Greenhouse Gas Emissions Trading and Project-based Mechanisms

OECD

Proceedings

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OECD Global Forum on Sustainable Development:
Emissions Trading
CATEP Country Forum
17-18 March 2003, Paris

OECD

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FOREWORD

The OECD hosted a Global Forum on Sustainable Development: Emissions Trading at its Headquarters in Paris on 17-18 March 2003. The Forum was held in conjunction with Concerted Action on Tradeable Emissions Permits (CATEP), a research network funded by Directorate General Research of the European Commission, and co-ordinated by the Department of Environmental Studies, University College, Dublin. The aim of the Forum was to bring representatives from OECD and non-OECD country governments together with representatives from the research community, to identify and discuss key policy issues relating to greenhouse gas emissions trading and project-based mechanisms for greenhouse gas emission reduction, such as Joint Implementation and the Clean Development Mechanism.

This book contains selected papers from the Forum, which were prepared by the workshop contributors, and subsequently revised to reflect feedback from Forum participants. The Secretariat is grateful to the individual authors, Forum participants, and for comments provided by Member countries. The views expressed are those of individual authors. The book is published under the responsibility of the Secretary-General of the OECD.

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INTRODUCTION

by

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Tradeable permit schemes and project-based mechanisms are market-based instruments that have potential for use in developed and developing countries to improve the management of natural resources as well as to reduce air pollution and greenhouse gas (GHG) emissions. Over the past few years, there has been increasing interest and activity in designing and implementing GHG tradeable permit schemes, as well as project-based mechanisms to reduce GHG emissions, such as Joint Implementation (JI) and the Clean Development Mechanism (CDM).

The OECD Global Forum on Sustainable Development: Emissions Trading and Concerted Action on Tradeable Emissions Permits (CATEP) Country Forum was held on 17-18 March 2003 at the OECD Headquarters in Paris. The Forum brought together policy practitioners on tradeable permits from OECD and non-OECD countries and researchers from the CATEP network. The objective of the Forum was to examine the results from CATEP research on tradeable permit design and implementation, as well as to identify and discuss key policy issues emerging in various countries and regions relating to greenhouse gas emissions trading and other project-based mechanisms for GHG emission reduction.

Although the focus of the Forum was on greenhouse gas emissions trading, considerable discussion focused on the use of tradeable permits in other environmental policy applications such as reducing conventional air pollutants. The Forum was particularly timely given the implementation of a number of key initiatives, including the European Union's Emissions Trading Directive, as well as increasing interest in these issues in developing countries. Around 170 participants from OECD and non-OECD governments, industry, non-government organisations, the research and finance communities attended the Forum. Those from other institutions involved with emissions trading, JI and CDM projects, such as the European Commission and the World Bank, also participated. The Forum provided a useful opportunity for participants from OECD and non-OECD economies to share and learn from experiences to date, to identify key opportunities for further participation in emerging trading markets, and to examine potential for the use of permit or project-based trading to meet sustainable development objectives.

This book comprises the proceedings from the Forum. The book is structured according to the key themes raised and discussed at the Forum. **Part I** of the book focuses on experiences with emissions trading and project-based mechanisms in developing and transition economies. There are several case studies from Central and South America, China, India and Costa Rica, as well as two commentaries from developed country analysts on the use of market-based instruments and emissions trading in transition and developing countries. There is also an emphasis on the institutional requirements for tradeable permit schemes and project-based mechanisms in these countries.

The paper by *Yang, Dong, Chazhong, Shuting and Schreifels* describes the SO_2 emissions trading program in China. It outlines the experience to date, analyses implementation opportunities and barriers, as well as the circumstances necessary for SO_2 emissions trading in China. In addition, it covers other SO_2 emission control policies in China, institutional requirements, case studies, as well as recommendations for the transition from pilot projects to a nationwide SO_2 emission trading program.

The paper by *Morera, Cabeza and Black-Arbeláez* examines the various barriers related to CDM project development in Latin America. The paper outlines the role of national CDM offices, or National Designated Authorities (NDAs), which are responsible for evaluating and granting national approval to proposed CDM projects. It presents results from surveys and interviews conducted by the Andean Center for Economics in the Environment, which gathered information on various national CDM offices in Central and South America, specifically evaluating the institutional capacity of these offices and their ability to support the efficient and effective development of the CDM potential in their countries, identify their main deficiencies and immediate needs.

The paper by *Manso* examines the experience with the Clean Development Mechanism in Costa Rica from the perspective of a developing country. It focuses on the various reasons for the success of the CDM in Costa Rica, and provides lessons learned from experience so far as a guide for those developing countries wishing to participate in the CDM. The paper focuses on the required framework conditions for CDM projects in developing countries, emphasising the importance of establishing institutional capacities – particularly a well-functioning National Development Authority for the CDM.

The paper by *Gupta* examines the likely nature and extent of India's involvement in CDM activities, including the possibilities of convergence across Kyoto-type flexibility mechanisms, particularly emissions trading and CDM. The paper looks at various issues related to the use of these instruments in India, particularly the linkages among them and issues related to their implementation. It also examines the question of whether India stands to gain or lose if emissions trading is realised even if it remains outside such an arrangement during the initial commitment period.

The paper by *Greenspan Bell* critiques the appropriateness of market-based instruments such as tradeable permits in transition and developing countries. The paper provides a brief history of the development of market-based instruments and their dissemination, discusses some of the practical and institutional reasons why these instruments are difficult to apply in transition and developing countries, and offers alternative approaches to economic instruments when addressing environmental policy in developing countries.

The paper by *Kruger, Grover and Schreifels* examines the use of cap-and-trade schemes to address air pollution in developing countries. The paper identifies problems faced by developing countries in implementing effective environmental programs generally, particularly issues relating to weak environmental institutions. It outlines some of the potential benefits of cap-and-trade schemes in developing countries, examines concerns raised in relation to the use of trading systems in these countries and addresses the question of whether cap-and-trade is an appropriate instrument. The paper concludes with recommendations for building the institutional capacity for effective cap-and-trade programs in developing countries.

Part II of the book focuses on tradeable permits in the policy mix and harmonisation of domestic emissions trading schemes. The paper by *Haites* discusses issues relating to linking national emissions trading schemes, with a focus on trading schemes for greenhouse gases. It notes the many and varied GHG emissions trading designs that are being considered and implemented by Annex I Parties to the Kyoto Protocol to help meet their national emissions limitation commitment under the Protocol. The paper examines the following questions: Can national trading schemes with different designs be linked or do the designs need to be harmonised? Which design features must be, or should be, harmonised to enable the potential cost savings to be realised? It concludes that while it is generally easier to link emissions trading schemes with similar designs, there are also technical solutions to linking schemes with widely divergent designs.

The paper by *Johnstone* explores the use of tradeable permits with other environmental policy instruments such as taxes and voluntary agreements, examining conditions under which it is efficient and effective to use tradeable permits in combination with other instruments. It also examines cases where the use of multiple environmental policy instruments is likely to be preferable to the application of a single policy instrument. The paper concludes that as a general principle it is unlikely to be economically efficient and environmentally effective to use more than one policy instrument to target the same environmental damage from the same sector, but addresses four cases where it may be necessary to introduce different policy instruments as part of a policy mix: reducing abatement cost uncertainty; overcoming technology market failures; increasing behavioural responsiveness; and, addressing local environmental impacts.

The paper by *Sorrell* explores the potential interactions between tradeable permit schemes and other policy instruments using the practical case of the European Union Emissions Trading Directive and the Climate Change Levy/Climate Change Agreement package in the United Kingdom. The paper compares the scope, timing, objectives and operation of the schemes and concludes that the coexistence of the instruments raises four important issues: double regulation; double counting of emission reductions; equivalence of effort; and the fungibility of trading commodities.

Part III of the book examines various transition issues relating to emissions trading and project-based mechanisms, including how different markets will merge over the longer term. The section addresses questions such as the potential fragmentation of markets and differentiation of prices, monitoring and enforcement requirements, as well as competitiveness and market power issues. This part of the book also includes a summary paper on key issues and conclusions relating to the experience of emissions trading and project-based mechanisms to date.

The paper by *Grubb* examines the emerging trading and project markets, and offers estimates of the prices and volumes that may be implied from each of the markets. It outlines the potential supply-demand balance of emission units across countries, particular qualities of the various emissions units that might influence the positions of buyers and sellers in the market, leading to price differentiation between the Kyoto units.

The paper by *Convery, Dunne, Redmond and Ryan* addresses issues relating to emissions trading and the political economy, with a particular emphasis on insights emerging as regards competitiveness, co-operation and market power. The paper by *Peterson* examines monitoring, accounting and enforcement in GHG emissions trading schemes, focusing on existing and planned domestic trading regimes as well as potential issues at the international level.

Finally, the summary paper by *Bygrave* in **Part IV** draws together key themes and discussions relating to the experience of GHG emissions trading and project-based mechanisms in OECD and non-OECD countries. The discussion draws mostly from the papers covered in this book, but also from recent literature on this topic. It aims to highlight important outcomes and conclusions, identify possible lessons for the future design and application of these instruments, as well as opportunities for targeted analysis and research.

PART I

EXPERIENCE AND LESSONS FROM EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN DEVELOPING AND TRANSITION COUNTRIES

ISBN 92-64-10576-X
GREENHOUSE GAS EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN OECD AND NON-OECD COUNTRIES

IMPLEMENTING SO_2 EMISSIONS TRADING IN CHINA

by

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1. Introduction

Acid rain and sulphur dioxide (SO_2) pollution in China are very severe — ambient concentrations in some regions are several times higher than air quality standards — and have significant impacts on human health, ecosystems, and cultural resources. The toll on human health and the economy from air pollution is estimated to cost as much as 2% of GDP annually (Xie, 1998). As a result, since 1995 the Chinese government has placed great importance on controlling acid rain and SO_2 pollution. In order to accomplish this, the government has identified key geographic areas where the problem is particularly severe and adopted a series of policies and measures to abate SO_2 emissions. Emission trading is one of the instruments the government is investigating. This paper analyses the opportunities and barriers to implementing SO_2 emission trading in China considering current institutional and legal conditions.

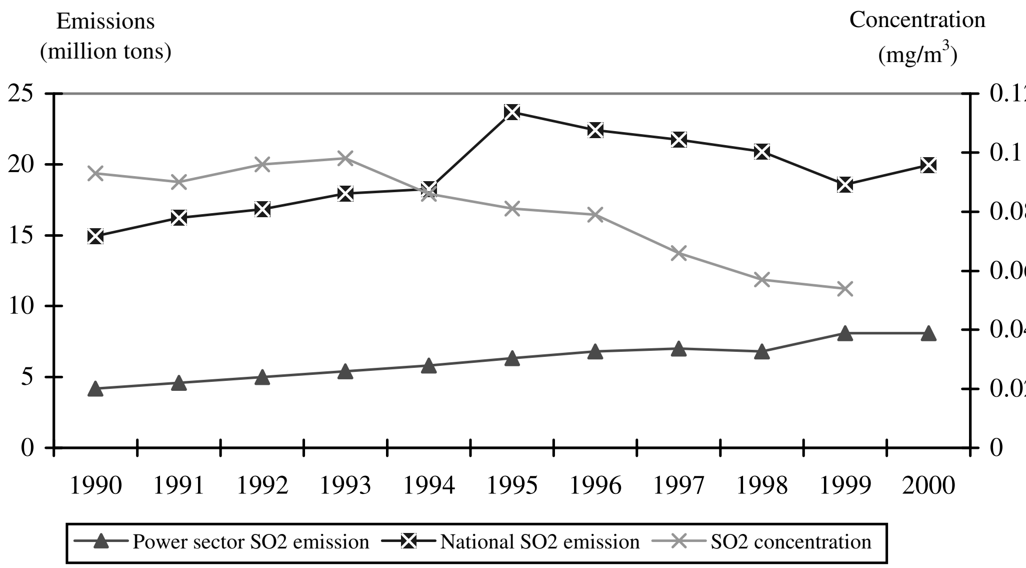
1.1 SO_2 emission trends

Coal is the principal energy source in China; it is used to meet approximately 69% of China's total primary energy demand (IEA, 2002). Due to a dramatic increase in China's coal consumption over the last two decades from rapid industrialisation and population growth, SO_2 emissions have increased and created serious environmental and human health problems. According to Chinese government statistics, SO_2 emissions in China were 19.95 million tonnes in 2000; of which, 85% were from direct coal combustion (Yang *et al.*, 2002). The largest consumer of industrial coal is the Chinese power sector. As a result, the power sector is a major source of SO_2 emissions, leading to acid rain and acid deposition across China. These high-stack sources emit 8.9 million tonnes of SO_2 annually, 45% of total emissions.

Government data show that total SO_2 emissions in China increased between 1980 and 1995 to 23.7 million tonnes. Since a series of SO_2 control measures were implemented in 1995, SO_2 emissions have declined each year with a small increase in 2000. Figure 1 illustrates the annual SO_2 emissions trend in China during the 1990s.

Emission projections through 2010 show a steady increase in energy demand in China. Much of this demand will continue to be met through coal combustion. By 2010, total annual coal consumption will reach 1.44 billion tonnes and SO_2 emissions are estimated to be 26.3 million tonnes (Yang *et al.*, 2002). Therefore, the task of bringing SO_2 emissions under control is crucial though challenging.

Figure 1. Historic SO_2 Emissions in China



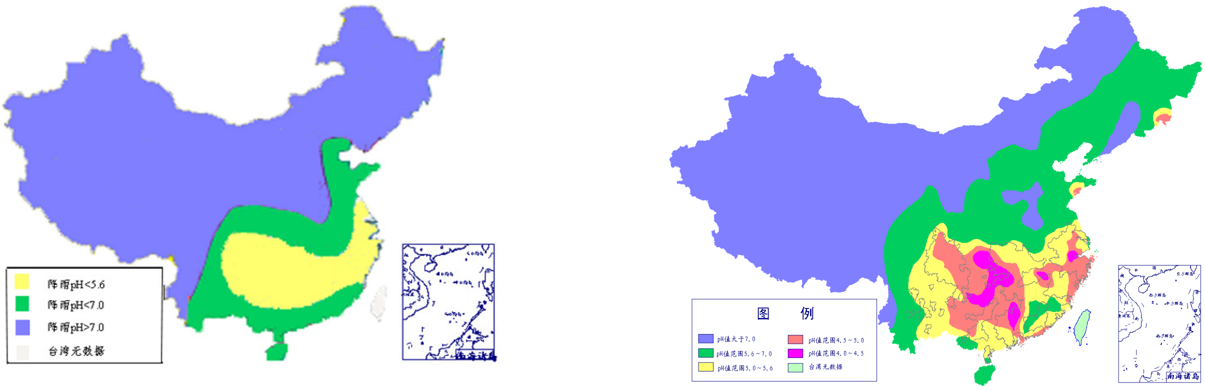
Source: China Environment Yearbook, 1990 to 2001.

1.2 Acid rain and environmental impacts

SO_2 emissions and the resulting acid rain have serious impacts on human health, visibility, agriculture, forestry, architecture, and cultural resources. From the 1980s to the mid-1990s, the area affected by acid rain increased by more than 1 million km^2. Currently, approximately 30% of China experiences precipitation with annual average pH values below 5.6 (Yang *et al.*, 2002). The distribution of areas affected by acid rain is shown in Figure 2.

While overall emissions are still high, China's total SO_2 emissions have decreased since 1995. As a result, the number of cities meeting the SO_2 concentration standards has increased. But the problem of acid rain has not diminished and the area affected by acid rain and the degree of acidification have not been effectively controlled. Precipitation monitoring data from 530 cities in 2002 showed that 48.9% of the cities suffer from acid rain, 171 cities or 32% have average annual pH values from precipitation below 4.5, and the number of cities with average annual pH values from precipitation below 4.5 is increasing (Qu, 2003). The main reasons are: (1) although total SO_2 emissions have decreased, high stack sources that transport emissions over long distances and contribute to acid rain are responsible for an increasing percentage of emissions; (2) SO_2 emissions from the power sector, which is composed of primarily high-stack sources, increased; and (3) there was an increase in emissions of nitrogen oxides (NO_x) — another acid rain precursor.

Figure 2. Distribution of Acid Rain in 1980s and 1990s



2. SO_2 emission control policies

In an effort to control SO_2 emissions and lessen the effects of acid rain, China has adopted a series of control policies and measures since 1995.

2.1 Identifying critical control zones

Based on areas affected by acid rain and high SO_2 concentrations in 1998, the government identified key acid rain control and SO_2 pollution control zones known as the "Two Control Zones" (TCZs). The first zone, the Acid Rain Control Zone, consists of areas with average annual pH values for precipitation less than or equal to 4.5, sulphate deposition greater than the critical load, and high SO_2 emissions. The second zone, the SO_2 Pollution Control Zone, consists of areas with annual average ambient SO_2 concentrations exceeding Class II standards, daily average concentrations exceeding Class III standards, and high SO_2 emissions. The TCZs are key areas for controlling acid rain and SO_2 emissions in China and receive priority for investment and management to control emissions.

2.2 Limiting the extraction and use of high sulphur coal

In 1998, China instituted policies to restrict the extraction of high sulphur coal and limit its use in the TCZs. Most cities now use low sulphur coal and have adjusted their energy structures to decrease urban SO_2 concentrations. The State Council explicitly requested in a national industrial policy that local governments shut down small, high-sulphur coalmines. Because of this policy, the sulphur content of coal combusted by the power sector has decreased every year (see Table 1 for average sulphur content values from coal combusted by the power sector).

Table 1. Average Sulphur Content of Coal Combusted in the Chinese Power Sector

1990	*1991*	*1995*	*1999*	*2000*	*Change*
1.20%	1.17%	1.09%	1.05%	1.00%	17%

Source: YANG, 2002.

2.3 Promoting SO_2 total emission control

In the Ninth Five-Year Plan Period (1996 - 2000), the Chinese State Environmental Protection Administration (SEPA) began to promote a policy of total emission control (TEC). National SO_2 TEC targets were established. SEPA then assigned individual TEC targets to provinces, autonomous regions, and municipalities. The regional governments subsequently assigned TEC targets to local governments and/or emission sources.

2.4 Levying SO_2 emission charges

In order to promote SO_2 abatement, SEPA piloted SO_2 emission charges in 1992 in 2 provinces and 9 cities where acid rain was severe and SO_2 emissions were high. The SO_2 emission charges were extended to the entire area of the TCZs in 2000.

In 2002, the national SO_2 emission charges generated RMB 1.15 billion (USD 140 million). Much of the money is used to install pollution controls and for general environmental improvement. In addition to providing revenue for environmental protection agencies, the charges have played an effective role in encouraging emission sources to assess the economic implications of SO_2 emissions, advancing the use of emission controls at new and existing sources, promoting SO_2 pollution prevention, raising funds for pollution treatment, and, as a result of these incentives, controlling SO_2 emissions and acid rain.

The current emission charge of RMB 0.2 per kilogram of SO_2, however, is less than the average marginal abatement cost of SO_2. As a result, the charges are insufficient to effectively stimulate pollution abatement to the necessary levels. To correct this, the government is gradually adjusting and enhancing the rate of the SO_2 emission charge.

2.5 Requiring cities to comply with national ambient standards for SO_2 concentrations

To speed up urban air quality improvements, SEPA promulgated requirements that all cities should meet air quality standards and emission standards for key pollutants by 2000. Under this policy, urban SO_2 concentrations have improved significantly and more cities meet the air quality and emission standards.

2.6 Adjusting the composition of the power sector

Beginning in 1997, the State Council and the State Economic and Trade Commission (SETC) started requiring power enterprises to shut down small generating units below 50 MW — units that are typically inefficient and emit significant pollution. By the end of 2000, small generating units with a total capacity of 10 000 MW were shut down. The resulting reduction in coal consumption and SO_2 emissions was 10 million tonnes and 400 000 tonnes, respectively. By 2004, an additional 25 000 MW of small generating units will be shut down, including 14 000 MW from the State Power enterprise.

2.7 Encouraging desulphurisation

Research into desulphurisation began in the 1970s in China. Experimental facilities were set up in the mid-1980s, but desulphurisation equipment was not installed on large capacity generating units until the 1990s. By the end of 2000, desulphurisation equipment was installed and operated on 5 000 MW of generating capacity in China, about 70% of the units with controls were operated by State Power. State Power is currently expanding its use of desulphurisation equipment and has a total of 10 000 MW of generating capacity with desulphurisation equipment in operation or under construction.

3. Requirements and existing foundations for introducing emission trading in China

3.1 Foundations for SO_2 emission trading in China

The SO_2 problem in China is characterised by the following: (1) approximately 45% of total SO_2 emissions are from high-stack sources in the power sector; (2) energy demand is growing rapidly and, as a result, coal consumption is expected to continue increasing; and (3) many areas in China are suffering from SO_2 pollution and acid rain. There are many policies and measures in place to address the problem. There is, however, a need to explore additional mechanisms and management instruments to reduce emissions cost effectively without constraining economic growth. In addition to powerful regulatory instruments, the government is interested in introducing economic and market-based policies to address the problem. Among the current control policies and measures, most are regulatory command-and-control policies; the only economic instrument is the emission charge. Due to the low charge rate, however, the effect is limited and adjusting the rate to the economically efficient level is difficult because of political, social, and other factors. Therefore, SEPA is pursuing experiments with emission trading as another way to promote SO_2 emission reductions.

3.1.1 Compatibility of emission trading and the TEC policy

The situation in China is particularly suitable for emission trading. Because a significant percentage of SO_2 emissions are from high-stack sources, the problem has become more regional in scope as SO_2 is transported to neighbouring regions. The TEC policy is aimed at controlling such pollution - it establishes a cap on total emissions, a key attribute of an emission trading program. The TEC limit for 2000 was 23.7 million tonnes but SO_2 emissions were only 19.95 million tonnes with additional abatement planned. During the Tenth Five-Year Plan period (2001 - 2005), the TEC limit is set to decline an additional 10% from 2000 emissions. In the TCZs, the TEC limit is even more ambitious with a 20% reduction from 2000 emissions. National and regional experts have acknowledged that emission trading can effectively lower the cost of achieving the TEC limits.

3.1.2 Flexible approach to meeting management requirements

Controlling SO_2 emissions will require an enormous investment of capital, a great deal of time, and long-term planning. Emission sources, according to medium- and long-term requirements, have the flexibility to determine how to control emissions. Emission trading formalises this flexibility and also enables emission sources to choose whether to invest in large-scale treatment and/or buy emission allowances in order to meet environmental requirements. In addition, revenue from the sale of surplus emission allowances can be used to offset investments in control equipment. Emission trading can further reduce costs by spurring innovation and encouraging competition between control options as demonstrated in the U.S. SO_2 and NO_x emission trading programs (Burtraw, 2000).

3.2 Basic conditions for emission trading

The U.S. experience has shown that emission trading can be an effective instrument to reduce emissions at lower cost than traditional regulatory policies. For it to be successful, however, several key conditions should be in place. Emission trading works best when:

- marginal SO_2 abatement costs differ among emission sources;
- the problem is regional or global in scope;
- emissions can be accurately and consistently measured;
- there is a strong legal basis for emission trading; and
- administrative institutions have sufficient capacity to administer the program.

3.2.1 Variation of marginal SO_2 abatement costs

Based on a survey conducted by the Chinese Research Academy of Environmental Sciences (CRAES), there are major differences in marginal SO_2 abatement costs among SO_2 emission sources. Some of the difference is due to age and type of equipment, access to technologies, technical capacity, location, and fuels. The difference in costs can be as great as 30-50% between regions and 40% between different sectors (Wang *et al.*, 2002). Emission trading has enormous potential to reduce overall costs to industry because of the differences in marginal SO_2 abatement costs (low-cost sources could reduce emissions greater than required and sell surplus allowances to high-cost sources, allowing all sources to attain the emission goals and saving money for high-cost sources.)

3.2.2 Regional problem

Although overall SO_2 emissions have been decreasing in China, emissions from high-stack sources are increasing. As a result, sulphates are transported over a larger area creating regional acid rain problems.

3.2.3 Emission measurement

An effective emission trading program is based on accurate emission measurement and consistent, effective enforcement. Accurate emission measurement from all sources is critical to determine compliance with SO_2 TEC policies. For the U.S. emission trading program, the U.S. Environmental Protection Agency (U.S. EPA) requires most emission sources to install continuous emission monitors (CEMs) for SO_2 , NO_x, and CO_2 . The U.S. EPA created a data registry to collect, audit, manage, and disseminate emission data. In China, the introduction of SO_2 emission trading will necessitate the establishment and improvement of emission measurement and data management.

Presently, China has mechanisms in place to support SO_2 emission measurement. The current emission reporting program stipulates "sources must complete a 'Form of Emission Reporting' and provide all necessary data within the time specified by the local Environmental Protection Bureau (EPB)." The emission reporting program forms the basis of the EPBs pollution management. The problem, however, is that most of the SO_2 emission data reported by sources are calculated with material balance based on coal consumption and sulphur content of the coal. This approach can be relatively accurate and cost effective when the fuel inputs and production processes are stable. However, when control equipment is installed, material balance does not provide sufficient accuracy for emission trading programs. For a small percentage of enterprises the data are based on monitoring, but only periodic monitoring (e.g., once per quarter or once per year). This, however, is insufficient for emission trading programs because it represents operating conditions over a very short time period and may not adequately reflect conditions during the rest of the year.

Because SO_2 emission sources are numerous — power sector sources and various industrial and heating boilers — it is neither feasible nor necessary to require all sources to install CEMs. Therefore, it is important to classify SO_2 emission sources and determine the most appropriate measurement techniques, considering technical, scientific, and economic factors as well as the type and scale of control equipment.

3.2.4 Legal basis

Emission trading is a market-based instrument to achieve the TEC limit already established in China. An emission trading program requires significant upfront work to ensure that the program's design is comprehensive and provides the proper incentives for sources to reduce emissions. Designing and operating a program involves setting the TEC target; allocating portions of the target to emission sources in the form of emission allowances; designing trading rules; collecting, verifying, and managing emissions data; managing allowance transactions; and enforcing the program and pursuing punishment for non-compliance. Unless the laws and regulations are clear and complete, the system may be difficult to implement and enforce.

A new amendment to the Air Pollution Prevention and Control Law further clarifies the TEC policy and requires local governments within the TCZs to check and approve total emissions from sources and issue emission permits in accordance with the conditions and procedures the State Council has stipulated, taking into consideration the principles of openness, fairness, and justice. The emission permit program explicitly defines emission rights for sources. When one enterprise obtains an emission permit, it receives the authorisation to emit the amount stipulated in the permit. The establishment of emission rights establishes a fundamental condition for emission trading — explicit or *de facto* property rights.

The current Air Pollution Prevention and Control Law does not contain provisions for a national emission trading program, but future amendments may create such a program.

3.2.5 Administrative institutions

Regardless of the type of policy instrument, a control program will only be effective if the proper institutions are in place to adequately administer and enforce the program. SEPA is engaged with project partners to enhance the capacity to administer emission trading programs. In addition, pilot projects will help identify deficiencies in local environmental protection bureaus. A special division within SEPA should be set up to administer the program once the national program for SO_2 emission trading is in place. This division will be responsible for overseeing the program, managing data systems to make sure the program is on track and transparent to every stakeholder involved.

4. Emission trading pilots

Early in the 1980s, China began discussing and piloting emission trading in combination with new projects. The government carried out case studies on the compensated transfer of emission quotas. However, due to legal and regulatory constraints, limited experience, and implementation issues, these experiments were primarily conceptual. In the Ninth Five-Year Plan period, significant progress was made when TEC was promoted nationwide. Interest in emission trading had grown noticeably by the Tenth Five-Year Plan period when TEC became more formal.

Emission trading has made the transition from concept to pilot stage. SEPA is increasingly attentive of the issue of introducing nationwide emission trading. This transition has occurred over three stages: (1) 1990 to 1995 — establishing the concept; (2) 1996 to 2001 — exploring the theory and methods of emission trading; and (3) 2002 to present — piloting and designing emission trading programs.

4.1 Progress in piloting emission trading in China

In 1994, SEPA conducted policy experiments in air pollutant emission trading in six cities (Baotou, Kaiyuan, Liuzhou, Taiyuan, Pingdingshan and Guiyang) on the basis of air pollutant emission permit pilots in 16 cities.

The pilot trades took many different forms, including:

- allowance transfers within an enterprise;
- environmental compensation fees to obtain additional emission rights;
- investments in non-point source pollution control to obtain additional emission rights; and
- allowance transfers from sources with surplus allowances to new or existing sources with insufficient allowances.

The trading during these pilots was influenced by political considerations and was not emission trading in the true sense. The pilots were combined with new, expansion, and technical innovation projects arranged by local EPBs. As there was no legal foundation for emission trading, the emission trading policy was implemented through the pollutant permit system that was not adopted nationwide.

In 1999, SEPA and the U.S. EPA began to cooperate on a study to assess the feasibility of introducing SO_2 emission trading in China. This study began with significant discussions about the theories, conditions, foundations, and methods of emission trading. The project further explored the opportunities and barriers to implementing SO_2 emission trading in the Chinese power sector. Through the cooperation, the countries have conducted several workshops and training activities. As a result, a number of Chinese management and research personnel have a much better understanding of how emission trading works and the conditions necessary for an effective program. The cooperation has promoted emission trading in China.

With financial assistance from the Asian Development Bank (ADB) and technical assistance from Resources for the Future (RFF) — a U.S. think tank — and the Chinese Academy for Environmental Planning (CAEP), Taiyuan city established an SO_2 emission trading program in 2001 to achieve their SO_2 TEC limit at least cost.

In 2002, in order to gain more experience and facilitate nationwide promotion of emission trading, SEPA organized pilots in seven provinces. After one year of preparatory work, some conditions necessary for emission trading were developed. For instance, two power plants in Jiangsu Province reached an agreement to trade SO_2 allowances to meet TEC limits.

4.2 Case studies of emission trading

4.2.1 SO_2 emission trading in Jiangsu Province

Located in Eastern China, Jiangsu is a province with a relatively advanced economy and effective management institutions. SO_2 emissions in the province are significant — 1.2 million tonnes in 2000 — and acid rain has had serious effects on the region. In order to control total SO_2 emissions and attain the TEC limit (1 million tonnes) allocated by the central government, Jiangsu introduced an emission trading program to promote cost-effective SO_2 abatement in the power sector. The policy framework is outlined in Table 2.

Table 2. The Emission Trading Framework in Jiangsu

Scope:	Power sector — 196 power plants in Jiangsu Province
Region:	The province
Total Emission Target:	TEC limits for the Tenth Five-Year Plan period
Allocation Method:	Emission performance standards
Legal Basis:	Document by provincial EPB and Economic and Trade Commission
Trading Situations:	Two power plants conducted a trade
Monitoring and Measurement:	CEMs, periodic source monitoring, and material balance

Source: Jiangsu Provincial EPB, 2003.

