper are aimed to prepare the European Union for the ratification of the Kyoto Protocol after the 6th Conference of the Parties, scheduled for late-November 2000. Although many in Europe have voiced strong opposition to emissions trading in the past, the Commission hopes its Green Paper will "launch a discussion on GHG emissions trading within the European Union, and on the relationship between emissions trading and other policies and measures to address climate change." According to the Commission, GHG emissions in Europe have been increasing rather than decreasing over the past few years.

Without a reinforcement of policy measures, including emissions trading, recent reports show that it is unlikely the EU will be able to reduce GHG emissions 8 per cent below 1990 levels between 2008 and 2012[16].

This intention is confirmed by the June 2000 Council of Environment Ministers[17]. The Council recognises the several emissions trading developments in the EU and stresses the need for emissions trading schemes that are compatible with emissions trading under the Kyoto Protocol and meet internal market requirements.

The Green Paper builds upon a number of conditions already covered in previous Communications, including:

- initiating a limited emissions trading scheme by 2005 within the Community to enable "learning-by-doing" prior to the Kyoto Protocol's emissions trading (from 2008);
- to start with CO_2, the most easily and accurately monitored of the greenhouse gases;
- the actors most suited to start emissions trading are large fixed point sources, which account for almost half of Community CO_2 emissions;
- to ensure compatibility between any Community scheme and emissions trading under the Kyoto Protocol; and
- envisaged sectors (total amounting for 45.1 per cent of EU emissions) for GHG trading are: electricity sector (24.9 per cent of EU emissions), iron, steel, refining, chemical, glass, cement, and paper/pulp. This is another picture than the IPPC sectors and mainly the large sources. Other sectors can opt-in by agreeing a certain cap.

In all other respects, the Green Paper leaves options open, although makes a good case for a strong Community role. The questions focus on which sectors should be included initially in any Community emissions trading system? What level of diversity is possible between Member States? How should allocations be made to companies within the emissions trading system? How compatible is emissions trading with other policies and measures? And what are the respective roles for the Community and the Member States in ensuring robust compliance and enforcement? In the end of the day it is about liquidity, political fate of CO_2 tax, role of state aid and coordination at EU level, with a competent Commission.

The Green Paper fulfils both an "informative" role, in explaining a much-misunderstood instrument, and an "analytical" role, in making a strong case for Community involvement in future developments in this area. However, as benefits a Green Paper, a number of options are explored without firm conclusions being drawn.

---

[16] See "The EU and Global Climate Change, A Review of Five National Programme", Pew Climate, June 2000 (www.pewclimate.com); "Evaluation of National Policies and Measures in the EU", Ecofys and Fraunhofer Institute, September 2000 for WWF (www.panda.org/climate).

[17] Council Conclusions, 22 June 2000, 9420/00, Press 219.

> Commissioner Wallström :
> *"The Green Paper rightly advocates a prudent commencement of emissions trading that, if successful, can be extended. It must be understood that we are breaking new ground with such a system and we need to get it right from the start. However, I am firmly convinced that **it can work if we put into place a strong framework with adequate controls**. Then emissions trading will ensure that emission reductions will be made where they are cheapest and hence we will all benefit economically. It's not just about leaving things to market forces, but creating the necessary structures in which cost-effective incentives can exist*".

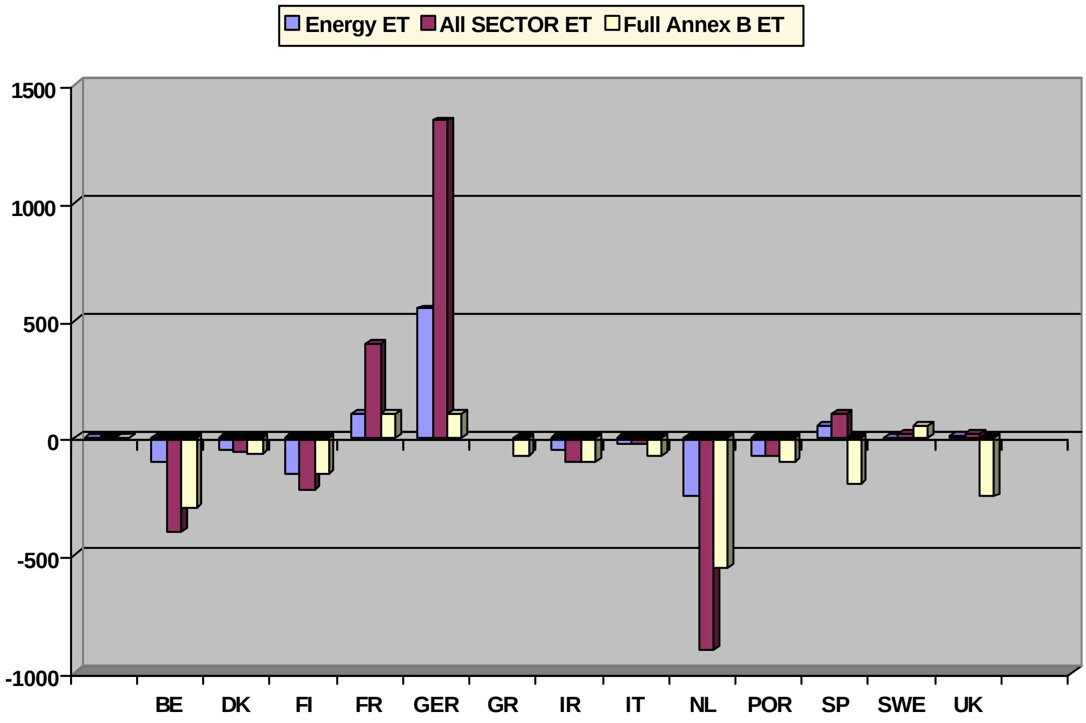
Recently, some studies assessing the *economic effect of intra European* CO_2-*trade* were published[18]. They were made as preparation for the Green Paper. Although the models are different in some major characteristics they both come to fairly similar conclusions about the achievable cost savings. They estimate them to be 25 and 30 per cent compared with a situation without EU-wide emissions trading. The models are restricted to energy-related CO_2 emissions and thus fail to capture the impacts of the six-gas basket and the inclusion of carbon sinks as means to implement the Kyoto commitments. However, this omission is not likely to alter the main conclusions. The studies do not consider effects of ceilings on the use of the mechanisms. Further the studies compare marginal reduction cost and do not address emissions trading prices. So, in the author's view, some member states are attributed with too high use of the mechanisms.

EU wide emissions trading would correct 'mistakes' made in the initial allocation of the reduction targets to sectors (known as 'burden sharing'). It is potentially much more negative for a sector to get a too high or too low target, if is not allowed to engage in EU wide trading. It is important to include in the trading regime players with widely differing marginal abatement costs. Also, member states ca take the advantage of fixing negative impacts of the burden sharing agreement itself. Author believes that the burden sharing agreement (distribution over the EU of the 8 per cent Kyoto commitment) is not flexible and not on a cost-effective manner: member states where the marginal CO_2 reductions costs are the highest, took the largest bit of EU reductions. EU emissions trading (plus the use of Joint Implementation) makes cost-effective reduction options in the EU available.

PRIMES suggests that Belgium, Finland and the Netherlands have the highest abatement costs (and thus net buyers) while France and Germany have the lowest (net sellers). Extending trading schemes deliver for each new participant lower costs and obtain gains in welfare. The Primes analysis shows that the electricity supply (power, steam generating) is a well-suited candidate to be included in an initial EU scheme.

[18] See: http://europe.eu.int/comm/environment/enveco/primes.pdf, and http://europe.eu.int/comm/environment/enveco/poles.pdf.

Figure 1
Sellers (+ segment) and Buyers (- segment) in EU-wide and Annex B allowance trading



Source: PRIMES 2000

The POLES model shows that Germany will be the larges net seller (reasonable rational values allowing for an exportable surplus). Also, the UK is expected to be a net seller, although a more modest one (due to an expected improvement of abatement costs) and France is seen as net buyer. Remaining countries in EU north are projected to become net buyers (of exports from Germany and the U.K.). EU South countries expecting to benefit from a step-wise implementation of ET appear to be economically attractive if they start with the ones gaining the most. Pioneers have nothing to lose; non-participants have incentives to join.

With a view to the *relation with EU policies*, some member states are of the opinion that emissions trading is incompatible with IPPC (Integrated Pollution Prevention Control EC Directive) because this directive obliges companies to install best available techniques in each unit and trading between units is not considered to be in line with the underlying principle. Further, they fear that the company that innovates to come up with a new, emissions-reducing technology can't claim that the resulting surplus allowances are surplus since, under the IPPC, the company should have been using that “best” technology anyway.

The author finds that the IPPC is in fact not addressing greenhouse gases and climate objectives at all and is in need of reform. BAT per unit is definitely not the most cost effective way to reduce emissions. When the IPPC was debated the EU had not considered that Kyoto Mechanisms would be available for climate protection. This is an aspect the European Commission can put forward in the legislative plan.

The Commission asks much attention for the *relation between the allocation of allowances and State Aid*. On one point of view, recently voiced by the European Commissions, because the secondary market will give allowances a market value, giving allowances for free is in principle benefiting firms. If that advantage is reserved for certain firms or goods, the Commission considers that as State Aid under Art 87(1) of the EC Treaty. It can approve the State Aid on the basis of Article 87(3)(c), if it will contribute to development of environmental protection (see the discussion on the Danish CO_2 quota case, earlier). The Commission considers the EU as an internal market as well. If all national firms received allowances for free, the competitive position of other EU firms could become distorted thereby creating a state aid issue.

Analysis

National System

Cap	Open, preference lies with upstream caps and for large sources and performance based standards for other IPPC sectors.
Definition of exchange unit	Open
Participation of entities	Open
Allowance system	Open, can very from at EU level to by member state
Monitoring, reporting, verification, certification	- GHG Monitoring Mechanism must be modified to the use of mechanisms. Verifiers could be accredited along the EMAS scheme - IPPC Directive provides potential vehicle for monitoring and measurement of GHG emissions (requiring suitable methodology and frequent reporting)
Enforcement system	EU compliance mechanism (vis-à-vis other member state) still to be elaborated; additional guarantee needed for infringement procedure against a member state. Court of Justice judgement plus fee and penalty system have proved to deter from non-compliance with environmental measures. Assumption is to leave compliance vis-à-vis companies on state level/jurisdiction.
Role civil society	NGO's and business community participate in Emission Trading Working Group for the European Commission to elaborate ideas.

Market Liquidity

Size of market and coverage	Step-by-step, starting with upstream CO_2 for large sources, including utilities (preference of Commission) is promising
Prevention of market power	Internal Market legislation is in place with a good working legal procedure
Political environment	- In general there is much interest with EU governments in voluntary energy efficiency agreements and taxation; - High oil prices and recent CO_2 performance analyse create a growing interest in market mechanisms for environment.
Incentives for business; use of opportunities	- Energy/CO_2 focus brings linkage with energy market within reach.
Phasing in of system	Pilot would start in 2005
Method of exchange	Open
Risk control	Open

Link with Kyoto Process

	Consultations end in September 2000. After CoP-6, the Commission will propose an EU emissions trade scheme, compatible with rules for IET, starting 2005.

Conclusions

The Green Paper provides the audience with all the designing elements countries and stakeholders will encounter in the discussion on emissions trading. The debate about national versus international helps to make clear which elements in the Kyoto discussion have to be addressed. Compatibility amongst schemes and elements for a sound international emissions trading are aspects that have to be discussed also in the framework of the FCCC discussions.

Necessary guidance such as learning-by-doing, step-by-step and a clear discussion on what needs to be harmonised and what can be done nationally are all essential to the elaboration of an EU-wide emissions trading scheme. These are also issues that are important to the emerging Kyoto Process since issues such as liability, compatibility and competition would all be part of an international emissions trading regime under the Kyoto Protocol.

Member states are preparing their comments on the Green Paper. In the meantime most European industry organisations have reacted cautiously positive[19]. They advocate the emissions trading scheme to be simple, transparent, preventing competitiveness distortion and market liquidity. This call clearly for coordination at EU level.

CONCLUSIONS

The particular sequencing of European emissions trade schemes and plans has meant that a fully comparable analysis cannot yet be made. It would be interesting to undertake further streamlined analyses over time. Having examined issues in detail up to this point, main conclusions, points for discussion and elements for an international framework, allowing domestic and regional tr**a**ding schemes to be compatible, are discussed in what follows.

Existing Dilemmas

National versus international schemes.
It is evident that some countries decided to prepare a very elaborated domestic emissions trading scheme (see UK and Denmark on a minor scale), because early action is helpful in modifying private investments and the ability of buying forward allowances depends on national compliance tools. Other countries prefer to wait for an international framework or for EU harmonisation because of certainty of compatibility. The European state-of-the-art shows us how governments struggle in their choice between benefits of the early start and the benefits of compatibility.

[19] See September, 2000 press releases by Eurelectric, CEFIC, Eurofer, Cembureau.

Benefits of national emissions trading scheme	Benefits of an international emissions trading scheme
- fast track	- high CO_2-reduction potential
- tailor made provisions	- lower average emission reduction costs
- possibility to gain experience first	- fits with the globalising economy and cross border acquisitions
- investments are foreseeable	- compatible with EU internal market
	- fungibilty of tonnes
	- Competitiveness rules
	- uniformity, compatibility
	- stability

The debate about national versus international plays indeed an important role in the EU (The Netherlands, UK and Denmark). The Danish and Netherlands governments are setting up limited domestic schemes. They and the private sector favour an EU-wide scheme, instead of 15 national systems. On the other hand the UK would favour an international emissions trading scheme directly. At the moment we see more learning alone than learning together. Obviously some countries want to have the benefit of the starter, but important findings can be neglected. For example, more value would be given to WRI/WBCSD, together with several companies' work on a GHG monitoring protocol for the private sector[20], instead of inventing the wheel again. Larger companies, especially the ones currently testing emissions trading, are worried about the compatibility of the schemes. Hence, in isolated schemes, a transnational company will be confronted with business units with various marginal costs in each country without having the opportunity for (internal) cross border trade. This goes of course for every company that wishes to look for more cost-effective reductions. Further, more attention for linkage with the energy market is needed as well, because that would provide business opportunities and reduction potential. The fact that the European Energy Market is one internal market makes linkages opportunities with the Kyoto Mechanisms obvious[21]. While different speeds and coverage are understandable, national, regional and international schemes will profit from compatibility. The streamlined analysis will show which elements should be fed into the emerging Kyoto Process and vice versa.

State Aid and GATT/WTO

Bearing in mind the Danish CO_2 quota, it may be argued that allocation of allowances free of charge would not constitute state aid. Hence, free allocation under a trade scheme is the same situation as when the government confers on the emitter the right to emit under a conventional permitting system. On this view, all environmental regulation would be state aid, and no environmental regulation other than absolutely uniform taxation would be consistent with the EC Treaty. Traditional environmental regulation is not seen as state aid, because no state money is involved and the rule is general. Further, a system of emission allowances resembles general regulation and constitutes the administrative framework of

[20] The GHG protocol is intended to serve a range of purposes including: helping companies to identify greenhouse gas reduction opportunities; establishing a foundation for greenhouse gas reduction goals; providing a tool for self-assessment or independent auditing; enabling stakeholders to assess progress; and providing data that supports flexible, market-oriented climate policies. See: www.ghgprotocol.org.

[21] Jos Cozijnsen: Energy Market: Key for Tackling Climate Change, Change July 2000, upcoming.

allowing emissions according to objective and transparent criteria. Seen this way, no individual company of certain sectors are benefited above others[22].

Nevertheless, the author believes that in the current phase of collecting experience in ET, the Commission will approve beneficial types of allowance allocation easily until such time as EU rules are applied. The Commission will look if the member state has a sound system (transparent and objective), if the state aid is temporary and is meant to bring environmental benefits. In the current Draft for the Revised Guidelines on State Aid for Environmental Protection[23] the Commission takes the view that allowances should be allocated by transparent and non-discriminatory procedures, with the same mechanisms for all firms operating in the particular state. This must ensure equal access to the market and preserving competition. When a member state buys or sells permits, the price must not comprise aid to the firm concerned. Also, these principles apply to emissions rights trade outside the system of tradable permits provided for in the Kyoto Protocol. Similarly, governments may be able to minimize state aid considerations in the case of tradable emissions allowance systems involving a mixture of free-of-charge allocation and auction, if governments take care to recycle the revenues from allowance auctions to the enterprises upon whom the emissions limitation burdens fall. This is the case with the U.S. sulphur dioxide emissions allowance-trading program (U.S. Clean Air Act Amendments of 1990), in which most of the emissions allowances were distributed free of charge according to a set of formulae specified in the statute, while revenues from the auction of a small number of allowances are distributed to the regulated entities[24]. The June 2000 Environment Council stresses the need to take into account to a greater extent environmental issues when preparing the revised definitive guidelines, with a view to application from January 1st, 2000. The Commission seeks in their proposal to “strike the balance between environmental needs and competition policies”. Although the internal market is EU business, and while the question of whether states can create 'non-level playing fields' are resolved at the federal level in the US through legislation and the courts, the harmonisation of allocation rules could set the tone of rules for the Kyoto Mechanisms to be taken by the COP/MoP, where international competition is considered.

WTO's MFN principle (Most Favoured Nation) prohibits members from discriminating between like goods from different WTO members. Several recent publications provide proof that an emissions allowance allocated by an authority and an emissions reduction unit cannot be seen as a like good, a service or security. That means also that keeping emissions trading national or limiting the issuance through a quantitative ceiling cannot be seen as a violation of a GATT rule. In line with the above discussion on state aid, the initial allocation to entities of emissions rights to entities cannot be considered a subsidy under the WTO's Agreement on Subsidies and Countervailing Measures (SCM)[25]. Also this aspect provides us with an element for an international framework on emissions trading, setting rules for acceptable allocation of permits.

---

[22] Analogously, the Commission stated that a case where Spanish authorities neglected the enforcement of environmental legislation did not create state aid, because there was no transfer of public capital (NN 118/97, SNIACE SA, PB C 68/97, p.2).

[23] European Commission, DG Competition, September 13, 2000.

[24] Annie Petsonk, , “The Kyoto Protocol and the WTO: Integrating Greenhouse Gas Emissions Allowance Trading into the Global Market Place”, 10 Duke Environmental Law and Policy Forum 185 (Winter 1999)

[25] See WWF, Nick Mabey, “Implementing Good Climate Governance”, March 1999; FIELD, Jacob Werksman and Jürgen Lefevre, “WTO issues raised by the Design of an EC Emissions Trading System under the Kyoto Protocol”, 1999; Annie Petsonk, “The Kyoto Protocol and the WTO: Integrating Greenhouse Gas Emissions Allowance Trading into the Global Market Place”, 10 Duke Environmental Law and Policy Forum 185 (Winter 1999); Aaron Cosbey, “The Kyoto Protocol and the WTO”, Seminar Note, 2000.

Cap-and-trade versus performance based standards

An underlying discussion is the difference between performance-based standards, including energy efficiency commitments and cap-and-trade. In some trading schemes we see a combination of both (NL, DK, U.K.). Mostly it is a matter of preference and political situation. Both can lead to absolute reductions as long as baselines are set, reductions are mandatory and measured carefully. Minimum process/product standards can be a threshold or starting point for allocation used in cap-and-trade. The discussion about comparisons between the approaches and combination of them will have to continue. Evidently, combining energy efficiency targets with emissions trading is likely to increase the complexity of emissions trading. Technical regulations have a role to play as regards diffuse sources, e.g. household and transportation sectors.

Mandatory versus opt-in

The US SO_2 trading scheme was established for the largest coal-fired power plants. It allows combustion sources not required to participate in the Acid Rain Programme the opportunity to opt-in voluntarily through a system involving a cap and allowances (based on historic emissions and energy use). Other sources might be regulated through technology or emission standards. The EC Green Paper has used this model. Cap-and-trade might be mandatory, while other sources addressed by policies and measures. Individual entrepreneurs can choose to opt-into trading.

How to treat early reductions / energy efficiency results in cap-and-trade

In the Netherlands, and also in EU discussions, companies are requesting credits for efforts they made by improving their energy efficiency - under voluntary agreements for instance.

They ask that first other OECD countries reach that efficiency standard before entering in more reductions or cap-and-trade. While this makes sense, this does not help their government meeting the absolute Kyoto targets. Firstly, governments have to decide how to allocate the assigned amounts over the sectors. The US SO_2 Allowance Programme design shows that it is difficult to allocate in a fully equitable manner. But the secondary market will provide all participants with cheaper reduction options.

There are ways to treat early action and reached reductions or efficiency in advance of 2008-2012 and to give companies some sort of credit. In annex I author gives an overview of examples of incentives for early greenhouse gas actions. It can for example be done as CO_2 tax exemption (see U.K.) or other fiscal incentives for GHG reductions in 2000-2008 (See NL). A certain energy efficiency improvement or emissions reduced can be granted as a minimum standard above/under cap-and-trade. Under the SO_2 allowance programme this is the case as minimum emissions limits under health regulation. Or one could introduce cap-and-trade in some sectors and use standards/efficiency improvement targets in other (diffuse) sectors.

Opportunities

Emissions trading can lead to over-compliance

As advocates of the instrument note, the incentives and market opportunities for emissions trading can be so profitable that it can lead to over-compliance. Surplus allowances have been banked in large amounts under the US SO_2 Allowance Programme and saved for the following, more ambitious reductions phase under that programme[26]. This could also be the case under the Kyoto regime. Deeper emissions cuts are expected in the second commitment period, so banking of emissions allowances or AAUs/ERUs can be profitable. Further, the expected short true-up period after the first commitment – during which Parties that are not in compliance yet can purchase additional AAUs/ERUs – presents a ‘third market’. Also insurance companies, financial institutions and compliance funds would want to make us of surplus ERUs/AAUs. Until now, governments and stakeholders include the Kyoto Mechanisms to ‘just-meet-the-target’, and tend to oversee the value of over compliance, as said, one of the proven merits of emissions trading.

- **Linking emissions trade with energy trade**

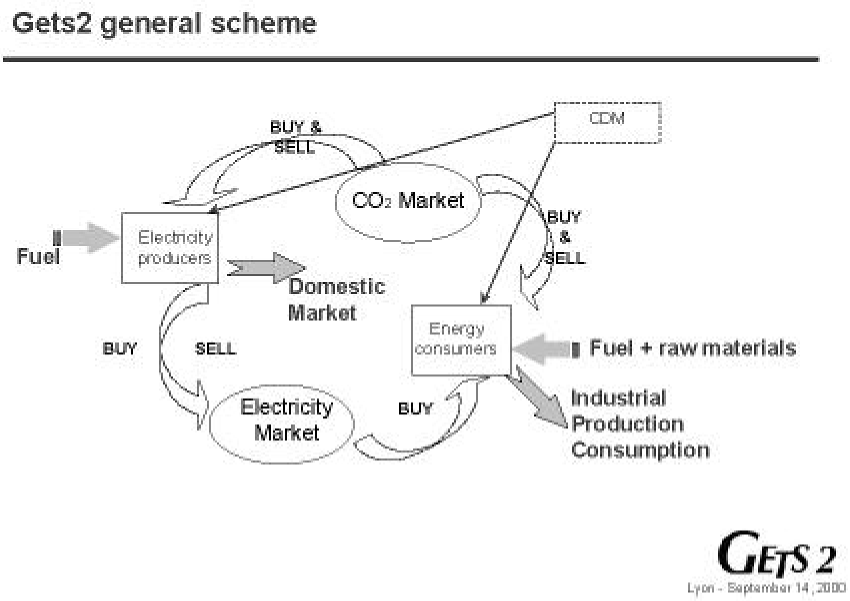
The ongoing liberalisation of the energy market, with the efficiency and cost optimalisation and cross border access and free trade provide opportunities of linking energy trade with transfer of ERUs/AAUs. At the moment the energy market is primarily cost driven, focussing on price competition and on building corporate brand names, without addressing the CO_2 component. This has been acknowledged by the European Commission and institutes[27]. As soon as governments allocate the national emissions cap over the economic sectors, the energy sector could include the CO_2 element in the fuel mix and energy transfer choices. Doing so, companies will also compete with low cost reductions[28]. On a small scale the Danish Utility cap-and-trade scheme links energy trade with emissions quota. The Union of Electric Industry (Eurelectric) simulated this linkage[29]. In the Green Paper the European Commission suggests starting an EU-wide emissions trading scheme for CO_2 and large sources and utilities.

[26] Environmental Defense, “More Clean Air for the Buck: Lessons from the Acid Rain Emissions Trading Program”, 1997

[27] See “Bringing our needs and responsibilities together – Integrating Environmental Issues with Economic Policy”, European Commission, COM(2000) 576 final, September 20th, 2000; “Sustainability and the Future of European Electricity Policy”, Felix Chr. Matthes and Christof Timpe, Oeko Institut, October, 2000 (www.boell.de).

[28] Jos Cozijnsen, “Energy, Climate Change and Accession”, WRI/REC, May 2000 (wri.rec.org); Jos Cozijnsen, “The Energy Market, Key for Climate Protection”, Change No. 53, Aug. 2000. (www.nop.nl/gb/nieuwsbrief/change53).

[29] See: www.gets2.org.



General Conclusions

Many Emissions Trading Developments in Europe under way

We see in Europe a number of governmental, private and branch level emission trading schemes, simulations or concrete plans. Lastly, the European Commissions Green Paper started an EU-wide debate on the design of an EU emissions trading market.

Emissions Trading can become a real thing in Europe

Seeing the early phase-in of the schemes (kick-start in Denmark and UK upcoming, and the planned EU-wide pilot for 2005) one can note emissions trading in Europe as a real thing to be. There is general support in Europe to meet Kyoto's commitments. Governments realise the need to add market options to the existing menu of policies and measures in order to stay within the emissions quota. Also we see that in most schemes there is financial support and favourable tax and regulatory treatment. In this start-up phase the European Commissions will probably accept this temporarily. Besides this we see in other sectors that more use is being made of market mechanisms (e.g. radio frequencies and GSM frequencies auctions). There is much room for early actors (BP, Shell, Eurelectric (Union of Electric Industry)). The proof of the pudding is in the eating: it remains for stakeholders and governments to succeed in granting credits for these early actions.

There is momentum to identify building blocks and spur developments

The boost of national, international, official and private developments as well as in the FCCC negotiations (Chairman's Text on Mechanisms) shows the apparent building blocks of successful emissions trading schemes.

Differences and convergence in emissions trading schemes

Some aspects of the current schemes and plans show convergence (practical aspects), some aspects show diversification (tailor made institutions to meet national politics and circumstances). The value added is to accept and learn from the differences (for instance regarding coverage and allocation), and to cooperate to promote cross border trade and mutual recognition of credits.