Jiangsu focused on the power sector for the pilot study. The sector makes the largest contribution to SO_2 emissions in the province. The two power plants that participated in the allowance trade were located in different cities; thereby making the transaction the first inter-city allowance trade in China. Some of the reasons for the program's initial success where: (1) total allowable SO_2 emissions from the power sector are controlled by the provincial EPB; (2) allowances were allocated according to uniform standards set by the provincial EPB; and (3) allowances were allocated based on an emission performance standard, or generation performance standard, which is an advanced concept that promotes efficiency; (4) the provincial EPB is capable to decide the total emission cap for the sector, identify the uniformed allocation method to facilitate the breakdown of cap to individual power plants involved and have the authority to give a go-ahead to this trade.

4.2.2 SO_2 emission trading in Taiyuan City

SO_2 pollution in Taiyuan is very severe — ambient SO_2 concentrations were 0.2 mg/m^3 in 2000, three times higher than the Class II standards of 0.06 mg/m^3. In an effort to improve urban air quality, the city formulated an ambitious TEC target of 50% below 2000 emissions by 2005. With financial assistance from ADB and technical support from RFF and CAEP, Taiyuan initiated the emission trading project to attain the TEC target at lower cost. After one year of preparation and study, Taiyuan promulgated the "Administrative Regulation for SO_2 Emission Trading in Taiyuan City" in 2002 as a local regulation to conduct emission trading. Twenty-three major sources were identified to participate in the first phase of the emission trading program. On the basis of a detailed survey and analysis of

SO_2 emissions from the sources, allowances were allocated using historic emissions or performance agreements with the city EPB as the basis for the new allocations. The U.S. EPA held training classes for the local EPB and the enterprises participating in the program. In addition, the U.S. EPA helped RFF and CAEP create SO_2 emission and allowance tracking systems. The policy framework for the Taiyuan emission trading program is outlined in Table 3. The training conducted by USEPA, RFF and CRAES had brought local officials and power plants representatives together to see simulation cases which facilitated their understanding the real emissions trading program and helped to build up the institutional capacities for the success of the Taiyuan program. The training also suggests that further extension training be held to clarify issues related to emissions trading such as the right of an allowance.

Table 3. The Emission Trading Framework in Taiyuan

Scope:	23 key pollution sources accounting for 50% of total SO_2 emissions
Region:	Urban area (excluding suburban districts and counties)
Total Emission Target:	TEC limits for the Tenth Five-Year Plan period — 125 000 tonnes
Allocation Method:	Historic emissions
Legal Basis:	Regulation on TEC in Taiyuan City and administrative regulation for SO_2 emission trading in Taiyuan City
Trading Situations:	Training, trading simulation, and implementation beginning January 1, 2003
Monitoring and Measurement:	CEMs, periodic source monitoring, and material balance
Management:	Emission and allowance tracking systems

Source: Cao *et al.*, 2002.

The Administrative Regulation for SO_2 Emission Trading in Taiyuan City creates a strong foundation for emission trading and provides detailed implementation requirements. There are seven key aspects of the regulation:

- identifies Taiyuan city EPB as the supervising institution for SO_2 emission trading;
- stipulates that enterprises participating in the emission trading program are not exempt from other environmental protection responsibilities;
- specifies the allowance allocations for each year of the Tenth Five-Year Plan period. New sources must obtain allowances through purchases from the city EPB or other sources;
- allows for the trading and banking of allowances. Surplus allowances from the current year can be banked for use in the future or sold to other sources. If surplus allowances are sold, the trading parties determine the price based on market conditions;
- authorises an allowance auction by the Taiyuan EPB. Auction income is set aside for improving urban environmental quality;
- requires the implementation of an emission tracking system and allowance tracking system to manage emission data and allowance transactions;
- specifies the legal liability of enterprises and financial penalties for non-compliance.

5. Opportunities and obstacles to implementing emission trading in China

5.1 Feasibility of national implementation

Although current conditions are far from perfect for an efficient emission trading program, they create the foundation for pilot emission trading programs that can help further develop necessary conditions and institutions. Prevailing conditions include:

- Wide acceptance of the emission trading concept: The role of emission trading in decreasing costs to achieve an environmental goal is well understood.

- Implementation of SO_2 TEC limits: The TEC limits establish the environmental goal, while emission trading and market-based instruments provide the means to achieve the goal at a lower cost.

- Experimentation with emission trading pilots: Pilots in some provinces and cities have provided valuable experience and forged the path to expand emission trading nationwide.

- Outreach and capacity building for emission trading: SEPA has organized a series of studies and has developed technical capacity in the design of emission trading programs.

5.2 Issues and barriers

Although there are favourable conditions for promoting nationwide emission trading, there are still some issues and barriers to overcome, including legal authority, policy coordination, allocation issues, emission measurement and verification, and supervision and management systems.

5.2.1 Legal authority

There are currently no explicit legal provisions authorising emission trading at the national level. The current Air Pollution Prevention and Control Law supports the TEC policy but does not directly assist in the adoption of emission trading programs. The law indirectly requires the application of economic and technical measures to control air pollution, implying that emission trading is feasible. However, in the new amendment of the law there are still no explicit provisions for emission trading.

Some pilot provinces and cities have local regulations on emission trading but corresponding national regulations are vital if nationwide emission trading is to be pursued.

5.2.2 Uniform allocation method

The current TEC targets are allocated to administrative districts and then further allocated by the local governments to emission sources. Each of these levels of government is free to create their own allocation method. If a nationwide emission trading program is implemented, the TEC management system and allocation method should be adjusted to create a uniform TEC allocation method. Once a uniform allocation method is established, the allocation process will involve three steps: (1) identify sources participating in the emission trading program; (2) determine the TEC limit of the community of participating sources; and (3) allocate allowances to individual sources in accordance with uniform allocation principles and methods. Whatever allocation method is chosen, it should embody the principles of sound science, reasonableness, and equity.

5.2.3 Monitoring and verification

The primary method for measuring and verifying SO_2 emissions is material balance. Few sources have installed continuous emission monitors (CEMs). For emission trading, however, it is important to provide accurate emission measurement to create a credible, effective emission trading program. Although material balance can provide the same level of accuracy as CEMs in certain circumstances (e.g., small units that are frequently cycled on and off), there are significant gaps between current measurement approaches and a system with the appropriate level of accuracy for an emission trading program. Emission measurement could be improved with standards for CEM installation and operation and alternative measurement methods. As the U.S. experience shows, sources participating in emission trading programs can rely on CEMs. However, because the SO_2 emission sources in China are numerous and CEMs are expensive, it would be difficult to install CEMs on all sources in the near term. Therefore, when identifying sources to participate in the first phase of an emission trading program, SEPA and local environmental protection bureaus should consider measurement capabilities as a priority.

5.2.4 Coordination with other policy instruments

The introduction of emission trading should be coordinated with existing regulatory policies to ensure that current protection policies are not diminished. In the U.S., emission trading is combined with traditional command-and-control policies and other market-based instruments to protect against emission hotspots that could occur if sources purchased allowances to increase emissions, causing a deterioration of local air quality. In China, emission standards and emission charges can integrate with an emission trading program to promote emission reductions. The emission charges are particularly important for raising revenue for general environmental protection. Therefore, consideration should be given to the design of an emission trading program to ensure that policies are compatible. Theoretically, the low charges for the emission charge system should not impede the effectiveness of an emission trading program (Ellerman, 2001).

In addition to environmental policy instruments, the power sector is faced with other policies that may affect the efficiency of an emission trading program. Some of these issues are discussed in the next section.

6. Recommendations for nationwide SO_2 emission trading

SO_2 emission trading has the potential to lower the cost of attaining the TEC targets nationwide. Pilots and research demonstrate that implementing and operating a program within China is feasible. It should, however, be implemented in stages and applied more broadly after pilots are used to test different aspects of the policy. This section outlines some strategies to help nationwide adoption of emission trading.

6.1 National SO_2 TEC targets

Emission trading is compatible with the national TEC targets. To ensure that the policies complement one another, the design of the emission trading policy should be integrated with the national TEC limit so as to facilitate the attainment of the TEC target.

SEPA has already established the national SO_2 TEC target for the Tenth Five-Year Plan period. The target limits SO_2 emissions in 2005 to 10% below 2000 emissions and 20% below 2000 emissions in the TCZs. Detailed TEC targets are presented in Table 4.

Table 4. SO_2 TEC Targets in 2005

	2000 ('000 tonnes)	***2005 ('000 tonnes)***
China	19 950	17 950
TCZs	13 164	10 536
SO_2 Control Zones	5 296	4 234
Acid Rain Control Zones	7 868	6 302

Source: State Council, 2001.

6.1.1 The power sector SO_2 TEC target

According to a CAEP research report on long- and medium-term emission control plans in the power sector, the TEC target for the power sector over the next 20 years will continue to decline (Yang *et al.*, 2002). See Table 5 for the power sector TEC targets.

Table 5. SO_2 TEC Targets in the Power Sector — 2000 to 2020

Year	***TEC Target ('000 tonnes)***
2000 (base year)	8 900
2005	8 000
2010	7 300
2015	6 700
2020	6 300

Source: Yang *et al.*, 2002.

6.2. Implementing the TEC

The circumstances for SO_2 emission trading policies in China and the U.S. differ significantly, including:

- the composition, distribution, and contributions of the emission sources;
- the structure and role of central management institutions;
- ownership — private versus state owned;
- experience with markets for commodities like electricity;

- access to capital and control equipment; and

- existing policies and measures.

SO_2 emission sources in China are primarily classified as industrial or social. Alternatively, the sources can be classified into regions, such as the acid rain zone, the SO_2 control zone, and the general zone. They can also be classified by emission source, such as high-stack sources, low-stack sources, and non-point sources. High stack sources are found mostly in the power sector. There are a limited number of sources, they are often controlled centrally, and they are easier to manage. The low stack sources are various types of boilers and furnaces. They are numerous, widely distributed, and difficult to manage. The non-point sources are primarily diffuse residential stoves.

6.2.1 Power sector

Promoting SO_2 emission trading in the power sector provides many advantages. The sector accounts for 45% of national SO_2 emissions, sources primarily use high stacks, and, as a result, are key contributors to the regional acid rain problem. Decreases in their emissions should significantly improve regional pollution problems. Other important conditions for emission trading exist in the power sector, such as strong management, good emission data, and a relatively high economic efficiency.

There are still, however, some key barriers to implementing emission trading in the power sector, such as:

- *Ownership:* The enterprises in the power sector are mainly state-owned and currently undergoing restructuring. The progress of restructuring will directly affect the implementation of a SO_2 emission trading policy.

- *Electricity pricing*: The price of electricity is an important factor limiting SO_2 abatement in the power sector. The government fixes prices and the sector cannot pass environmental costs to ratepayers. If the electricity pricing policy is not adjusted, sources of funding will be limited and it will be difficult for the sector to adopt effective abatement measures. However, the government is currently reforming national electricity price policy.

- *TEC limit allocation:* The allocation of TEC limits is a two-stage process. First, portions of the national target are allocated to the power sector. Second, portions of the power sector target are allocated to individual sources. There is currently no standard allocation methodology for sources. In addition, allocations are often for short periods (e.g., five-year plan periods) and may not provide enough information for sources to develop investment plans.

- *Emission measurement:* Few enterprises in the power sector, some 10 to 19 new plants, have CEMs. Even in the new plants, CEMs often fail to operate normally. In order to promote SO_2 emission trading, it is important to establish standards for certification, installation, operation, maintenance, and calibration of CEMs.

- *Data management systems:* It is critical to establish management systems to collect, verify, manage, and disseminate emission data. It is also important to develop data standards for reporting.

6.2.2 Two control zones

Sixty percent of national SO_2 emissions occur in the TCZs. Since the TCZs are identified as areas of national focus for controlling SO_2 and acid rain, the promotion of SO_2 emission trading in the TCZs can be a part of a national SO_2 control strategy. There are abatement targets and emission caps already defined for the TCZs. Therefore, it is practical to conduct SO_2 emission trading pilots in the TCZs. In these pilots the following issues should be considered:

- There are several types of sources in the TCZs and it is impossible to implement emission trading for all source types. It is therefore necessary to classify sources in the TCZs and select the key ones for an emission trading pilot before broadening the scope.

- In the TCZs it is necessary to distinguish between high-stack sources and low-stack sources. The former have regional pollution impacts and can therefore trade in a larger area while the latter have primarily local impacts and should therefore only trade with other local sources.

6.3 Implementation phases

The feasibility study on SO_2 emission trading in China prepared by CAEP, U.S. EPA, and other experts recommends implementing SO_2 emission trading at the national level in four stages (WANG *et al.* 2003):

- *Phase One:* a pilot phase with trading limited to large power plants (i.e., annual SO_2 emissions greater than 5 000 tonnes) in the TCZs;

- *Phase Two:* an expanded pilot with trading between all power plants in the TCZs on the basis of phase one;

- *Phase Three:* a nationwide program including all power plants in China; and

- *Phase Four:* an expanded nationwide program including other types of high-stack sources.

A pilot restricted to sources in the TCZs is consistent with China's current SO_2 management framework. Limiting the pilot to power plants focuses SO_2 control in China and facilitates management of emission trading. From the standpoint of the power sector, it is feasible to establish a national SO_2 emission trading program as it may help balance the cost differences in pollution abatement among different sources.

7. Conclusions and Suggestions

In summary, the following conclusions and suggestions are provided:

7.1 Conclusions

- SO_2 TEC in China should be combined with a national emission trading policy to help achieve the control target at lower social cost.

- After nearly 10 years of analysis and emission trading pilots, several cities and regions have the practical experience that provide the necessary foundation for introducing emission trading nationwide.

- There are issues and barriers to overcome before implementing a nationwide emission trading program, including establishment of a legal authority, policy coordination, allocation issues, emission measurement and verification, and supervision and management systems.

7.2 Suggestions

In order to support national implementation of emission trading, some basic conditions should be improved, including:

- Establish an explicit legal basis for emission trading. SEPA should draft emission trading provisions that are integrated with the TEC regulation.

- Strengthen measurement and verification of SO_2 emissions to improve accuracy. Major stationary sources of SO_2 should install CEMs. Those sources without CEMs should be encouraged to apply more accurate emission measurement methods. SEPA should draft standards and/or guidelines for CEM certification, installation, operation, maintenance, calibration, and verification to ensure accurate emission measurement. SEPA should also develop procedures for measuring and verifying emissions from sources without CEMs.

- Design an equitable allocation method that provides proper incentives for sources to take action to reduce SO_2 emissions.

- Implement management systems to collect, verify, manage, and disseminate emission and allowance data. The management systems should complement existing systems already in place for the TEC policy.

- Strengthen education and outreach on emission trading.

- Implement emission trading in phases, with high-emitting, high-stack sources in the TCZs participating in the first phase and a gradual expansion as capacity increases.

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THE STATE OF DEVELOPMENT OF NATIONAL CLEAN DEVELOPMENT MECHANISMS OFFICES IN CENTRAL AND SOUTH AMERICA

by

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1. Introduction

The Clean Development Mechanism (CDM) offers great potential to assist Annex B countries in meeting their emissions reduction commitments by increasing the supply of low-cost emissions mitigation projects, thereby reducing the international market price of emissions reduction credits and the national cost of compliance.

However, CDM project development is facing a series of barriers, which if not addressed, may constrain the effective supply of Certified Emission Reductions (CERs) into the international marketplace. Low CER prices coupled with high formulation and transactions costs make for weak benefit-cost ratios. Owners of potential projects perceive major institutional, regulatory and market risks. These conditions are compounded by a lack of capital in developing countries to appropriately formulate or to execute projects, both from the weaknesses of the capital markets and from the unfamiliarity of bankers with the CDM[1].

One of the requirements for developing countries to participate in the CDM established by the COP7 Marrakech Accords pertains to the designation of a national authority for the CDM. Specifically, this accord stipulates that a Non-Annex B country choosing to participate in the CDM must only do so voluntarily, and shall designate a national authority in charge of the mechanism, which shall be responsible of evaluating and granting national approval to the projects developed within said framework.

According to Article 12 of the Kyoto Protocol, projects to be carried out under the (CDM) must be "additional", produce real and long term emissions reductions, have the consent of the participating Parties, and contribute to the sustainable development of the countries in which said projects are established.

[1] For more information on these barriers see World Bank NSS Program, "Capacity Building for the Kyoto Protocol" Workshop Report sections 3 and 4. World Bank, March 2003.

If the expected supply of CERs from Latin America is to materialise, national CDM offices must come on line, operate effectively and approve projects. National approval, which forms part of the CDM project cycle established by the Convention, is an indispensable requisite so that the operational entities responsible for the external technical evaluation of a project may develop the validation report. This in turn, permits the project to be registered by the Executive Board as a CDM activity.

2. Objectives

The general objective of this study was to evaluate the institutional capacity of the Central and South American CDM offices, specifically to:

– Determine the current state of the national CDM offices with respect to the requirements and legal responsibilities established by the Convention, the Kyoto Protocol, the Marrakech Accords and the decisions taken by the CDM Executive Board.

– Evaluate their ability to support the efficient and effective development of the CDM potential in their countries; and

– Identify their main deficiencies and weaknesses and their immediate needs with respect to said obligations.

– Evaluation Methodology and Criteria.

To meet these objectives, the Andean Center for Economics in the Environment carried out the following main activities and analyses:

i. A written survey of the CDM offices for preliminary gathering of information to determine the characteristics and provide a diagnosis of the National Offices.

ii. Direct interviews with the directors/coordinators of each one of the offices, to discuss key issues identified in their survey responses.

iii. Examination of legal, operating and planning documents related to the undertakings of their offices and their development.

Thirteen national CDM authorities of the Latin American region were evaluated during the second semester of 2002. Information on the offices was gathered with respect to their constitution, organisational structure and functions, portfolio of CDM projects, financial sustainability, relationships with other entities, obstacles to their development, and strengths and weaknesses of the undertaking. Furthermore, we examined their charters, legal documents and relevant national norms, their regulations on procedures, and any other available information that would enable us to determine the current state of development of the offices.

Table 1. Countries that Participated in this Study

Argentina		Nicaragua
Bolivia	El Salvador	Panama
Colombia	Guatemala	Paraguay
Costa Rica	Honduras	Peru
Ecuador		Uruguay

Notes: Mexico, Venezuela and Chile were invited to participate, but stated that their governments had not yet established national CDM offices or responsibilities, and therefore could not respond to the survey or the interviews. Brazil initially stated it would participate, but the designated representative developed health problems impeding his participation.

3. Results and findings

The implementation of CDM offices is advancing rapidly throughout Latin America, demonstrating important political commitments and investments from the governments of these countries. The consolidation of the CDM by the COP7 Marrakesh Accords, the ratifications of the Protocol by the European Union, Japan, and Canada, and the effective demand for projects from the PCF and the Dutch CERUPT programs, have increased confidence regionally that the carbon markets will develop and the CDM will be viable, in both governments and productive sectors. Although the average number of approved projects per CDM office is still very low—2.7—the trend is clearly toward consolidation of physical space, qualified directors and personnel, regulations for project evaluation and approval, capacity building in key sectors, and promotion of project portfolios: continued development of the CDM offices should improve the rate of project approval in the short to medium term.

However, several issues have been identified by this report that may affect the development of the CDM offices, the number of projects approved, and the quality of the projects in the national portfolios. If these issues are not adequately addressed, the flow of projects into the carbon markets and the developmental benefits of CDM may remain low.

4. Current state of the CDM offices within the framework of the Marrakech accords

All of the Latin American countries included in the survey have implemented or are preparing to implement their national CDM offices[2]. As expected, the stage of development is quite diverse among countries. Few offices have managed to consolidate criteria and procedures on evaluation and national approval, and to develop a qualified technical team with a broad knowledge on the Mechanism. The majority is still in the stage of redefining functions and activities in the light of the decisions and rules established by the Marrakesh Accords, due in part to the uncertainty and lack of defined rules for the CDM before COP7. This circumstance had lead in the past to limited institutional investments for the consolidation of technical personnel and for the definition of criteria and procedures on project evaluation and approval.

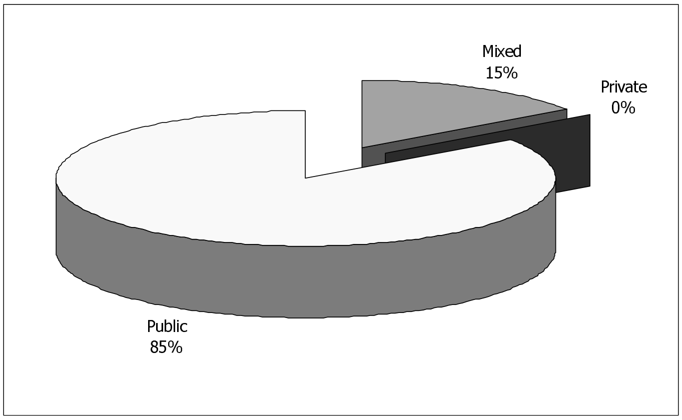
Some offices do not yet have a clear legal foundation that entitles them to confer the national approval required by Marrakesh. The evolution undergone by offices to adapt to the CDM requirements has not, in all cases, been accompanied by a development of appropriate legal frameworks to maintain and validate the activities. This situation may generate conflicts or

[2] See Table 2 for specific country information.

competition with other institutions working on climate change which may consider themselves the national CDM authority.

Most of the national CDM authorities in Latin America are public entities created within governing institutions such as Ministries or Secretariats of the Environment and also have specific functions assigned to them concerning scientific climate change issues which go beyond the scope of the CDM. 15% have private participation in their Board and decision-making processes. Argentina, Bolivia, Colombia and El Salvador have established separate offices for CDM and for scientific climate change activities.

Figure 1. Public and Private Participation in CDM Offices



Although most of the offices have operating regulations that establish a specific administrative structure, in general these offices have been unable to fully fund their technical positions. They lack qualified permanent staff, or a sufficient number of personnel, to be able to meet minimum requirements. To carry out their activities, they sometimes receive the support of personnel from other related offices or departments and from external consultants, often counting on international cooperation for specialised support and project work, when available.

The scarce development of some offices creates uncertainty to developers and investors alike, and may increase delays and transactions costs associated with the projects. The inability to establish an office in Mexico, for example, is a clear hindrance to the development of the country’s great CDM potential. The lack of clear rules and criteria and procedures for the evaluation of CDM projects, impedes a transparent and efficient process necessary to reduce the risks incurred by project formulators at this stage and may lead to demotivation in developing projects in some countries of the region.

5. Project evaluation and national approval processes

The stage of development of criteria, processes and procedures to carry out the evaluation and national approval established by the Marrakech Accords varies considerably among the evaluated institutions. Although many of the offices surveyed are currently developing formal procedures, only five of the total surveyed (38%) have duly regulated evaluation and approval procedures and criteria.

These procedures vary according with the criteria established by the offices to evaluate and grant national approval: of note, 62% of the offices use the contribution of the projects to national sustainable development as their sole evaluation and approval criterion. Only four offices examine the submitted projects for compliance with UNFCCC CDM rules regarding baselines, additionality, and monitoring and verification protocols.

The evaluation and approval periods vary between offices. Evaluation periods average 17.3 workdays, but range between 10 and 50 days among offices. Once evaluated, the official approval process averages 4.5 days, ranging between 2 and 10 days, depending on the criteria analysed and the methods of evaluation that are applied.

Even though the majority of offices will only apply projects' contributions to sustainable development as the approval criteria, to date few have been able to define concrete methods to carry this out. This situation creates great uncertainty for project formulators and interested investors, and the delays may constitute an important transactional cost for the projects. Clearly, this is an area CDM offices are struggling with and need technical assistance in.

Most offices' approval processes will not assure that approved projects are additional, impose real emission reductions, and have adequate monitoring programs: they will leave those key issues to the Operational Entities (OEs) in the process of project validation. This leaves a serious question: if CDM offices choose not to approve baselines and additionality arguments, will the OEs be prepared to consistently evaluate the additionality and real greenhouse gas mitigation of nationally approved CDM projects to the Executive Board and the Parties of the UNFCCC?

Table 1. CDM Project Evaluation and Approval

Country	Evaluation Processes Established	Approval Processes Established	CDM Project Evaluation and Approval	
			Examination of UNFCCC CDM Formulation Rules	CDM Rules Used as Criteria For Approval?
Argentina	Yes	Yes	Yes	No
Bolivia	No	Yes	No	-
Colombia	No	No	No	-
Costa Rica	Yes	Yes	Yes	Yes
Ecuador	No	No	No	-
El Salvador	No	No	Yes	Yes
Guatemala	No	No	Yes	Yes
Honduras	No	No	No	-
Nicaragua	No	No	Yes	Yes
Panama	Yes	Yes	No	-
Paraguay	Yes	Yes	No	-
Peru	Yes	Yes	No	-
Uruguay	No	No	No	-

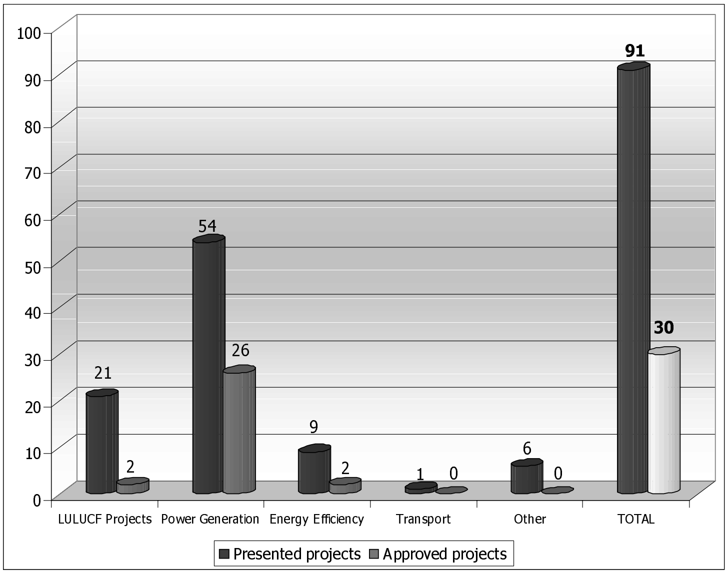
Project approval processes may be affected by political disturbances. Given the institutional and budgetary dependence of these offices on their central governments, new political administrations can mean the imposition of new office directors and staff, resulting in disruption of approval processes and project reviews. Two examples of such upheaval in CDM offices are Paraguay and Honduras, both of which have completely replaced directors and professional staff following political change[3].

6. Project portfolio development

In general, the project flow is notably smaller than expected. Since the Marrakesh rules were established, the 13 Latin American CDM offices have on average received only 7 projects per office and approved only 2.3. Although this indicator varies among offices, it raises questions regarding the regions' ability to fulfil its emissions reduction potential and contribute to efficient carbon markets. Factors that limit the number of new initiatives are the lack of knowledge among sectors with CDM potential, the uncertainty and risks associated with the international and domestic regulatory frameworks, the current low price of CERs and the high costs of project formulation.

Currently, regional portfolios of approved projects consist mostly of power generation (87%). Future project potential might be determined by the high number of available projects in the areas of power generation, energy efficiency and forestry. The high degree of difficulty associated with the estimation of sectoral baselines for national or international interconnected power grids may limit approvable projects. The rate of increase in approved projects in the short to medium term will depend on CER prices and CDM formulation costs, increased formulation capacity in the CDM sectors, project quality and institutional consolidation.

Figure 2. Projects Presented and Approved in the Region, by Project Type



The resource and capacity constraints faced by the offices also will affect the quality of projects and portfolios. A recent study by the Andean Center carried out for the IADB, analysed 56 projects in 3 national portfolios in Central America and found that more than 90% of the projects have serious

3 This statement does not relate to the political or technical correctness of the changes, simply that these complete replacements resulted in disruptions of approval processes and other office responsibilities.

technical deficiencies and require further work in order to be approved by OEs and the Executive Board[4].

7. Other Activities Performed

Most offices perform other functions related with the CDM. In order to achieve financial sustainability, some are gearing towards project formulation services. In some cases, this may lead to conflicts of interest: can the same entity formulate a project and then provide it national approval?

Marketing of the CDM opportunity and capacity building are key activities. Some also perform responsibilities that go beyond the scope of CDM and that pertain to other topics related with climate change such as adaptation and vulnerability, placing additional demands on professional staff.

8. Indefinition of property rights

One area of potential risk identified by the study is the lack of a legal definition of the property rights for the CERS generated. This lack of clarity could lead to future rent-seeking struggles between developers, political interest groups and the State, when projects begin to produce important financial flows. 38% of the offices evaluated are now working to determine said property rights; this includes studies on legal frameworks, assistance during the negotiation of the CER purchase agreement, and the formulation of national laws.

In most cases, the national policy seems to be that the CERs will belong to the owners of the projects, although clear legal basis for this is lacking in most cases. The Bolivian government intends to establish joint ownership of CERs, that would fix a 50-50 distribution in cases where the State provides resources such as land, and a 10-90 distribution (10% for the State) in the case of projects on private property.[5]

9. Financial sustainability

Most offices identify the lack of financial resources as a chief limiting factor to operate adequately. Argentina has a well established office but lacks funds for capacity building and marketing, and has no approved projects yet.

CDM offices created within institutions such as Ministries or Secretariats can depend on resources from the national budget to finance operational costs, and obtain resources in-kind.

At present, all of the offices are looking for additional financing sources or developing financial strategies to procure the resources necessary for their operations in the longer run. Most charge for, or are studying the possibility of charging for, the rendering of their project evaluation and approval services, although the majority have not defined the cost of this service. This is particularly critical in

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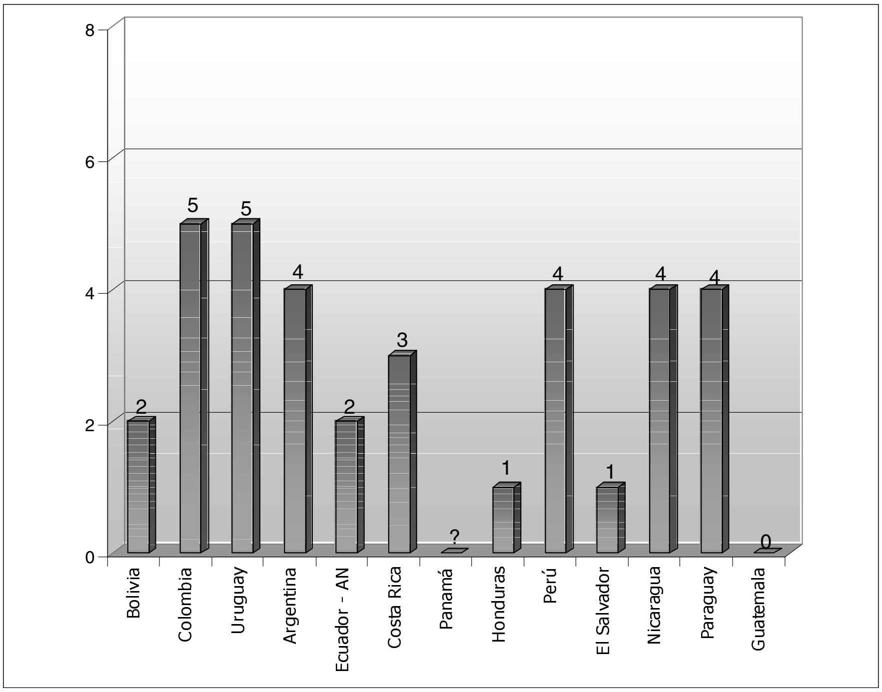
4 Inter-American Development Bank, Andean Center for Economics in the Environment: Evaluación del Potencial de los Países Centroamericanos para Participar en el MDL y el Mercado Internacional de Carbono: Un Análisis Técnico y Económico de 56 proyectos MDL. Washington, D.C., December 2002.