International Cooperation is necessary to ensure cross border emissions trading

An international framework for cooperation in the elaboration of trading schemes is needed. This can ensure cross border emissions trading for international Kyoto arrangements. When domestic schemes are solely a result of national politics, which can create blockades for mutual recognition of national allowances and international schemes (see for example the risk of very detailed trading plans such as those of the U.K.). Especially, when we consider design aspects such as allocation, with regard to competitiveness concerns and WTO rules, the EU debate can act as a sort of dress rehearsal of the discussion that will take place among all OECD countries. The author proposes that international cooperation in trading design, as domestic policy, can be undertaken under Article 2, 1 (b) of the Kyoto Protocol.

No Detailed Decisions on Emissions Trading Design needed by the COP

The challenge of the Conference of the Parties is to make decisions that provide the conditions for cross border trade (namely compliance and accountability rules including registry), rather than to set detailed, practical rules. Hence, emissions trading should, as a market-based mechanism, promote flexibility, ensured by market discipline. In general no governmental intervention is necessary regarding trade execution.

NEXT STEPS

What the streamlined analysis helps elucidate is that a distinction needs to be made between the major building blocks of trading schemes and national preferences. In the authors' view, a framework within which compatible schemes can be developed is made necessary by the eventual international implementation of the Kyoto Mechanisms. This is of interest to governments, that need timely absolute greenhouse gas reductions, and to stakeholders that are asked to provide the reductions.

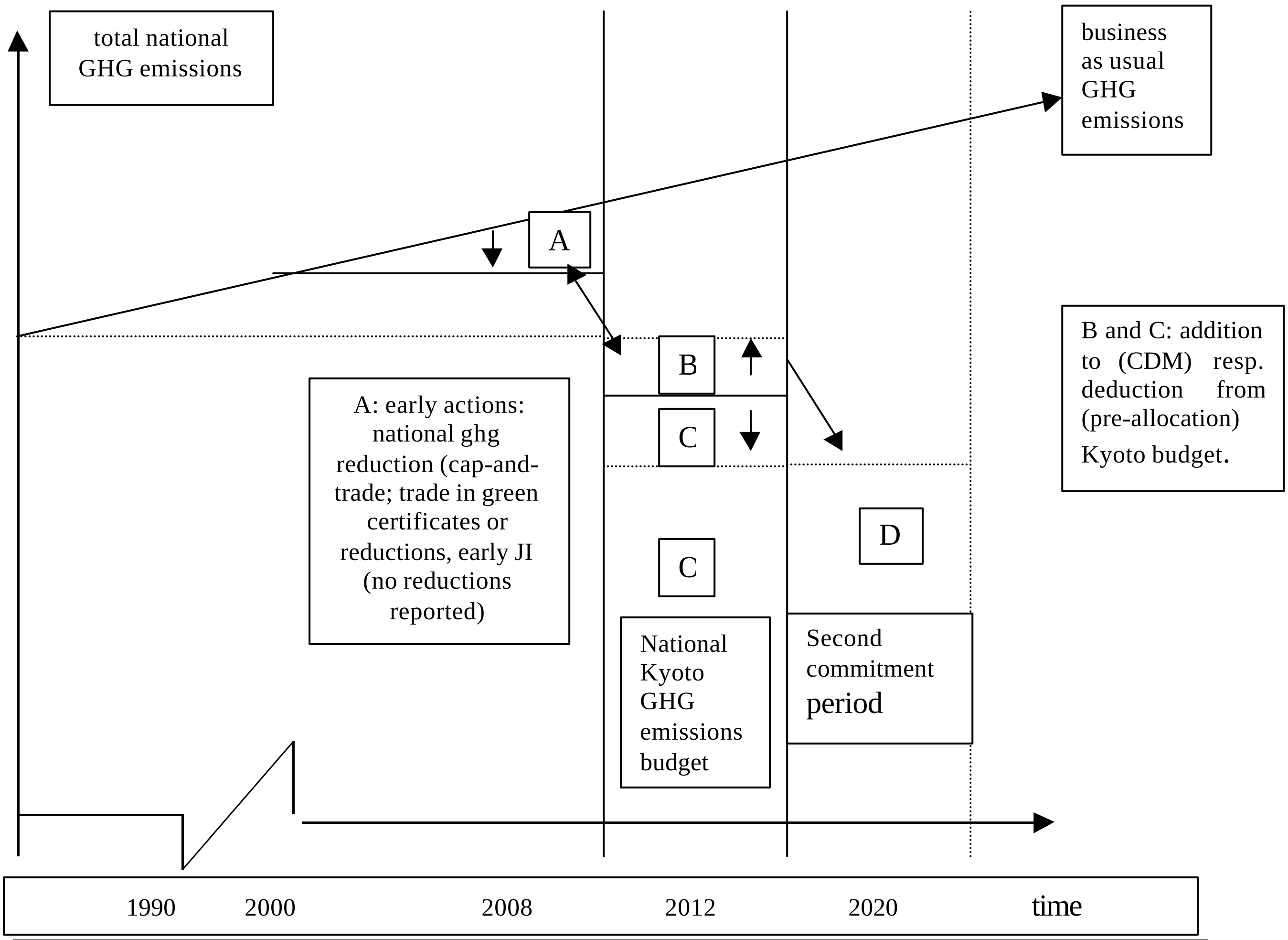
This paper provides a tool for streamlined analysis of emissions trading schemes. It also provides input for the elaboration of a cooperation framework and for ensuring a workable and effective linkage between the Kyoto Process and emissions trading developments. Further, the paper may be used as input in the Kyoto discussions, which are leading the way to an integrated, multilateral implementation of the Kyoto Protocol.

Elements of such a framework are:

	Recommendations
A**)** **National System**	• establish main common elements of a tracking system and registry prior to other arrangements; • participation: start with a broad as possible participation, in combination with an opt-in system; • make use of ongoing and corporate work on tracking systems; • a hybrid combination of cap-and-trade for large emitters with performance based standards for other companies and diffuse sources is possible. On the longer term absolute caps are essential.
B**)** **Market Liquidity**	• prevent state aid problems; this can be the case in tradable emissions allowance systems involving a mixture of free-of-charge allocation and auction. • combine obligatory cap-and-trade with opt-in.
C) **Kyoto Linkage**	• Give information on the national accountability and enforcement provisions of the National System to other Parties to feed and simplify the international discussions on the Kyoto Protocol Compliance Mechanism; • Create clear links between domestic emissions trading pilots and the Kyoto Process; • Cooperation on the elaboration of emissions trading schemes between Annex B Parties: under Art. 2,1(b), of the Kyoto Protocol.

Annex I

Examples of incentives for early GHG emissions actions including use of market mechanisms, resulting in forms of early crediting or early allocation of the Kyoto commitments.



Incentives for early actions and the results regarding the Kyoto GHG emissions budget (O):

i. Entities could achieve a CO_2/energy tax exemption or analogous fiscal incentives in exchange for GHG, during 2000-2008. This early action doesn't change the Kyoto budget. It helps a timely bending of the emissions trends. While a simple tax exemption might raise a subsidy issue under EC law (see Germany), an exemption is only granted when real reductions occur and is therefore no subsidy issue.

ii. Domestic emission permits trade and trade in certificates for used/bought green electricity or realised/financed ghg reductions could promote early actions. Such an early market can be promoted by introducing cap-and-trade, voluntary agreements on GHG reduction or targets for renewables (for companies, utilities or citizens). These options ask for early national policy (companies hope to get a relief later) and targets (renewables).

iii. National voluntary agreements between government and companies themselves can ask for early reduction or energy saving, without the need to modify or pre-allocate the Kyoto budget. Companies anticipate relief in a later stage.

iv. Pre-allocation of the Kyoto emissions budget could work as incentive for action - in anticipation of the Kyoto Protocol -. Companies can reduce emissions early in order to earn allocations that they could bank for future use or sell. The same amount has to be deducted from the national Kyoto budget (B).

v. CDM projects, with banking, promote early action. This would lead to a partial addition to the national Kyoto emissions budget (C).

vi. Early joint implementation (or portfolio management of JI) itself is a way of early action, but no credits for the investor will accrue, unless deducted from the Kyoto budget. In the absence of such crediting an incentive for early JI investors can be found in national agreements and in the profit of lowering transaction costs of JI once that JI be credited (from 2008). In the host country JI reductions will have to be regarded as normal early GHG reductions, which lowers the BAU ghg line and no deduction of the Kyoto budget is needed.

vii. Insurance or bank activities: it is expected that insurers or bankers will early start seeking GHG reductions, green certificates etc. to be saved for future sell to entities/Parties to help them comply.

viii. Environmental and future commitments incentives: a general incentive for everybody is that the atmospheric cumulative effect of early reductions allow to lower emissions caps level as well as some relaxation for future commitments (D).

Post-COP-6 Perspectives:

Farhana Yamin*

In the last ten years much has been written about the efficacy of emissions trading as a policy instrument for tackling greenhouse gases. Yet, as Jos Cozijnsen's contribution to this publication shows only one GHG trading scheme is currently up and running in the world today– that set up by Denmark covering CO_2 emissions from the electricity sector. True, the UK is not far behind in launching two pilot trading schemes, one limited to CO_2 emissions from energy intensive sectors excluding electricity generators and the second relating to gas flaring in the North Sea.[1] But it is unclear if, when and how these schemes will be converted into a statutory scheme with broader sectoral and international significance. The Norwegian and European Commission schemes are at an early stage of conceptualisation and have yet to be translated into a framework suitable for launching even as pilot schemes. Finally, it is arguable whether the Dutch ERUPT programme provides a framework for emissions trading at all. This is because as currently conceived it focuses on the efficient procurement of credits for the Dutch government from the two project-based Kyoto Protocol mechanisms – joint implementation (JI) and the Clean Development Mechanism (CDM) – than on entity-level trading within the Netherlands.

Thus although Cozijnsen's analytical survey is a very useful guide to current emissions trading related developments in Europe, it cannot disguise the fact there is a dearth of real world experience with GHG emissions trading as an environmental policy instrument. The fact that where experimental schemes are being put in place, they are far more limited in scope than the theoretical models recommended to policy-makers in the last ten years must also be borne in mind. Given the voluminous literature on the merits of emissions trading, one may well ask why the "take-up" rate of this instrument has been so slow and partial.

Part of the explanation lies surely in the lack of political commitment to tackling GHG emissions by industrialized countries as a whole. High oil prices and low perceived priority accorded to environmental issues combine to make current policy-makers loath to commit the kind of political and economic resources needed to launch large scale emissions trading schemes. A few countries are "accidentally" on course to meeting their Convention and Kyoto commitments, but for most OECD countries, GHG emissions are now well above 1990 levels and rising. By the end of 2000, US emissions of CO_2, for example, were some 13 per cent above 1990 levels. Reversing such trends requires a range of new policy instruments that few governments have been able to put in place.

The growth in developed countries' transport related emissions is illustrative of the problems involved and one that most of the proposals surveyed by Cozijnsen would fail to address. This is because all the practical evidence of emissions trading in Europe has focused on "downstream" approaches covering limited numbers of entities in specific sectors rather than "upstream" approaches that cover CO_2 emissions in a comprehensive manner. Thus despite their high environmental efficiency, the early dismissal of upstream approaches in all the surveyed countries is based largely on an assessment of what is currently politically feasible rather than environmentally and administratively efficacious. This is because upstream

* Senior Lawyer, Foundation for International Environmental Law and Development (FIELD), London, UK.

[1] See announcement in the Financial Times, 8 February 2001.

trading systems appear, for all intents and purposes, to amount to an introduction of a carbon tax, which remains a highly unpopular policy instrument. The palatability of the "downstream" system has been increased through "grand fathering" permits. The prospect of free permits, a valuable asset on a company balance sheet, has damped industry opposition to emissions trading. Whilst building an important pro-climate constituency, the decision to grandfather permits to polluters has important equity considerations, which have received little public scrutiny in the schemes surveyed. Not least because most have been developed in close association with the industries concerned. Domestic equity considerations could have been addressed more explicitly had the schemes discussed by Cozijnsen been based on permit auctioning which again is currently considered to be too unpalatable for industry.

A second set of problems arise for policy-makers that manage to overcome political hurdles: the technical, legal and administrative complexity of implementing emissions trading system within existing legislation – an issue little covered in the theoretical literature on emissions trading. This is a pity since a wide range of national, regional and international legislation covering, inter alia, energy, environment and trade regulations, must be taken into account when developing and implementing emissions trading. Integrating emissions trading into existing policies is a serious complication for policy-makers devising an emissions trading scheme and one on which much more analytical work is needed to base future guidance. Close attention must be paid to the regulatory approaches, and capacity, of countries with economies with transition, particularly those positioned for inclusion in the potential enlargement of the European Union, as they will be required to integrate and harmonize their environmental legislation as part of EU accession proceedings.

An additional hurdle for the development of emissions trading schemes is the uncertainty generated by the collapse of international negotiations at The Hague. This makes the task of getting emissions trading off the ground difficult as many aspects of national emissions trading policy-making were "on hold" pending agreement at the international level on a global (or at least Annex I wide) trading scheme.[2] But such agreement is proving elusive.

Even if agreement is reached at the resumed session of COP-6 some time later this year, it may prove difficult to give it practical effect. One of the criticisms of The Hague negotiations was the early abandonment of the "technical" draft decisions on emissions trading which negotiators had developed in the three years since Kyoto in favour of elaborating a political document comprising bullet points on "crunch issues" identified by the President of COP-6. The note produced by the President on the 23rd November contains little more than a few lines on emissions trading leaving lacuna in policy-making on many aspects of emissions trading that continue to generate controversy amongst Climate Convention Parties. One significant example concerns the "red light/green light" dispute concerning entitlement to participate in emissions trading at the Party level. No guidance was provided by the President on whether Parties that want to trade should first have to prove they have adequate national systems/inventories (red light, supported by developing countries) or whether countries should be free to trade until the compliance system discovers a good reason to suspend trading (green light, supported by the US and other umbrella group countries). The resumed session of COP-6 must result in more detailed guidance to settle this issue, as this will have important practical consequences for the way and the speed at which domestic emissions trading emerge in the post-Hague period.

[2] For a discussion of the main outstanding issues relating to emissions trading at COP-6, see Yamin, Burniaux and Nentjes, "Kyoto Mechanisms: Key Issues for Policy-Makers for COP-6", International Environmental Agreements: Politics, Law and Economics, 1: 187-218, 2001.

Likewise, another area covered with insufficient depth in the President's note: the issue of "commitment period reserves." Since Kyoto, it has become evident that weak international compliance institutions and non-compliance consequences may provide financial incentives for countries to "oversell" and hence, potentially seriously undermine the environmental integrity of the Protocol. It is not clear whether the compromise proposed by the President on this issue (that reserves of 70 per cent of the assigned amount for each commitment period be retained) when examined in the light of the nature and size of the "sticks and carrots" available to the Protocol's compliance system would substantially reduce this possibility.

Finally, a number of areas concerning the modalities of emissions trading that might provide real guidance to policy-makers devising national trading systems appear to have dropped off the agenda at The Hague. It is widely recognized that an international emissions trading system must provide for a "common currency" or otherwise secure the widespread mutual recognition and acceptance of permits granted by particular countries. Either way, Parties or entities engaged in trading must have some reassurance that the emissions reductions embodied by permits have been measured in a verifiable and standardized manner by all concerned. This "quality control" aspect requires common measurement and verification protocols among trading participants. Development of this technical, but essential, component received little attention at The Hague. Given the intractability of larger political issues surrounding emissions trading, such as "hot air" and supplementarity, perhaps this is not surprising.

But this does point to one aspect of the Hague negotiations as highlighted by Michael Grubb: that many of the issues on the table were not only too technical for politicians to understand but also too political for the technical community to resolve.[3] This could not be truer of emissions trading. Unless ways are found to bridge the gap between the "high politics" of climate change and the technical details required to operationalise emissions trading, initiatives will be limited to a patchwork of domestic, pilot-level schemes. Linking these into a cohesive trading system that allows for cross-border exchanges on any significant geographic scale could be a costly and time-consuming process that will slow the "take up" of this instrument further. A speedy conclusion of the issues outstanding from The Hague, coupled with more attention to developing a detailed programmed of technical work, will ensure that emissions trading is a fast tracked component of developed countries' implementation strategies to tackle GHG emissions.

****

[3] Michael Grubb, remarks made at Chatham House, 6 December 2000, World Affairs, *forthcoming*.

Chapter IV

International Greenhouse Gas Emissions Trading and Issues Related to Voluntary Participation by Developing Countries

Malik Amin Aslam*

CONCEPT AND EVOLUTION OF EMISSIONS TRADING

Emissions Trading – Theoretical Edge

In general, regulatory environmental policy tools and measures are used to place a scarcity value on environmental resources, either by restricting the “quantity” or by controlling the “price”. The aim is that of internalising the external costs of pollution and, thereby, making the polluters bear the cost. Table 1 provides a convenient taxonomy for understanding the concept of “emissions trading”, by giving an overview of the range of policy instruments used for pollution control, moving between “Command and Control” and “Economic Instruments” on one scale and between quantity and pricing based instruments on the other.

Table 1. Classification of Major Environmental Control Instruments

TYPE OF INSTRUMENT	QUANTITY	PRICING
ECONOMIC OR MARKET BASED	Tradable Permits	Charges (taxes)/Subsidies
COMMAND AND CONTROL (CAC)	• Standards • Enforcement Mechanisms • Licensing	

Command and Control (CAC) or direct regulatory control mechanisms aim to “insure” against the probability of highly damaging events by controlling the pollutant quantity rather than the prices, through standards, whereas Economic or market based instruments (EI/MBI) rely on pollution taxes or tradable permits as a leverage to motivate pollution sources to seek ways to limit pollution.

A comparative description of the aforementioned instruments is provided in Table 2 below, illustrating the merits of the “tradable permits” approach to pollution control as it combines the “insurance” benefits of standards (CAC) with the “incentive” effects of taxes and provides a strong impetus for least-cost compliance through provision of enhanced flexibility, choice and the option of tradability.

* Executive Director, ENVORK, Islamabad, Pakistan.

Table 2. Comparative Analysis

Instrument	Advantages	Disadvantages
Standards	• Insurance benefits • Effective for simple prohibition	• Not cost-effective • No "one size fits all" solution • Innovation constrained, unless revised • Inequitable solutions if lax enforcement
Taxes/ Charges	• Environment Quality at least cost • Source of revenue • Incentive for innovation	• Complicated and costly to set optimal level. • Very high levels for behavioural changes • Political acceptance low • Avenues for misuse
Subsidies	• Promote environmental goals • Effective if controlled usage	• Phase-out ignored practically • Political misuse
Tradable Permits	• Ration a fixed supply • Combine "incentive" and "insurance" benefits • Flexibility, choice and tradability leads to least cost compliance	• High transaction costs • Initial allocation can be cumbersome • Baseline emissions data reliability issue

Practical experience and evolution of emissions trading

The concept of emission trading takes its roots in the US where, beginning in 1975, the high compliance costs associated with the inflexible and traditional "Command and Control" approach to controlling air pollution led the Environmental Protection Agency (EPA) to begin experimenting with a tradable permit approach, termed "Emissions Trading/Credit Trading". Under this program, any source could choose to reduce emissions to a greater extent than that required by the emission standard and, subsequently, capitalise the excess control as an "Emission Reduction Credit" (ERC), which was described as the currency of emission trading. Moreover, these ERCs were made transferable and, as long as they did not interfere with the attainment of desired environmental goals, they could be used to offset another pollution control obligation either within the same firm (internal trading) or between different firms (external trading) thus allowing firms the flexibility to choose the cheapest means of meeting with regulatory requirements.

The concept was initially introduced through the process of "netting" of emissions in 1974, which authorised internal trading to modify or expand sources rather than meet with the stringent requirements of the, "New Source Review Process[1]" and which was considered more of a regulatory relief than regulatory reform. The "Offset Policy" of 1976, which allowed for location in "Non Attainment Areas[2]" through internal/external trading, was seen as significantly putting to practice the concept of emission trading. This was followed by the Bubble policy in 1979 and the Banking concept in 1980, both of which extended the

[1] The US EPA's administrative process of review and approval of permit conditions for new sources.
[2] An area with air quality worse than ambient standard.

flexibility required for creating, certifying and using the ERCs and also helped develop a strong industrial constituency for emissions trading.

Some follow-up experiences

Following the example of the "Credit Trading" program, the concept was later applied to several areas of environmental policy, proving the versatility of its application. Both the “Lead Trading” program (1982-87) and the “Program for Trading of Ozone Depleting Chemicals” (1988) in the USA, emanated from the “credit trading” concept and provided flexibility and incentives to the regulated firms and resulted in reductions in the cost of compliance[3].

The “SO_2 Allowance Trading Program”, initiated in 1990 for addressing acid rain problems in the US, is regarded as a turning point in the development of the emission-trading concept. The program applied a refined trading model, aimed at providing greater flexibility, clarity, transparency and cost-savings while meeting pre-specified environmental goals. Under this system of allowance trading transferable allowances to emit SO_2 for a specific calendar year are allocated to the electric utilities, who are then given the flexibility to trade any unused or freed allowances (for instance through energy conservation, clean technology, fuel-switching measures).

This approach culminated from the congressional belief that, through this instrument, acid rain reduction goals could be achieved at a much lower cost to the economy than otherwise. The allowances would go where they could be used best, minimising the overall cost of control in the process, while the legislatively mandated total emissions target would be held constant.

Following the SO_2 scheme, the 1993 RECLAIM[4] program, sets an emissions cap for most stationary sources of NOx and SOx in the Los Angeles area in the US. This program has also been noted for its success in significantly reducing the price of compliance as compared to Command and Control regulation [5].

In addition to the wide-scaled application of the instrument in the USA, it has also been used in some other countries. A limited form of the concept has been used in Germany whereby, new plants seeking to locate in areas where allowable ambient conditions have been exceeded are required to obtain emission offsets from the renovations or renewal of old plants. This program carries a unique characteristic of allowing reduction of other pollutants, as offsets, as long as they are shown to have a comparable effect on the environment.

The only documented experience at any significant scale of environmental trading system, in developing countries is the “Particulate Matter Compensation Scheme” in Chile, targeted for air pollution problems in the city of Santiago and its environs. Industrial emission sources of PM-10[6] have been addressed by a governmental decree[7] which in turn provide the policy

[3] Hahn, Robert W. (1995), “*Using markets to achieve environmental and resource management objectives*”, Oxford Review of Economic Policy, Vol.9 No.4: pp-112-123.

[4] Regional Clean Air Incentives Market.

[5] Tietenberg, Tom, Grubb, Michael, Swift, Bryon and Xiang Zhong Zhang (1999) “*International Rules for GHG Emissions Trading*” Report prepared for UNCTAD, Geneva-Switzerland.

[6] Particulate Matter (less than 10 microns in diameter).

[7] No.04/1992 issued by the Ministry of Health, Chile.

framework for a tradable pollution rights approach as it combines an emission standard[8] with an "allowance" trading system, to be phased in by 1997. Under the program a phased compliance was allowed for existing sources while new sources were required to compensate all their emissions before the deadline of Jan'97[9].

However, this program suffered from some serious design flaws owing to the government's eagerness to adopt a "pro market" approach and offer simplicity of design. Most significantly, the initial allocation of permits to the point sources was undertaken in haste, working with unreliable baseline data and a simple and a formula[10] standardised for simplicity. Subsequently, the distributed allowances were, in most cases, more than the actual emissions thereby posing a risk of deteriorating rather than improving, the air quality. The localised nature of the particulates, which allow them to concentrate in certain areas to create "hot spots", made matters worse. Thus, a lot of important design considerations, were over looked by the Government in their eagerness to adopt a "pro market" approach offering simplicity of design and promising paper cost savings. The result was a system that hampered trade and led to potential air quality deterioration.

Pertinent lessons from US and Chilean experiences

A number of useful lessons, particularly pertinent to the design and development of an emission-trading scheme at the global level, have been drawn out of the evolution, development and implementation of the emissions trading concept in USA and Chile[11]. Principal among these are:

a. ***Cost Effective Environmental Control*** *:* The concept of emission trading has proven to be a success in achieving cost savings over a CAC approach, estimated at billions of dollars in the US alone. In particular, costs were reduced by increasing flexibility and choice for enhancing compliance while maintaining desired environmental quality as well as meeting specified environmental control targets.

b. ***Evolution of trading program design:*** In terms of design, US emissions trading programs have evolved from "credit" towards "allowance" trading which, though seemingly quite similar, display subtle but significant, differences:
   - Allowance trading has proven to be the superior form of trading both in terms of environmental integrity and compliance as well as cost savings for industry. However, it has to overcome a number of significant barriers before implementation, such as initial allocation of permits and provision of adequate and reliable inventory data. It is said that for trading, "Both the God and the devil reside in the design" and Chile's case is a good case in point, where the benefits of an "allowance based system" were sought without an accurate resolution of the design and implementation issues, thus aggravating the very problems that the trading system was meant to solve. The credibility of the concept was thus eroded at its inception.

[8] Maximum allowable concentration of particulate matter set at 112mg/m3 N.
[9] See O'Ryan, Raul (1995), "*Emissions Trading in Santiago de Chile: Current situation and some lessons*", paper presented at World Bank Conference for Environmentally Sustainable Development in October-1995, Washington D.C.
[10] The formula consists in as a simple multiplication as follows: current gas flow*56mg/m3N*24 hours operation
[11] The detailed evaluation is beyond the scope of this paper and the lessons have been derived from the evaluation based on (Aslam, 1996). A summary of the evaluation is provided as Annex-I.