5 Interview with Mr. Sergio Jáuregui, coordinator, Clean Development Office (Oficina de Desarrollo Limpio), Bolivia, December 2002.

the case of capacity building, identified by all the offices as a key activity for the development of their CDM potential. Capacity building in the CDM is highly specialised and costly, and there are insufficient funding sources to date to assist with this key start-up activity.

Figure 1. Staff assigned to offices



10. Other Limiting Factors

Several other factors may limit the development of the offices. These include (a) constant political changes which impose frequent replacement of authorities, decision-makers and professionals; (b) the lack of financial alternatives to support the adequate formulation of CDM projects, and (c) the slowness and uncertainty in international negotiations related to the Convention and the Kyoto Protocol.

11. Conclusions

The implementation of CDM offices is advancing rapidly throughout Latin America, demonstrating important political commitments and investments from the governments of these countries. However, several issues may affect the region’s ability to deploy its CDM potential, beginning with the state of development of National Designated Authorities. To date, the average number of approved projects is low: only 2.7 per country. The supply of approved projects from the developing world will depend on the efficiency and effectiveness of the development process in said offices.

In addition to the institutional issues, a series of factors will affect the supply of approvable projects. These include the low price of CERs in comparison with high costs of CDM formulation and transactions. At such low prices many desirable projects from renewable energy will not be feasible.

Economic sectors with high CDM potential still do not recognise their CDM potential or perceive current risks as too great to take on. The other major constraint is the lack of available finance in developing countries to address the high costs of project formulation and implementation. If these issues are not adequately addressed, low levels of supply of CDM projects may affect the price of emissions reduction credits in the world carbon market, and the cost of compliance of Annex B countries. In order to fulfil the region's CDM potential, the issues and needs identified in this study have to be addressed by domestic and international policymakers.

ESTABLISHING A NATIONAL AUTHORITY FOR THE CLEAN DEVELOPMENT MECHANISM: THE COSTA RICAN EXPERIENCE

by

Paulo Manso **(Costa Rican Office on Joint Implementation)**

1. Introduction

The challenge of climate change is now a global issue and part of the international agenda. The Kyoto Protocol (KP) and its provisions for flexible mechanisms have provided a framework for an effective and equitable global response. Among these instruments, the Clean Development Mechanism (CDM) using the market as its driven force has the potential to not only contribute to the ultimate objective of the UN Framework Convention on Climate Change (UNFCCC), but also encourage developing countries to move their economic growth under a less carbon-intensive development path.

A flexible mechanism such as the CDM, the surprise on the KP menu, has never been attempted before and it is a clear case where lessons can only be learned by doing and every mistake is a valuable lesson learned. One lesson already learned is that host countries that established national oversight entities during the pilot phase of Activities Implemented Jointly (AIJ) were remarkably more successful in accessing its benefits than countries that had not. Now, setting-up a National Authority (NA) is a compulsory requirement for all developing countries wishing to participate in the CDM.

The scope of this paper is to present a guide for those developing countries willing to develop its institutional capacity needed to participate in the CDM. Required framework conditions for CDM projects, roles of the NA in the CDM project cycle, possible structures of and tasks to be performed by the NA, steps in creating a NA and challenges of its institutionalisation, are considered from the perspective of a developing country.

2. Framework for CDM projects

The CDM has been taking shape since the package of decisions of the seventh sessions of the Conference of the Parties to the UNFCCC (CoP7) known as the Marrakesh Accords, a 250 page interpretation of the KP, was agreed (November 2001). Many parties are already in the process of preparing CDM project activities and these project proposals must meet the demanding requirements of the CDM rules. However, some details such as guidelines for baseline and monitoring methodologies, in addition to definitions and procedures for afforestation and reforestation projects still remain to be clarified.

Key procedural requirements in developing projects include approval of the project by both the host and investor country, and definition of a baseline scenario, which quantifies the emissions level in the absence of the CDM project activity. Before the project can be officially registered as a CDM activity, the project design document (PDD) including the baseline have to be validated by an accredited third party known as the Operational Entity (OE), usually a private sector certification company. This includes a period of 30 days when the validator invites comments from stakeholders.

During the lifetime of the project, actual emission reductions are monitored following a pre-defined protocol, and verified by another OE. Based on these emission reductions, the United Nations CDM Executive Board, which is responsible for overseeing the CDM, will periodically issue Certified Emissions Reductions (CERs) as the tradable unit.

In addition, all projects must fulfil the substantive administrative and institutional conditions valid in both the host and investor countries. The investor country might only be interested in purchasing CERs rather in actually investing in CDM projects. However, some investor countries programmes such as the CERUPT from the Dutch government or from multilateral organisations such as the World Bank's Prototype Carbon Fund (PCF), additional conditions for trading CERs must be fulfilled in addition to the CDM ground rules.

In general, CDM sits to attract foreign and promote local investment in projects that reduce greenhouse gases emissions and in addition promote sustainable development. In this vein, Costa Rica's CDM program is one of the elements in a strategy to obtain sustainable financing for the national development agenda. CDM has the potential to facilitate the transfer of clean technology and stimulate more cost-effective achievements through carbon marginal financing, and in this way, encourage sustainable development. Concomitantly, it provides a basis for an equitable cost sharing of the burden of climate change.

The CDM is often perceived as an instrument to provide added incentives for emission-reduction projects and afforestation-reforestation project activities in developing countries. However, the CDM market has not yet matured, and it is therefore difficult to judge exactly how financially attractive CDM projects are.

Furthermore, some critics have argued that CDM will never take off because the complex rules would put an excessive burden on the project developers. Indeed, the CDM's ability to generate carbon credits at acceptable transaction costs remains to be proven in practice.

Some developing countries can independently create the framework required for the CDM. This will not be the same, however, for others, in particular in Africa. Many of these countries lack the capacities required to prepare and implement CDM projects, and therefore, will need additional support for capacity building.

3. Role of the National Authority in the project cycle

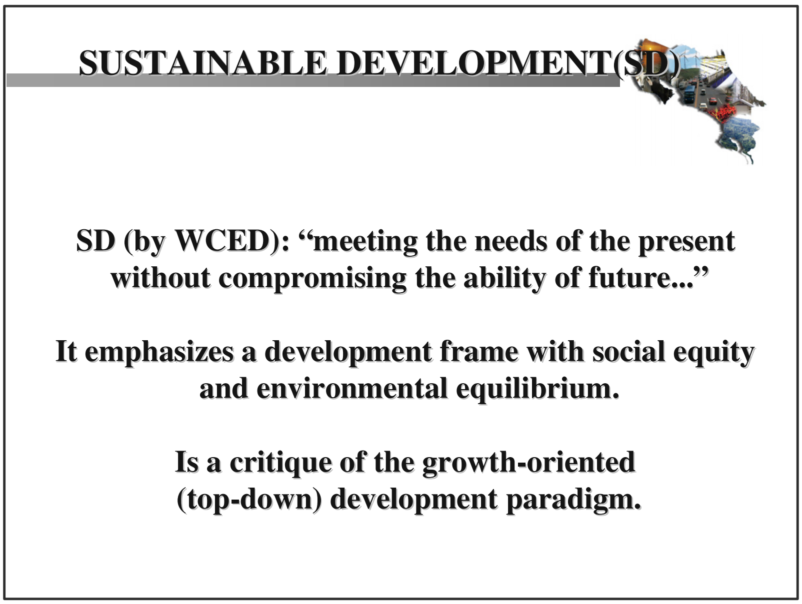
Under the Marrakesh Accords, the NA must ensure that the host country participates in a CDM project activity voluntarily. This condition also applies to all project participants. The NA must also confirm that a project contributes towards a country's sustainable development, in accordance with the standards set by the host country and whether projects will result in real, measurable and long-term benefits to mitigate climate change.

The former is the centrepiece of the regulatory function of the NA, a compulsory requirement and an important aspect to increase the probability of approved projects being successfully validated and to reduce the perceived and real risks to local suppliers and buyers (of CERs) in implementing CDM projects.

It is advisable that the NA design and establish an evaluation procedure that adopt international eligibility criteria to secure the expected global benefits[1] and assess the contribution to sustainable development based on the framework of the CDM national strategy and local policies.

If the NA approves implementation, it must also ensure that the project environmental impact is adequately assessed.

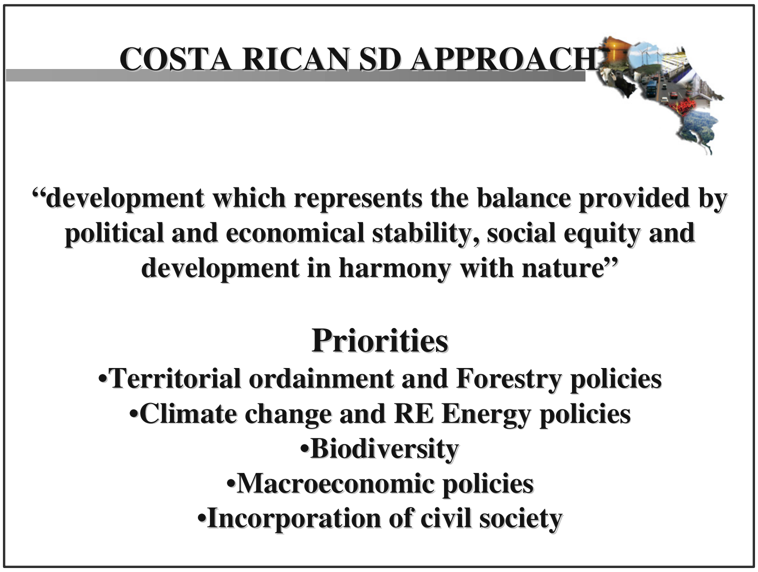
Figure 1. Sustainable Development



During the validation process, the NA shall make comments on the validator draft report and these comments must be taken into account and may have a significant impact on the validation process. Once the registration process has been completed and approval granted for the project, the NA can no longer intervene directly. However, it should regularly review verification reports to ensure that project implementation does actually contribute to a country’s sustainable development.

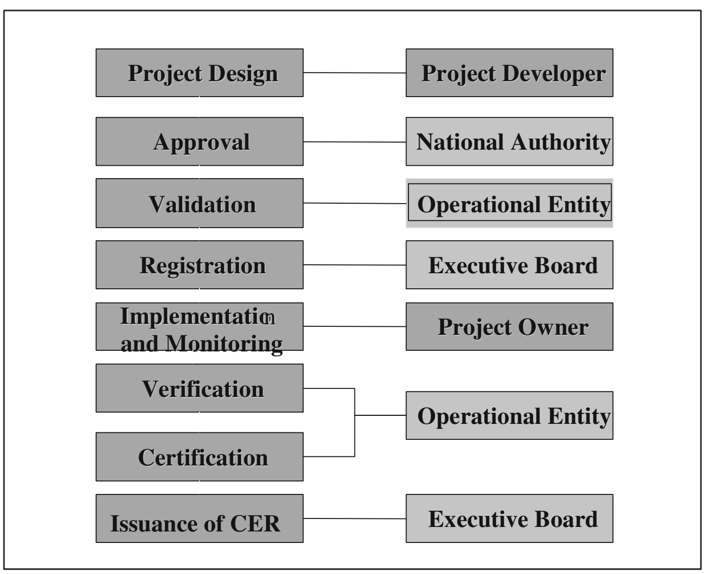
[1] Additionality criteria expressed in terms of real, measurable and long-term benefit related to the mitigation of climate change. Requires a baseline and the quantification of the impacts of the project activities on carbon stocks and flows. Externalities such as the managing of leakage and provisions for the management of other risks should be considered in addition to a monitoring protocol suitable to secure the long-term benefit related to the mitigation of climate change.

Figure 2. Costa Rican Sustainable Development Approach



Marketing is another important task to be performed by the NA. The entry into the CDM is likely to be highly competitive. The market has been diminished both by stringent requirements imposed by the Marrakesh Accords as well as by the exit of the United States from the KP. Only those projects deemed of high quality will compete in the emerging market. Therefore, a host country interested in being actively engaged in the carbon market needs an aggressive marketing strategy. It should take full advantage of international experiences, internal and external consultants that provide inputs for identification, formulation and development of proposals for potential CDM project activities, as well as multilateral banks acting as intermediaries for buyers in addition to brokers that bring potential buyers and CERs suppliers together.

Figure 3. National Authority in the Project Cycle (simplified)



Note: Figure 3 outlines the basic tasks that the NA must carry out in the project cycle.

4. Structures of National Authority

There is no right approach to structure but rather a number of approaches are possible to respond to the needs and availability of resources in each individual developing country.

Some countries have attached the NA to the climate change office. The climate change office is a fully governmental entity responsible to report on national commitments under the UNFCCC. These offices are more scientific by nature and not business oriented. Under this structure the NA could be responsible for determining and drawing up CDM national policy and strategy, developing guidelines, processes and approval procedures for CDM, and dealing with comments and complaints.

On the other hand, some developing countries have attached their NA to governmental entities accountable to a CDM Board entrusted to the National Climate Change Committee. Usually these boards have no permanent staff. However, day-to-day tasks involved in preparing and processing CDM project activities could be carried outside of a state administration, to ensure greater and more rapid scope for action. A technical office or clearinghouse would carry out the following tasks on behalf of the NA entrusted to a CDM Board or any other governmental entity:

- carrying out secretariat duties for the CDM Board;
- serving as a focal point and provide support for investors/buyers;
- promoting the CDM project approach;
- providing potential projects for investors;
- processing framework agreements with investors/buyers;
- assessing statements made on environmental impact;
- providing legal advice for investors/buyers;
- coordinating with other official entities and authorities;
- drawing up standardised baselines;
- monitoring ongoing CDM projects; and
- conducting public relations work, updating the web, etc.

In general, the range of tasks should reflect the country's potential opportunities on the emerging market.

Figure 4. CDM Institutions

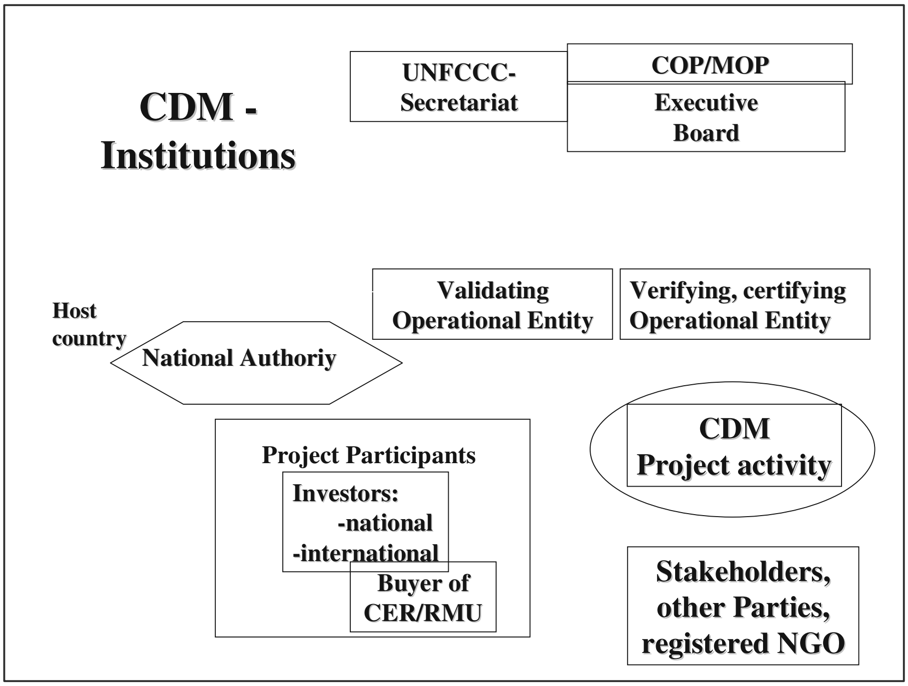
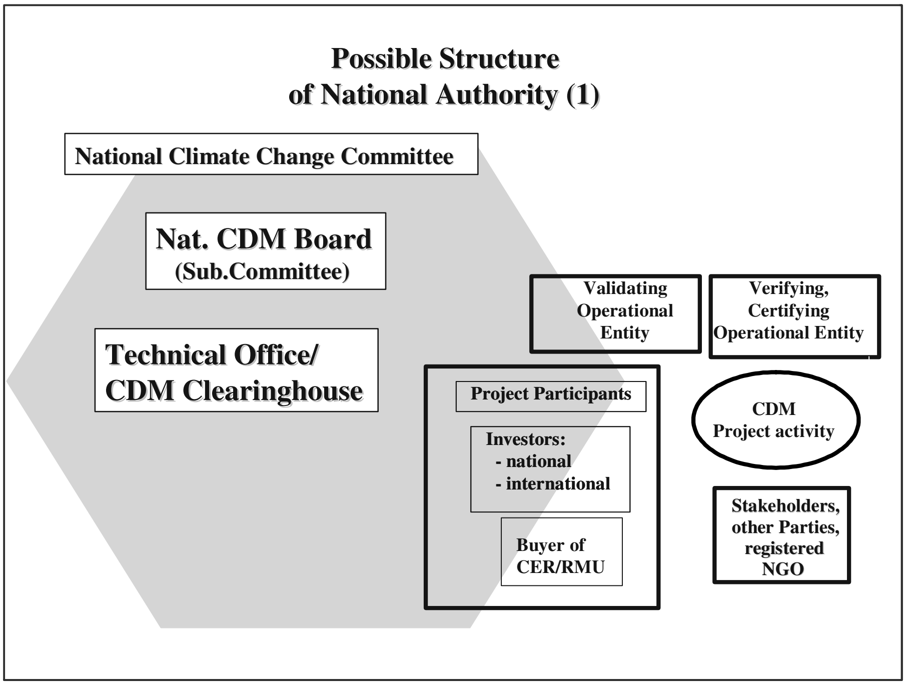


Figure 5. Possible Structure of National Authority (1)



5. Costa Rican experience

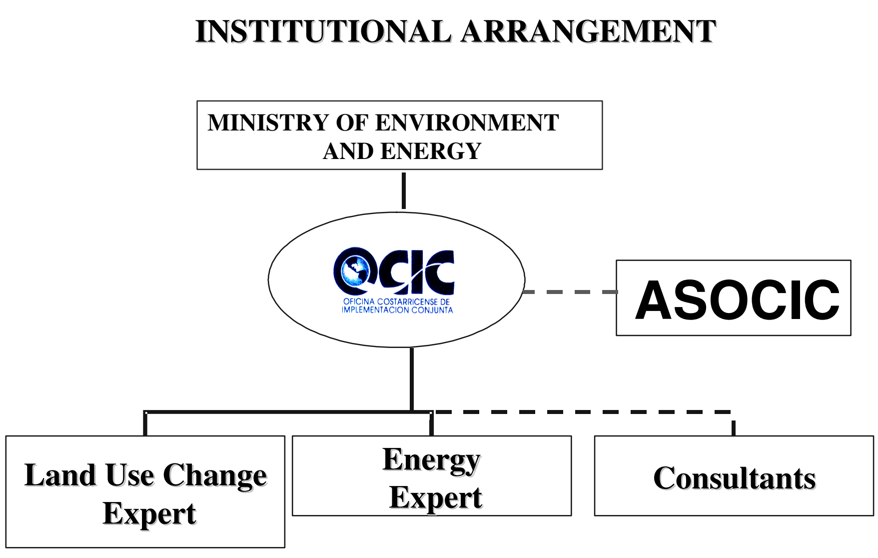
It is precisely the compatibility that exists between local development priorities and what can be called a responsible policy on climate change that climate change issues are addressed at its highest political level in Costa Rica. Under a two pronged approach such as implementing the Kyoto Protocol flexibility mechanisms (AIJ/CDM) and no regret policies and measures on mitigation, Costa Rica has inflected its greenhouse gases emissions curve during the last decade. Nevertheless, national emissions are expected to double during the next 15 years.

Costa Rica's experience with the UNFCCC flexibility mechanisms started in 1995 with the creation of a national Activities Implemented Jointly (AIJ) programme, envisioned and implemented by the Ministry of Environment and Energy (MINAE), the rector entity in climate change, as a new component of the national agenda on sustainable development. An agreement of cooperation was signed among public, private and NGO sectors for the development of the national AIJ programme.

The MINAE signed this initial agreement of cooperation with the Investment Board of Costa Rica (CINDE), a private entity specialising in the attraction of direct foreign investment, a forestry NGO (FUNDECOR) with recognised experience in sustainable development and the Association of Private Energy Producers (ACOPE).

In 1996, the national AIJ programme was legally elevated to the rank of maximum deconcentration office of the MINAE. This decision taken by an executive decree allowed the programme to have an administrative office — the Costa Rican Office on Joint Implementation (OCIC) — and also guaranteed all participating sectors a voice in policy development. Figure 6 illustrates the institutional arrangements put in place.

Figure 6. Institutional Arrangement



In 2002, Costa Rica ratified the Kyoto Protocol and underwent another transformation. To move toward sustainable financing, a private association of stakeholders was established, known as the Costa Rican Association of Joint Implementation (ASOCIC). Founding membership was offered to main national utilities from the public and private sectors, as well as the Forestry Chamber and other public and private forestry entities, comprising a total of 16 associates.

Under this structure, OCIC is a mixed institution with a political mandate from the MINAE and under administrative guidance of ASOCIC. This coordination is framed under a new cooperative agreement between MINAE and ASOCIC. This structure allows for financial sustainability and flexibility for OCIC, now the National Designated Authority (NDA) for the CDM.

At a time when most countries were still trying to understand the main basic concepts of the CDM, OCIC forged ahead with effective institutional developments as well as innovative financial instruments.

6. Steps in creating a National Designated Authority

Prior to creating a National Designated Authority (NDA), it is advisable to perform a quick assessment of the political and institutional feasibility of establishing a successful entity. The initial assessment should consider aspects of: political stability, since CDM projects consider long-term effects; potential institutional rivalries in climate change issues; level of intersectorial communication; technical expertise in project development and evaluation; general level of interest and understanding of the CDM, etc.

Once the initial assessment is accomplished indicating favourable conditions for the NA, the following steps provides a general framework for establishing a NDA:

– Define its mission and objectives; from a development country perspective it must at a global level contribute to the ultimate objective of the Convention, and at the domestic level it should help meet national sustainable development goals.

– Seek support of political entities such as Ministries of Environment, Energy, National Resources, etc; and establish a legal framework via Presidential or Ministerial Decree or any other legal instrument. This legal instrument shall contain justifications, authorities, objectives and organisational structure, financing functions and procedures that will be the platform for the development and sustainability of the NDA. Furthermore, the NDA should have the authority to grant export of emissions rights (CERs).

– A review of the national legislation is crucial. The legal framework of a host country will directly affect the success of the national authority. Depending upon the development priorities of the host country, some legislation might be compatible with CDM. As such with trade and investment in general, those host countries with the most transparent rules and most streamlined procedures, will be in the best positions to compete for CDM resources. CDM projects will not only compete with each other but also with the other KP flexibility mechanisms.

– National strategies for CDM should be based on local sustainable development objectives. It is important to identify national policies already established for social and economical development in areas related with climate change such as energy, land use change and forestry, industry, etc. These policies will ultimately have the greatest impact on national resources and the environment at the local level and on climate change at the global level. CDM is a real opportunity to channel resources towards projects that are most likely to further national development priorities.

- Attaining broad stakeholder participation is one of the most challenging steps. Some countries have centralised programs within the central government institutional framework. Others have achieved active participation from all sectors of society and different sectors of the economy. Including participation of the private sector encourages a less bureaucratic, more result-oriented and business-like approach. Private and public developers together or by themselves are the real actors and the driving force for the implementation of cost-effective mitigation options.

- Funds will be crucial and the source of funds will depend on stakeholders' involvement. NDAs based on public funding may face funding constraints and one way to deal with this is to broaden the sources of in-kind support from stakeholders for items such as the physical facilities for offices etc. as well as logistic assistance such as financial and accounting management support from private or NGO entities. This will allow for more flexibility to the NDA. Operational costs for running a NA might also be financed via a small commission fee on CER trading.

All these elements are generic and there is no one best approach to establish a NDA. However the NDA shall have the capacity to act as an effective entity that will allow the host country to be competitive in this emerging market.

7. Challenges of the Institutional Organisation

The nature of the NA varies widely in regard to legal structure, financial support and responsibilities. However, the identified main challenges of the institutional organisation are the following.

7.1 Awareness raising

It is clear that CDM can further national goals and at the same time these projects have ancillary benefits above climate change mitigation. In this regard, the most difficult aspect to handle is managing expectations. CDM is an instrument to finance only a certain subset of sustainable development initiatives and it is not the only one. In this regard, expectations should be kept in its realistic dimension.

7.2 Political will

It is evident that in those countries where climate change has been made a priority, progress is made more quickly. In this regard, long term planning, vision and political will, are critical to successful implementation of the NDA for the CDM.

7.3 Cross-sectorial coordination

Despite the fact that it is governments who have signed the UNFCCC and the KP, most of its implementation will be performed by private and public developers and most of the CDM benefits channelled to their projects. Therefore, it seems logical that stakeholders share the costs of a NA. The governmental leadership is vital in this regard.

7.4 Full-time champion

Having a leader who is responsible to make the NA will be very effective. Many people with little direct involvement will not be able to get the job done.

8. Conclusions

There is no cookie approach and each country has to decide on the particular form of its NA institutional development. Participation in CDM is a learning process in each country. At the beginning it is impossible for a newly formed NDA authority to exercise all relevant functions. Over time, the growing maturity of the market will allow the NDA to gradually assume additional responsibilities. In the mean time, capacity building and technical training can be provided by specialised agencies and funded by different sources of Official Development Aid (ODA).

In the specific case of Costa Rica, the reason for success has been a country driven effort with strong political support, in addition to a solid technical platform integrating local and global market-driven instruments with domestic sustainable development initiatives. The Costa Rican enriching experience on the UNFCCC flexibility mechanisms is a lesson to be shared among those developing countries willing to be part of the emerging market of CERs.

In achieving sustainable development under the CDM it seems to be less a factor of project design but more a result of the national capacity to establish and implement policies and measures, a compatible legal framework and a supportive institutional capacity. However, in achieving the ultimate objective of the Convention under social equity and environmental integrity via the CDM, the global benefit shall by far surmount the local environmental cost.

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IMPLEMENTING KYOTO-TYPE FLEXIBILITY MECHANISMS FOR INDIA: PROBLEMS AND PROSPECTS

by

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1. Introduction

With the incorporation of 'flexibility mechanisms' in the Kyoto Protocol (KP), namely, emissions trading, joint implementation (JI) and the Clean Development Mechanism (CDM), incentive-based (IB) policies are being widely discussed in the context of greenhouse gas (GHG) abatement[1]. This paper examines various aspects of these incentive-based approaches for India, particularly the linkages among them and issues related to their implementation.

Whether developing countries (DCs) such as India will take on commitments to reduce GHGs in the long-run and whether they will eventually take part in a global emissions trading system is something that will only become clear as time passes. It is clear, however, that these countries will be affected by any global architecture for GHG abatement that emerges. In this context, this paper reviews recent developments (Bonn and Marrakech and beyond) and the implications of these for India. Thus, it examines the market for KP flexibility mechanisms, particularly emissions trading and CDM. For instance, it has been argued in light of various concessions, the market for CDM projects will be small (compared to GHG emissions in developing countries) and that it will be characterised by low demand and low prices (Halsnaes 2002, Jotzo and Michaelowa 2002).

The following section presents a brief overview of the nature and composition of greenhouse gas (GHG) emissions in India. This sets the context for the discussion that follows. Section 3 examines the likely nature and extent of India's involvement in CDM activities. It also addresses the division of gains from implementing CDM projects between host and funding parties as well as banking of CERs from 'low fruit' projects. Section 4 focuses on emissions trading and addresses the questions of equity and whether India stands to gain or lose if emissions trading is realised even if it remains outside such an arrangement during the initial commitment period. In the longer run, however, it is inevitable that

[1] Both JI and CDM, are project-based mechanisms that are included in the Kyoto Protocol under Article 6 and Article 12, respectively. JI enables countries with specific emission reduction target under the Kyoto Protocol (Annex B countries) to obtain credit for implementing GHG reduction projects in other Annex B countries. CDM is broadly similar but pertains to abatement projects implemented in non Annex B (developing) countries. Article 17 of the Protocol allows emissions trading among Annex B countries.

India along with other rapidly industrialising countries will have to take on GHG reduction commitments. In this context, Section 5 examines the possibility of convergence across Kyoto-type flexibility mechanisms, particularly emissions trading and CDM, and issues of monitoring, enforcement and verification for these mechanisms. With regard to the latter, the pros and cons of emissions trading and CDM are compared from a conceptual and practical point of view. In the ultimate analysis, however, market-based instruments (MBIs) for GHG abatement in India cannot be viewed in isolation from an overall incentive-based orientation towards environmental policy as well as broader economic and legal reform that creates a suitable milieu for MBIs. Therefore, Section 6 examines problems of implementing MBIs in India in general, particularly those related to monitoring of emissions and of enforcement. Several specific solutions are also proposed. The final section concludes.

2. GHG emissions in India

It may be useful to begin by briefly reviewing the nature and composition of GHG emissions in India[2]. India has the world's second largest population and is the world's sixth largest emitter of carbon dioxide (CO_2). It is estimated that India emitted 908 million tons of CO_2 in 1998, four percent of the world's total (UNEP 2002). However, per capita emissions are 0.93 MT of CO_2 per annum were well below the world average of 3.87 MT per annum. The rate of growth of GHG emissions in India is 4.6 percent annually, compared to a two percent world average.

The most recent and most comprehensive national GHG inventory for India was prepared under the ALGAS (Asia Least-cost Greenhouse Gases Abatement Strategy) project of the Asian Development Bank (ADB 1998). In sum, its main findings were: (i) on a CO_2 equivalent basis, CO_2 emissions account for 53% of the total emissions, whereas methane (CH_4) and N_2O contribute 39% and 8% respectively; (ii) the energy sector is the main emitter of CO_2, accounting for 87% of total CO_2 emissions, the rest coming from the cement industry (4%) and land conversion (9%), and (iii) biomass burning and agriculture sector are the main sources of CH_4 and N_2O emissions with a small portion contributed by the transport sector (TERI 2001).