- The actual design and system development costs for "allowance trading" are high but the subsequent transaction costs for trading are very low.
- Credit trading, on the other hand, does not require creation and allocation of a "currency of trade" at the onset and is quicker, simpler and cheaper to set up. However, owing to the lack of the commodity nature of credit trades, they need to be handled on a case-by-case basis with the result that transaction costs are significantly increased. This has been a major factor in limiting the success of this form of trading.
- Credit trading programs allow for refinement and progressive build-up in a diverse environment whereas allowance-trading programs can have very limited flexibility for incorporating change. It is therefore not surprising that trading has progressively evolved from "credit" towards "allowance" programs. The only two US allowance trading programs (SO_2 Allowance system, RECLAIM) have evolved from credit-based systems with considerable lag times, extending to a number of years.

c. ***Degree of success dependent on various factors***: The degree of success achieved by emissions trading has been strongly influenced by the following factors:
   - The efficiency and cost-effectiveness properties of emission trading schemes are based on the assumption that polluters are guided by a profit maximising behaviour and will reduce pollution when there is money to be made.
   - The presence of *different abatement costs* across sources is an essential impetus for trading.
   - *Greater participation and larger number of trades* help to increase the cost effectiveness of the emissions trading concept. It is worth noting that provisions for *voluntary opt-in* of, initially uncovered sources can increase the scope and success of the program.
   - Trading works best with problems that manifest themselves over a *large geographical area with a large population of agents*, as shown by the "Allowance Trading Program" with a larger coverage (all of the US).
   - The concept has worked particularly well for trading involving *uniformly mixed pollutants and for non-uniformly mixed pollutants involving contiguous discharge points.* An example of the former are volatile organic compounds (VOCs), which accounted for the majority of trades under the "Credit Trading Program", as the trades did not involve dispersion modelling and so were cheaper to consummate and also alleviated concerns about formation of "hot spots".
   - *Effective price revelation mechanisms*, such as auctions used for the "Allowance Trading Program", tend to reduce transaction costs and in so doing increase cost savings as well as the probability of trades occurring.

d. ***Clarity of problem and policy stability***: The concept has proved to be more effectively implemented, when clearly defined and directed towards specific environmental goals, e.g., acid rain reduction in the "Allowance Trading Program". This clarity of purpose provides credence and integrity to the program and enhances its acceptability among the various interest groups whereas unpredictable or erratic policies can erode the basis of the program, as was the case in Chile where frequent rule changes caused serious credibility concerns.

e. ***Definition of property rights:*** One of the factors attributed to the success of the "Allowance Trading Program" was that uncertainties inherent in the previous program were reduced, e.g., by ensuring that the EPA can not extinguish any allowances, once issued, and also that any changes in environmental standards would not affect the prevailing status of allowances. However, whereas the clear definition of property rights remains a basis for enhancing trading credibility, it has to be weighed up against the risk of making mistakes during initial runs and when making adjustments or refinements during the design phase. This risk factor was accounted for early on in the US experience, at the cost of non-optimal trading, but was almost entirely overlooked in the case of Chile which consequently faces increased risk of environmental deterioration based upon clearly defined but inadequately measured emission allowances.

f. ***Private sector participation:*** All trading programs have involved trading between private entities, which have provided the real engine for the success of these programs. This has been achieved by allowing them a maximum flexibility to choose the least cost path of compliance, which, coupled with the profit maximising goals of the private sector, has resulted in greater environmental compliance and higher economic efficiency.

g. ***Banking provides significant time flexibility****:* Along with the geographic flexibility offered by the trading programs, the flexibility in time, which can be provided by including banking provisions, has proved to be very helpful. Banking facilities were used extensively in both the US "credit" as well as "allowance" trading programmes, which encouraged early reductions and lower overall costs of compliance[12].

h. ***Monitoring and Enforcement:*** Conditions for monitoring and enforcement need to be specified and then strictly adhered to in order to ensure compliance under an emissions trading program. Self-enforcement/reporting techniques accompanied by stiff penalties have generally been found to work very effectively. Reversing the burden of proof and placing it on the polluter, who knows more about their emissions than regulators, can reduce the social cost of enforcement.

i. ***Method of initial allocation and distribution crucial to acceptability:*** The distribution and allocation of government-issued emissions allowances is especially important for allowance trading programmes, which generally use an auction, or an initial and weighted distribution based on historical emissions (termed "grandfathering"). The respective advantages/disadvantages of either system are outlined in Table 3 below:

Table 3. "Grandfathering" vs. "Auctioning" methods of initial allocation

ALLOCATION METHOD	ADVANTAGES	DISADVANTAGES
Grandfathering	-Free for polluters initially, thus allowing inducement into new regime -More politically acceptable[13]	-Initial allocation can be inefficient and correction depends on volume of subsequent trading -Availability and reliability of baseline data crucial for effectiveness of program. -Creates bias against new firms who have to buy allowances -Does not generate any revenue
Auctioning	-Results in a more efficient initial allocation -Raises revenue for regulatory body	-Causes financial burdens for firms, which can be a deterrent for adopting the new program.

[12] See footnote 5.
[13] All tradable permit programmes in the US have placed great importance on this mode of distribution.

Emission trading concept at the global-level

A major step in the evolutionary progression of "emissions trading" came in 1995 when the concept was put to the test within a global context through the Berlin Mandate, which authorised the initiation of the AIJ (Activities Implemented Jointly) pilot phase. The idea emanated from the 1992 "Framework Convention on Climate Change"[14] which presented the concept of "Joint Implementation". This generally referred to actions which countries could jointly develop to mitigate "Greenhouse gases"[15] and it permitted a country with lower abatement costs to over control emissions or create greater carbon absorption capacity and potentially trade the "over complied reductions" with a country having higher marginal emission abatement costs. The constrained vision as outlined, in the Berlin Mandate was made more concrete in the "Geneva Declaration" of 1996 through use of explicit terms such as "legally binding constraints" and "flexibility", which form the cornerstone of any emissions trading regime. The declaration can therefore truly be taken to be the "turning point" for the application of the emissions trading concept at the global level.

The ongoing "AIJ" pilot phase allows for OECD (Annex I) countries to undertake GHG reduction projects with any of the Parties to the convention subject to certain conditions such as prior approval of Governments, non-crediting of these endeavours towards national commitments and satisfaction of "additionality" and accurate measurability requirements. The concept is similar to those underlying the "emissions credit trading" programs in the USA and "AIJ" has consequently been viewed as a prelude to the multilateral trading of emission rights. Just as the "Offset and Bubble" policies in the US led to a full fledged emissions trading program, which later further refined into the "allowance trading" scheme, AIJ was expected to metamorphose into a tradable permits program owing to the following attractive advantages as deduced from the lessons of domestic utilisation of the concept:

a. The *physical characteristics of* CO_2, which are believed to be the major cause of "Global Warming", tie in with the economic characteristics of the trading market, which has been shown to work best for uniformly mixed gases. The gas is not localised, diffuses very rapidly and is very stable in the atmosphere, thereby making it ideally suited for an international trading program.
b. Moreover, the *global nature of the problem* means that the location of emission abatement is irrelevant in terms of the environmental impact. However, as the cost of abating greenhouse gases varies from country to country, the total cost of global abatement, which is very important, can be reduced if more abatement takes place in countries with lower marginal emission abatement costs.
c. Also, compared to the local or regional applications, a global transferable entitlements market in CO_2 offers the *maximum potential for cost reductions* and minimum potential for problems such as rise of market power and cartelisation of markets.
d. Very importantly, global emissions trading offers an in-built feature of *resource and technology transfer* to developing countries, which could provide a vital incentive for creation of a global system.

[14] The FCCC was formally adopted by the United Nations in 1992 and has to date been signed by more than 165 states and ratified by over 140.

[15] Major GHGs include water vapour, CO_2, CH_4, and nitrous oxides but in case of JI, the focus is primarily on CO_2 as the major contributor to global warming.

e. *Other advantages* of the scheme include the fact that only the overall level of CO_2 needs to be specified, avoiding the need for country-by-country targets. Also, there is full scope to innovate and be flexible while reducing emissions, owing to a globally diverse distribution and possibilities of reduction through various mechanisms (avoidance, sequestration, conservation) in a number of sectors (forestry, energy, transportation, land degradation etc.).

However, although "AIJ" in a constrained and embryonic form promised to be a natural starting point for the creation of a tradable permit system, the potential progression and development has encountered a number of impediments and contentious issues across the "North/South" divide.

The AIJ pilot phase has, subsequently, failed to live up to expectations and has been mired with a lot of scepticism fuelled by lack of understanding, complexity of issues such as proving "additionality" and agreeing on counter factual project-by-project baselines, and an overall lack of transparency in the bilateral transactions. Other factors such as high transaction costs, inadequate data availability and low incentives for private sector participation have resulted in a skewed geographical distribution of the projects and a low global acceptability of the concept. Thus, the limitations of a credit trading approach have been very much evident in the pilot AIJ phase.

In-spite of these limitations to the use of AIJ, as mentioned above, the pilot phase did manage to project the substantial cost advantages to be gained by proper global design and utilisation of the "emissions trading" concept. This advantage was duly pronounced owing to the wide divergence in abatement costs between the developed and the developing countries. It provided the opportunity for mutual benefits to be attained in the form of huge compliance cost savings for the developed countries as well as the chance of directing large resource flows towards sustainable development priorities in developing countries. This perception laid the foundation for the wide-scaled utilisation of the emissions trading concept under the Kyoto Protocol.

EMISSIONS TRADING UNDER THE KYOTO PROTOCOL

After the initiation of the AIJ pilot phase, the next logical step towards the establishment of a global emission trading system came in December 1997. A total of 160 countries reached a historic agreement at Kyoto (Japan) that carved out a definite and clear vision for the future global response to the Climate Change challenge, based on the following two premises:

a. The overall reduction of greenhouse gas emissions by Annex B countries[16] of at least 5.2 per cent by 2008-2012 compared to their levels in 1990. This overall emission limit encompasses varying limits within individual developed countries.

b. The introduction of "flexibility mechanisms" such as "CDM" (Clean Development Mechanism), JI (Joint Implementation) and ET (Emissions Trading), which heralded a new and innovative approach, aimed at tackling this global problem. The impetus was to shift away from "command and control" systems towards a market-based approach that can potentially provide the most cost effective and flexible compliance with stated environmental targets. Although, all three instruments employ the basic concept of

[16] Includes the OECD countries, Russian Federation and certain other emerging market economies

trading of emissions, there exist significant differences in the three modes of trading (Table 4).

c.

Table 4. Flexibility Instruments under the Kyoto Protocol

Emissions Trading	Joint Implementation	Clean Development Mechanism
Allowance Trading	Credit Trading	Credit Trading
Quota based	Project based	Project based
Multi/Bi-lateral	Bi-lateral	Multi/Bi/Uni-lateral
Banking Possible in Commitment period	No Banking specified ~ possible only during commitment period	Banking Possible from 2000
Applicable 2008-12	Applicable 2008-12	Early Start-2000
Includes Sinks	Includes Sinks	Ambiguous about Sinks
Compliance of host party required for trade	Compliance of host party required for credit transfer	Not applicable
Trade between parties with emission limits	Trade between parties with emission limits	At least, one party does not have emission commitments

The concept of "emissions trading" was, thus, chosen as the instrument of choice by the Kyoto Protocol. This choice was based on the theoretical advantages as well as the practical success of the concept, as discussed in one previous section, for extending flexibility and choice, reducing the costs of overall compliance and, thereby, providing a powerful incentive to comply.

The Protocol recognises the respective benefits of both credit as well as allowance trading and aims to combine them for attaining the maximum advantage. The refined system of "allowance trading" has been applied for the Annex-B countries that bear the historical responsibility for the Climate Change problem and have demonstrated a willingness to take the lead in tackling the issue by agreeing to legally binding emissions limits (termed assigned amounts). With this political acceptability, the "cap and trade" system provided the ideal instrument for achieving the agreed targets at the lowest possible cost. Under the chosen system of trading (Article 17) one Annex B country can purchase the rights to emit GHGs from other Annex B countries who are able to over-comply and reduce their GHG emissions below their assigned amounts.

Along with the provision for "allowance trading", project based credit trading has also been allowed between countries with legally binding emission limits under the system of "Joint Implementation" (Article 6). This form of trading would be quite similar to the earlier AIJ pilot phase experience, in that it is a project oriented emission reduction which can be credited to the investing country provided the reductions can be proven to be "additional" to what would have occurred otherwise. The basic unit of trade in this case has been termed an ERU (emission reduction unit) and this system of JI between Annex B countries is generally viewed as a fall-back position for those parties that believed that trading in assigned amounts would not be agreed in the Protocol, but was left in after the latter was agreed.

The other, significant, application of credit trading is that under the Clean Development Mechanism (Article 12), which allows the generation of project, based CERs (certified emission reductions) in Non-Annex 1 countries for utilisation against the national commitments of Annex B countries. These CERs are approved conditional to the proof of "additionality" as well as proof of contribution to sustainable development of the host country. The credit trading under the CDM is thus seen as a means of achieving dual objectives of providing cost effective compliance to the industrialised countries while at the same time generating resource flows for development in the Non-Annex 1 countries. In the backdrop of contentious political negotiations, the advantages of speedy implementation, ease of design and flexibility of incorporating change offered by a credit based system were recognised and agreed to even at the cost of enhanced design complexity and higher transaction costs.

With the higher efficiency and potential cost savings offered by the "allowance trading" system, both the CDM and JI could well turn out to be transitional institutions which eventually metamorphose into the global emissions trading market. However, even this transitional role serves a very important function of enhancing the global constituency for the acceptance of the trading concept through actual projects and clear demonstration of benefits to the importer and the exporter while also enacting capacity and extending experience in measurement and enforcement of such trades. Thus, the working of the CDM can provide a period of fine tuning for a global trading regime, thereby leading to the necessary "conflict resolution and consensus building" around the issue and eventually forming a basis for a more cost-effective allowance based system.

Although, the system of International Emissions Trading (IET) is viewed as a refined system in terms of its potential for reducing the costs of overall abatement, the system under the Kyoto Protocol has come under criticism from certain quarters.

A point of impending concern is the absence of any objective principle, other than political bargaining and a weighted negotiation process that has been applied for the initial allocation of the allowances to the Annex 1 countries. The closest principle one can characterise the process to, is that it is based on the notion that a property right is established through use and the allocation has been undertaken on a "grand fathered" basis by using a previous years emissions (1990) as the base year and then setting the emission reduction or enhancement cap.