Further, among sectors of the economy that account for CO_2 emissions from energy, prominent are fuel combustion in industry (41%), electricity production (34%) and transport (17%). The main source of energy in India is coal mainly used for producing electricity and industrial energy requirements, and accounts for 62% of CO_2 emissions. During 1990-95 emissions in electricity grew at 8.6% annually and industrial sector emissions grew at an annual rate of 4.7%.

With respect to CO_2 emissions, therefore, the focus of CDM projects (and/or emissions trading in future) has to be in electricity production, industry and transport. The industrial sector consumes about 50% of the total commercial energy produced in the country. The most energy-intensive industries are fertilisers, iron and steel, aluminium, cement, and paper and pulp, collectively accounting for about two-thirds of total industrial energy consumption. There is significant scope for improving energy efficiency in these sectors as also in electricity production and transport (see TERI 2001 and RFI 2003 for details).

[2] For a detailed discussion on India's emission inventory see Garg and Shukla (2002).

3. Some issues for CDM in India

As mentioned earlier, under CDM, developed countries (or firms in those countries) can fund GHG abatement projects in developing countries where abatement costs are much lower. In turn, the developed countries receive credits ("certified emission reductions" or CERs) that can be used to offset their emission reduction obligations (for details see Toman 2000, Karp and Liu 2000 and Babu 2003 among others). There are two issues relating to CDM that are important in the context of incentive-based policies. First, CDM will be implemented on a project-by-project basis-the basic rationale for undertaking a CDM project is the difference in marginal abatement costs — (MACs) between the host country and the Annex B country. A key feature of a market, however, is a competitively determined price that is missing under CDM[3]. Thus, unlike a tradable permit market where inframarginal units of abatement are also sold at the prevailing market price, this may not always be the case under CDM and division of gains (the difference between MACs) could be an important issue for CDM projects. Some researchers have suggested that rather than receiving a competitive market price for emission reductions, developing countries may simply be paid the actual cost of abatement, perhaps with some markup (Chander 2003). On the other hand, Babu and others (2003) posit that the total gains from CDM as well as the share of developing countries will depend on their relative bargaining power vis-à-vis developed countries. This result holds whether CDM projects take place between individual firms across countries or through bilateral negotiations between governments. Thus, while a project-specific basis for defining and creating CERs under CDM may imply bilateral transactions (betweens firms or governments), a situation where the host country is required to accept payment at its MAC (or a small markup over it) is only one of a set of possible outcomes. The actual outcome would depend to a considerable extent on how well CDM itself is defined as an institution and how well market institutions (e.g., brokerage for secondary transactions) evolve.

The second issue vis-à-vis CDM as an incentive-based policy is that if developing countries took on emission reductions in future, implementation of low cost abatement projects (the so-called low hanging fruit) now would leave them with higher cost options later. However, as Karp and Liu (op. cit.) point out, the main problem with CDM is not that the most lucrative projects would be taken up first (as they should be) but the possibility that the host country receives inadequate compensation. The latter of course, is a function of the way CDM is set up as argued above. Thus, if host countries could create and bank their own CERs (if they thought the current price was too low) this would solve the problem[4]. More fundamentally, the question facing developing countries in this context is whether to cash in on CDM opportunities now or to wait. In any event, it would perhaps be more desirable to have global emissions trading where developing countries such as India could sell their emission reductions at a competitive market price. This is discussed in greater detail below. In passing, it should be noted that even if competitive trade in emissions were not established, developing countries

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3 Some modelling exercises, however, treat the flexibility mechanisms as fungible and assume CERs will be traded in a perfect international market along with other carbon emission credits such that there is a single global price (Jotzo and Michaelowa 2002). While this assumption may be useful in estimating likely prices under different model scenarios, until the Kyoto Protocol comes into force and CDM projects start getting implemented widely, it is not clear what will exactly happen. We come back to this issue later in the paper.

4 It is a moot point whether additional 'low fruit' opportunities would keep arising. This would happen only if convergence of technologies between North and South did not occur. This (lack of convergence) seems unlikely especially with deregulation and globalisation taking place in several economies in the South particularly India and China. Most of the old technologies in the energy intensive sectors in the South (power and transport for example) are being replaced by state of art technologies. Therefore, it seems more plausible to view the 'low fruit' as a one time opportunity.

(other than energy exporters) would still benefit from the implementation of the Kyoto Protocol since international prices of fossil fuels would fall due to cuts in Annex B consumption (Babiker *et al.*, 2000). This would facilitate faster economic growth in developing countries (Chander 2003).

We now turn to an examination of the likely nature and extent of India's involvement in CDM activities. There have been several recent exercises post-Marrakesh to estimate CDM potential and likely prices of CERs (Chen 2003, Halsnaes 2002, and Jotzo and Michaelowa 2002). The overall consensus of these studies is that the inclusion of sinks, hot air and withdrawal of the United States have changed the picture considerably. Nevertheless, it is also agreed that a host of factors could lead to wide variations in future carbon quota prices and CDM potentials. Broadly, one may classify these factors as either affecting supply or demand in the market for CDM projects. For example, carry-over of assigned amount units (AAUs) by transition economies to the subsequent commitment period would reduce effective supply of hot air thus increasing demand for CDM projects (and price of CERs). A similar impact could work through the supply side if carry-over of CERs reduced the effective supply of CDM projects. Other factors that could impact on CDM would be the extent of domestic action in Annex B countries, the extent of market power exercised by Russia and Ukraine, transactions costs, and such like. We do not go into details of these scenarios but refer the reader to the studies cited above. As an illustration of the impact of these factors, however, Jotzo and Michaelowa (2002) estimate in their standard case about one-third (32%) of effective emission reduction requirements of 1.2 Gt/CO_2 per year would be met through CDM projects at a price of USD 3.78 per ton of CO_2.[5] But in the same study the share of CDM in the global carbon market could vary from as much as 44% to 15% across different scenarios. Similarly, the international price of CO_2 according to the study could range from USD 6.24 to USD 1.33 per ton of CO_2 depending on the assumptions used. As and when the Kyoto Protocol comes into force and as negotiations for the second commitment period commence and unfold, it will become clearer which of these scenarios will prevail.

Irrespective of this, the relative ranking of marginal abatement costs and transactions costs will most likely determine the distribution of CDM projects across countries. Thus, countries that rely heavily on coal for their energy needs and/or countries where the major energy users (e.g., power plants and heavy industries) are relatively energy intensive and inefficient would have the greatest potential for large and cheap CDM projects (Jotzo and Michaelowa op. cit.). By this token, both China and India can expect a relatively large share of the CDM market—together, they are projected to account for about 60% of non-sink CDM projects (47% and 12% respectively). It is, therefore, certain that whatever the nature and scope of CDM projects that emerges globally, major coal-based GHG emitters such as China and India will play an important role.

Sector specific studies conducted for India indicate a significant potential for CDM projects in the power sector and in enhancing energy efficiency in industries (to the tune of about USD 1.05 billion each) over the next decade (CRISIL 1999). The investment potential for CDM projects in the transport sector is estimated at USD 23.5 billion over the same period (op. cit.). In contrast, non-CO_2 gases such as methane that are an important constituent of GHG emissions (39%), come from widely dispersed sources mainly in the agricultural sector. Thus, livestock and paddy cultivation account for 42% and 23%, respectively of total methane emissions in India. It is generally believed given the dispersed nature and small size of such sources, they will not be cost-effective as CDM projects.

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5 As stated earlier, in this study the international price is same across the flexibility mechanisms due to fungibility of credits.

4. Looking beyond CDM: equity and tradable permits

In the short-run, if emissions trading among Annex B countries is realised (under the Kyoto Protocol or otherwise) India would stand to gain even if it remained outside such an arrangement, at least during the initial commitment period. As noted earlier, a decrease in fossil fuel demand by industrial countries triggered by cuts in CO_2 emissions would lead to a reduction in world energy prices and benefit major energy importers such as India (Babiker *et al.*, 2000). In effect this would facilitate faster economic growth in developing countries other than energy exporters (Chander 2003). In addition, developing countries such as India also stand to gain through arrangements such as the Clean Development Mechanism.

Looking at the long-term horizon, international negotiations to decide on the architecture of GHG abatement regime beyond 2008-2012 will start in earnest by 2005. Even though India's annual per capita emissions are well below the global average, in the aggregate its emissions are large and growing rapidly. Thus, it is quite likely that India in particular (and developing countries in general) will have to take on some commitments to reduce GHG emissions. In fact, some experts have argued "the size of its (India's) aggregate emissions makes its participation in any future developing country commitment regime a *foregone conclusion*" (Sagar 2002, p. 3925, emphasis added). If India decided to accept a voluntary national commitment (which is what it would need to do to participate in Article 17 emissions trading) the basis for establishing this commitment would be vital. In addition to the widely discussed (but unlikely) per capita criterion, another possibility would be a 'growth baseline'[6]. It could also retain the option just to participate in project-based credit trading. In the long-run, however, there would have to be some international consensus on allocation based on equity, howsoever that were defined. Cazorla and Toman (2000) provide a useful survey of various concepts of equity and how these concepts could be applied in the context of climate change. According to them, while the concept of equity can be interpreted in many ways, "any criteria that might be used to distribute current and future burdens of GHG mitigation *must be based, explicitly or otherwise, on some concept of equity*" (op. cit., p. 5, emphasis added).

In particular, an allocation based on the per capita rule would give India permits in excess of its actual emissions much like Russian "hot air", which would be a financial windfall, at least in the short run[7]. For instance, on the basis of the per capita criterion, India could potentially increase its emissions in 2010 by 722 percent over the 1990 level (Gupta and Bhandari 1998, Table 6). Actual emissions, however, may not increase even three times over the same period[8]. This creation of Indian "hot air" may not be acceptable internationally and some compromise may be required[9]. As an

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6 This is an approach to developing country emissions commitments that would not cap emissions in absolute terms but would require countries to increase their GHGs emissions at a slower rate than their economies (Hargrave and Helme 1997). In other words, emission intensity (the ratio of GHG emissions to gross domestic product) would decline—very much like the Clear Skies Initiative announced by President Bush in February last year.

7 Some writers refer to this as 'tropical hot air' since it originates in developing countries (Philibert 2000). In general, hot air implies giving allowances for emissions that could be reduced at no cost.

8 In calculating per capita entitlement in year t, population is not pegged at some reference year but is taken at the actual level that prevails in year t. Thus, India with an increasing population gains disproportionately as compared to countries such as China that have stabilised their population. The "hot air" that India would acquire would be less if the reference population level were fixed at year 1990 or 2000.

9 In this context, it should also be noted that China's emissions are projected to roughly double (from 833 Mton in 1990 to about 1800 Mton in 2010). However, under the per capita criterion it can

extreme case, if all developing countries were successful in obtaining more emission allowances through a per capita criterion than what a "no-regrets" baseline would provide, huge amounts of tropical hot air would be generated undermining the UN Framework Convention on Climate Change (Philibert 2000). Even if a tighter cap on global emissions were agreed upon but allocated on a per capita basis, large financial transfers could result from countries with actual per capita emissions above this allocated level, to countries with actual per capita emissions below it. It is unlikely that there would be international consensus on such transfers.

In this context, however, it should be mentioned that such worse case scenarios may not come to pass. For instance, as we argue below, technical progress in abatement technology may depress permit prices and revenues for the South. Similarly, experience with the US sulphur dioxide trading program and with the nascent GHG market have led some to predict that prices for GHG permits will be below USD 10 per ton of CO_2 in 2010 (Springer and Varilek 2003). Thus, resource transfers to developing countries associated with emissions trading will be relatively low.

A recent study by Leimbach (2003) provides new insights on how the equal per capita allocation principle of emission rights influences the intertemporal path of emissions and the distribution of mitigation costs in the long run. For a variety of assumptions, the study shows that several developing countries (particularly India and those in sub-Saharan Africa) could benefit considerably from joining an international emissions trading system, thereby becoming potential collaborators in post-Kyoto climate agreements. The important variables considered are: (i) the point in time at which a complete per capita distribution of emission rights is realised (that is, early as in the year 2025 or late as in the year 2100), (ii) the share of allocated emission rights that can be sold (all or sale is limited to 30%), and (iii) the portion of emissions that can be covered by purchased emission rights. As expected, the highest gains for African countries and for India arise if the per capita rule takes effect sooner than later (op. cit.).

This result is corroborated by an earlier study by Manne and Richels (1995) that compares the impacts of a faster and slower transition to an egalitarian rule (that is, by year 2030 and 2100, respectively). Under the quicker transition scenario the burden would fall on the more industrialised regions (OECD and former Soviet Union), whose share in global CO_2 emissions falls from 66% in 1990 to 22% in 2030, whereas the less industrialised countries (China and Rest of the World) would gain. A slower transition, however, would lead to a preferential treatment of industrialised countries, since it would still allow them to emit 60% of total CO_2 emissions in 2030. An interesting point to note in the paper by Leimbach (and already alluded to in a footnote above) is that China's high rate of economic growth and its entry into middle income country status over the model horizon, implies under all scenarios it would be purchaser of emission rights. Of course, a shorter transition to the per capita allocation rule would still be slightly more beneficial to it.

More important, the implications of technical progress for permit prices and for alternative allocation criteria needs to be carefully thought through. An important result in the literature is that once the South has secured a quota allocation based on the per capita principle, it stands collectively to lose from progress in abatement technology because of the strong link from technical progress to the world market price of quota (Bertram 1996). A more restricted business as usual allocation rule gives the South smaller gains from the quota system, but enables it to retain some of the rents from its own technical progress. In other words, diffused technical progress of the kind that leads to a downward shift in the marginal abatement cost (MAC) curve of developing countries, could actually lead to a fall

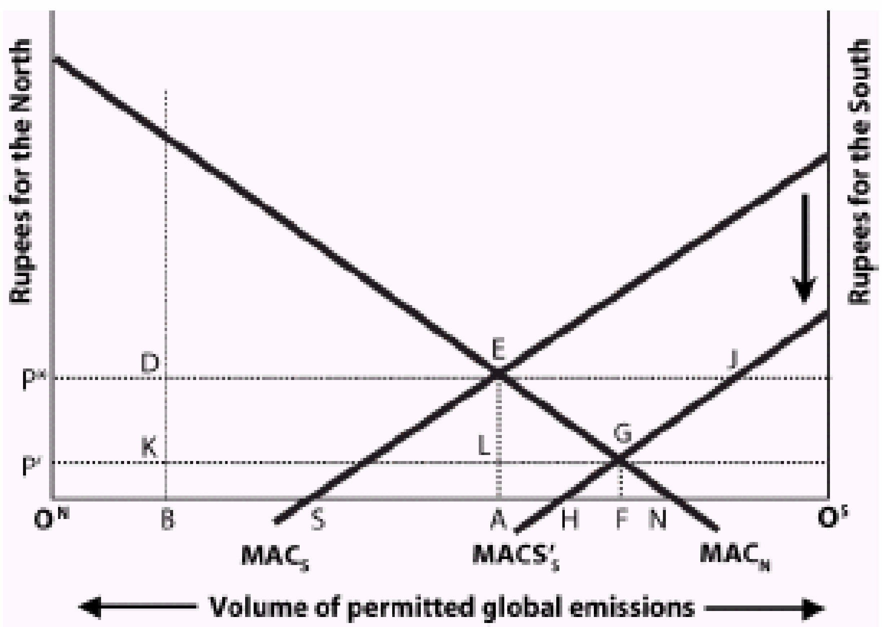
increase its emissions by 162% over the same period (Gupta and Bhandari op. cit., Table 6). Thus, it does not stand to gain as much by creation of "hot air" and may therefore be a less enthusiastic supporter of allocations on a per capita basis.

in revenue for permit exporting countries, and this result is particularly true when quotas are allocated using the per capita rule that gives developing countries such as India a large number of permits.

To elaborate, a downward shift in the MAC curve for developing countries has three effects which are relevant to their gains and losses from technical progress for a given global emissions budget: (i) abatement costs fall which frees up resources for other uses, (ii) the volume of quotas sold by developing countries to developed countries increases, and (iii) the world price of quota falls (Bertram op. cit.). The first two effects represent gains for developing countries whereas the third is a loss. The net result depends on the slopes of the MAC curves as well as the rule used to allocate quotas.

Figure 1 (cf. Bertram, op. cit., Fig 1) depicts MAC curves for two regions — the industrialised North and the developing South with the global emission budget fixed as the length of the horizontal axis. Emissions in the North are measured from ON and increase to the right. Thus, maximum unconstrained emissions for the North are ONN and its marginal abatement curve (MACN) is drawn sloping up from N. The South's emissions are measured from OS and increase to the left and its marginal abatement cost is MACS. Since aggregate business-as-usual emissions (ONN+OSS) would violate the global emission budget, under a tax or a permit system both regions would move up their MAC curves to E with a corresponding emissions tax/permit price P*.

Figure 1. Technical progress and permit prices



Technical progress, e.g., through CDM leads to a downward shift in the South's MAC curve to MACS'. As Bertram shows, if the North's MAC curve is sufficiently steep over the relevant range, then the decline in price of quotas will mean a fall in revenue of the South. For instance, the per capita rule would allocate ONB and OSB of quotas to the North and South, respectively. In the original situation (before technical progress) the North would abate to point E and buy BA of quota from the South paying a sum of BDEA. After technical progress, the North would abate less (to point G) and buy BF of quota from the South paying a sum of BKGF. Total revenue for the South would fall since BDEA > BKGF (effectively, KDEL > ALGF)[10]. Further, if this fall in revenue is greater than the reduction in the South's abatement costs then the South will lose overall from its own technical progress. He further shows that the slope of the North's MAC curve varies directly with the quota allocated to the South. In other words, with a liberal allocation rule such as the per capita rule the South could lose revenue due to technical progress[11].

5. The way forward: convergence across flexibility mechanisms?

In light of the forgoing discussion it appears likely that India could undertake CDM projects in the short-run and in the long-run take on some commitments (howsoever they were defined) and also possibly participate in an emissions trading regime. In this context, there exist various possibilities of linking project-based mechanisms such as CDM and more generic flexibility approaches such as emissions trading. Here we distinguish between convergence across these mechanisms in the long-run and the short-run.

With respect to long-run convergence for instance, there could be banking and carry-over of CERs by India beyond the first commitment period. This would particularly apply if some CERs were created suo moto by India (not through funding from Annex B parties) and banked with a view to future utilisation. Such a step would also address concerns about excessively low prices for CERs under current conditions and would also prove useful if a large potential buyer such as the United States came on board later. With fungibility across flexibility mechanisms and with eventual participation of India in an emissions trading regime, the CERs could be merged and traded along with permits. Thus, notwithstanding the vexatious problem of initial allocation of permits, it is possible to view India's participation in CDM activities as a bridge to taking part in full-blown emission trading in future.

Another way to think about long-run convergence of CDM and emissions trading would be to approach the issue from the other end, that is, to examine how a system of international emissions trading would be implemented by India, if it were to participate. Presumably, total permits allocated to India, howsoever this allocation were determined, would have to be distributed internally. If these permits were not sold, auctioned or grandfathered (or otherwise distributed in some hands-off manner) to firms, but instead were given away by the government to firms on a case by case basis in return for specific GHG abatement activities (with surplus permits retained by the government) this would de facto become a project-based mechanism. In effect, then the government could convert its (presumably generous) emissions cap into an 'exactly fitting cap' domestically and attain it through CDM type project-based mechanisms.

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10 It can be easily verified that an alternate allocation rule such as OSS to the South (in effect covering the South's baseline emissions) would lead to less loss in revenue to the South from technical progress.

11 "...with an exogenously set global budget allocated by the per capita rule with a consequent large redistribution of global permanent income towards the South, inhabitants of the South would lose from technical progress wherever in the world it takes place" (Bertram op. cit., p. 480, emphasis added). It is important to note that as a permit exporter the South would also be a net loser from technical progress in the North alone or from uniformly diffused technical progress. Thus, given the possibility of technical progress it would be better for the South to opt for a more conservative quota allocation rule such as one that covers its business-as-usual emissions-that is, a NRFTS (no-regrets for-the-South) rule.

With regard to convergence in the short-run, as argued earlier both India and China offer the greatest scope for a large class of CDM projects. But is also true in general that countries with stronger institutions and better capacity for CDM, more streamlined project approval process and lower transaction costs, would have a competitive edge in acquiring and implementing CDM projects. Thus, it is these areas that India could focus on and improve upon and this is where CDM and emissions could be linked in the short-run.

A possible organising principle here would be to conceive of CDM projects as broadly and at an aggregate level as possible. For instance, an umbrella CDM project for abating GHG emissions for coal-based thermal power sector as a whole could lower transaction costs and also garner a large flow of funds. There could be two possibilities here. First, an aggregate reduction in emissions could be agreed upon ex-ante (say by an association of industry or power producers) on the basis of specific interventions that are already under consideration such as improved operation and maintenance, coal washing and use of better coal, and employing energy efficient conversion technologies such as boilers, integrated gasification combined cycle (IGCC) and pulverised fluidised bed combustion (PFBC), (see TERI 2001 for details on these technologies and their CDM potential). The umbrella project then in turn could be implemented by instituting emissions trading or some other flexibility mechanism domestically across the power plants. At the plant level, actual reductions in GHG emissions could comprise a combination of specific interventions mentioned above. However, there would be flexibility in using specific technologies across plants and over time. Better information on costs and technology could alter the mix of measures that plants instituted. Further, as with all market-based instruments this approach would not require knowledge of plant specific marginal abatement costs—each unit would on its own adopt the most cost-effective combination of technologies. Thus, an umbrella approach would offer several advantages over a 'project by project' approach where each project at each plant is scrutinised and approved individually. For one, it would save time and lower transaction costs. Second, depending on the scale of the umbrella project the CDM funds acquired could also be substantial.

A second possibility would be for the plants (or an entity acting on their behalf) to collectively and ex-post present an aggregate amount of emission reduction as a CDM project. In other words, projects undertaken in consonance with CDM procedures could be aggregated and collectively put up for consideration for CDM funding. While less flexible than the ex-ante approach, this would still reduce transaction costs associated with case-by-case approvals and funding.

Another advantage of an umbrella approach both in the ex-ante and ex-post variants, would be that it would facilitate collective bargaining, and prevent individual project proponents from undercutting each other. While it may not be easy to achieve all these objectives, this suggestion is worth examining in greater detail. An important issue here would be the agency that would play the role of a coordinator or facilitator. Likely candidates could be the designated national authority (DNA) under CDM guidelines, industry associations or financial institutions. For instance, depending on the scale of the umbrella project financial institutions could implement such CDM projects unilaterally and get them funded later. This would be particularly useful for a collection of small projects that may be too small in themselves and may not have the resources to go through the CDM approval process.

Likely CDM scenarios with respect to the number of buyers and sellers may be summarised in a stylised manner below (Table 1). While there may be a continuum of buyers and sellers we simplify this into two categories—'many' and 'few'. Collective bargaining may be particularly relevant if there were many firms offering CDM projects within India but a few international funders, that is, the monopsonist market outcome. A situation with many 'buyers' and 'sellers' would be somewhat similar to emissions trading where CERs could be traded in something resembling a tradable permits market.

Table 1. Likely CDM Scenarios

CERs → ↓	**Many sellers**	**Few sellers**
Many buyers	'emissions trading'?	Monopolist market
Few buyers	Monopsonist market	Bilateral bargaining

Finally, an umbrella approach would avoid an ad hoc and eclectic portfolio of CDM projects that could result if these were taken up on a case by case basis. In the latter, the DNA would simply be in a reactive rather than a proactive mode. Whereas in the former it (or other agencies such as industry associations working under its guidance) could guide the process such that India maximised its share of CDM projects.

Thus, in the short-run (first commitment period) too there may be convergence of a different kind, namely, combining CDM internationally with emissions trading domestically. The experience with the phaseout of ozone depleting substances (ODS) under the Montreal Protocol may be instructive in this regard. Both India and China were major producers of ODS and thus eligible for funding of ODS phaseout projects under the Multilateral Fund (MF). The typical approach would be for individual projects to be screened by national steering committees and forwarded to the MF secretariat for funding on a case-by-case basis. In the case of China, however, for some sectors such as halon producers a sectoral approach was adopted and funding for an umbrella project was obtained. In turn, a tradable permit scheme was initiated domestically for phasing out production of halons, (see "Sector Plan for Halon Phaseout in China" at http://www-esd.worldbank.org/mp/whatsnew/fin-ap97.shtml for details). It is likely that a more comprehensive approach rather than forwarding projects on a case-by-case basis enabled China to garner more funds from MF than India.

With regard to monitoring, enforcement and verification, both CDM and emissions trading throw up their own challenges. The nature of the problem would be quite different for CDM projects approved and implemented on a case by case basis, than for sectoral or umbrella CDM projects. For the former, elaborate guidelines and procedures have been specified. In the latter case, the nature of monitoring and enforcement would be similar to market-based instruments (MBIs) in general. Similarly, monitoring and enforcing under emissions trading is a subset of similar issues under market-based instruments (MBIs) in general. As such, it is considered in detail in the following section.

6. Problems in implementing MBIs in India and possible solutions

The preceding discussion indicates that, the vexatious problem of carving up the global commons aside, incentive-based policies are beneficial both for India and for developed countries. It should not, however, be presumed that implementation of MBIs by India is an easy task. To begin with, the framework for environmental regulation in India is predominantly command and control (CAC). In the ultimate analysis MBIs for GHG abatement cannot be viewed in isolation from an overall incentive-based orientation towards environmental policy as well as broader economic and legal reform that creates a suitable milieu for MBIs. The following discussion applies to MBIs in general and not specifically to those targeted at GHG abatement.

Given the growing number of MBIs that are being used by countries around the world, the question is whether India is so different that none of the country experiences can be replicated here. And if so, what are these differences? In this context, note in particular the experience of China, Thailand, Malaysia, Indonesia, and other developing countries including the formerly planned economies of Europe. Many of these countries have (or had until recently), problems similar to those that are cited in the Indian context against the use of MBIs: imperfectly functioning markets, problems of monitoring and enforcing standards (due to an inefficient bureaucracy, shortage of resources, large number of micro and small-scale firms), and so on. While these difficulties are real and cannot be ignored, it is also true that the Indian situation is amenable to the implementation of well designed MBIs.

The implementation of MBIs has certain prerequisites like well-functioning markets, information on the types of abatement technology available and its cost (O'Connor 1995, p. 23-24). In addition, the collection of an emissions charge depends on a reasonably effective tax administration and monitoring of actual emissions. Tradable permit schemes require an administrative machinery for issuing permits, tracking trades, and monitoring the actual emissions. Since the development of these capabilities is crucial for the effectiveness of the instruments, MBIs cannot be considered as a short cut to pollution control. In other words, MBIs have institutional requirements just like regulatory measures.

It is important therefore, to examine potential problems in using MBIs in India and how they could be addressed. In the following discussion, we focus specifically on issues of monitoring and enforcement. We also suggest possible solutions.

6.1 Monitoring of discharges: conceptual issues and suggestions

Moving from a CAC regime to MBIs implies that attention has to be paid to the problem of monitoring emissions. For MBIs such as tradable permits to work well, the credibility of the system is important. If holders of permits cheat (by discharging more than their permits allow them to, and/or sell their permits and still continue to emit), then the confidence of players in the permit market will be undermined. Further, it is argued that since the effectiveness of MBIs depends crucially on the ability to successfully monitor discharges, till such time as the capability to monitor plant-level emissions/effluents is in place in India, it is not feasible to introduce MBIs. In response, it can be argued:

- Monitoring of discharges is also required under a properly functioning command and control regime. The emphasis on the phrase "properly functioning" is deliberate: the current practice of merely confirming that pollution abatement equipment is installed and working is not enough[12]. This "checklist" approach to ensuring compliance does not provide much information about actual emissions/effluents. Therefore, monitoring of discharges is not a problem unique to MBIs.

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12 In some cases, all that is required is that pollution abatement equipment is installed, not even whether it is operating properly. This is particularly true when courts are deciding whether to shut down polluting units.

In cases where direct monitoring of discharges is not possible (or is expensive), both theory and practice suggest several "second best" alternatives. To begin with, there are a number of ways to indirectly estimate these discharges. For instance:

- Data on inputs and/or output can be used to estimate emissions/effluents as long as the production function relationship between these variables is known. All that is required to implement these methods is detailed data on output in physical units or in monetary values. Of course, the more disaggregated the data, the more fine-tuned are the pollution coefficients, and the more accurate are the estimates of pollution.

- The example of Sweden shows that it is possible to promote a system of self-monitoring among large firms. In this case standard emission rates were used for determining NO_x charges for firms whenever emissions were not measurable. These rates were greater than the average actual emissions, and consequently encouraged the installation of measurement equipment by firms (OECD 1994, p. 59). This could be a feasible monitoring mechanism for large plants in India.

If it is not possible at all to estimate emissions/effluents (even indirectly), the following options are still available to regulators:

- They could use indirect instruments aimed at the outputs and inputs of the polluting industry or substitutes and complements to its outputs. For example, a tax on leather products would be an indirect method of addressing pollution from tanneries. These indirect instruments should be fine tuned to the extent possible, based on the pollution potential of different products/processes. For instance, a presumptive emissions tax on fuels should be differentiated by the emissions coefficients in different industries — thus, the cement industry which does not discharge the sulphur of its fuels, should ideally be refunded presumptive sulphur taxes on fuels (Eskeland and Jimenez, 1992).

- If emissions are fully determined by the consumption of one good, then that good can be taxed (e.g., carbon taxes based on the carbon content of fuels). By the same token, substitutes to the polluting good should be subsidised (e.g., mass transit if private vehicles are a cause of urban air pollution), and complements to the polluting good should be taxed (such as parking space).

Finally, in the context of GHGs particularly CO_2, it should be noted that monitoring of emissions is intrinsically easier — consumption of fossil fuels (and their carbon content) such as coal, oil and gas should be easily verifiable at an aggregate level

6.2 Monitoring and enforcement regime in India: stylised facts and directions for reform

Specific suggestions are offered below for modifying the current monitoring and enforcement regime. Again, these observations are made in the context of pollution in general and not GHGs in particular.

- While emission standards are set at the central level the responsibility for monitoring and enforcement rests with state pollution control boards (SPCBs).

- There is too much reliance on "pseudo-monitoring and enforcement", namely, verifying that pollution control devices are installed (also known as initial compliance), rather than on monitoring actual discharges (i.e., continuing compliance).

- For firms, the probability of being monitored is low. The same is true for enforcement. This is not only due to a shortage of resources and underfunding of SPCBs, but also due to the manner in which the Acts have been framed (see next point).

- The monitoring procedures are cumbersome. There is no provision for on-the-spot or remote monitoring. Samples have to be physically collected and sent to approved laboratories for analysis. In order for these samples to be used as admissible evidence in a legal case, elaborate procedures have to be followed. Thus, there is excessive burden of proof on the SPCB to prove that a violation has occurred. This reduces the expected penalty and weakens enforcement.

The following recommendations on changing the current monitoring and enforcement rules and practices are made with a view to introducing MBIs such as emissions trading. These recommendations, however, would also make the current CAC regime more effective:

- The definition of monitoring and enforcement should be changed from the static one used at present to a dynamic one that emphasises emissions discharged per unit of time. This implies that in addition to monitoring the ability to meet discharge standards, attention should also be given to frequent measurement of actual performance[13].