Linked to this subjective distribution is the issue of allocation of "relaxed targets" to certain countries, such as Russia and Ukraine. However, this criticism has to be objectively weighted in the context of having achieved an agreement to limit emissions by -5.2 per cent of 1990 levels during the first commitment period. In this context, the relaxed targets would still allow the achievement of this overall objective and need to be seen as a necessary compromise and political incentive that was offered for the inclusion of certain, marginally willing, countries into the system of international trading. With the uncertainties associated with predicting future economic growth, no one knows for sure what the national emissions would be in the future and thus the relaxed targets provide a secure "headroom" for the prospective countries that are willing to undertake the responsibility of an emissions cap. Furthermore, it provides a basis for future tightening of the targets once the system progresses and refines.

This issue of relaxed targets is, nevertheless, of paramount importance as it directly bears upon the issue of voluntary participation of developing countries that will be discussed in the next section.

THE ISSUE OF "VOLUNTARY PARTICIPATION" AND OPTIONS FOR DEVELOPING COUNTRIES

One of the most contentious issues in the run up to COP-4 at Buenos Aires was the issue of "voluntary participation" for emission reduction by developing countries. The term entered into the fray in the backdrop of the demands for a broad-based participation for tackling global Climate Change. These demands emanate from the genuine concerns about future unbridled industrial and economic growth in large developing countries, which could quickly swamp out any emissions restraint measures in Annex1 countries. The maximising of benefits that can take place if the system of international trading can be expanded at the global level augments the impetus for "participation".

On their part, the developing countries bear serious reservations against taking up any emission commitments at this stage. Their opposition is based on the fact that although the historical responsibility of causing the climate change problem lies solely on the North[17] they have yet to practically demonstrate their "leadership" role for tackling the issue as is evident from their poor performance in reducing their emissions to 1990 levels by 2000[18]. In the backdrop of these reservations, the issue has been beset with confusion and caution across the North-South political divide.

With uncertainty and controversy looming over the nature and timing of developing country participation, the debate surrounding the issue has mostly worked with the assumption of rigid and "absolute emission caps" for developing countries based on the precedent of Annex B Kyoto commitments. However, recent research on the subject has brought forth a multitude of flexible participation options aimed at exploring potential avenues for involving developing countries without constraining their sustainable growth. These are all founded on the concept of "differentiated" responsibilities of the North and the South as advocated by the FCCC and the Kyoto Protocol. Before investigating these options, it would be useful to outline some of the participation benefits as well as procedures for accession available to the developing countries.

Participation benefits

Having outlined the major developing country reservations to the issue, this sub-section puts forth the participation benefits that are offered by the "voluntary participation" of developing countries into a global emission-trading regime. The more potent of these benefits become apparent from a further insight into the unilateral announcements by Kazakhstan and Argentina at COP4.

The incentives for Kazakhstan are obvious. Its emissions, by 1996, had declined by almost 50 per cent as compared to the 1990 levels. Moreover, its projected growth in CO_2 emissions is estimated at –8.6 per cent while the energy intensity[19] of its economy is one of the highest in the world. These indicators translate into an inefficient and declining economy that carries a tremendous opportunity for cheap abatement options. If the country can manage to negotiate

[17] This notion is based on the global imbalance for carbon emission patterns which is evidenced by the fact that 63 per cent of global CO_2 emissions are produced by the richest 20 per cent of the world's population while, quite inequitably, the poorest 20 per cent are only responsible for 2 per cent of the total historical CO_2 emissions
[18] As agreed under the UNFCCC.
[19] That is, it's per capita energy consumption.

a target anywhere near the 1990 base year emissions it will, in all probability, have a significant supply of excess emissions to sell in a global trading market. The benefits for Argentina, on the other hand, are not that obvious but it is conjectured that they are linked with its desire to get accepted as a member of the Organisation for Economic Co-operation and Development[20] (OECD).

a. ***Right to participate in Annex B trading:*** The most powerful incentive for developing countries that voluntarily take up emission commitments would be the right to participate in the system of Annex B allowance trading as well as the system of Joint Implementation. This right would lead to a host of other benefits that are outlined separately in the items below.

b. ***New source of export earnings:*** The acceptance of "voluntary participation" and subsequent accession into the system of global emissions trading net provides developing countries with an opportunity to earn significant revenues from export of a new and, hitherto, "unvalued" commodity. With the incidence of trading the reduction of a ton of CO_2 would carry an intrinsic value that would release a corresponding amount of emission allowances from the national target and would, thus, be capable of being capitalised in the international emissions trading market. This opportunity emanates out of the potentially low cost abatement options that would be present in most developing countries as pointed out through various trading models. For instance, one of the models predicts an investment flow of 10 billion per annum towards developing countries if the Annex 1 targets are met through an unrestricted system of global emissions trading[21].

c. ***Financing of a carbon-efficient growth trajectory***: The developing countries will be able to tap onto a potential source of financing for putting their economies, especially energy expansion, on a trajectory of low carbon emissions. Participation in an emission-trading program would allow them the opportunity to finance policy shifts and investment strategies that could reduce their emissions from a Business as Usual (BAU) scenario. The CO_2 emissions in developing countries from the electricity sector alone are projected to triple over the next 20 years thereby increasing GHG emissions substantially. This sharp rise in emissions can be lowered, without compromising on economic growth, by enacting certain measures such as the shifting to low polluting technologies and increasing efficiency of electricity supply and demand. These two measures alone could potentially reduce the CO_2 emissions by 35 per cent from BAU[22]. These shifts could be financed through the sale of the emission allowances that would get released from the country cap, owing to the lowering of CO_2 emissions. Similar measures could also be undertaken for other sectors, such as transportation and forestry.

d. ***Avoid high "credit trading" transaction costs:*** The "voluntary participation" of a developing country into the allowance trading regime, through the acceptance of a legally binding obligation, allows it to maximise the benefits from trading by avoiding the higher transaction costs associated with the credit trading program under the CDM. Any emissions obligation or cap would automatically create a credible commodity that could

[20] See Sharma, Anju (1998), *"Crosscurrents"*, Volume 7, No.14, December 15-1998, CSE Publication, New Delhi, India.
[21] See Ellerman, A.Denny and Annelene, Decaux (1998) *"The Effects on Developing Countries of the Kyoto Protocol and CO2 Emissions Trading"*, MIT Joint Program on the science and policy of Global Climate Change, Cambridge-USA.
[22] See Bernstein, Mark and Hassell, Scott, (1999) *"Developing Countries and Global Climate Change : Electric Power Options for Growth"*, PEW Centre on Climate Change, Washington DC-USA.

be directly used for meeting the cap or sold in the international market. It would do away with, the cumbersome procedures and complexities involved in working with counter-factual, project by project baselines for proving "additionality" and certifying the emission reductions, as stipulated under the credit trading based CDM system. These savings in transaction costs would not only increase the flow of investments for GHG mitigation activities but also enhance the export earnings. This is one of the most significant benefits to be accrued by shifting from a credit (CDM) towards the allowance trading system.

e. ***Acquisition of appropriate technology:*** Participation in an allowance trading system would create a direct incentive to choose the best available technologies that can provide maximum carbon benefits, which can then be capitalised in the market. This would direct investment flows in developing countries towards providing a platform for "technological leapfrogging" and employing the latest technologies, chosen not only on a "low cost" basis but also incorporating CO_2 emission reduction aspects as well.

f. ***Possible "hedge opportunity" for crashing market economies*:** The past few years have seen the dramatic economic collapse of the ex-Soviet Union as well as the East Asian "tiger" economies, most of which defied all projected patterns of economic growth. Such unexpected collapses could potentially provide a very useful opportunity for freeing up encashable allowances under any scheme with "rigid" commitments.

g. ***Competitive edge:*** Developing countries voluntarily choosing to lead the pack would undoubtedly attain a competitive edge over the countries to follow. With a growing consensus on the need for global involvement for an effective response to climate change, the impositions of some sort of emission restrictions on developing countries seem to be a looming reality. The only question is of the time frame and type of involvement. In such a scenario, the countries that transcend the contentious and polarised political debate on the issue stand a good chance of gaining an advantage on at least two fronts.

Firstly, the system of target selection is, to date, an arbitrary one based on the weight of political negotiations. Though unfortunate, it does offer a very powerful incentive for early commitments combined with the strong precedent of awarding "relaxed and generous" commitments to expand the system[23]. A voluntarily negotiated commitment providing ample "headroom" to the developing country could create an almost assured surplus of allowances for sale in the market while allowing for sustained economic growth. This eventuality is strengthened by the recent overtures that suggest an acceptance of such "accession hot air" as the price for getting new countries into the system of specific commitments[24]. However, this incentive would need to be weighed up against the domestic risk of short-term political exploitation in developing countries. It is quite possible that shortsighted political governments could economically reap the expected capitalisation benefits of "relaxed targets" even at the cost of mortgaging away the future economic growth of the country in question. Such a risk might be mitigated by local checks and balances, such as a multi–stakeholder participation, as well as ensuring that any "allowance" proceeds are channelled towards priority development objectives.

[23] The case of the Former Soviet Union states has already been discussed earlier in the context of "hot air".
[24] See footnote 17.

Secondly, for reasons of apparent transaction cost savings, developing countries voluntarily engaging in allowance trading would be at a vantage point for attracting mitigation project investment flows as compared to the other Non-Annex 1 countries who would be vying for the same investments to flow through the high transaction cost CDM projects.

h. ***Local environmental benefits****:* The easier accessible financing, under an allowance trading system, could result in increased incidence of mitigation activities in the developing country as mentioned above. In addition to the desired climate change mitigation benefits, most of such activities would also result in secondary local environmental benefits such as reduction of local air pollution (SOx and NOx gases), afforestation and other associated health benefits. Focussed policy planning could enhance this benefit by establishing effective linkages between the local environmental needs and the appropriate mitigation projects to further sustainable development objectives in the country.

i. ***Securing secondary national benefits:*** With a direct and aggressive Annex 1 interest involved in expanding the circle of countries with concrete emission commitments, the accession or voluntary acceptance of such a commitment could be effectively used as a negotiating chip to further other national objectives. The case of Argentina, which is, supposedly, linking its commitment to its acceptance amongst the OECD countries is a good example of the astute handling of this issue for garnering the maximum national benefit.

As the politically contentious debate rages on between developed country “non performance” and developing country “non participation”, it is also important to take note of certain technical and legal issues involved in “voluntary participation”.

Procedures of accession

Another pending aspect of the debate around the issue of “voluntary participation” is the legal and procedural uncertainty surrounding such an accession by the developing countries. The provisions for allowing “new entrants” into both the Convention’s Annex 1 as well as the Protocol’s Annex B[25] are pretty much the same, whereby an amendment to the Annex can be made by consensus (or if that fails through a three quarter majority) along with the condition of approval of the Party concerned[26]. In the case of Annex B, a written consent of the Party is required. Furthermore, the amendment to Annex B can only take place after the Kyoto Protocol has entered into force, an eventuality that certainly does not seem possible in the near future. This legal obstacle could possibly be overcome through a decision taken at the COP level and strongly backed politically. However, with a strong developing country opposition to the issue of “voluntary participation” this strong support seems quite elusive presently.

This system of incorporating an amendment to the Annex, though quite rigid, could act as a safety filter for blocking out any proposals that could undermine the environmental integrity of the system or alternately could be used by some countries to block new entrants in order to guard self driven interests. Considering the above-mentioned limitations, another option

[25] Almost similar to Annex 1, it includes all those Annex 1 countries that had ratified the FCCC by Kyoto plus those whose application to Annex 1 was accepted at Kyoto.
[26] See FCCC Article 4.2(f).

available to a new entrant is to undertake the Conventions "quasi target" on emission limitations without necessarily joining Annex 1 or Annex B.

In addition to the above obstacles, the relative rights and obligations associated with the two pathways are also still far from clear. For instance, it is debatable whether the acceding developing country would have to take on all the responsibilities and obligations of the existing Annex 1 countries or whether a "relaxed" and progressive system of accepting responsibility would be possible. Also, to what extent would a country forgo its "rights" as a developing country, such as participation as a "host" under the CDM, if it was to take up a commitment. Clarity on such questions can have a strong bearing on the prospects of future voluntary participation of developing countries. It is no surprise, therefore, that although the Kazakhstan declaration of joining Annex B through Annex 1 of the FCCC is relatively clear, the content of the Argentinean declaration (discussed in sub-section below) which has opted to undertake a "voluntary" emissions cap without changing its status as a Non-Annex 1 country is still unclear in terms of future admissibility under the Protocol.

Moreover, a host of uncertainties will be faced by developing countries wishing to participate, including: the absence of an indicative process or set of principles for deciding on the target emissions; a loose precedent based on the sheer weight of the negotiations; problems with lack of credible developing country data for historical base years; and, perverse "inflation" problems with future baselines.[27]

The participation options of developing countries, voluntarily agreeing to some sort of legally binding obligations remains an open-ended issue and is investigated in the next section in light of some recent approaches aiming to extend some flexibility to the debate.

Participation Options

As mentioned earlier, a multitude of flexible participation options aimed at exploring potential avenues for involving developing countries without constraining their sustainable growth are being discussed. Some of the more viable options are briefly analysed below to bring out their relative strengths and weaknesses:

a. Growth Baselines: The concept of growth baselines proposed by the Centre for Clean Air Policy[28] endeavours to fulfil the dual objectives of emissions curtailment and economic growth in developing countries. Under this approach, the participating countries would agree to an emissions "growth baseline" which would be set below the BAU[29] emission projections but above the "no-regrets baseline"[30]. The exact profile of the growth baseline would not be an arbitrarily negotiated one but could be established by tying emissions budgets to improvements in the ratio of carbon intensity (CI)[31]. The motive being to allow the developing countries to grow but along a more carbon efficient path and to ensure that their GHG emissions grow at a slower rate than their economic growth.