- The monitoring capabilities of SPCBs should be strengthened. Pecuniary incentives could be offered to SPCB staff such as rewards for detecting violations that ultimately result in conviction.

- The laws should be amended to allow on-the-spot measurement of pollution parameters where technically feasible, with portable monitoring equipment for quick detection of violations. The Acts should also be amended (particularly the Air Act), to allow the use of remote monitoring as admissible evidence where technically feasible.

- Self reporting of discharges by firms should be encouraged[14]. To this end, the Environmental Statement (an annual report required from firms on their environmental performance) should be implemented in a mandatory manner. In fact, this statement should be a part of the company's Annual Report, and the Companies Act should be appropriately modified to reflect this. If firms do not submit these statements, a presumptive value could be used for the amount of pollution generated by them[15]. The role of NGOs and other independent groups in assisting self-reporting by firms should be examined.

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13 This distinction was made by Russell and others (1986) in their seminal study on enforcing pollution laws in the United States.

14 Even in developed countries such as the United States with extensive monitoring of point sources self reporting is widely used.

15 One method would be to assume that the pollution intensity (i.e., pollution per unit output) of non-reporting firms, was equivalent to the highest decile of pollution intensity for firms in the same industry using similar processes. This figure could then be multiplied by the actual output of the non-reporting firm to arrive at a presumptive value of the amount of pollution generated by it.

– Regular monitoring of discharges by firms is essential. Often, however, due to paucity of resources random monitoring may be required. In this context, to use the resources available for monitoring and enforcement efficiently, it could be announced that firms detected violating the rules[16] would be placed on a special list and put on probation for a specified period. During this period they would be subject to a higher than average frequency of inspection[17]. If they followed the rules during this period they would be removed from the list. However, if they violated the rules during this period they would be treated as habitual offenders and action would be taken against them.

7. Conclusions

Despite near-term uncertainty about the size of the CDM market and the price of CERs, it is very likely that India will be a major player. This is also true in the long run where India along with other developing countries may take on some commitments and where emissions trading may be an important component of the GHG abatement architecture. While there are several issues of concern such as the impact of technical progress in abatement technologies on the gains from emission trading for India, on the whole it may stand to benefit from participating in such trading. Further, there are good prospects of convergence across CDM and emissions trading both in a short-run and in the long-run. However, it is important that we understand and address the problems in using a broad market-based approach to environmental management in India, particularly with respect to monitoring and enforcement.

16 Under MBIs, violation of rules by a firm would include, inter alia, discharges in excess of levels allowed by permits held by the firm, non-payment of effluent taxes, non-reporting/under-reporting of discharges, etc.

17 In other words, once a firm is caught a history is created and increases its chances of being caught again.

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CHOOSING ENVIRONMENTAL POLICY INSTRUMENTS IN THE REAL WORLD

by

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1. Introduction

The predominant environmental policy advice that OECD and donors like the international financial institutions have provided through environmental development assistance and advice to the developing world and transitioning countries has a familiar ring. Its themes— principally market solutions—parallel what the institutions and their advisors (advice tagged the Washington Consensus) tell the same countries to do to reform their economies generally.

Clifford Russell, formerly of Vanderbilt University[1] and I have argued that there is a parallel "Environmental Consensus", that tips heavily in the direction of saying that the best hope countries have to clean up some very badly polluted environments is by adopting management systems based on economic incentives. And, perhaps because many of the advisors are academics on the cutting edge of research, rather than practitioners (there are exceptions), the advice is to try to adopt some of the most difficult of the market-based instruments, namely tradable emissions permits and various taxing schemes. Our concern is that the message about what kinds of institutions, practices, habits and legal and economic culture are necessary to support these very sophisticated instruments is buried in the footnotes or as an afterthought. This reverses the appropriate order of inquiry.

We have expressed concern that the Environmental Consensus deserves a much wider debate. The Washington Consensus[2] is now a very prominent subject; even among economists, there are a wide range of opinions from Stiglitz to Sachs, and the dialogue has opened up to include, as it should, lawyers, sociologists, anthropologists and politicians.

To date, the Environmental Consensus has been a tightly held monopoly of the economists, who dominate both the OECD and the international financial institutions. The difficulty is that economists are only one part of a much larger conversation in the domestic environmental dialogue in the mature environmental regimes, and for good reason. The choice of environmental policy instruments should

1 See References for joint writings on this subject.

2 The Washington Consensus is the name commonly attached to the advice that the international financial institutions' (IFI) tell the developing world and transitioning countries to do to reform their economies — principally market solutions. The phrase was coined by John Williamson, currently Senior Fellow at the Institute for International Economics in Washington, D.C.

value efficiency as much as possible, but the policy choices must also be politically acceptable to a wide range of stakeholders, and must be supportable by existing institutions, notably the legal system, the human capital and infrastructure, and by the dominant culture, traditions and habits of each country. Choices about the tools and goals must reflect domestic resolve, will and readiness to perform, since environmental protection requires so much of so many actors in society.[3] It is therefore understandably rare in any of the developed economies that any one group of experts or stakeholders would have such a predominant role as do the economists in policy setting in the developing world.

As a consequence, the countries most in trouble are not getting a well-rounded picture about what is achievable. What the Consensus does not say is that the institutions, infrastructure, and human capital needed to support the sophisticated environmental instruments the West promotes are not present in much of the developing world. The other missing truth is that the experience with the most highly sophisticated instruments is not very large or deep even in the mature environmental regimes — indeed, some instruments popular with advisors are still more theoretical than applied. This presents little reason to hope that they will be easy to apply in the more difficult contexts of the developing world and countries in transition.

This is a difficult message to deliver to proud countries that, despite having excellent minds in their universities fully capable of running sophisticated models and writing laws, have extremely weak histories of environmental regulation and compliance. Moreover, as many at the International Financial Institutions (IFIs) acknowledge privately, advisors are under pressure to provide "solutions," when most realistic observers recognise that there is no silver bullet or single solution, for the magnitude and depth of problem that exists.

This paper sets out a brief history of the development of market-based instruments and their dissemination. It then discusses some of the practical and institutional reasons why they are very difficult to genuinely apply — as opposed to plan — in the countries in economic and political transition. The next section discusses my view of the experiment in Taiyuan, China, sponsored by the Asian Development Bank, to promote SO_2 emissions trading. Finally, I make some recommendations about how actual improvements in air and water might be achieved in the future.

2. Western instruments

Incentive-based approaches to environmental control were being developed in academia at the same time that many of the basic environmental laws were being written in the United States. As Mikael Skou Andersen (2001) has pointed out, the academic thinkers plainly stated that their aim was to change policy, not just to pursue economic research. However, none of those early laws used economic tools. Although professionals at the US Environmental Protection Agency (EPA) were aware of this thinking, they did not begin to incorporate it into regulatory programs until they were confronted with some very knotty Clean Air Act implementation problems. In response, the EPA set up a system that gave industry the opportunity to bank or sell emission reduction credits in the context of air regulation.

The success of this early experiment led to the enactment in the 1990 Clean Air Act of the now well-known SO_2 -reduction credit banking and trading program as a way to attack acid rain. Firms that

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3 One obvious example is the effort to control non-point pollution. The very nature of non-point is that it is generated, and therefore controlled at uncountable locations, and requires wide-spread cooperation and willingness to act.

can control their pollution more cheaply may accumulate credits and can then sell the credits to others, who must otherwise spend more to reduce pollution.

It is important to remember that these were controversial provisions. They were enacted as a small part of a larger legislative package, but not before considerable scrutiny, as part of Congressional proposals that were considered throughout the 1980s. The design of the SO_2 trading program had to satisfy a wide range of stakeholders. Significant interest groups opposed emissions trading, and partly because of that, the program that was enacted contained a number of important conditions and safeguards. The entire system was developed in the context of a mature "rule of law" society, which means that non-compliance is vigilantly punished through the enforcement system, and there is room for private litigants to enforce against cheating. The government firmly manages system integrity, requires expensive monitoring equipment to assure that genuine reductions are being sold, and assigns every credit (called an "allowance") a serial number, to ensure that a unit's emissions did not exceed the number of allowances it held over a year. All transactions are online and completely transparent.

Trading has clearly helped meet the goal of reducing sulphur dioxide discharges in the United States and has apparently saved society money in the bargain, although unrelated developments like railroad rate deregulation and increased competition in the western low-sulphur coal fields also contributed to this end.

Despite this success, trading is not the dominant U.S. approach to environmental protection, even in a fully developed market system. Most regulatory programs use traditional methods, because to do otherwise poses significant technical challenges and generates political firefights. In fact, there is very little consistency among the approaches embedded in the various U.S. environmental statutes and the tools they impose. Some require cost/benefit balancing; others forbid it. Some are health-based; others are technology based. This is not presented as a virtue; it's just a fact that reflects the considerable political and bureaucratic interests involved in writing and passing legislation.[4]

And incentive approaches are not universally embraced. Some public advocates oppose economic instruments because they fear that emissions trading cannot be adequately enforced; others mistakenly think these programs sanction pollution. Sometimes industry is resistant. Keohane offers one explanation:

> *Firms may simply support the continuation of the status quo…because replacing familiar policies with new instruments can mean the existing expertise within firms becomes less value (Keohane, et al 1997).*

In other words, firms have a number of potentially conflicting objectives and are not only driven by efficiency.

To date, the functioning emissions trading programs in the United States are for air, not water, although the Bush Administration has recently announced a program for water quality trading. Some analysts, my colleague James Boyd among them, have expressed doubts whether the challenges of water basin-based effluent trading — among them highly disparate sources (including non-point), hydrology and the difficulties of monitoring — can be overcome (Boyd, 2000).

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4 Several articles by Daniel H. Cole & Peter Z. Grossman (1999), (2002) explore whether so-called command and control is in fact inefficient, and examine in detail the slow evolution of U.S. practice and law.

A vivid example of the importance of vigilant enforcement in the success of emissions trading was provided by the breakdown of at least one other U.S. air trading program. Christine Todd Whitman's New Jersey state trading system for trading nitrogen oxides and volatile organic compounds was recently shut down when enforcers discovered that the biggest single seller of allowances was in violation of its regulatory obligations. Presumably, it was selling suspect credits. The collapse of this seller left little to trade in New Jersey. The much-acclaimed RECLAIM program in the L.A. basin has encountered its own share of problems, concerns about whether it is really reducing pollution, and currently, many doubters.[5]

Cole and Grossman nicely summed up the actual complexity of the choices for and against market-based environmental instruments, in their examination of the U.S. system:

> *…[S]tandard economic accounts of the comparative efficiency of alternative regulatory schemes are insensitive to historical, institutional and technological contexts. Most importantly, they tend to assume 'perfect (and, incidentally, costless) monitoring,' or they assume that monitoring costs are the same regardless of the control regime that is chosen. … [T]here are many other economic, institutional and technological variables that can affect the comparison of regulatory options, which is precisely why* case-by-case examinations are required." (Cole and Grossman, 1999 - citations omitted)

Emissions trading is obviously not the only market-based instrument for environmental control. Other economic instruments include deposit-refund systems, which pay people for dropping recyclable material at a centre, and taxes on fertiliser, gasoline, and other polluting agents, tools used in Europe. Germany, France, and the Netherlands charge industry for certain kinds of emissions, but the charges are designed to raise revenue for infrastructure investment rather than to discourage pollution.

Andersen has examined the actual functioning of European systems to use market incentives to control water pollution. He takes the economics profession to task for treating "the issue through micro-economic partial equilibrium analysis that disregards the complexities" (at p. 6) and is concerned that "to apply economic instruments thoughtlessly may quickly discredit this policy instrument" (at p. 23):

> *… the choice and implementation of specific policy instruments depends to a considerable degree on the national context .. the national policy style. Strategies for pollution control reflect deeply-rooted traditions of government intervention, and in particular, of the relationship between government and industry. … Each nation's regulatory style is thus a function of its unique political heritage. It requires comprehensive knowledge of*

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5 See, e.g., the concerns expressed by William D. Nordhaus of Yale University (Nordhaus, 2002), with respect to CO_2 emission trading: "A final concern arises in the wake of the recent revelations of financial finagling in the world's largest and, it used to be said, most transparent market economy. A cap-and-trade system relies upon accurate measurement of emissions by all relevant parties. If firm A… sells emissions permits to firm B… where both A and B are operating under emissions caps, then it is essential to monitor the emissions of A and B to make sure that their emissions are in fact within their specified limits. … It was generally supposed that monitoring would be relatively straightforward in countries with strong legal and enforcement systems such as the United States. This was probably naïve and overly optimistic. The accounting scandals of the last year have not been limited to dollar scandals, but these have also spilled over into emissions markets. They are not yet emissions scandals because the dollars involved have not cross the nine-digit threshold of perception. … If emissions finagling takes place in countries with relatively solid legal systems like the United States and the United Kingdom, it would be foolish to overlook the likelihood of emissions cheating in Russia, Ukraine, and many developing countries."

constitutional, administrative, historical and cultural institutions to understand the opportunities and limitations arising from a particular policy style. (Andersen, 2001 - citations omitted).

Most experts are well aware of the odd fact that many countries formerly under the domination of the Soviet Union also appeared to be using market-like instruments for pollution control early in or even before the transition. They imposed fees and fines on certain emissions and exceedances of regulatory standards, and deposit-refund regimes on bottles and cans. But pollution charges were not an incentive to reduce pollution because they were paid out of the soft budgets of state enterprises; today, they are too small or too inconsistently collected to make a real dent on industry's behaviour. In some cases, they have made donor addicts of the environmental agencies that depend on this money for their funding. Deposit-refund systems hit an interesting cultural hot button, as many now perceive them as a grim reminder of a world of poverty in which recycling was a response to deprivation (they may go over better with younger Central Europeans who don't remember the reality of state socialism — compare Drakulic, 1991). These schemes have been the subject of considerable attention from bodies like OECD, who have sought to improve them to fit the new circumstances.

3. Economic solutions for the developing world and countries in transition

The enthusiasms of academic economists from the 1960s and '70s were rekindled in the environment and development community, particularly with the fall of the Soviet Union and the high optimism that market economies would spring up in place of socialism. The countries in transition, with their impressive histories of environmental activism, seemed the right place for their message. These countries were more like industrialised economies than developing countries. They had technically trained civil services, high rates of literacy, excellent universities, and existing, frequently forward-looking, environmental laws. And, the countries (and certainly the local environmental experts) were in a strong reactive mode against anything that smacked of central planning.

There was also high optimism that the countries in transition could leapfrog the "mistakes" made in the name of environmental protection in the West. Much of the advice either came from or was sponsored by the development banks, who occupy the role of the proverbial 800-pound gorilla in the policy deliberations of the developing world. The environmental departments of the international financial institutions tend to be staffed by Western-trained analysts, proficient in efficient markets, but I think it is fair to question whether their understanding of institutional issues is as complete. Their in-country partners are also often well-grounded in the academic literature of environmental economics, rather than the experience of practitioners.[6]

They (and sometimes their advisors) may not have fully understood how mixed was the use of environmental tools in the West.[7] Using phrases like "command and control" called to mind an excessive role for governments in private markets (implying the equivalent of the soviet system dictating every detail from production goals to dates for harvesting crops); in fact, this had little to do with what was really going on in environmental protection in the west, where most often, traditional (a

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6 There was a strong parallel in the environmental law assistance and state-to-state cooperation that took place during the same period. The Russian environmental law drafters at the time, for example, were principally academics not practitioners, whose knowledge of the laws of the west was encyclopedic but who had no experience in applied environmental regulation.

7 Andersen (2001) finds fault with a theory that inaccurately "treats economic instruments not as a complement to other regulations, but as a perfect substitution to all other regulation." (at p. 6, footnote omitted).

better tag for the category of command and control instruments) and market-based instruments are used jointly in pursuit of a common goal of environmental protection.

Another problem in applying market instruments post-1989 was that it was not as easy to find partners in industry, as it was to find theoreticians. The people who ran state enterprises gained their experience operating in an economy structured under the rules of state socialism. Before 1989, they knew nothing about Western accounting principles and had never encountered shareholders or a stock market. Profit and loss were unimportant. The residue of a trading mentality that had survived in some of the Western-most countries usually manifested itself in small businesses, rarely in large enterprises.

4. Lessons from the countries in transition

There was much effort through the 1990s in places like Kazakhstan, Poland, the Czech Republic, the Slovak Republic and other transitional countries to jump directly to market-based instruments, especially emissions trading. These are often held up as examples of the success of market-based instruments (MBIs). In fact, these were largely planning efforts, or confined to models, demonstrations or pilots. The Slovak Republic wrote a law, but it is not clear whether that law will meet the same fate as many of the environmental laws written in the 1990s throughout the countries in transition, that sit on the books un-implemented. In fact, none of these plans or pilots have gone beyond the experimental, because the prescriptions simply did not fit the conditions for which they were suggested. The intuition that these countries were stronger candidates than developing countries overlooked the fact that they lacked the important institutions and skills that serve as cornerstones of sophisticated market-based instruments for environmental control.

Perhaps the most important of these was motivation. Although it does not seem to have been articulated in the literature, there must have been two assumptions among the advisors: one, that enterprises were motivated to be efficient; and two, because of that, that firms would be natural allies in support of the most efficient environmental tools. But industry in the U.S. did not become advocates for emissions trading on the basis of theory; if that had been the case, perhaps the laws would have included this tool at an earlier stage. They (or some) did so after they had been forced to grapple with actual environmental regulation and genuine enforcement (even now, some resist). Then, the price tag for meeting environmental requirements was made clear in a way that theory can never teach. Economic pain is a great motivator. Importantly, industry in the western economies was able to understand and analyse its economic pain because it was the beneficiary of a century of experience with cost accounting.

Industry in the period when the Soviet Union was dominant had rarely been forced to be in compliance. The laws in Soviet times were called "aspirational"—idealistic ambitions, not guides to day-to-day behavior. Production goals almost always trumped environmental requirements. Regulatory bodies continue to be weak in many of the successor countries, and it is a society-wide challenge to make laws work. The constituency for market-based instruments, in truth, is largely in the academic community. Why should firms try to save money on regulation if they are not yet forced to spend it and do not expect to be in the foreseeable future? The basic issue of motivation was never confronted.

But even had there been genuine motivation, there are still other important issues to take into account. A key consideration is whether institutions exist to manage failure. People who trade emissions exchange an exceedingly complex and intangible property right. They are selling rights to air, and not only that, often rights that extend into the future.[8] These are extremely sophisticated market concepts. Sellers default; buyers go into bankruptcy; participants fall victim to the temptation to false accounting, as did the U.S. firms Enron and WorldCom in a different context. When real money is at stake, some authority, administrative body, or court must be available to police trades and ensure their integrity.

Donor advice on emissions trading rarely mentions the possibility that transactions might fail. Indeed, the same advice was peddled in countries with working legal systems and those without such institutions. Some of the transitional countries recently have begun to restore a European legal system, free of "political and economic safety valves - the legal means of last resort by which Party and state authorities could avoid their own rules," in the words of Daniel Cole (Cole, 1998). To the east, in Russia and the other parts of the Former Soviet Union, there was no rule-of-law tradition to revive.

There must also be basic trust within society that trading regimes are administered in a fair manner and that allowances represent real commitments to reduce emissions. Particularly since air is such an ephemeral commodity, these are transactions that can easily be abused. The possibility of abuse becomes clearer when you consider that emission trading can result in very different environmental standards for like industries. If the system works, plant A will pay plant B to reduce its emissions, instead of doing so itself. The potential bottom line is a series of varied requirements that hopefully refer back to the trading transaction. But what if Plant A is owned by the most influential politician in the country, in a culture accustomed to helping out privileged people. It's easy to obscure the fact that the grant of discretion to Plant A to pollute less is not based on a legitimate trade, and the outcome benefits the owner of the plant, not the environment. Nordhaus has pointed this problem out in the context of global CO_2 emissions trading:

> *An emissions-trading system creates a scarcity where none previously existed and in essence prints money for those in control of the permits. Such wealth creation is potentially dangerous because the value of the permits can be used for non-environmental purposes by the country's leadership rather than to reduce emissions. It would probably become common practice for dictators and corrupt administrators to sell parts of their permits, pocket the proceeds, and enjoy wine, partners and song along the Riviera. [To illustrate the perils,] [a] Russian scientist recently reported the people in Moscow were already considering how to profit from the 'privatization' of the Russian carbon emissions permits. Alternatively… [I]f Nigeria could sell its allowances… [they] could easily sell for between USD 0.2 and USD 2 billion each year of hard currency. This in a country whose non-oil exports in 1999 were around USD 600 million (Nordhaus, 2002).*

People in the countries in transition are unusually aware of this possibility; their experience includes many years of corruption and under-the-table differential treatment.[9] The environmental experts I've worked with in Central Europe want the assurance that a program that essentially grants

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8 One interesting test of a country's capacity for environmental MBIs could be whether it is running successful financial markets; money is a familiar and relatively simple concept, compared with emissions permits.

9 Wedel (2001) has written eloquently about the breakdown in social norms that happened first in the context of the German occupation of Poland and then in the "twilight world of nods and winks" that characterised the period of communism. Wedel (1986) covers these issues in greater depth.

discretion[10] to certain industries to emit at lesser amounts than others will not be hijacked to serve the purposes of people in power.

Confidence in emissions trading transactions has been developed in the United States through a high level of transparency. Competitors, NGOs, and public interest groups can monitor trades and know relatively quickly whether or not industry is meeting its commitments, a sort of "trust but verify" approach. Some sort of appropriate safeguard would be appropriate in all implementing countries. This does not mean that the exact protections contained in U.S. law must be replicated. For example, in Western Europe, the public is more tolerant when industry and government sit down to negotiate, so Central European trading programs might work without as much transparency as the United States demands. On the other hand, architects of any trading program cannot ignore the legacy of the Soviet period, especially in countries struggling with endemic corruption.

The final area of serious weakness in the support structure for emissions trading in the former Soviet bloc is monitoring—knowing what pollutants and in what amounts are released into the environment by particular plants. Although one can argue about the degree of precision that is necessary, it is beyond dispute that regulators and the public must be assured that real, not imaginary, pollution reductions are being traded. Counting through monitoring can be costly. It requires good equipment, but also a level of integrity (it's as easy to turn off monitoring equipment at inconvenient times as it is to turn off pollution control equipment). It also requires that the monitoring be of plant-specific emissions, not of ambient conditions as is common in many countries.

These are the factors that have prevented the experiments in market-based instruments from developing into full-fledged programs for controlling environmental pollution. Although there has been much trumpeting of the efforts, there has been far less written about actual outcomes, and a seeming reluctance to admit the importance of these issues, except to vaguely caution that market-based instruments are effective if implemented properly and under the right conditions. Most important, little of the literature acknowledges that those conditions are rare outside the Western democracies.

5. What about the developing world?

If transparency, accurate monitoring, a working legal system, and realistic incentives to trade are scarce in transitioning economies, the problems run much deeper in the developing world. There are fewer people with the necessary skills and experience to implement these sophisticated programs, the available talent is generally concentrated in capitals rather than field posts, monitoring equipment is in short supply, even baseline data are unreliable, and informal and even institutionalised corruption is rampant.

Despite this, a few advisors have compounded the confusion by holding out the tantalising, but unsupported, hope that adoption of economic instruments might even eliminate the need for regulatory bodies and enforcement programs.[11] Another claim that is totally at odds with empirical evidence from

[10] Although a trading program can be understood as a transaction, it can also be understood as a grant of discretion to some actors to pollute more (or less) depending on whether they are buyers or sellers of allowances. Otherwise, they would all be held to the same standards. The variability in their requirements is what creates opportunities for corruption.

[11] Theodore Panayotou of Harvard University has argued that economic instruments take full advantage of the self-interest and superior information of producers and consumers without requiring the

the United States is that economic instruments as a group substitute for efforts to enforce compliance and "tend to have lower institutional and human resource requirements than command and control regulations" (Panayotou, 1994). Perhaps this is true in an ideal world or a model, but the assertion can't be backed up with experience, particularly in the gritty conditions in the developing world and the countries in transition.

The discussion above details the institutional gaps that make viable economic instruments a long-shot. But my colleague, Clifford Russell, would argue that even the pure economics arguments are deficient because they usually assume a regulator with complete knowledge of costs and a complex mathematical model to determine the cheapest solution, or that environmental ministries can and will use costly, time-consuming trial and error to find the appropriate charge or permit a total that exactly meets the desired standard (Russell, C. and Vaughan, W., forthcoming).

We have also pointed out how misleading are the arguments for using taxes or levies to achieve environmental protection goals. It is far from easy to collect this revenue in a reliable way. Efforts to collect sales and income taxes in most of the countries in which these ideas are proposed already encounter the difficulty of monitoring sales or wages, and corruption. Taxes on pollution raise the same collection concerns, and additional ones also, as they are highly dependent on good environmental monitoring. Pollution discharges generally must be measured by special equipment as they occur, monitoring capability does not exist in much of the developing world.

The more fundamental question is whether or not the governments of the developing world have the political will to impose and actually collect charges significant enough to force industry to seek new technology. After all, many of these governments have insulated certain firms from market pressures by the equivalent of soft budget constraints. In other places, firms are accustomed to benefiting from loans made on the basis of connections and favouritism, rather than sound business principles and sober assessment of credit. Using the market to spur technological change is only plausible if the many ways in which market forces are undermined can be ruled out.[12]

In the final analysis, market-based instruments do offer some highly desirable features when appropriate conditions exist. To make them work, however, requires data gathering, mathematical modelling, and monitoring or auditing of emissions, skills and understanding in both government and industry, and considerable political will, a tall order in the small, understaffed, and under-funded environmental ministries of much of the world. This hardly makes MBIs the free lunch they are made out to be.

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disclosure of such information or creating large and costly bureaucracies. See, for example Panayotou (1994).

12 Financial Times, New York Times and other newspapers have reported repeatedly on lax banking practices in China. See, e.g., New York Times, February 1, 2002, "Bank of China's Mounting Problems," reported by Elisabeth Rosenthal: China's most prominent state bank, the Bank of China, was hit first by a report from China's National Audit Office, which found that USD 320 million of bank funds had been diverted from several branches of the bank through "unlawful loans, off-the-books business and the unlawful granting of letters of credit and issuing bank bills", and then by a lawsuit between the Bank and former clients in New York. American bank regulators said an investigation begun in 1999 had turned up the same kinds of irregularities at Bank of China's United States operations during the 1990s. Eventually this led to the dismissal of one of China's most influential bankers.

5.1 The case of China

A number of donors and advisors have focused on China as a place to introduce emissions trading. Their logic echoes the arguments previously heard in both the countries in transition and the developing world. China is developing a market economy, and it presents all the dilemmas of the developing world that create a compelling rationale in favour of the maximum efficiency for environmental regulation. It is not a country that can afford wasted effort and it is confronted with significant environmental health problems. Human exposures to harmful pollutants are so severe and unrestrained in some cities that western governments are conducting epidemiological studies in China that cannot be conducted elsewhere.

5.2 SO_2 emissions trading and conditions in Taiyuan

Typically, China pilots or tests new ideas for environmental control before they are adopted for nation-wide use. China's environmental agency, SEPA, has made the development and piloting of SO_2 emissions trading programs a priority, building on on-going efforts of a number of prominent Chinese environmental experts including the research institute Chinese Research Academy for Environmental Science (CRAES), Ma Zhong of People's University Beijing, and various other universities and institutes. This has resulted in a series of efforts to try the ideas out in various parts of China. In the last 10-15 years, a number of Chinese cities have had some experience with tradable permits.[13] Elements of these parallel efforts toward knowledge creation and understanding include US Environmental Protection Agency (EPA's) multi-year partnering with SEPA to understand and put into place the elements of a market-based approach to controlling sulphur dioxide emissions and the damage they inflict. SEPA, EPA and others most recently sponsored a conference in Beijing to consider progress to date and challenges ahead.

Another effort has been developed over an approximately five-year period in collaboration with the U.S. NGO, Environmental Defense (ED). ED has worked in two industrial cities: in Benxi to draft tougher air pollution legislation based on the U.S. acid rain model, and in Nantong to develop a demonstration SO_2 trade whereby a light manufacturer can expand operations in exchange for contributing funds for pollution control to a local power plant. ED is also working with China's largest power generator, State Power of China (sic).

The effort I am most familiar with is an Asian Development Bank-funded project in Taiyuan, Shanxi Province. Since Spring 2001, an RFF team has been working with international and domestic experts to demonstrate the feasibility of emissions trading among large emitters in Taiyuan, the capitol of Shanxi Province. The Taiyuan project and ED efforts were widely reported in the press, including an extremely favourable mention in The Economist Magazine in a story dated May 9, 2002.

5.3 Taiyuan conditions/Chinese standards

Taiyuan, with a population of 2.7 million, is a heavily polluted industrial city in the coal belt of northern China about 500 kilometres southwest of Beijing. With mountains on three sides, Taiyuan traps air pollutants much in the way that smog is contained in Los Angeles. Particulate matter (PM)

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13 The experience as of 2000 is collected in Wang Jinnan, Yang Jintian, Ma Zhong and Stephanie Benkovic, eds (2000). Note there that Chen Fu, Gao Shuting and Luo Hong (2000) characterise the trades as of that date as having a "strong administrative flavor… participated by the various government agencies — no real market has formed".

and sulphur dioxide (SO_2) represent a serious public health threat. SO_2 concentrations averaged 200 ug/m^3 in 2000 (a representative year), more than three times China's Class II annual standard (60 ug/m^3). Some data indicates that SO_2 emissions have been relatively flat despite economic growth.

Current pollution policy sets standards for stack gas concentration of SO_2. As there is currently no reliable monitoring, pollutant concentrations are based on self-reported data from the enterprises and periodic stack testing by the local Environmental Protection Bureaus (EPBs). These estimated concentrations are combined with limited data on pollutant flows to calculate mass emissions from the enterprises, which form the basis of a small emissions levy (USD 25/ton), whose proceeds support the local EPB's activities with the balance returned to individual enterprises to finance their pollution control investments.

China has worked for a decade to develop a new, more sophisticated mass-based system — the so-called 'Total Emissions Control' (TEC) — as a supplement to the existing stack-gas concentration standards, "but has only recently achieved the capacity to implement *pilot* mechanisms reflecting the concept" (Smith, 2003 - emphasis added). The TEC system is similar in many ways to individual facility-level caps on SO_2 emissions imposed under Title IV of the U.S. Clean Air Act (1990).

Consistent with the policy of "experiments," the Taiyuan city government began experimenting with emissions permits and earlier pilot versions of the TEC in the 1980s, including a 1985 local regulation. The city conducted experiments with emissions offsets and (administratively-determined) trading in the mid 1990s. In 1998, the Taiyuan city government issued "management rules" for TEC, including a provision for "permit exchange," a form of emissions permit trading. The Taiyuan EPB has issued about three dozen updated permits with TEC-based limits to large enterprises.