[27] See Werksman, Jacob (1999), *"Procedural and Institutional Aspects of the Emerging Climate Change Regime"*, FIELD document, UK.
[28] See Hargrave,T (1998) "*Growth Baselines: Reducing emissions and increasing investments in developing countries*", Centre for Clean Air Policy, Washington DC, USA.
[29] The acronym refers to the business as usual projection, which assumes that the country takes no abatement policy initiatives.
[30] This baseline refers to what would happen if all negative or zero cost options were undertaken by the country
[31] Specifically, the CI ratio may be expressed as carbon emissions/GDP or per capita carbon emissions.

The emissions budget for each commitment period would, subsequently be calculated using the formula 1:

Emissions Budget = GDP x C/GDP

The CI indicator would accordingly be used to define a firm and fixed commitment for the developing country during the commitment period. The above emissions budget would be calculated ex-ante based on using a "target" CI ratio and the expected projected GDP. The selection of this "target" CI could be undertaken by grouping the participating countries with similar circumstances, such as rate of economic growth, fuel mix, level of technology and policy frameworks, and then applying the same CI to a particular group. Also, for ease of implementation, it has been suggested that this methodology be applied only to sectors such as power utility emissions, which are characterised by credible data and a strong potential for policy response. Moreover, the paper proposes a phased involvement from amongst the developing countries, based on their crossing certain pre-decided participation thresholds such as the total national emission levels.

This approach carries the advantages of allowing participating developing countries to take part in the system of allowance trading as sellable allowances would be released if the country's emissions fall below the stipulated emissions budget. This could, potentially, occur if the country undertook aggressive policy measures for improving its CI ratio while benefiting from the "no regrets" options or alternatively if the gross domestic product (GDP) growth falls below projections. Participation in allowance trading would allow it to reap benefits such as capital inflows and lower transaction costs trading.

However, this system of involving developing countries does seem to fall short of alleviating the developing country concerns. First, it indirectly brings them into the net of firm commitments while providing a compelling incentive to undertake the "no-regrets" options as soon as possible for freeing up maximum allowances in the first commitment period. This, however, would potentially subject them to the risk of a much more stringent commitment in the follow up period without the luxury of possessing any low cost options to capitalise on. Second, though it could provide a joining incentive through a "relaxed entry", based on the setting of the projected GDP and CI ratios, any unexpected rise in GDP or growth rates could subject it to go over the emissions budget as easily as an unexpected economic collapse would allow it to free up sellable allowances. Third, the likelihood of "hot air" is increased through this approach, which, even though it might be considered as a necessary price to pay for the long-term involvement of the developing countries, could still threaten the environmental integrity of the process. Fourth, the procedure for grouping countries on the basis of CI as well as deciding on the participation thresholds is still vague and carries the potential of opening up yet another contentious political debate where the force of negotiations could override other decision making factors. Finally, the whole approach relies on the availability of credible and sufficient emissions as well as economic data that could prove problematic for most developing countries.

b. ***Carbon Intensity Indicator Approach:*** The World Resources Institute has suggested a subtle, but significant, modification to the "growth baselines" approach[32]. Their method argues for a phased approach towards the acceptance of any developing country emission commitments and suggests that in the first step, no absolute commitments should be taken even if they are growth oriented. This would carry the dual benefits of allowing the developing countries to economically grow without the threat of surpassing any pre-determined emissions cap while also providing a safety against the incidence of excessive "hot air" which could soften up the Annex 1 commitments.

Their approach is also based on the CI indicator and advocates the same formula 1 for calculating the Emissions Budget, as stated above. However, the difference comes in the application of the formula variables. Whereas a *projected* GDP coupled with a target CI is used for the growth baseline, this approach utilises the target CI coupled with the *actual ex-post* GDP. Hence the CI itself becomes fixed as a target, which is set as a percentage improvement on the starting CI, while the total emission budget is left flexible and varies with the rate of economic growth. This flexibility allows an enhancement of the emissions budget if the economy grows and, conversely, tightens the budget if the economy collapses, thereby providing a protection against the incidence of "hot air".

The major advantage of this approach, other than those related with the developing countries participation in the system of allowance trading which have been outlined earlier also, is that it provides a very effective safety valve against the emergence of any "tropical hot air. At the same time it also provides the developing countries a chance to enhance their emission budget in a situation of unexpected economic growth. On the basis of this balanced approach it merits serious political attention.

However, on the flip side, this approach takes away a major joining incentive away for the developing countries by minimising the possibility of any generous growth targets. In its absence, developing countries whose prime interest lies in safeguarding their own development and economic growth interests, may sense a discriminatory, rather than differentiated, division of targets. If the Russian "hot air" is environmentally acceptable and palatable so, in the same moral vein, should the "tropical hot air" be as a short-term measure for extending the net of future commitments. This proposal undermines the possibility of any such gains accruing to participating developing countries that agrees to accept limitations on its future growth emissions.

The selection of acceptable CI targets, required under the scheme, poses another politically contentious issue confounded by the unavailability of reliable data in developing countries. More importantly, this approach only allows the trading benefits to accrue ex-post after the end of the commitment period. Thus, any trading related benefits are long term and uncertain. This is a major drawback over the other approaches where the budgets are calculated ex-ante and any "generous" allowances can be encashed to raise development financing.

Thus, the ultimate acceptability of this "flexible targets" approach would eventually depend on the political palatability of "tropical hot air". If generous targets were viewed as "accession hot air" and as an inevitable price to be paid for developing country

[32] See Baumert, Kevin, Bhandari, Ruchi and Kate, Nancy (1999) "*What might a developing country climate commitment look like?*", World Resources Institute, Washington DC, USA.

participation, then something akin to the growth baselines would likely be preferred. On the other hand if concerns for avoiding “tropical hot air” reign paramount then a CI approach could provide an effective preferred option.

c. ***Emission Budget “Options”:*** Another variation to the proposals for participation options of developing countries has been provided by the suggestion of extending “optional emission budgets”[33]. This approach advocates the agreement of firmly established budgetary commitments with the developing countries, which would act as a contingent entitlement but not a limit on emissions. The contingency would arise from the fact that only if the country’s emissions fall below this commitment, can it sell the reductions or allowances in a trading market. On the contrary, if its emissions exceed the budget it incurs no penalty and is neither subjected to any limitation. Thus, the option presents a conditional and “non-binding” alternative.

Two further sub options have been proposed under this scheme. Under one of them the country is imposed a limit as soon as it starts selling any ex-ante allowances in the market. In the second option, the country can only sell the allowances ex-post after the end of the budgetary period provided its emissions fall below the budgeted level.

This scheme seems to allow the developing country to agree to a non-binding emissions limit, which permits it to reap the benefits of participation in allowance trading without incurring any downside “non-compliance” risks. However, in so doing it exposes the developing country to an open-ended risk whereby it confers upon itself a contingent commitment but at the same time, establishes an indelible footprint for a future firm commitment. Also, the scheme obtains such an outcome without the incentive of any definite or certain benefits, because if the country does not over comply with the commitment it does not enter into any trading and neither does it attain any associated benefits.

Moreover, by agreeing to a target budget it sets forth a future national baseline target and growth trajectory, which could jeopardise possible projects under the CDM by confounding the (already controversial) project baseline assumptions. Finally, the procedure for allocation of these emission budgets is also not clear and again seems to be hinging upon the (highly biased) negotiations process.

The merits of the scheme lie in the fact that it provides a “soft” and non-binding option to the developing country that may be exercised at the peril of some of the shortcomings mentioned above. Another positive point is that it could provide the most viable exercisable option under the present legalistic constraints of the Kyoto Protocol.

d. ***The Argentinean Proposal:*** As earlier stated, Argentina announced its intention to "voluntarily" take up a greenhouse gas emission target in Buenos Aires (COP4). This announcement has been given a concrete form at COP5 in Bonn recently through the tabling of a very interesting and innovative proposal which has the following salient features:

[33] See Philibert, Cedric (1999) “How could emissions trading benefit developing countries?” Report presented to the 4th OECD Forum on climate change, Paris-France.

- The overall objective of announcing a target is to contribute to the abatement of global emissions without relinquishing the national objective of sustainable socio-economic growth.
- The voluntary emissions target chosen is a "dynamic" one which would be the product of an index multiplied by the square root of the five year average GDP corresponding to the first commitment period of 2008-2012.

$$E=I*\sqrt{P}$$

Where: E = Emissions measured in tons of carbon equivalent
P = GDP in 1993 Argentinean Pesos
I = Index chosen as 151.5

- The value of the index has been chosen after carrying out an internal exercise to project the national BAU emissions through various scenarios dictated by two major variables, GDP and the Agriculture/Livestock emissions. The value of the Index has then been chosen to reflect the national priority of reducing the emissions between 2~10 per cent depending on the input variable values.
- The inclusion of the square root aims to decouple emissions growth from the growth of the economy and tries to place it on a lower growth trajectory.
- For the purpose of the formula, the emissions would include those from sources as well as net of those sequestered by sinks.
- Argentina has also opted to maintain its Non-Annex 1 status while asking for the right to participate in all the Kyoto mechanisms including CDM, JI and IET. It has, thus, called for developing a "new option" under the Convention to accommodate its proposal and also open the way for other countries willing to adopt a voluntary national emissions target.

This innovative and bold formula proposed by Argentina builds upon most of the options discussed in the text above and refines them as per the particular circumstances prevalent in the country. The scheme used to ascertain the value of the Index (I) provides the cornerstone for safeguarding national interest and is based on the premise that Agriculture and Livestock emissions are a major contributor to the national inventory amounting to roughly 35 per cent of total emissions. Moreover, these emissions do not have a strong correlation with changes in national GDP and, thus, have been considered as an independent variable in the calculation of the index.

In proposing this novel approach for "voluntary participation", Argentina has chosen not to follow the path of negotiating "relaxed but fixed" targets which could potentially provide "accession hot air" at the cost of questionable global environmental acceptability. On the contrary, the chosen dynamic target which associates the target to an economic activity index, substantially reduces uncertainty while at the same time guaranteeing an effective emission reduction between 2~10 per cent of BAU. The proposal, potentially, extends Argentina the advantages of participation in international emissions trading without taking up any of the other obligations imposed upon other Annex 1 countries.

On the downside, the Argentinean scheme extends a conceptual framework but does not provide a generalised or standard formula that can be applied across the board to all Non-Annex 1 countries as the particular formula has been specifically designed to suit particular circumstances in Argentina. This renders the setting of the 'index' associating national GDP with emissions targets both open-ended and subjective, which in turn can lead into yet another round of contentious political negotiations. Moreover, the development of such indexes and application of the formula pre-supposes a very high level of emission data availability and reliability within the country. Also, the legality of this commitment is still unclear as are the associated penalties in case of non-compliance.

e. ***Other avenues for flexibility:*** Along with the above proposals, various other avenues of extending flexibility to the participation options of developing countries amenable to accepting some level of emissions commitment have also been opined[34]:

- Allowing developing countries to undertake commitments within regional "bubbles" such as ASEAN.
- Introduction of "partial caps" based on selected industrial sectors, with higher data availability and reliability, which could progressively expand towards a national cap.
- Extending the choice of choosing different base years for each GHG that the developing country proposes to bring under a sectoral or a national cap.

What the ensuing discussion has evidenced is the fact that, although various participation options for developing countries have been proposed none of them really is comprehensive enough to work across the contentious political divide on the issue. All of them carry certain merits as well as de-merits and a consensus approach needs to be devised out of a possible amalgamation of the approaches to effectively account for the political and economic realities of the debate surrounding the "voluntary participation" issue.

If the process of expansion of the emissions trading regime were to move forwards, it would need to be supported by the provision of a clear framework for accession. Whereas the political process could ultimately benefit from the interim role played by the CDM as well as the "performance assessment" of Annex 1 initial commitments, the system of implementation could eventually include the possible adoption of alternative indicators and non-binding pledges along with local capacity and institutional support.

THE QUESTION OF "SKEWED BENEFITS"

Although the Convention and the Kyoto Protocol generally bifurcate the Parties into developed (Annex1/B) and developing countries, the lines of division are not so simply marked out in reality. This is evident especially in the case of developing countries, where the Non-Annex 1 group constitutes a highly heterogeneous collection of countries with widely divergent perspectives and interests under the Climate Change debate (large/small/middle income; least developed; commodity exporters; agricultural importers/exporters and other differences). The cohesion of the Non-Annex 1 grouping under the "G77+China" umbrella has been frequently tested owing to the highly polarised and contentious nature of the Climate Change debate. A number of issues, such as the inclusion of Land Use, Land Use Change and Forestry (LULUCF) under the CDM and the timing and design of its implementation, have confronted the multifarious interests within the developing countries.

[34] See footnote 5.

However, the issue of "voluntary participation" seems to be challenging the diverse grouping with a greater risk of fissure than ever before in the negotiations. Already, two countries have broken ranks to announce their intent of accepting commitments. Moreover, the growing realisation within the group of an eventual acceptance of emission limitations for effective global action as well as the potential of "unequal benefits" being accrued is fuelling this division within the developing countries. It is becoming evident that there are going to be relative "winners and losers" in this process of engaging in emissions trading and also that a competitive edge may be attained by some countries by an early entry into the regime.

Some initial research is being done to suggest further division of the Non-Annex 1 grouping, which ranges from partitioning them on the basis of some quantifiable factors[35] to proposing a system of "progressive engagement"[36] according to levels of development. However, considerable work needs to be done to assess the relative benefits amongst developing countries for engaging in the process of voluntarily accepting commitments and capitalising from global emissions trading.

A first illustrative list of indicators is provide below which would, subsequently, need to be expanded upon in follow up research:

a. *Opportunity for cost effective abatement:* The whole impetus for emissions trading being the response to an opportunity for lower cost global abatement, it follows that the developing countries that offer the most of such opportunities stand to gain considerable resource flows through participation. In this regard, as discussed earlier, indicators such as the levels of energy intensity[37] and the rates of deforestation[38] or cost of afforestation can be used to rank the relative benefits that can accrue to the involved developing countries. Also, with the uncertainty surrounding inclusion in CDM of LULUCF, countries possessing sink enhancement opportunities could also be net beneficiaries from participation in emissions trading which includes the provision of such projects. Moreover, along with the presence of these opportunities the comparative costs amongst developing countries could also play a decisive role in procurement of investments and project financing through the trading regime.

b. *Presence of advanced market systems*: In tandem with the opportunities for low cost abatement projects the relative presence of advanced market systems would also be a strong indicating factor to judge the accruing benefits to the country from involvement in the system of global emissions trading. The trading concept, though quite simple in theory, depends strongly on the presence of a conducive domestic environment which can both accept the presence of market based instrument for environmental control and also facilitate the in-country project development, approval and registration process. This, in turn, is reliant on a host of factors such as the level of market liberalisation, development level of local commodity and stock exchanges and the extent of private sector mobilisation in the country. Some indirect indicators, such as the membership of the countries in the OECD[39] can also be used for judging the country preparedness for emissions trading.

[35] See footnote 21.
[36] See JUSSCANNZ's pre-Kyoto proposal.
[37] See footnote 27.
[38] A higher rate could mean a greater opportunity for sink projects.
[39] Such as South Korea and Mexico.

c. *Domestic awareness, political support and capacity:* Related to the above factor, is the extent of domestic awareness to the Climate Change issue and international debate as well as the political faith in market forces to address the issues, which can also be very pertinent for fully capitalising any low cost domestic abatement opportunities. Any in house capacity catering to Climate Change issues, such as the development of national communications or AIJ development programs could provide a large advantage for maximising the benefits through trading. The prospective analysis of participation benefits and the setting up of any rational voluntary commitment to reduce emissions requires a thorough knowledge of the most updated structure of these emissions, their recent evolution as well as future projections. This is quite evident from looking at the two initiating countries, Kazakhstan and Argentina. Both are at advanced levels of preparation in terms of their national emission inventories and have already started establishing support endogenous capacity. The Argentinean proposal has come forth after an extensive exercise organised through the National Commission for the formulation of the GHG emission target, which involved the active participation of a range of stakeholders.

d. *Experience with foreign direct investment (FDI)*: The flow of private sector foreign direct investments has shown an inequitable balance with most of the flows being attracted by a very small percentage of the developing countries. At the base of this inequitable flow are a number of factors, such as those cited above, which can influence and attract the private investments. The key factors can be political and economic stability, transparency, low red-tapism and domestic private sector involvement and empowerment. The benefits of resource flows under the emissions trading regime should not be expected to flow any differently, unless otherwise restricted[40]. It can be reasonably assumed that countries at the fringes of historical investment flows, could manage to lure in the funds with the added attraction of any low cost reduction. However, countries with poor political and economic stability that have not been able to attract any FDI flows should not be expected to suddenly attract investment flows under the emissions trading umbrella.

e. *Data availability and reliability:* The countries that are already at an advanced stage of preparation of GHG inventories and emissions profiles might be able to gain an investment advantage over countries without such reliable data availability. However, in a perverse sense, the countries with uncertain emission profiles might gain through the adoption of negotiated “relaxed” national baselines for growth.

f. *Vulnerability to Climate Change:* Countries that are highly vulnerable to the deleterious effects of Climate Change and who do not bear the historical burden of responsibility for the issue, such as the low lying small island states, are pressing more for concrete action to be taken to ameliorate the already chaotic situation for them. Thus, this variance in the desire for immediate and strong steps is also a factor of divergence amongst developing countries that could link up with their relative positions on the issue of “voluntary participation”.

The above list is a first endeavour to provide some key factors and indicators that could be used to create a ranking of benefits for developing countries from participating in a global emission-trading regime. The list is by no means conclusive and would need to be expanded

[40] The disappointing AIJ flows towards Africa have compelled the African group to press for “Quotas” under the CDM.

upon through further focussed research work on the subject. However, it does provide a basis for highlighting the diversity of interests involved influencing the advancement of the complex issue of “voluntary participation”.

AREAS FOR FURTHER RESEARCH

The preceding sections have attempted to investigate the issues and controversies surrounding the issue of “voluntary participation” of developing countries, in light of the available research on the topic, as well as elaborate some of the workable options being discussed in this context.

The search has brought forward certain research gaps in this ongoing debate which need to be filled in order to inform the political decision making process and move the debate in a positive direction towards consensus building.

Some of the more pertinent ones include:

The differentiation of developing countries in terms of relative benefits to be accrued through trading. This needs to be undertaken through the use of some quantifiable indicators that can weigh out the relative benefits. Also, this could be coupled with associated research on the development of an incentives regime for the involvement of the relative “losers” under global trading.

The “threshold” requirements for triggering the shifting of a developing country into Annex 1/Annex B. Work needs to be carried out to lay out clear, transparent and objective rules and procedures for shifting of interested developing countries into the system of Annex 1/B allowance trading.

Amalgamation of the participation options in light of their relative merits and de-merits as well as the political realities facing the debate to develop a consensual approach towards the progressive participation of developing countries.

Identification of data deficiencies and, subsequent, technical requirements as well as institutional support capacities in developing countries. This needs to be done relative to the advancements required for domestically accepting and applying the system of “allowance trading” within those countries.

Further legal clarification on the procedures for accession of interested developing countries.

ANNEX 1: Evaluation of USA/Chile trading experiences

The evaluation criteria listed below were used to compare the performance of US "Credit Trading"[41] and "Allowance Trading" programmes for SO_2 reductions with the Chile-PM Compensation scheme. The results of the comparative exercise are summarised in the table below[42]:

EVALUATION CRITERIA	US-CREDIT TRADING	US-ALLOWANCE TRADING	CHILE-PM COMPENSATION
Cost Savings	USD 5 bn – USD 12bn since 1975 but less than expectations	-Allowance costs much less than expected -USD 300 million from one transaction	-Cost savings less due to nature of market (number of small sources and internal trading prospects).
Regulatory Costs	USD 10 m	More than USD 50 million since 1989	-Approx.USD 1m -Benefit: cost ratio of 2.4
Flexibility	Constrained	Enhanced	-Maximum (no zonal restrictions)
Participation	-VOC Maximum -Internal trading	-lower than expected -internal trades (precautionary approach)	-Vary less -Only internal
Program Start-up	-Simple and Quick -Phased voluntary build-up possible	-Complex and time consuming -Need for complete industry consensus	-Quick, with strong Government and Industry support
Compliance	Enhanced by lower costs	-Ensured by project design -Spot checks/high penalties	-Deadlines not met -Lack of compensation credits
Administrative Ease	-High transaction costs (less info) -Ambiguous property rights	-Standards directly linked to environmental goal -lower transaction costs (auction info)	-Bureaucratic difficulties /Autonomy curtailed -"Control vs Facilitate" -Rule changing
Environmental Goals	-Neutral -Moral opposition by environmental groups -Fear of "phantom trades"	-Safeguards built in -"Hot spot" problem alleviated by small distributional impact -More allowances bought than required.	-Goals not specified properly -Faulty baselines on "full load" -Too much simplicity for speed of program
Innovation	Incentivised	-Competition for compliance options (e.g. scrubber costs)	Not applicable
Consumer Benefits	-Env. Quality reached at lowest cost -No pass through of cost savings	-Env. goal achieved at lower costs -Some states required "pass through" of cost savings	-Potentially high health benefits but not attained so far
Changing Perception	-Progressive acceptance through "constructive ambiguity"	-Tangible demonstration -Constituency enlarged (Superfund)	-Reversal occurred -Enthusiastic start lead to alarming situation
Monitoring and Enforcement	Same as CAC regime	-Self monitoring proviso -Random spot checking	-Self monitoring abused in absence of spot checking and penalty enforcement
Overall Assessment of Experiences	***-Substantial improvement over CAC approach*** ***-Environmental quality attained at lower cost*** ***-Fell short of expectations***	***-Success story*** ***-Improved upon CAC and previous program*** ***-Outperformed expectations for cost and compliance***	***-Text book errors in project design*** ***-Effectiveness curtailed by desire for simplicity and speed*** ***-Framework established for improved performance***

[41] Generally termed as "emissions trading"

[42] See Aslam, Malik Amin, (1996), "Emissions Trading: Utility for Pakistan", M.Sc. thesis at Oxford University, United Kingdom.

Post-COP-6 Perspectives:
Youba Sokona[*]

In the context of Malik Amin Aslam's paper on "International Greenhouse Gas Emissions Trading and Issues related to Voluntary Participation by Developing Countries", emissions trading should be analysed and reviewed in terms of:
Enforceability
Equity
Supplementarity
Non compliance

The idea of strict monitoring conditions and stiff penalties, which Aslam refers to at the start of his paper, is an inevitable trajectory to ensure that the rules of the game are adhered to by all concerned. However, due to the uncertainty which shrouds the very concept of emissions trading and its efficacy, any rigorous program that advocates its application should be reviewed to allow for and enable rapidly evolving dynamics within the global climate change environment, from both a theoretical and practical standpoint.

The benefits of voluntary participation appear to be overstated in the paper by Aslam. While some of the arguments are well articulated and coherent, he fails to mention that developing countries come in different "packages". There are obvious distinctions to be made between a country like Kazakhstan and Bangladesh (or even Chad). While the former may reap certain advantages through emissions trading, the latter would perhaps be more concerned with adaptation strategies and most importantly reducing its vulnerability. The key issue is for Least Developed Countries (LDCs) is not trade rather it is their survival.

Furthermore, the examples of Kazakhstan and Argentina cited in the paper draw attention implicitly to the general question of South/South equity and the multitude of countries that remain on the margins and hence require a different set of measurements and analyses. Accordingly, it would have been preferable had the paper included a broader horizontal analysis addressing the heterogeneity of developing countries and a recognition of the inherent difficulty in applying a unitary scale of measurement to impacts of emissions trading or, for that matter, to defining policy prescriptions.

In addition, the following key points are neglected in Aslam's paper:
How do the LDCs fit into this general mould of "voluntary participation" given their basic constraints in terms of technological capacity, human resources, institutional knowledge, infrastructural difficulties and the litany of economic development impediments they have to overcome?

Although the paper gives a good evolutionary break down of emissions trading (ET), it does not conceptualise it within the global framework of International Emissions Trading. The paper presents a fairly good overview of the flexibility mechanisms within the Kyoto Protocol, especially with regard to the CDM in order to properly elucidate the concept of "voluntary participation". However, one wonders whether the concept of "voluntary

[*] Executive Secretary for International Relations and Coordinator of the Energy Programme of *Environnement et Développement du Tiers Monde* (ENDA-TM), Dakar, Senegal.

participation" is still accorded a high premium in the international climate change debate. If it is, it was not raised during COP-6 in The Hague and it certainly seems to have lost some of its potency since Buenos Aires where it was heralded as an important step in terms of climate change emissions abatement and reduction. Also the question of its legal validity, which will be created if the proposal had been accepted, needs to be developed further.

It would seem that the whole purpose of "voluntary participation" is approached from a purely market-driven perspective. What are some the social benefits that could be gained in terms of job creation or poverty reduction?

The question of low or high transaction costs is relative. The argument regarding developing countries gaining from "voluntary participation" through low transaction costs in comparison to other Non-Annex 1 countries "vying for the same CDM projects at high transactions" should be approached from a more holistic perspective. In developing countries where institutional, functional and technical capacities are weak, transaction costs could be extremely high and the question of affordability of new technologies poses a great deal of problems and challenges

The paper mentions energy conservation and efficiency as benefits of voluntary participation. However, in some African countries for instance, energy poverty poses phenomenal difficulties. How can you conserve energy or increase its efficiency when there is an overwhelming need to increase energy consumption both from a per capita and aggregate basis in order to accelerate economic growth?

The paper makes a valid and cogent point with regard to a more "relaxed entry" option in spite of its uncertainty and imperfections rather than a programme, which offers no set rules or guidelines at all in terms of voluntary participation of some developing countries. Yet one must ponder over the very concept of "voluntary participation". It must be remembered that in 1992, due to increased scientific consensus regarding the growth in concentration of greenhouse gases, countries such as the US signed the United Nations Framework Convention on Climate Change (FCCC). This was a legally non-binding voluntary commitment that industrialised countries took to reduce their greenhouse gas emission to 1990 level by the year 2000. However, as human activities continued to negatively impact on global climate, it became clear that countries such as the US and Japan would not be in a position to fulfil their initial commitment of GHGs reductions through voluntary action. A legally binding treaty that would bring industrialised nations to take cognisance of the magnitude of the problem and take appropriate measures was patently needed. Even today, experts and pundits remain sceptical about the chances of a legally binding protocol, in the light of President's Bush recent comments on carbon dioxide emissions. Many environmentalists believe this could well be the final nail in the coffin as it casts renewed doubts on the otherwise troubled waters of international diplomacy towards combating global warming. In this vein, one could ask whether "voluntary participation" has the least chance of seeing the light of day and pulling it off when legally binding options are already a matter of great controversy.

****