5.4 Institutional issues

Conceptually, market-based controls for environmental purposes are attractive to Chinese policymakers because the idea fits the general thrust of Chinese economic policy — the push toward a market economy "with Chinese characteristics". But there is still a disconnect between policy and on-the-ground conditions. Much of industry continues to be owned in whole or in part by some part of government, an inherent conflict of interest that bedevilled other socialist economies. In similar economies, the environmental regulators' lack of independence significantly impacted their ability to enforce environmental requirements, particularly when environmental requirements collided with other government goals such as production targets or full employment.

Other institutional challenges are also very similar to those found in the countries formerly dominated by the Soviet Union. Despite the interest expressed in Chinese environmental policy circles for using market-based instruments, there is still a considerable learning curve to be overcome by officials and also by industrial managers. Chinese officials do not appear to understand the connection between environmental enforcement and the prospects for a robust trading program. Indeed, most observers agree that, "despite China's rapidly evolving and complex network of environmental policies and laws, compliance with environmental regulations remains low" (Karasov, 2000).

There is little if any experience in the details of complex markets to trade intangible commodities. As noted above, trades to date in other parts of China have been administratively determined, which fits the comfort level of the Chinese. Many in Taiyuan wanted to do the same. In addition, Chinese officials sometimes appear to have the impression that trading is a costless way of achieving environment reductions; there has been less emphasis than I think warranted on the plain fact that in a trading system, someone, somewhere, must engage in concrete emission reduction practices, which are likely to be costly. In sum, the institutional factors would argue against the success in China of market-based instruments, and particularly of emissions trading.

5.5 What was accomplished in Taiyuan?

A large part of the effort in Taiyuan and more generally in Shanxi Province, was spent developing understanding and skills necessary for emissions trading, and working to develop a consensus in support of using emissions trading programs and of the details of how they work. There were multiple discussions with officials of the local and provincial EPB, Taiyuan City government, Shanxi Provincial government and local industry.

In view of the highly top-down nature of Chinese authority, it was never clear, however, the basis for the attention that officials paid to these ideas — was it genuine interest or was it because they were expected to appear interested. While the central government through SEPA clearly expressed interest in examining SO_2 trading, the motivation for Taiyuan and Shanxi Province was less obvious to outsiders.

One unsurprising motivation may have been the financial clout of the Asian Development Bank (ADB). Activities in Taiyuan were funded as a small part of a much larger loan package from the ADB to finance environmental technology improvements. To some extent, the trading experiment reflected the interests of a specific ADB environmental economist who initiated a number of efforts that began when Harvard Institute for International Development (HIID) was tasked to examine prospects for market based environmental instruments in China. The Taiyuan project was formulated by ADB and RFF was selected to run it. The issue of the degree of Taiyuan/Shanxi motivation is a particularly important question, since sustained, continuous efforts will be necessary to carry the ideas through, and the program itself was funded for roughly two years.

There were three actual accomplishments, beyond broad discussions. The Taiyuan EPB enacted a regulation that provides the legal basis for emission trading; RFF and US EPA developed an allowance tracking system ("ATS") and an emission tracking system ("ETS"); and the Taiyuan EPB issued allocations through 2005 of the goals that had been established through the 10th (2000-2005) 5-year plan.

It is hard to assess the significance of these accomplishments. On the one hand, the passage of legislation signalled an intent on the part of the EPB to move forward. On the other hand, as noted below, the regulation had significant defects. More important, writing a law in China does not have the same significance as it might in, for example, the western democracies. China has not historically been a law-based society. China has enacted a number of environmental laws in recent years but the mere writing of laws says little about the force and effect of those laws on actions. And unlike, for example, the United States, there is no available judicial remedy should the government fail to implement or enforce laws (judges are appointed by and answer to the local people's congress, often the same body that controls provincial industry). Nor is there a free press to assess whether the government is meeting the standards it sets for itself.

The allowance tracking system, developed by the foreign advisors, is an important technical component, essentially the accounting system for the trading program. It keeps track of account information, authorised account representatives, allowance holdings, and allowance transactions.[14] It was created as a tool for the Taiyuan EPB to manage the emissions allowances, but it is really just a tool, and says little about the likelihood of compliance with a trading system, much less about success. The goals and allocations are discussed below.

5.6 What lessons can be learned from the Taiyuan experiment?

Genuine progress toward environmental reductions using any tools, including market-based instruments and emissions trading schemes, is, in my view, hampered by the unrealistic way in which pollution reduction goals are set in China. This, and lack of serious efforts to pursue compliance and apply the pain of enforcement removes the incentive industry might have to participate in schemes to reduce the cost of environmental compliance and reduces the seriousness with which industry might consider supporting such plans. Finally, the specific regulation passed in Taiyuan to support emissions trading has serious deficiencies, in addition to questions that can be raised about what is the meaning of laws in China.

A) Overly ambitious pollution reduction goals accompanied by a history of retreat would challenge the effectiveness of any environmental tool

The Tenth Five-Year Plan for Taiyuan calls for 2005 SO_2 emissions to be reduced by about 50 percent below 2000 levels, a goal widely seen as extremely ambitious.[15] This may be because of the way the goals were set. Every society decides in its own way what are its goals. Five year planning is a process well-rooted in PRC government and culture, and there is no reason why five year planning cannot generate achievable goals that can be met in a cost-effective manner. But the Chinese emission reduction goals are set in a process divorced from much realistic consideration of feasibility. The central planners appear to work in somewhat of a vacuum and it is not clear what their reference points are for the numbers they select. Once formulated, it appears that goals are announced to the EPBs and industry, who otherwise appear to be excluded from the goal setting process, and then allocated to specific industries.

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14 One allowance is equal to one ton of SO_2 emissions and may be used to authorise SO_2 emissions during the year for which it was allocated or for subsequent years. The key components of ATS are:
- Emission trading subsystem to trace the trading status among the sources.
- Allowance deposit and reuse subsystem to verify the deposit and use of allowances.
- Allowance auction subsystem to trace the auction of allowances.
- Comprehensive accounting subsystem to comprehensively verify the actual emissions and the effective emission allowances of the sources.

15 It appears that previous goals were equally ambitious, for example calling on China to hold total pollutant emissions to the 1985 level by 2000, and bringing them even lower in the designated “key” pollution control areas. But at the same time that they provide data that purports to support the claim that SO_2 emissions were reduced in that time period as a consequence of the pollution levy, Jing Lixin, Zhu Jianping and Fu Deqian (2000), in SO_2 Pollution and Acid Rain Monitoring in China, at p. 68 acknowledge problems: “However, the real SO_2 reduction effect may be not as good as the data show. This is because … the amount of SO_2 emission is [derived] from the energy consumed and is mainly based on the reporting data of enterprises (the data will be smaller than the actual one since SO_2 is charged and enterprises have self interest to report less).” In truth, it’s difficult to get reliable data, and there is reason to believe that lower officials often provide the data they believe higher officials want to see.

A related problem is how goal setting interacts with the time frames contained in the five-year plans. The specific goals seem currently to be developed and then re-thought within the specified time for compliance, that is, within the five-year period in which they are supposed to be achieved, in this case well into the 2000-2005 period. As a result, industry has no lead-time to adjust to the targets or to plan to undertake its share of the responsibilities. This can undermine the process of progress.

Even in the absence of a learning curve, the goals set for Taiyuan would require extraordinary efforts that normally are time and resource intensive. There is also nothing wrong with ambitious goals, but they are less likely to succeed when they are understood from the very beginning by the EPBs and industry to be unachievable.

Unsurprisingly, even when goals are firm, experience indicates that industry needs adequate time to plan environmental investments. The extended period in which goals are set in the U.S. and then built into plant-specific permits is one way in which industry is put on notice of its ultimate responsibilities and has time to engage in the planning, financing, and specific activities (to identify, purchase and install technology, for example, or make in-plant process changes) necessary to come into compliance. These decisions and activities include whether to install technology, or make other adjustments to reduce emissions or to purchase allowances. Our experience indicates that even after industry is able to identify appropriate technology, the identified technology isn't always immediately available, to give just one problem. Similarly, financial analysis is necessary in order to determine whether to purchase allowances and at what price. It is certainly appropriate to make adjustments in or to update allocations every five years, but sources need enough certainty to properly plan investments.

Moreover, experience in the United States suggests that if industry senses that goals will be eased, some will wait until the last minute to undertake their own responsibilities, on the chance that they won't have to make the environmental investment. Goals and targets that consistently overreach are likely destined to be modified as reality sets in or at the stage when industry does have some form of access to the decision process. This in turn encourages industry to wait out the goal setters (the situation may be even worse when the goal setters, the enforcers and the owners of industry can all be traced back to the same source, the government; then, decisions are made in inner councils that sort out which value or demand will take precedence).

If China is interested in real emissions reductions, it could build explicit consultation with industry and with environmental regulators, enforcers and the public into the process during the time the goals and targets are being set, and make the entire process more transparent and publicly accessible. Emission reduction goals appropriately represent a combination of both political and technical targets. But the relatively closed process suggests China is weighted toward appearance, not reality, much like the "show laws" of the former Soviet Union. A more transparent process would increase the amount of knowledge and data available to the planners, and begin the process of setting targets that are ambitious but achievable. A more inclusive process might increase the planners understanding of what is truly feasible, what technology is available, what the costs might be of compliance, and other factors that affect the likelihood of achieving genuine reductions. On the other hand, the greater the isolation of the planner from critical information and data, the more likely are targets to be set that cannot be met.[16]

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16 This reasoning assumes that China can and will work out the conflicts of interest between industrial and governmental goals.

B) Poor history of environmental enforcement

China's industries have not experienced vigorous environmental enforcement. Interviews with enforcement personnel disclosed their primary objective was to collect the environmental fees that provided funding for the EPB.[17] Secondarily, they responded to complaints about particularly egregious environmental problems.[18] Extreme cases might lead to temporary shut downs of plants, much as pilots on transatlantic flights asked smokers to refrain from smoking for 20 or 30 minutes when the cabin was particularly full of blue smoke. BNA quotes Xie Zhenhua, Chief of SEPA, who has said that China will "close down heavy polluting, unprofitable, small and backward factories," and ban "heavy-polluting fuels" from downtown areas of major cities (Bureau of National Affairs, 2003). The difficulty is the tension China clearly feels between its environmental goals and it's notable concern about labour and social unrest.[19]

When pressed for explanations about their efforts, enforcers in Taiyuan expressed some embarrassment about the situation. For example, we were told that enterprises were essentially rated for their compliance. But an enterprise could consistently "flunk" by getting a low score, year after year, without penalty or consequence. This is hardly the kind of signal that forces enterprises to consider finding cheaper means of achieving their environmental requirements.

As part of our efforts, we examined with Taiyuan environmental enforcers what enforcement tools were available to them. These were, as noted, mostly the power to collect fees and fines, and to shut plants down — almost always temporarily[20] — to curb immediate exceedances that people (including communities) perceive as threatening. It would help to give enforcement personnel more "tools" which could be used to achieve compliance goals, which could include civil and criminal penalties, the use of compliance schedules, etc.

Whatever tools are used, enterprises must receive a steady, reliable message that the environmental requirements are serious and require continuous efforts on the part of all involved toward meeting the regulatory goals. If it is known that the environmental regulator has only weak tools (or motivation) for catching violators, the probability of getting caught appears to be low, reducing substantially the chances of the program being a success. But it would also help if enforcers

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17 Chen Fu, Gao Shuting and Luo Hong (2000) point out that because the fees are "too low," "many enterprises would rather pay emission fees than remedy their pollution problems, which will not lead to effective SO_2 emissions control among polluters." Under the new Air Act, Article 48, Chapter 6, the practice that enterprises could pollute in excess of national standards provided they paid fees may change; if emissions exceed the discharge standard, they must be reduced within a specified deadline, and at the same time, the polluter must pay a fine (between 10 000 and 100 000 China Yuan Renminbi (RMB)) to the provincial/local EPBs. See Beverage & Diamond, P.C. (2001). Implementing sub-laws or regulations are still pending.

18 The so-called "letters and visits (xinfang)" method of citizen notification of officials of problems such as construction noise, dust, etc is active in Taiyuan. See also, William P. Alford and Yuanyuan Shen (1998), at page 420. The process in response to complaints is to send EPB employees out to take measurements using, e.g. mobile monitoring gear, binoculars, and noise readers. The remedies are to (1) ask for corrections; (2) close facilities; or (3) impose fines. Two levels of appeal are available to enterprises or others who dispute these findings or the remedy. The hierarchy of appeals include administrative appeals, appeals to the city EPB, the province and then to a court.

19 This is what the Chinese call the "double burden requirement," when economic development and environmental protection come into conflict. See also, Pan (2002).

20 Highly polluting industry in Beijing is being physically moved to new locations, in anticipation of the Olympics.

were independent enough to enforce the rules without fearing that they might arouse powerful interests and endanger their own wages and social benefits.

Finally, as noted above, experience in the western democracies indicates that enforcement is more likely to succeed if sources know what their real and actual targets are. As noted above, the impact of a process in which allocations are not known until the early part of the five year period, and might be modified during that period, may be to discourage enterprise compliance; enterprises may be more likely to take a "wait and see" attitude, than to invest for pollution control. Allocations can be updated every five years, but a process that appears to move both directions — setting goals but then moving away from them - sends the wrong signals.

Until the message is made clear to enterprises that compliance is mandatory (that they must either install control technology or purchase emission allowances), it is difficult to predict whether enterprises are likely to take an emission trading program or any other regulatory program seriously. When the message is that compliance obligations seem to be relatively malleable and potentially subject to change, particularly through negotiation, the main incentive for trading - the opportunity for cost savings against real expenditures toward compliance — is diminished. Few businessmen, Chinese or otherwise, make investment decisions based on theory.

C) Inadequate penalties

The regulation passed by Taiyuan lacks teeth. Paragraph 23 of the Taiyuan regulation sets a yearly cap of 30 000 Yuan (roughly USD 3 586, as of April 3, 2003) on the total penalties that can be assessed against polluters.[21] The obvious difficulty with this language is the predictability of instances in which the cost of compliance (either installing technology or purchasing allowances) is greater than the maximum allowed penalty. At that point, the incentive for enterprises will be to be out of compliance and simply pay the capped penalty. This defect and its practical consequences was noted by enterprises during a public meetings in Taiyuan in November, 2002. To some extent, Taiyuan's discretion to set appropriate penalties was restrained by overriding National Chinese air laws that set a penalty cap, which means that Taiyuan cannot fix this problem by itself.

A deeper question, however, is to understand how much weight should be placed on the passage of a law, and the significance of a regulation, in a society that has not historically been governed by laws. Rule of law was eroded in Central European Countries like Poland and Hungary, but not entirely extinguished; despite many years including World War II and the Soviet occupation, that made people cynical about law and encouraged the population to work their way around rules as best they could, there is an historical experience to fall back on. The picture is more mixed in Russia where for many years, law was applied when it was in the interests of the authorities and ignored otherwise. China has never been a law-based society. Environmental laws are new, there is little experience applying them, and, as noted above, when they are ignored, no independent judiciary exists to step in to give the rules credibility.[22]

21 The specific language is as follows: "If the polluters' actual annual SO_2 emission exceeds the SO_2 emission allowance they hold at the end of the same year, they shall be fined by environmental protection department 3 000 to 8 000 Yuan per ton of excess emission, and the maximum penalty shall not exceed 30 000 Yuan."

22 To give some sense of the cultural issues involved with introducing instruments of any kind into China that harness private action in support of public goals such as environmental protection, commentators have noted that the Chinese word for "rights" was imported from Japan in the early 20th

In sum, my own view is that the Taiyuan project provides no evidence about the ultimate success of market-based instruments in China or any other developing world context. If anything, because there is no independent enforcement, the rules are so riddled with practical exceptions, monitoring is so weak and the basic incentives lacking, the Chinese situation is much more like the countries in transition before 1989, than after, in that China lacks basic institutional prerequisites and domestic motivation that might make effective emissions trading possible.

6. How can genuine environmental progress be stimulated in the developing world?

Being realistic about the challenges to be faced in the countries in transition and the developing world does not mean abandoning hope for environmental improvement. A concerted but realistic effort to support these countries as they tackle their environmental challenges is necessary, if for no other reason than the cliché that pollution respects no borders, but more to the point, because many face the health consequences of heavily polluted air and water.

I would start with the question: is it realistic to expect that countries only beginning the process of environmental protection can start with the most difficult environmental instruments? As I strongly believe the evidence shows, the answer to this question is, "no," the next question is, what can be done? Institutional inadequacies such as low functioning legal systems, historical experience (or inexperience) with markets, distorting and often institutionalised corruption, and public acceptance certainly can be fixed, and it is important to start to do so. But changing these fundamentals will take a long time. What can be done in the meantime?

Russell and I have suggested in two articles cited in the References that the donors and advisors start instead by thinking small, and considering alternative approaches. One way is to encourage, rather than disparage, incremental improvements and pragmatic goals, even if they are not the most efficient approaches. Countries might consider a transitional or tiered approach that will take into account existing capabilities and institutions, and explicitly acknowledge that a long learning curve lies ahead with inevitably uneven implementation and slippage from time to time.

A concrete way to think about this would be a tiered approach. Countries with a low level of institutional capability and environmental protection experience might start with simple discharge-control technology requirements, which are hard enough when experience and funding is lacking. Tools would be selected by asking what is achievable and relatively easy to monitor. Ideally, success will breed regulatory confidence and more success.

Countries with a bit of experience under their belts could move to technology-based discharge limitations similar to those found in the U.S. Clean Water Act. They might establish discharge standards, such as plume opacity, which can be easily monitored, or put in place deposit-refund

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century and, in contrast to the hundreds of years of western history involving this concept, has no previous meaning or history for the Chinese layman. This is because of the nature of the traditional social relationship between the individual and the state. "In ancient China, and ever since, to rule is tantamount to keeping order (zhi) and failing to rule is chaos (luan), which brings all kinds of disasters" (Sisci 2001). Thus, this new and evolving role for the state, particularly in terms of environmental controls, is quite different from China's several thousand year history. The experience emphasises the imperative of a continuing state role, and makes it difficult for Chinese regulators (and the Chinese government) to accept the more hands-off aspect of trading with which we are familiar in a more deeply entrenched market economy. It also does not provide much grounding for the role of government that backs up a trading scheme.

systems, not only for beverage containers but also for car batteries, tires, and dry cleaning fluid. Only the highest functioning countries should attempt the most difficult of the economic instruments: making discharge permits tradable or charging per unit of pollution discharged.

Another approach would be to find examples of small, admittedly imperfect, efforts that seem to be working, find out why they are achieving some measure of environmental progress, and build on them. There are a number of interesting such examples. These could include China's apparent success with energy efficiency and the Kitakyushu, Japan effort to control air pollution that started when housewives noticed that newly washed clothes on the Kitakyushu clotheslines were instantly turning black.

Air quality in Delhi, India, a city that was incurring an annual health cost of ambient air pollution on the order of about USD 200 million, is another. RFF is about to undertake a study of this, to see what lessons might be more broadly applicable. A 1998 Indian Supreme Court order required Delhi's public vehicles (buses, taxis and three-wheelers) to convert from diesel to compressed natural gas (CNG) fuel, and public vehicles more than eight years old to be retired. The public interest environmental organisations were happy with the Court's ruling, but the Court was demanding costly and inconvenient changes, particularly for some parts of Indian society without great resources. The Court's decision was opposed by bus, taxi, and three-wheeler operators and by numerous special interests including diesel fuel dealers, companies that own and operate diesel busses, parts of the government such as the Ministry of Petroleum and Natural Gas and the Delhi Administration, and competing users of CNG. Lines of three-wheelers waiting for CNG fill-ups sometimes stretched for kilometres, forcing the drivers to spend hours away from their livelihood and families. Various attempts were made to systematically discredit CNG technology and others argued that the Court's solution was not cost effective. These dynamics explain why the apparent result, the current phase out of diesel and increasing reliance on CNG, was not necessarily predictable or expected. In view of this, how was it that the phase-out took place, and what might this experience teach future environmental regulators, both in India and elsewhere?

The most important thing the donors and advisors can do is to encourage the development of credible behavioural rules, mechanisms for verifying and encouraging compliance, and a culture in which compliance is the first choice of action rather than the last.

7. Conclusion

Institutional capacity should not be an eternal barrier. Regulatory capacity and confidence can be developed in a number of ways. In my view, the effort to promote market-based instruments has been a distraction from the urgent task of developing appropriate actions with a likelihood of success, that would, in turn, build the requisite institutional confidence.

The suggestion (connected with development assistance dollars) that market instruments should be the first goal set the standard for success too high, and may have created a crisis of confidence. The developing countries are not environmental laboratories; they are real places with severe problems and limited resources. They are not the right places to insert theories that have only been tested in models and in the minds of the people who thought of them, where confounding facts and poor conditions can be assumed away.

Environmental protection is a gritty and difficult business. Theory has much to offer, but in the end, local traditions, culture, institutions, and infrastructure will determine the success of any policy.

Policy selection should not be a function of fads or ideology. Like good doctors, the Environmental Consensus should examine the patient before, not after, it prescribes the cure.

If credibility and success are built incrementally, institutions, like people, have the opportunity to practice and to learn from both their successes and their mistakes. Environmental policy is a particularly good practice ground because clean air and clean water is something most societies want; in many places, it will be possible to find the requisite public support for undertaking reasonable steps.

Taking more measured steps does not have the same sense of adventure as a great environmental leap forward. But it will result in real, although initially small, environmental gains, and could be accomplished without losing sight of the ultimate goal, which is to reach the goals of environmental quality at least cost to society.

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BUILDING INSTITUTIONS TO ADDRESS AIR POLLUTION IN DEVELOPING COUNTRIES: THE CAP AND TRADE APPROACH

by

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1. Introduction: Addressing air pollution problems with weak environmental institutions

There is growing interest in the use of market-based incentives, such as cap and trade, for addressing environmental problems in developing countries. These instruments have been used successfully in the United States to reduce sulphur dioxide (SO_2) and nitrogen oxides (NO_x) in a cost-effective manner. However, it remains a question whether cap and trade is an appropriate measure for use in developing countries.

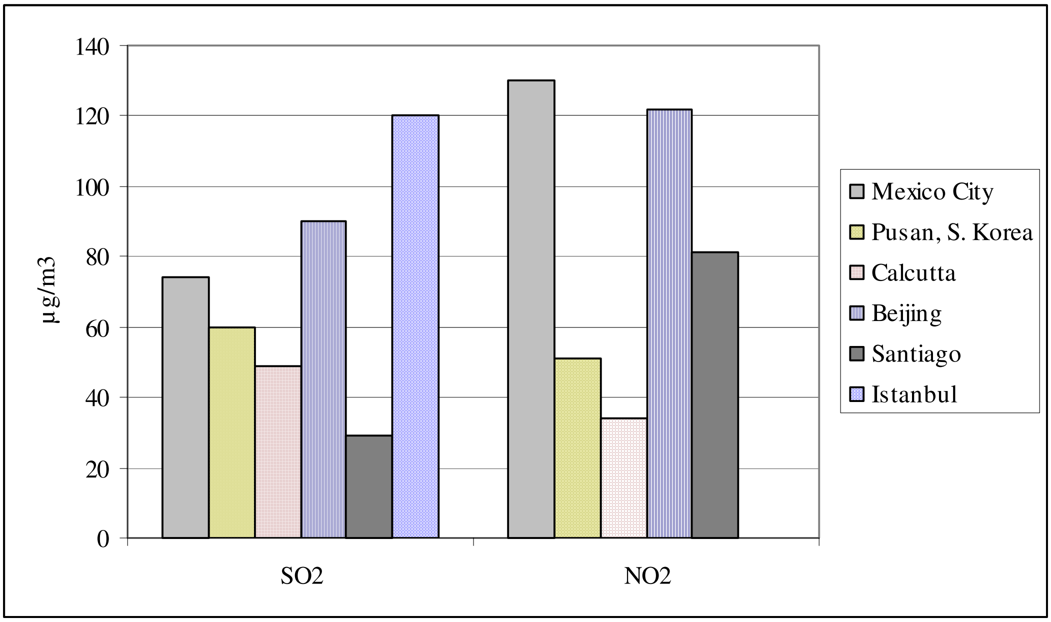
Before considering the role of cap and trade in developing countries, it is necessary to look more closely at the environmental and institutional context of these countries. While in developed countries many indicators of pollution levels are improving, the horizon is not as bright in much of the developing world. Population growth, rapid industrialisation, and increasing urbanisation have resulted in severe air pollution.

The magnitude of the problem can be illustrated by looking at ambient concentrations of SO_2 and nitrous dioxide (NO_2) in numerous large cities of the developing world. As is illustrated in Figure 1, pollution levels in many of these cities exceed the World Health Organisation (WHO) guidelines[1].

In particular, the urban air pollution problem is growing as economic development drives increased combustion of fossil fuels for industrial processes and electricity consumption. Figure 2 illustrates how electricity use and industrial fuel consumption in developing countries have increased by 145% and 65%, respectively, between 1985 and 1999.

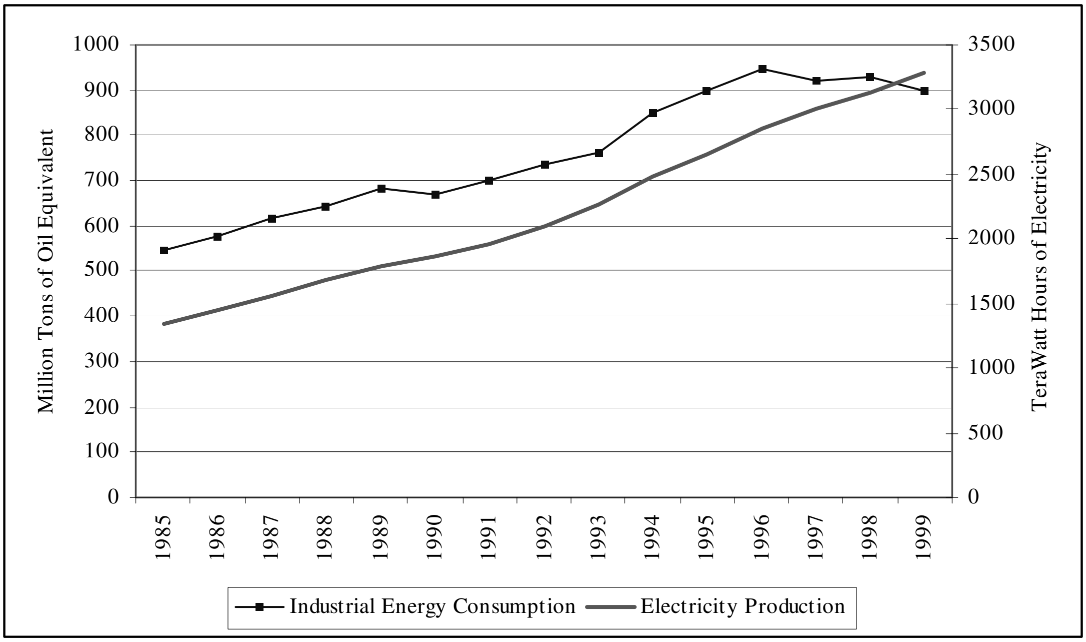
[1] WHO annual mean guidelines for air quality standards are 50 micrograms per cubic metre for sulphur dioxide and 40 micrograms per cubic metre for nitrous dioxide.

Figure 1. Urban SO_2 and NO_2 Concentrations in Select Cities



Source: World Bank, 1998.

Figure 2. Electricity and Industrial Energy Consumption in Developing Countries 1985 — 1999



Source: IEA, 2001a; IEA, 2001b.

Facing the growing problem of deteriorating air quality, most developing countries have used regulatory measures with a long history in developed countries, such as emission concentration standards or mandates of certain control technologies (Hettige *et al.*, 1996). Despite the existence of environmental regulations on paper, however, compliance at the source level and enforcement by government officials is often problematic. Some analysts have argued that the use of market-based environmental approaches is the answer to this dilemma. Advocates of market-based approaches in developing countries note that these instruments, such as emission taxes and tradable permits, have a variety of benefits, including increased economic efficiency; improved decentralised decision-making about control options; greater incentives for technological change; and lower overall compliance costs.

Finally, these advocates note that market-based instruments more readily accommodate economic growth and changing environmental objectives (Blackman and Harrington, 2000). Unlike command-and-control programs that may require the regulator to make significant regulatory modifications to accommodate economic, technological, or political changes, market-based approaches allow sources to develop source-specific abatement strategies and free regulators to focus on emission verification and program enforcement.

Though some are enthusiastic about market-based instruments, other analysts have expressed some scepticism. These analysts assert that the pursuit of market-based policies in developing countries wastes valuable time and resources that could more effectively be directed to command-and-control programs. They maintain that developing countries lack the experience and institutions necessary to design and operate effective market-based policies (Bell and Russell, 2002; Russell and Vaughan, 2003).

Although both sides in this debate have some valid points, there are also flaws in each side's arguments. Some advocates of market-based programs gloss over critical institutional issues that can make or break successful environmental programs. The difficulties that developing countries face in building effective environmental institutions of any kind are well known. These difficulties can include limited resources, lack of well-trained personnel, weak and unpredictable systems of environmental enforcement, lack of respect for the rule of law by industrial emitters, corruption, and even simple lack of equipment (Russell and Vaughan, 2003). Without tackling these difficulties, a market-based approach is no panacea for pollution problems.

On the other hand, while "market sceptics" correctly diagnose the problem, they often fail to offer concrete advice on what specific regulatory approaches would be more effective than market-based approaches. The challenge of developing successful environmental programs, market-based or not, is significant. However, there is little empirical evidence that the resources or expertise necessary to implement market-based programs, such as cap and trade, are greater than those for other types of environmental programs. Moreover, "market sceptics" tend to focus more on the "trade" aspects of emission trading and less on the attractive qualities of the compliance infrastructure necessary for achieving a cap on emissions. Even if there is no trading initially, cap and trade programs may still have some advantages over conventional regulatory approaches. Specifically, the compliance infrastructure needed for cap and trade may be both more effective and less resource intensive than the compliance infrastructure necessary to implement an effective command-and-control program.

Meanwhile, some developing countries are not waiting for the debate to be resolved. The desire to reconcile economic development with environmental improvement, combined with the well-documented success of the U.S. SO_2 allowance trading program (Ellerman *et al.*, 2000; Burtraw, 1998; Stavins, 1998), has led some countries to show an interest in cap and trade. For example, China is actively pursuing numerous cap and trade pilots, Chile has implemented a cap and trade program in

Santiago, and the Philippines included emission trading in recent amendments to the Filipino Clean Air Act.

Given the limited resources and often weak and ineffective government institutions in developing countries, is this the best direction for developing countries to be heading? The following sections identify problems faced by developing countries in implementing effective environmental programs, outline some of the potential benefits of cap and trade for these countries, and address concerns about whether cap and trade is an appropriate instrument. The paper concludes with recommendations for building the institutional capacity for effective cap and trade programs in developing countries.

2. Addressing air pollution problems with cap and trade

Before making the case for cap and trade programs in developing countries, it is necessary to provide some background on how these programs work. Under a cap and trade program, policymakers establish a cap that limits total emissions from sources participating in the program. The cap is divided into allowances, each representing an authorisation to emit a specific quantity of pollution (e.g., one ton of SO_2), and distributed to emission sources. The sources are obliged to report their emissions and, at the end of the compliance period, surrender one allowance for each unit of pollution. The sources, however, have the flexibility to design a compliance strategy that accounts for their circumstances. A source may install control technologies, implement process changes, or switch fuels to reduce emissions. In addition, sources have the flexibility to buy or sell allowances to meet the program requirements. Those sources that reduce emissions more than required can sell surplus allowances to other sources. The revenue from allowance sales can offset the cost of emission reduction measures and provide a financial reward for better environmental performance. Sources with high costs to reduce emissions may purchase allowances from other sources at a lower cost, thus complying with the program requirements at a lower cost. Because total emissions are capped, proper program design and enforcement will maintain the emission goal.

Cap and trade is not appropriate for all environmental problems. Cap and trade can be an effective approach if the environmental problem meets several criteria. First, the problem is primarily regional or global in nature and the precise location of emission reductions will not hinder the ability to achieve the environmental goal. Second, there are technically and economically feasible means of measuring emissions from each source. Finally, the economic benefits of cap and trade programs arise when the costs of abating emissions vary from source to source (USEPA, 2003).

3. Addressing concerns about the use of cap and trade in developing countries

"Market sceptics" that assert developing countries are not prepared for cap and trade often cite three primary concerns:

- accurate emission measurement is too difficult and too expensive;
- developing countries lack the expertise to implement and enforce cap and trade programs; and,
- developing countries lack fully developed markets.

Each of these three concerns is discussed below.

3.1 Concern 1: Accurate emission measurement is too difficult and too expensive

Accurate measurement and consistent, credible enforcement are the foundation of an effective cap and trade program. Emission measurement is critical because it ensures the environmental integrity of the emission cap. Ultimately, the number of allowances an emission source must surrender to the regulator for compliance is determined by measured emissions. Moreover, since compliance costs are linked directly to total emissions, sources have an incentive to underestimate their own emissions. Accurate emission measurement is therefore the backbone of a cap and trade program, and ensuring that emission measurement is accurate is the fundamental government role in these programs.

Much of the scepticism about developing countries' ability to measure emissions focuses on the expense and technical challenges of using continuous emission monitors (CEMs) to measure emissions. Although CEMs may be the most accurate measurement method in many circumstances, and may be necessary if a source utilises post-combustion controls, different pollutants may permit alternative measurement methods. Emissions that are based on fuel composition can often be estimated using engineering calculations in lieu of CEMs. The mass-balance approach uses fuel composition and consumption data to calculate total emissions. It provides reasonably accurate estimates of total mass emissions over the entire compliance period, mitigating the "clean for a day" effect associated with periodic stack inspections where facilities modify processes, operate control equipment, and change fuels for the inspection period but revert back to the previous state after the inspection (Jahnke, 2000). To reduce opportunities for false reporting and improve verifiability, the regulator can collect supplemental information (e.g., fuel purchases, product output) and use this information to verify fuel consumption and compare emission intensity over time to look for unexpected values. Whatever measurement approach is used, policymakers, program participants, and other interested stakeholders must perceive the approach as fair and accurate (Drayton, 1978).

Developing a complete, accurate accounting of total mass emissions provides additional benefits beyond the enforcement of cap and trade programs. An emission inventory can help regulators determine the effectiveness of an environmental policy, improve air quality modelling efforts, and set more appropriate emission targets for applicable sources. In the Santiago, Chile total suspended particulate (TSP) trading program, the regulating authority developed an emission inventory for the purpose of allocating allowances in the cap and trade program. The identification and inspection of stationary sources provided the best accounting to date of stationary TSP sources in Santiago and it revealed important differences between the emission inventory and expected results (Montero *et al.*, 2002).

Once emission data and supplemental information is collected, the regulator must track and manage the data. In larger programs this can be a significant undertaking requiring considerable resources. However, advances in information technology have made it easier and less expensive to use computerised tracking systems, or registries, to reduce the administrative burden. In the U.S. SO_2 cap and trade program, computerised tracking systems make it possible to collect, verify, manage, and disseminate emission data from more than 2 000 sources. Without such technologies it would be difficult if not impossible to ensure the accuracy of the more than four million hourly SO_2 emission measurements reported each quarter. Such systems can be implemented in developing countries at relatively low cost. For example, Resources for the Future, a U.S.-based NGO, developed emission and allowance registries capable of collecting and managing emission data, generating public reports, managing allowance transfers, and assessing compliance. The cost of building and implementing the system was less than USD 5 000. Other systems, such as the U.S. Environmental Protection Agency's generic Emission and Allowance Tracking System (EATS), can be employed at very low cost.

3.2 Concern 2: Developing countries lack the expertise to implement and enforce cap and trade programs

The environmental departments in developing countries are often understaffed, underfinanced, and lack public support (Blackman and Harrington, 2000). As a result, many environmental policies in developing countries have failed. Regardless of the type of policy chosen, these constraints will affect a policy's effectiveness. Given these constraints and history of limited success, some analysts argue that institutions are insufficient for all but the most simple command-and-control programs. However, many of the requirements for cap and trade programs are the same as those required for command and control. Each type of program requires regulators to promulgate rules, allocate the emission reduction burden to sources, determine the requirements to place on sources, and enforce compliance (Ellerman, 2001; USEPA, 2003).

More specifically, an emission trading program, like any other environmental program, requires certain capabilities of the governing institution and the regulated community in order to achieve environmental success. Those elements that are common among environmental programs include:

- Historic emission and air quality data to determine the extent of the problem and the sources and/or sectors that contribute to the problem.

- An understanding of the options and costs for reducing emissions. This understanding is necessary to determine what level of emission control is technically and economically feasible.

- Access to control technologies or practices to reduce emissions. If the regulated community cannot purchase, install, transition to, or operate the technologies or practices to reduce emissions, the environmental program will not succeed.

- Administrative and legal institutions with the legal authority, institutional capability, and culture to enforce environmental regulations. Sources need to be certain that the rules of the program will be applied equally and will not change without adequate process and notification.

- Senior government officials that are engaged and willing to champion the program. This support is instrumental in moving an environmental program from concept to regulation to implementation.

Although many elements are similar, it is useful to examine how expertise and institutions differ for cap and trade and conventional programs. Cap and trade programs focus most staff resources on measurement, reporting, and auditing of source specific mass emission data. The key to a cap and trade program is that emission measurements be as accurate and complete as possible and measurement methodologies be as consistent as possible. In the U.S. SO_2 program, approximately 75% of staff resources (approximately 75 people, including personnel in Regional EPA offices and State agencies) are focused on these activities (USEPA, 2003). In addition, cap and trade programs require administrative resources to manage allowance data and the transfer of allowances. In the U.S. SO_2 program, approximately two people handle these tasks.

Some market sceptics argue that a technology requirement is the appropriate first step towards regulation for developing countries. According to this view, it is relatively easy to tell if a technology is installed correctly and is operating effectively (Russell and Vaughan, 2003). Putting aside the cost of requiring standardised technology on all facilities, there are several problems with this argument.

First, ensuring that control technology is properly installed is not a simple task for government officials. Power plants and industrial facilities often have significantly different configurations, and ensuring proper installation requires substantial engineering expertise. In addition, ensuring that control technology is turned on and is operating properly requires some form of periodic monitoring. Operating costs for many control technologies (e.g., flue gas desulphurisation) are not insignificant, and there may be a huge incentive to shut them off if there is not appropriate oversight of the technology's performance.

Second, the standard way that governments around the world enforce technology requirements is through a detailed permitting process. In most cases, sources submit detailed permit applications describing plant configurations, the proposed technology and its specifications, expected emissions and levels of operation, proposed expenditures, and other information. Government officials review this information for each facility and issue a detailed, legally enforceable permit. In some countries, significant changes at a facility require additional extensive submissions by industry and review by government officials (U.K. Environment Agency, 2000; USEPA, 2000).

Thus, for some types of sources, implementing cap and trade programs can be simpler than command and control. Focusing on measurement and tracking of emission data rather than on detailed, facility specific technology or compliance plans is arguably a more straightforward role for government officials because it removes them from facility specific decisions and focuses them on measuring results. Measurement expertise may be applicable to a wider variety of facilities than the detailed, facility specific knowledge required to review permits. Similarly, fine tuning measurement techniques to different plants usually requires less adjustment and variation than adapting control technologies to different plant configurations. Moreover, as noted above, conventional regulatory approaches still need some form of emission measurement, particularly if there are post combustion controls. The experience of the U.S. SO_2 cap and trade program has demonstrated that administration of a well-designed program can be simpler and less expensive than other types of effective environmental policies, including command-and-control policies (McLean, 1996).

Finally, another administrative advantage of cap and trade is that it provides little discretion for the regulator when determining whether a source is in compliance. The test is simple: does the source have sufficient allowances to cover emissions? Under command-and-control programs, equipment can break down or practices might not be followed, leaving the regulator to determine if the incidents are egregious enough to warrant non-compliance penalties. Reducing the discretion of regulators also reduces the opportunities for corruption — a major threat to development in general (Keefer and Knack 1997) that makes the design of policy instruments difficult (Sterner, 2003).

3.3 Concern 3: Developing countries lack fully developed markets

Critics of market-based approaches argue that operations managers at emission sources do not have sufficient understanding of how markets work and that developing countries do not have developed market institutions (Bell and Russell, 2002). It is true that for the trading part of a cap and trade program to work, a country must have some of the same institutions and incentives in place that are required for other types of markets. These include a developed system of private contracts and property rights, a private sector that makes business decisions based on the desire to lower costs and raise profits, and a government culture that will allow private businesses to make decisions with a minimum of intervention. The regulated community must have confidence that allowances, if not explicitly provided as a property right, will function similarly to property rights and not be confiscated by the government without warning or reason. Although the allowances in the U.S. SO_2 and OTC NO_x

allowance trading programs are not property rights, they are treated as *de facto* property rights (Ellerman *et al*., 2000).

Focusing on the adequacy of a country's market institutions as the primary criterion for whether cap and trade is appropriate assumes the primary goal of a cap and trade program is trading. From an environmental perspective, it is the cap and its associated institutions (measurement, enforcement, data systems, etc.) that represent the most important components of cap and trade programs. Thus, even in developing countries where laws, institutions, and practices associated with market economies are not fully developed it may still be valuable to experiment with cap and trade. These countries may experience a transitional phase for cap and trade where there is initially very little trading. The extent of that phase and the ability to achieve economic efficiency from cap and trade will depend on the pace of more general economic transformation (Ellerman, 2001). Even in the absence of trading, the flexibility for sources to develop compliance strategies that account for their circumstances and the limit on total emissions provided by cap and trade can form the foundation of a credible, more efficient environmental program. This flexibility can encourage innovation and competition among emission reduction approaches, thereby further reducing the costs of complying with the emission cap (Burtraw, 2000).

Other analysts argue that uncertainty (Hahn, 1989), transaction costs, imperfect information, and institutional rigidities can hinder market performance (Blackman and Harrington, 2000). However, even with high transaction costs and other market constraints, cap and trade can be more environmentally and cost effective than command and control. In some developing countries, the government may provide some market services to reduce transaction costs. For example, in Taiyuan, China, the government provides standard contracts to participants in the cap and trade program and helps match buyers and sellers.

In the long run, cap and trade may also address a chronic problem in developing countries — access to capital. Many environmental programs in developing countries fail because industries do not have access to capital or equipment necessary to reduce emissions. Without access, industries cannot reduce emissions and the government must decide whether to allow the source to operate in non-compliance, provide the source with financial grants or loans, or shut down the source. With emission trading, industries can use revenues from allowance sales as collateral to finance technologies or process changes. It may, however, require experience before financial institutions are comfortable granting loans for environmental projects on the basis of allowance revenues.

4. Conclusions and Recommendations

No one should underestimate the challenges of designing successful environmental programs in developing countries. Many developing countries lack some of the prerequisites for effective environmental programs, such as credible enforcement authority and adequate resources and expertise to implement a program. Nevertheless, the departure point for this paper is that as countries develop and as controlled economies and political systems become more open, there will eventually be political will to impose real environmental requirements. If this does not occur, then neither market-based programs such as cap and trade nor more conventional regulatory programs will be adequate.

Thus, if one assumes that over time, developing countries will put resources and political will behind improving the environment, the critical question is: what institutions should they build over the coming years? We argue that where large stationary sources of air pollution contribute to regional pollution problems, the institutions associated with cap and trade can be good building blocks for a credible environmental program. This is true even if there is no actual trading of emissions or if the onset of trading is delayed until general market institutions develop in a country.

International capacity building efforts should focus on these building blocks, which include credible enforcement practices, good measurement and tracking of mass emissions, economic and air quality models which allow for good environmental decisions about where to set the cap, and education. These key elements are elaborated below:

- **Emission measurement and reporting:** Capacity building should focus on the compliance structure necessary for mass emission accounting. Good emission measurement and reporting are essential building blocks to whatever approach developing countries implement, including cap and trade, emission taxes or fees, and command and control.

- Where possible, standardised protocols should be developed that can be adapted and made more specific to address national circumstances. Standardised emission measurement protocols have been developed for greenhouse gas accounting, and similar protocols could be developed for conventional pollutants. Funding institutions might also consider providing ongoing financial support for emission data collection activities, a move that would raise the importance and visibility of local staff that conduct these activities.

- **Data systems:** Information technologies are critical for cap and trade programs and can provide easy access to data that could be useful for compliance purposes in many forms of environmental programs. In addition to the obvious benefits for cap and trade, data systems can increase data accuracy, improve transparency, enhance public access to data, improve consistency and comparability of emission data, and build credibility in the environmental program (USEPA, 2003). Data systems can improve the management and enforcement of an environmental program, regardless of whether it is cap and trade or command and control.

  Although data systems development can be a significant start-up cost for cap and trade programs, standardised data systems for tracking emissions and allowances could be used to reduce the costs of setting up cap and trade programs in developing countries. Systems such as EPA's Emission and Allowance Tracking System (EATS) can be adapted at relatively low cost to meet the needs of new cap and trade programs.

- **Modelling capability:** Models that project emissions, costs, and air quality impacts are important for making decisions on air pollution policies such as where to set an emission cap and which emission sources to include in an environmental program. Building this analytical capability within countries will provide them with the tools to design and more fully understand cap and trade as well as other environmental programs.

- **Enforcement:** Training, capacity building, and technical assistance on enforcement techniques is a critical aspect of building confidence in any new environmental initiative in developing countries. In some cases, modification of existing environmental laws may be necessary to provide adequate enforcement authority. Technical assistance may also be helpful in establishing appropriate penalty levels. Cap and trade programs require explicit consideration of how high to set penalties based on the marginal costs associated with reaching different emission levels.

- **Education:** Many environmental professionals, particularly at the local level, do not have adequate access to education and information. Yet, studies have shown that education and technical assistance can dramatically increase compliance with environmental programs

(Dasgupta, 1999). Developing education materials for government, industry, and the public can improve the understanding of cap and trade and emphasise the institutional capacities necessary to effectively operate and participate in a cap and trade program.

Emission trading has attracted worldwide attention, due to the success of programs such as the U.S. SO_2 cap and trade program. Although the prospects of reduced environmental costs may make developing countries take notice, it is important for advocates of emission trading to acknowledge that the institutions discussed above need to be in place to make emission trading credible. We believe that the prospect of helping to reconcile economic growth with environmental protection will lead governments to develop the accountable and transparent institutions necessary for effective environmental programs. Our hope is that cap and trade programs can become one of the organising principles behind efforts to build capacity for effective environmental institutions.

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PART II

TRADEABLE PERMITS IN THE POLICY MIX AND HARMONISATION OF EMISSIONS TRADING SCHEMES

ISBN 92-64-10576-X
GREENHOUSE GAS EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN OECD AND NON-OECD COUNTRIES

HARMONISATION BETWEEN NATIONAL AND INTERNATIONAL TRADEABLE PERMIT SCHEMES[1]

by

Erik Haites **(Margaree Consulting)**

1. Introduction

Many Annex I Parties to the Kyoto Protocol are designing, or have implemented, national emissions trading schemes for greenhouse gases to help meet their national emissions limitation commitment under the Protocol. The designs of these national trading schemes are quite varied.

Increasing the number of participants in an emissions trading scheme usually reduces the cost of achieving the overall emissions limit. So linking two or more national emissions trading schemes offers the prospect of being able to meet the combined emissions caps at a lower total cost. Other potential benefits of linking include increased market liquidity, a more competitive allowance market for schemes with few participants, and more efficient technology development.[2] Can national trading schemes with different designs be linked or do the designs need to be harmonised? Which design features must be, or should be, harmonised to enable the potential cost savings to be realised? These are the broad questions addressed by the papers reviewed.

The answers to the questions depend to a considerable degree on the institutional setting assumed. The institutional settings assumed by the papers reviewed are:

- voluntary links between national trading schemes absent any international commitments;
- voluntary links between national trading schemes of Annex I Parties to the Kyoto Protocol prior to 2008; and
- voluntary links between national trading schemes of Annex I Parties to the Kyoto Protocol during the 2008 - 2012 commitment period.

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1 This paper is a synthesis of presentations and papers presented and discussed at Concerted Action on Tradeable Emissions Permits (CATEP) workshops in Venice (2001), London (2002), Kiel (2002) and Budapest (2003), on the theme: "Linking and Harmonisation of National Emissions Trading Schemes".

2 Organisations developing low emissions technologies have a larger market with a single price for avoided emissions rather than several smaller markets with different prices.

The institutional setting affects how national trading schemes can be linked, so the synthesis is organised in terms of these three contexts. First it is useful to clarify some definitions.

2. Definitions

A national emissions trading scheme is one where the regulatory authority(ies) responsible for enforcing compliance is designated by the national government and all of the emissions sources with compliance obligations are located in that country. The emissions trading schemes implemented by Denmark and the United Kingdom are national schemes. So too are the schemes Member States would be required to implement to comply with the EU emissions trading directive and those that might be implemented by Canada, Japan, Norway, Switzerland and possibly other countries.

Two national emissions trading schemes are linked if one country's allowance can be used, directly or indirectly, by a participant in the other country's scheme for compliance purposes. National schemes are linked if the allowances can flow in either direction between the countries.[3] The link may be indirect. For example, the seller may exchange a national allowance for an assigned amount unit (AAU) that is transferred to a participant in the recipient country's scheme, which exchanges it for a national allowance that it uses for compliance.

The EU Directive and Kyoto Protocol establish international emissions trading schemes that link national trading schemes. The EU Directive, assuming it is adopted, will require that allowances be transferable between persons within the Community and that allowances issued by one Member State be recognised for the purpose of meeting a participant's obligations in another Member State.[4] Thus, the Directive will link the national greenhouse gas emissions trading schemes of all Member States from its expected commencement in 2005.

Assuming that the Kyoto Protocol enters into force, it will establish an international emissions trading scheme for Annex I Parties that can link national trading schemes in those countries. Each Party may establish rules governing acceptance of AAUs and other Kyoto units from, and transfer of Kyoto units to, other countries.[5] These rules are not expected to significantly restrict trade in Kyoto units. In that case national trading schemes in Annex I Parties can be linked through AAU transfers as described in the example above.

A country may be able to unilaterally link its emissions trading scheme to that of another country. Many national trading schemes allow any legal or natural person to own allowances and allow the owner of allowances to have them cancelled so that they can not be used for compliance. Country A can unilaterally link its emissions trading scheme to any other scheme that includes such provisions. Country A simply decides to accept for compliance purposes allowances that a participant in its

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3 A swap of Danish and UK allowances reported early in 2002 does not involve a link between the two schemes because the allowances continue to be used for compliance in their respective jurisdictions. The Danish allowances were sold to Shell for compliance with obligations in Denmark. Elsam, the seller, received UK allowances that will be banked or sold to another entity for compliance use in the UK.

4 CEC, 2001, Article 12, paragraphs 1 and 2.

5 The other Kyoto units are emission reduction units (ERUs), certified emission reductions (CERs) and removal units (RMUs). A Party may limit acceptance of Kyoto units to ensure that emission reductions are implemented domestically or for other reasons. A Party may restrict transfers of Kyoto units to ensure compliance with the commitment period reserve requirement.

scheme has purchased and cancelled in country B's scheme. This does not permit country A's allowances to be used for compliance in country B, however that does not matter if the price in the absence of such a unilateral link is higher in country A than in country B. Such a unilateral link to the national emissions trading schemes of Annex I Parties is part of a bill recently introduced in the United States Senate to establish a national greenhouse gas emissions trading programme in that country.[6] Unilateral links are not discussed further.

3. Voluntary links absent international commitments

Rehdanz and Tol (2002) consider links between national emissions trading schemes when countries determine their own emission reduction targets. In this case linking two trading schemes may cause the exporting country to increase its emissions target so that it can export more allowances. Here linking the schemes reduces the environmental benefits anticipated by the importing country when it agreed to link the schemes. To discourage the exporting country from raising its emissions target, the importing country could: discount imported allowances, apply a tariff on imported allowances, or limit the quantity of imported allowances.

Rehdanz and Tol find that a tariff or import quota can act as a deterrent to the adoption of a low emissions reduction target by the exporting country and so can protect environmental integrity. A quota on imported allowances is less costly to the importing country than a tariff. The import quota should be set equal to the quantity of imports under free trade with the exporter's original emission reduction target.[7] The importing country benefits from the trade in allowances despite the quota. The exporting country is better off with the limit on allowance imports than with no international trade in allowances, so allowance trading continues. Non-compliance by an Annex I Party with its emissions limitation commitment is equivalent to a country setting its own emissions target. This result, then, offers insight into strategies for limiting overselling by Annex I Parties if the current combination of a commitment period reserve and non-compliance penalties proves ineffective.

4. Voluntary links between schemes prior to 2008

National trading schemes for greenhouse gases are already operating in Denmark and the United Kingdom (Hartridge, 2001). Additional schemes are expected to begin operation in the Member States of the European Union, Norway and possibly Canada, Japan and Switzerland prior to 2008 (Burkhardt, 2003; Boemare and Quirion, 2002; Drexhage, 2003; Haites and Mullins, 2001; Takamura, 2003; Yamin, 2001). In addition, sub-national trading schemes are expected to be implemented in the states[8] of Massachusetts and New Hampshire (United States), the province of Alberta (Canada) and

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6 United States Senate, 2003 and Haites, 2003.

7 Policies to keep allowance imports constant are more effective than policies to keep the quantity of allowances issued by the exporting country or the aggregate emissions targets of the two countries constant.

8 Oregon has a requirement for new energy facilities to offset part of their greenhouse gas emissions. Allowances or credits from emissions trading schemes can not be used to meet this requirement and the offsets purchased can not be traded, so this is not an emissions trading scheme. Although it does not have a regulatory requirement that new facilities offset part of their greenhouse gas emissions, Washington state requires this through its approvals process.

the state of New South Wales (Australia) during this period. Most non-government trading schemes have come to an end.[9]

The designs of the existing and proposed trading schemes vary significantly. Baron and Bygrave (2002) and Haites and Mullins (2001) review the designs of emissions trading schemes to determine which features preclude links between schemes. Both papers analyse possible designs rather than specific schemes because the detailed designs of proposed schemes are not yet known.

Both papers find few technical barriers to linking emissions trading schemes despite differences in their design. Where barriers exist, solutions are usually available. The design features that pose the greatest difficulty when linking schemes are the: allocation method, point of imposition, non-compliance penalty, banking of pre-2008 allowances into the commitment period, and trading restrictions.

4.1 Allocation method

Allowances can be distributed by auction; free, based on output; or free, based on historic activity. The method used affects the total cost and/or aggregate emissions as well as the distribution of costs among participants. Adoption of different distribution methods can create competitive distortions when participants can sell their products in other countries. Different distribution methods do not preclude the use of one scheme's allowances by participants of the other scheme for compliance purposes. Linking can, however, accentuate or attenuate competitiveness impacts due to differences in the distribution methods adopted by the schemes.

Free distribution based on output is an implicit production subsidy. If one of the linked schemes, country C, uses such a distribution and the allowance price rises due to the linkage, the production subsidy is larger.[10] A higher allowance price due to the linkage would then stimulate production in country C and so enhance its competitive position relative to all other countries. The emissions associated with the increased production could lead to higher total emissions for country C or could lead country C to impose additional emission reduction obligations on sources to achieve its national emissions target.[11] If linkage causes the allowance price in country C to fall, the competitive distortions and emissions impacts are reduced.[12]

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9 The Pilot Emission Reduction Trading (PERT) project, the Greenhouse Gas Emission Reduction Trading (GERT) project and the internal greenhouse trading schemes at bp and Shell have come to an end. The Chicago Climate Exchange, which recently began operation for 2003-2006, is now the only non-government trading scheme.

10 See Baron and Bygrave, 2002, sections 3.1 and 3.5; Boemare and Quirion, 2002, section 3; and Gielen *et al*., 2002, section 4.

11 The additional reductions might be imposed on the participants in the trading scheme by reducing their allocations proportionally. Or they might be imposed on sources outside the scheme by adjusting the policies that regulate the emissions of those sources. Any combination of these approaches may be used.

12 If all of the trading schemes to be linked distribute allowances on the basis of output, linking will strengthen the production subsidies in some countries and weaken them in other countries. The net effect is unknown a priori.

Allowance distribution by auction or free based on historic activity does not create competitive distortions.[13] Baron and Bygrave (2002) note that if one or more of the linked schemes uses an auction, allowing all participants in the linked schemes to participate in the auction is desirable. Free allocation based on historic activity requires a decision on how to treat new entrants. Schemes are likely to differ in their treatment of new entrants and this may affect where they locate.[14] Linking schemes may change the relative attractiveness of different jurisdictions for new sources and hence affect location decisions.

4.2 Point of imposition

Energy related CO_2 emissions can be regulated at the point of release to the atmosphere (downstream) or at any point in the distribution chain for fossil fuels (upstream) by regulating the carbon content of the fuels.[15] Schemes with upstream and downstream designs can be linked provided the allowances use common units.[16] Exempting exports of fuels from the upstream scheme avoids possible double coverage of the emissions associated with combustion of those fuels.[17]

Emissions due to fossil fuel use by electricity generators can be regulated directly in a downstream design by requiring them to participate in the trading scheme. These emissions can be regulated indirectly by holding customers responsible for the emissions associated with the electricity they use. The emissions associated with electricity imported from a scheme with direct coverage into a scheme with indirect coverage are regulated in each jurisdiction. Conversely, the emissions associated with electricity imported from a scheme with indirect coverage into a scheme with direct coverage are not regulated. Linking schemes with direct coverage poses no problems. If one or more of the schemes being linked has indirect coverage, linking may require cumbersome arrangements to ensure that all emissions are properly accounted for in the combined regime.[18]

4.3 Non-compliance penalty

Emissions trading schemes require accurate monitoring, tracking of transactions, and effective enforcement of compliance. Penalties sufficient to deter non-compliance are one element of effective enforcement. A non-compliance penalty defined strictly in financial terms might be lower than the

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13 Gielen *et al.*, 2002 note that such a free allocation can have wealth effects that could influence competitiveness. They claim that such effects are likely to be less severe than those associated with a free allocation based on output.

14 Baron and Bygrave, 2002, section 3.1.3.

15 The CO_2 emissions due to combustion of a fossil fuel are very closely linked to the carbon content of the fuel. Upstream is sometimes considered to be the point at which each of the fossil fuel enters the national economy. Regulating the carbon content of fossil fuels at other points in the distribution chain is then called a mid-stream design. The upstream, mid-stream distinction is not important for this discussion.

16 Baron and Bygrave, 2002, section 3.2.

17 The emissions of the exported fuel would be covered through the carbon content of the fuel in the upstream scheme and again when the emissions due to combustion of the fuel are covered by the downstream scheme.

18 See Baron and Bygrave, 2002, section 3.3 and Gielen *et al.*, 2002, section 4.

market price if the scheme is linked with other schemes.[19] Haites and Mullins (2001) argue that this situation would lead to non-compliance in the scheme with the lowest penalty. Baron and Bygrave (2002) suggest this need not be the case. Firms may be uncomfortable profiting from deliberate non-compliance and governments may restrict such purchases or sales through the registries. While that may be the case, the best solution is to ensure that linking does not create a situation where non-compliance may be rewarded. This requires not only appropriate non-compliance penalties,[20] but also confidence in the monitoring, verification and enforcement regime; the integrity of the registry; and the level of the "safety valve"[21] price.

4.4 Banking into the commitment period

A government may authorise participants in its emissions trading scheme to bank pre-2008 allowances into the Kyoto commitment period to encourage early reductions. This awards some of the country's AAUs to reductions that occur prior to the commitment period and requires that emission reduction obligations during the commitment period be increased by a corresponding amount. Due to the increased obligations during the commitment period, countries are likely to limit banking into the commitment period, if it is allowed at all.

Linking a scheme that does not allow banking into the commitment period with one that allows such banking may lead to an inflow into the scheme that allows banking into the commitment period (Baron and Bygrave, 2002; Haites and Mullins, 2001). There will be a net inflow as long as purchased units increase the quantity that can be banked into the commitment period. The UK program allows direct entry participants to bank into the 2008-2012 period to the extent that they have over-complied with their targets (i.e., they cannot buy to bank). Such a rule effectively addresses this issue.

4.5 Trading restrictions

The UK program has a "gateway" to limit flows from the rate-based (allocations tied to output) sector to the absolute (reductions in total emissions) sector. The existence of such restrictions could complicate attempts to link different programs (Haites and Mullins, 2001). For example, the Danish program, which has an absolute cap, could be linked to the absolute sector of the UK program and the proposed French program, which would allocate allowances on the basis of output, could be linked to the rate-based sector of the UK program. If the French and Danish programs were also linked, it could be used to circumvent the gateway in the UK program. The impact on trading restrictions of linkages with other programs must be examined on a case by case basis.

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19 At times the price of allowances in the absolute sector of the UK program exceeded GBP 10.00 (over USD 15) per metric ton of CO_2 during 2002. This was well above the Danish penalty of DKK 40 (about USD 5).

20 A non-compliance penalty defined as the loss of an allowance plus a financial penalty for each tonne of excess emissions will usually be higher than the market price of an allowance.

21 The cost of meeting emissions targets is uncertain. To cap the compliance cost, some schemes adopt a safety valve. A safety valve is a relatively high price at which the regulator sells enough additional allowances to enable participants to comply. If the safety valve price in one scheme is lower than the market price when it is linked with other schemes, additional allowances would be issued until the market price fell to the level of the safety valve.

To repeat, differences in design present few technical barriers to linking emissions trading schemes. Clearly, linking schemes is easier if the designs are similar. The greatest barriers to linking schemes through mutual recognition prior to 2008 are time and political will. Most countries are still at an early stage in the design and implementation of their national schemes. The potential benefits that can be realised over the two or three years that links can be operational prior to 2008 may not justify the time and effort that would be required to negotiate such links. Devoting the resources to linking schemes during the commitment period is likely to yield greater benefits.

The political will to link schemes may be diminished by the higher emissions in some countries and the creation of winners and losers in each scheme. The country with the higher prices prior to linking becomes a net importer of allowances meaning that its actual emissions are higher than projected entering the commitment period (Haites and Mullins, 2001). This means it will have to continue importing allowances or make additional emission reductions to comply with its commitment, a significant difference from the situation analysed by Rehdanz and Tol.

Linking schemes creates winners and losers in each scheme. The buyers in the scheme with the high price prior to linking and the sellers in the low price scheme benefit from the link. Conversely, the sellers in the high price scheme and the buyers in the low price scheme lose as a result of the link. The creation of winners and losers is likely to weaken support for voluntarily linking trading schemes.

5. The EU Emissions Trading Directive

The EU Directive will establish an international trading scheme that links the national schemes of Member States from 2005 (Vis, 2001). The Directive harmonises many features of the national schemes, but allows other features to vary (Zapfel and Vainio, 2002). The Directive requires each Member State to establish a greenhouse gas emissions trading scheme that covers a well defined set of participants.[22] In addition, the point of imposition,[23] non-compliance penalty,[24] and other features[25] are harmonised. Boemare and Quirion (2002) conclude that the features harmonised by the Directive are quite similar to those harmonised by the Ozone Transport Commission NO_x programme in the north-eastern United States.[26]

National schemes are required to distribute allowances to participants at no cost during the 2005 - 2007 period. Member State governments have considerable discretion in setting the overall cap and in determining the allocations to individual participants.[27] Each national allocation plan must apply common criteria, be reviewed by the Commission and other Member States, and may be rejected by

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22 Some of the small states might not have enough participants to create a competitive allowance market. Linking the national schemes solves this problem and so increases the total number of participants.

23 The Directive specifies a downstream design with direct coverage of the emissions by electricity generators.

24 The penalty is loss of one allowance plus a penalty of at least EUR 40 for each tonne of excess CO_2 emissions.

25 Annual compliance and common monitoring and registry requirements, for example.

26 Boemare and Quirion, 2002, section 7.

27 Member States are allowed to request that specific installations (not sectors) be allowed to opt-out of the scheme until 31 December 2007 at the latest. Such installations must be subject to similarly ambitious emissions reduction measures, including sanctions, to avoid creating competitive distortions. Requests for opt-out must be published and be agreed by the Commission.

the Commission for failure to comply with the criteria. A report for the Dutch government found that the criteria are not sufficiently clear and can be contradictory, thus allowing for differences in allocation with potentially important economic consequences (KPMG and Ecofys, 2002).

Each participant must be allocated a specified quantity of allowances, but the Commission notes that this quantity can be calculated using an output-related performance standard and a production forecast.[28] An allocation based on historic activity can increase profits for some participants, but does not protect competitiveness if capital is perfectly mobile (Boemare and Quirion, 2002). Given the differences in industrial structure and in existing environmental regulations across Member States, the Commission obviously found the task of specifying the allowance distribution to individual participants too daunting and chose to leave it to the Member States but with a review process to minimise the potential for economic distortion. Only experience can reveal whether the review process will keep economic distortions to a minimum or whether allowance distribution needs to be further harmonised.

Member States are free to decide on the extent of banking from 2005 - 2007 into the commitment period, but banking must be allowed within each period and between periods after 2008. Thus, the issues related to banking into the commitment period have not been resolved by the Directive. While Member States could introduce trading restrictions in their national schemes, the common design features required by the Directive and the requirement that allowances must be freely transferable throughout the Community make it unlikely that any Member State will introduce trading restrictions that pose problems for linking the schemes.

The Directive allows the Community to enter into agreements with non-members for mutual recognition of allowances between their greenhouse gas emissions trading schemes.[29] Norway has announced that it plans to launch its national scheme in 2005. Japan has stated that 2005 - 2007 will be the second step of a three step implementation process for greenhouse gas emissions trading (Takamura, 2003). Links with other trading schemes, by mutual recognition, has been identified as a desirable element of the second step. In Canada, attention has focused on design of a national scheme beginning in 2008, but implementation could begin earlier (Drexhage, 2003). Under the Swiss CO_2 law an emissions trading scheme could be implemented for 2008 - 2012, but ongoing negotiations with major industries have raised the possibility of a pilot scheme for 2005 - 2007 and links with other schemes (Burkhardt, 2003).

It is possible then, that Norway, Japan, Canada and Switzerland negotiate links with the EU emissions trading scheme and/or with each other beginning in the 2005 - 2007 period. However, several considerations reduce the prospects for links among schemes in these countries prior to 2008. First, all of these countries are expected to be net buyers during the 2008 - 2012 period, links with potential sellers make more sense than links with other buyers. Second, links will cause the actual emissions in some of the linked countries to be higher than planned entering the commitment period. Third, negotiating links is likely to involve considerable time and effort, and may require changes to the design of the linked schemes, at a time when all of the schemes are just being launched. Finally, the emissions trading schemes in several of these countries may not begin operation until 2008.

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[28] CEC, 2001, section 8.

[29] CEC, 2001, Article 24.

6. Links between Annex I party schemes during the commitment period

Article 17 of the Kyoto Protocol, if it enters into force, will establish an international emissions trading scheme for Annex I Parties that can link national trading schemes in those countries. The rules for international emissions trading were agreed as part of the Marrakech Accords in 2001.[30] The rules govern transfers of AAUs between the national registries of Annex I Parties. Parties must satisfy eligibility criteria to participate. Parties may establish rules governing acceptance of AAUs and other Kyoto units from, and transfer of Kyoto units to, other countries. Parties may designate which legal entities are allowed to have accounts in its registry and hence to own and trade AAUs.

The allowances used by a national emissions trading scheme in an Annex I Party after 2008 could be the country's AAUs or separate national allowances. To ensure compliance with the commitment period reserve, the export of AAUs will need to be regulated. If AAUs are used as the allowances in the national emissions trading scheme, some will need to be identified as exportable and others as for domestic use only. In practical terms an AAU that can only be traded domestically is equivalent to a separate national allowance. The exposition, then, will assume that the national schemes have national allowances.

National allowances can not be used by Annex I Parties for compliance with their national emissions limitation commitments under the Kyoto Protocol; only Kyoto units can be used for that purpose. Thus, links between national emissions trading schemes after 2008 must ensure that any international transfers lead to the appropriate transfers of Kyoto units as well. Assume that countries D and E are Annex I Parties eligible to participate in international emissions trading under Article 17 and that their national emissions trading schemes are linked by mutual recognition or through the EU Directive. Now assume that a participant in country D's scheme, entity D-1, wishes to sell surplus allowances to E-1, a participant in country E's scheme. The sale together with the appropriate transfer of Kyoto units can occur in either of two ways:

- Entity D-1 arranges with its government to exchange its surplus domestic allowances for country D AAUs. The government cancels the domestic allowances, so that allowable emissions are reduced. The AAUs are transferred to entity E-1 under the rules for international emissions trading. Entity E-1 arranges with its government to exchange the AAUs for an equal quantity of new domestic allowances, which it uses for compliance. This allows the emissions in country E to rise by the amount of the AAUs received. Call this the "exchange" model.

- Entity D-1 transfers the country D national allowances to entity E-1 using the provisions established by the registries for their national emissions trading schemes. Entity E-1 uses those allowances for compliance in the same way as country E national allowances. The international transfer of domestic allowances triggers an equal transfer of country D AAUs from the government of country D to the government of country E (Hobley, 2003). Call this the "shadow transfer" model.

The provision of the EU Directive requiring that allowances issued by one Member State be accepted by other Member States for compliance purposes suggests that national schemes subject to the Directive will need to use the "shadow transfer" model.[31] Implementation of this model raises

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[30] United Nations Framework Convention on Climate Change, 7th Conference of the Parties, Decision 18/CP7, November, 2001.

[31] CEC, 2001, Article 12, paragraph 2.

several questions. Is each international transfer of allowances matched by a shadow transfer of AAUs or is there a transfer of AAUs at regular intervals to reflect the net flow during the period? If each allowance transaction is matched, how are the government transfers triggered and what happens if a proposed government transfer violates the rules governing trades under Article 17? If government transfers occur at regular intervals, what is an appropriate interval and what happens if a proposed government transfer violates the rules governing trades under Article 17? How can government transfers be made if a Member State, such as Cyprus and Malta, is not an Annex I Party or if a Member State loses its eligibility to participate in international emissions trading under Article 17?

The “exchange” model resolves these questions by allowing international transfers to occur only if they are consistent with the rules for international emissions trading under Article 17 at the time of the transaction. It appears that both models could be used as long as transfers between two countries were governed by one model. For example, transfers between countries with national schemes governed by the EU Directive could be made using the “shadow transfer” model while transfers between EU Member States and other Annex I Parties could be made using the “exchange” model.

The Kyoto Protocol gives Annex I Parties complete freedom to choose the domestic policies to meet their national emissions limitation commitments. Annex I Parties that choose to implement national emissions trading schemes are free to design their own schemes; the Kyoto Protocol imposes no requirements relating to harmonisation of the national emissions trading schemes. The national schemes of Member States of the European Community will be subject to the EU Directive, but the schemes of other countries could have very different designs.[32]

As a result, most of the potential technical barriers to voluntary links between national emissions trading schemes prior to 2008 remain.[33] The methods of distributing allowances in different countries could create competitive distortions, although linking the schemes to the Kyoto mechanisms may attenuate or accentuate the distortions. Countries and entities that are adversely affected by the allowance allocation implemented by an emissions trading scheme may be able to use international institutions, such as the World Trade Organisation (WTO), to redress these impacts.[34] Differences in the point of imposition could lead to double coverage or exemptions of some emissions. However, each Annex I Party has an incentive to ensure that it receives allowances for all emissions it is accountable for if its trading scheme is linked with other schemes. This may require schemes that use indirect coverage of some sectors, such as electricity, to switch to direct coverage if the output of those sectors is exported to other Parties and may require schemes that have an upstream design to exempt fossil fuel exports (Baron and Bygrave, 2002).

The potential problems due to differences in non-compliance penalties also remain. Annex I Parties are subject to penalties for failure to meet their national emissions limitation commitments. Those penalties are not adequate to ensure compliance by participants in a domestic emissions trading scheme.[35] The importing country may decide to accept allowances even if they are issued to the seller

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32 See Burkhardt, 2003; Haites and Mullins, 2001; and Takamura, 2003 for information on the proposed designs for Switzerland, Canada and Norway, and Japan.

33 Baron and Bygrave, 2002, section 4 and Table 1.

34 Member States of the European Community also have access to Community laws and institutions to redress adverse competitiveness impacts, although such impacts are less likely to occur due to the degree of harmonisation imposed on the emissions trading schemes of Member States by the EU Directive.

35 The penalty is loss of 1.3 AAUs in the second commitment period for each tonne of excess emissions during the first commitment period. This penalty is effectively not collected until compliance is

at the safety valve price or if they leave the seller in non-compliance, as long as it gets the corresponding AAUs, because the extra emissions are the responsibility of the seller's government under the Protocol. However, the government of the buyer entity could also decide not to accept safety valve or non-compliance allowances in an effort to enhance the environmental integrity of the Kyoto commitments. The government would need to reject those transactions at the time they enter the national registry.[36] To be effective such a restriction would need to be adopted by almost all Annex I Parties.[37]

In summary, Article 17 of the Kyoto Protocol establishes an international emissions trading scheme capable of linking the national emissions trading schemes of Annex I Parties beginning in 2008. The rules governing international emissions trading under Article 17 impose no requirements for harmonisation on the national emissions trading schemes linked. Some design differences could create technical problems, although solutions are available and at least one of the governments involved has an incentive to solve the problem. Adverse competitiveness impacts due to differences in the distribution of allowances across national schemes may need to be addressed through institutions such as the WTO.

The EU Directive will apply to a relatively large number of the national emissions trading schemes and the Directive will impose even greater harmonisation on these schemes post 2008.[38] The opt-out provision is not available from 2008, the non-compliance penalties are higher after 2008, and differences related to banking into the commitment period no longer apply. The distribution of allowances is likely to be harmonised further after 2008. The Commission is required to specify a harmonised method of allocation for the 2008-2012 period and this is likely to incorporate auction of a share of the total allowances. Finally, the Directive allows additional sources and gases to be added to the emissions trading scheme post 2008, which may facilitate greater harmonisation with non-EU schemes.

The legal status of allowances in different national trading schemes and of Kyoto units has been discussed in two presentations at the CATEP Workshops (Yamin, 2001; Hobley, 2003). Hobley concludes that allowances in national schemes under the EU Directive are "property" in a legal sense with the property rights being protected by EU law, the European Charter on Human Rights and the domestic laws of Member States. The legal status of an allowance could differ in other national

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established for the second commitment period, probably 2019 or 2020. A delay of up to 10 years in collecting the non-compliance penalty is not appropriate for commercial firms.

36 In the exchange model it would be done at the time the AAUs are exchanged for domestic trading scheme allowances by the buyer. In the shadow transfer model, it would need to be done at the time the allowances enter the registry of the buyer's country. This would need to be implemented through the transaction log linking the registries of the national emissions trading schemes.

37 Assume that country F does not allow imports of AAUs associated with safety valve and/or non-compliance allowances. Those AAUs could be sold to another Annex I Party (country G) that does not restrict imports of such allowances. Then country G's AAUs could be sold to country F, effectively circumventing country F's restriction.

38 The EU Directive would apply to over 25 of the 37 Annex B country Parties. Since two countries have indicated that they will not ratify and some Parties are unlikely to implement national emissions trading schemes, there may be only four or five national trading schemes (Canada, Japan, Norway, Switzerland) not governed by the Directive.

schemes; the Clean Air Act in the United States, for example, states that an SO_2 allowance does not constitute a property right.[39]

The Marrakech Accords state that "the Kyoto Protocol has not created or bestowed any right, title or entitlement to emissions of any kind on Parties included in Annex I."[40] This may mean that Kyoto units have a different legal standing than an allowance in a national emissions trading scheme. If all of the national allowances and the Kyoto units can be used to comply with an obligation to hold an allowance for each tonne of emissions and if the regulations clearly specify the conditions under which one unit can be exchanged for another, differences in legal status may have little practical impact. But the implications of differences in the legal status of allowances in the national emissions trading schemes and of Kyoto units on links between schemes has not yet been thoroughly analysed.

7. Summary

It is technically possible to link national emissions trading schemes with widely divergent designs. Where design differences create potential problems, technical solutions are available. The greater the similarity of their designs, the easier schemes are to link.

During the 2005 - 2007 period the EU Directive, if it is adopted, will lead to the establishment of at least 25 national emissions trading schemes. The Directive specifies many of the design features of these schemes, but leaves the allocation of allowances, rules for banking allowances into the commitment period, use of the opt-out provision, and a few other design features to Member States. The resulting differences among Member State schemes are unlikely to undermine the links between the schemes established by the Directive. The Community may enter into agreements with non-members for mutual recognition of allowances between their emissions trading schemes, but few, if any, links of this type are expected prior to 2008 for practical reasons.

Beginning in 2008, Article 17 of the Kyoto Protocol establishes an international emissions trading scheme that can link the national trading schemes of Annex I Parties. It imposes no requirements for harmonisation on the national emissions trading schemes linked. Some design differences could create technical problems, although solutions are available and at least one of the governments involved has an incentive to solve the problem. Adverse competitiveness impacts due to differences in the distribution of allowances across national schemes may need to be addressed through institutions such as the WTO. Most of the national trading schemes will also be subject to the EU Directive and be subject to greater harmonisation after 2008.

The result is likely to be a progressive expansion and integration of greenhouse gas allowance markets over the next decade (Drexhage, 2003).

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39 United States, *Clean Air Act*, section 403(f), "An allowance … is a limited authorization to emit sulfur dioxide in accordance with the provisions of this title. Such allowance does not constitute a property right."

40 United Nations Framework Convention on Climate Change, 7th Conference of the Parties, Decision 15/CP7, November, 2001.

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EFFICIENT AND EFFECTIVE USE OF TRADEABLE PERMITS IN COMBINATION WITH OTHER POLICY INSTRUMENTS

by

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1. Introduction

The use of environmental policy mixes has been advocated by the OECD Environment Directorate (and others) for many years (see for instance, the OECD *Environmental Outlook and Strategy*). However, surprisingly little work has been done on the conditions under which the use of multiple environmental policy instruments is likely to be preferable to the application of a single policy instrument. Moreover, little work has been done on examining the combinations of policy instruments which are likely to serve as effective and efficient complements.

The links between tradeable permits and other policy instruments is explored in this report. It builds on previous work (Johnstone 2002) which discussed these issues from a theoretical perspective in a more detailed manner, and examined the links between tradeable permits and five types of environmental policy instruments:

- direct regulations;
- taxes and charges;
- environmentally-motivated subsidies;
- voluntary agreements; and,
- other tradeable permit systems.

The earlier report focussed on instances in which the instruments were targeted at the same environmental damage arising from the same sector. As such, important related questions such as the links between measures which target different sources, or the links between measures which target technologically-related (i.e. joint product) or environmentally-related (i.e. synergistic) pollutants were not addressed in a systematic manner. However, as an initial exploratory study it was felt necessary to focus on the simplest cases.

The earlier report also found that in many cases the use of an environmental policy mix can decrease economic efficiency, and in some cases also reduce environmental effectiveness. In most cases, administrative costs are also likely to rise. Thus, using "two stones to kill one bird" is not usually a sensible policy prescription. However, this is by no means always the case — and some of the conditions under which the use of two instruments might be warranted were identified. In this report, these conclusions are explored in greater detail — focussing on the implications for policy design.

Four motivations for introducing different policy instruments as part of a policy mix are addressed in this paper:

- reducing abatement cost uncertainty;
- overcoming technology market failures;
- increasing behavioural responsiveness; and,
- addressing local environmental impacts.

It will be argued that under certain conditions a combination of instruments may be preferable to the use of one or other on their own. As in the previous report, this paper concentrates on cases in which more than one instrument is used to hit the same environmental target - i.e. a given environmental damage.

2. Reducing abatement cost uncertainty

One of the great advantages of tradeable permit schemes (or at least cap-and-trade tradeable permit schemes) is their environmental certainty. Relative to all other environmental policy instruments, they provide — assuming perfect monitoring and complete enforcement — complete certainty with respect to the total level of emissions. This is not true of performance standards since even if they are expressed in absolute terms (i.e. emission limits) they can not address issues of firm entry and exit. Nor is it true of technology standards, for which there is additional uncertainty arising from the abatement effort - emission level relationship. Even taxes and charges do not provide environmental certainty since they are dependent upon the firms' behavioural responses, which are unknown ex ante.

The flip-side of this relative certainty with respect to emission levels is, of course, considerable uncertainty with respect to abatement costs. This issue was addressed almost thirty years ago by Roberts and Spence (1976). In effect by fixing the environmental impacts with greater certainty, ex ante estimates of abatement costs become more uncertain. In political terms this is not unimportant. In some cases excessively lenient caps have been introduced in order to ensure that abatement costs are not excessive. In other cases proposals to introduce tradeable permit schemes have been abandoned altogether.

One solution would, of course, be to introduce a different instrument when there is considerable abatement cost uncertainty. However, it is possible to do better still. Through the use of combinations of policy instruments it is possible to "bound" this uncertainty in a way which increases the economic efficiency of the environmental policy regime. In effect, by introducing taxes when abatement costs are greater than expected, the policy maker is able to place an upper bound on permit prices.

Analogously, by providing subsidies to firms when abatement costs are lower than expected, the policy maker places a lower bound on permit prices.

This is important from a social welfare perspective. Assuming that the cap was initially set at a level which was assumed to be optimal, deviations from the expected equilibrium permit price indicate that marginal costs will not equal marginal benefits. By placing upper and lower bounds on the possible deviation — the use of taxes and subsidies serve to constrain welfare losses relative to the optimal equilibrium.

Do environmental policy makers actually do this? The answer is quite clearly yes, although usually only in the upward direction. For instance, in the Danish CO_2 permit trading case for the electricity supply industry, the penalty for non-compliance was set at a relatively low DKK 40/ton. In effect this has set an upper bound on permit prices. While the permit price has not reached this level, it is clear that the presence of the "cap" helped to ensure that the measure was politically acceptable (Pedersen 2003).

Similarly in the original proposals for the EU Directive on greenhouse gas emissions trading, the permit price cap was set at EUR 50/ton in the first phase and EUR 100/ton in the second phase (CEC 2001). However, it also included the provision that the penalty shall be twice the average market price if higher than these levels. In a subsequent amendment to the Directive this provision was removed (CEC 2002). In effect, by removing this clause the penalty becomes a price cap, which would have not been the case under the previous system proposed. Indeed, the Commission explicitly stated that price certainty was the objective of the amendment.[1]

There are not any obvious examples of cases in which countries have explicitly introduced subsidies which are "triggered" if the permit price falls too low. However, it is clear that there are many on-going subsidy programmes which serve to depress permit prices on a continuous basis. For instance, capital depreciation allowances for carbon-free technologies would serve this role.

The down-side of "bounding" permit price uncertainty is, of course, that emission levels become more uncertain. In particular, emission reductions with abatement costs in excess of the cap will increase indefinitely. Analogously, when the magnitude of the subsidy has been pre-determined, emission reductions will continue to be undertaken as long as the magnitude of the subsidy exceeds marginal abatement costs.

Arguably this increased cost certainty can also be achieved with the permit trading programme by keeping permit reserves available for use. For instance, under the US SO_2 Allowance Trading program the government initially held reserves of permits which it could have released onto the market if the price had reached USD 1 500 (see Tietenberg 1998). In practice, permit prices never approached this threshold, but some initial estimates were sufficiently high to elicit some concern about compliance costs. However, such a scheme has the disadvantage that the price can only be capped for as long as the reserve holds - excessive demand will eventually drive the price higher. Thus, the price effects are less certain, undermining the benefits in terms of reduced uncertainty. On the other hand, of course, the environmental effects are more certain with a permit reserve since under a tax-based price cap the government has no direct control over emissions.

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1 Conversely, in the UK's landfill permit scheme for biodegradable municipal waste, the government considered the possibility of introducing a cap through a penalty/tax, but felt that this was unnecessary since there was little uncertainty concerning the costs of waste diversion (UK DETR 2001).

Whether or not a regulatory authority decides to bound permit prices through the joint use of taxes and subsidies alongside tradeable permits is likely to be more of a political question than an economic one. Getting acceptance for tradeable permit schemes has not been politically easy in OECD Member countries, and amongst others, those firms which are directly affected by the programme have presented some of the most significant obstacles. This is of course, not surprising if permits are auctioned, but in some cases it has also been true when permits have been allocated gratis.

3. Overcoming technological market failures

The incentive effects associated with the introduction of tradeable permits is, of course, entirely a consequence of changes in relative prices. A tradeable permit system increases the opportunity cost associated with emitting a particular pollutant, and thus production technologies and management practices which are relatively intensive in the emission of that pollutant become relatively less attractive in the marketplace. Firms and households will respond by reducing their demand.

In the long run, this should result in significant benefits in terms of the innovation and diffusion of environmentally-less damaging technologies. Indeed, it should do so more effectively than other types of policy instruments. Firstly, given that all emissions face an opportunity cost and not just those beyond a prescribed level, it will provide incentives above and beyond the levels arising from other policies such as performance standards or emission limits. Secondly, given uncertainties about the optimal direction of environment-saving technologies, the non-prescriptive nature of tradeable permit regimes which are targeted relatively directly on the externality concerned are less likely to result in sub-optimal technology choices than other measures such as technology-based standards or input or capital subsidies.

There is a vast body of theoretical literature which supports the view that tradeable permits (along with environmental taxes) provide the strongest and most efficient incentives for environmentally-preferable technological change (see Johnstone 1999 for a discussion of some of the literature). However, most such literature assumes that the only market failure which exists is that which relates to the existence of the environmental externality. Other markets are behaving perfectly. In many cases this is clearly not the case.

In particular, it is generally argued that due to the pervasiveness of positive externalities in technology development and diffusion, market forces will not generally provide the optimal rate of innovation in the absence of government intervention. These externalities arise due to the "spillovers" which exist in technological development and diffusion. A number of related factors may be at work (see Jaffe *et al*. 2002), including:

- difficulty of excluding others from the benefits of applied research and product development, resulting in firms not having sufficient incentive to undertake the necessary investments; and,

- credit market failures which discourage lenders from providing loans to firms for low-probability high-return investments such as research and development of new technologies.

Such failures can slow the direction of technological change. Even if the tradeable permit system should be providing the types of incentives for innovation in newer environmentally-preferable technologies, the rate of such innovation may be slower than that which is optimal. Thus, in the presence of joint market failures (environmental and technological) there may be a case to be made for the joint application of two environmental policy instruments. More particularly, it may be preferable to use a tradeable permit system to address the environmental externality and another complementary measure to address the technology market failure.

The appropriate tool to address the latter is dependent upon the nature of the failure. In some cases, OECD Member country governments support research "clusters" to encourage the internalisation of external benefits across firms. In other cases, they become more directly involved through public-private partnerships, perhaps underwriting some of the risks associated with technological development. And in still other cases, they provide direct support for environment-related research and development (see OECD 1998a and 1998b for discussions).

There is no such question that such measures are likely to increase the rate of technological change. However, in all such cases it is important to bear in mind that one of the great benefits of tradeable permits is undermined — namely the benefits of neutrality with respect to the direction of technological change. Any measure which seeks to overcome such technology market failures is almost always prescriptive with respect to the direction of technological change — picking winners is no easy task, and thus it may be better to use 'neutral' policies such as support for basic research and strengthened intellectual property rights.

There is, therefore, a trade-off. Policy makers must balance the potential benefits of increasing the rate of environmentally-preferable technological change with the costs of misdirecting the trajectory of such change. Jointly applying tradeable permits and technology-oriented policies can provide a means of making these trade-offs in a more satisfactory manner. However, a recognition of the links between the two types of policy, and an understanding of the potential dangers associated with using policies which are prescriptive with respect to the direction of technological change is key.

4. Increasing behavioural responses

Market failures may not only affect the supply side of the market for environmentally-preferable technologies, but also the demand side. There are two principal reasons why this might arise:

- due to the presence of consumption externalities potential demanders of a new technology may be unwilling to undertake initial purchases until there is evidence that the technology is economic; and,

- due to inadequate information about the environment-related environmental characteristics of different potential substitute goods and services, households and firms may not be able to express their preferences effectively in the marketplace.

In both cases, demand for environmentally-preferable goods and services may be less than optimal — even in the presence of a tradeable permit scheme which affects relative prices in such a way as to encourage their diffusion. The potential market for environmentally-preferable technologies is constrained by information failures in the market. In such cases it may be economically efficient to complement a tradeable permit system with measures which are targeted at potential consumers, increasing responsiveness on the demand side. For instance:

- consumption externalities might be addressed through a demonstration project or an information campaign related to environmental technologies; and,

- other information failures might be addressed through measures such as eco-labels and certification schemes which give consumers the information necessary to express their preferences in the markets.

A good example of the potential importance of the latter case is provided by Newell *et al.*, (1998), in a study of product innovations for energy-using household appliances. Looking at the energy-efficiency of air conditioners and water heaters offered for sale in the United States, Newell *et al*. (1998) estimated the responsiveness of manufacturers to rising energy prices, before and after the introduction of an energy labelling scheme in 1975. The results indicate that the effects of energy price changes on the mean efficiency of appliances supplied by manufacturers rose appreciably (and became statistically significant) once appliances were labelled.

While the introduction of such policies are not costless they can be effective complements to tradeable permits. This is likely to be true in cases where there are significant differences in short-run and long-run behavioural responses. In effect, the provision of information may serve to reduce adjustment lags.

5. Addressing local impacts for pollutants with heterogeneous impacts

Another great advantage of tradeable permits is their ability to equalise marginal abatement costs across different emission sources. For any given environmental target this minimises total abatement costs. This is, of course, untrue of other environmental policy measures such as performance standards or technology standards. With heterogeneous firms such measures can never result in the minimization of total abatement costs, except at inordinate administrative cost.

However, while this means that tradeable permits are a cost-effective means of meeting given levels of emissions, it does not necessarily mean that they are economically efficient. For any pollutant in which the impacts differ by place of emission (i.e. which is not a pure public bad such as carbon dioxide or ozone-depleting substances), the equalisation of marginal abatement costs will not be economically optimal. In effect if the spatial scale of the tradeable permit market incorporates sources with heterogeneous environmental impacts, a single undifferentiated market for tradeable permits will not be economically optimal.

In such circumstances, regulatory constraints are often used to protect local environmental conditions. For instance, in the United Kingdom, the architects of the proposed trading programme for NO_x and SO_x have made it clear that the regime would have to protect local environmental conditions. However, it is not yet clear whether this would require the application of "Best Available Technologies" as directed under the IPPC Directive, which would severely restrict trading opportunities (see Palmer and Davies 2002).

Even in the American SO_2 Allowance Trading program — arguably the 'purest' existing tradeable permit system - there are regulatory constraints imposed to protect local environmental conditions. For instance, in Wisconsin, local air pollution regulations prevented generators from buying permits even though their marginal costs exceeded the prevailing permit price. In Illinois, the use of scrubbers was mandated (see Conrad and Kohn 1996 and Fullerton *et al*., 1997). In New York, the Department of Environmental Conservation filed a suit to force the EPA to use "deposition standards" to restrict the use of permits in environmentally-sensitive areas (see Tietenberg 1995).

It would, of course, be possible to protect local environmental conditions within the tradeable permit scheme itself. For instance, in the Los Angeles RECLAIM program for NO_x and SO_x permits are restricted between sellers in the coastal zone to buyers in the inland zone due to the more significant ozone concentrations in the latter area. In the EPA's NO_x programme for the northeast of the United States, there were discussions about the use of trading ratios, with sellers from high-ambient zones receiving proportionately more for each permit sold (see Nash and Revesz 2001).

However, all such measures complicate and 'thin' the market for tradeable permits. Given the widespread concerns about the need for markets to be simple and deep (see OECD 2001), it may therefore be preferable to use direct regulations as a 'backstop', ensuring that particular thresholds are not exceeded. This is further supported by the fact that trade restrictions of the sort described above will have uncertain environmental consequences unless the regulator is able to forecast market developments in the affected zones with precision.

6. Conclusions

As a general principle it is unlikely to be economically efficient and environmentally effective to "kill one bird with two stones". In many instances it is likely to be administratively costly, economically inefficient, and/or environmentally ineffective. However, there are conditions under which it may be necessary to use two instruments, and this report has discussed four such cases. Indeed, there are certainly other cases as well, indicating that efficient environmental policy is often likely to involve the use of mixes of instruments, even when targeting the same environmental damage arising from the same source.

However, in all cases the objective of each instrument must be clearly defined, and the relationship between the two instruments must be properly understood. Thus in order for the use of an additional policy instrument to be increase efficiency and effectiveness in the presence of a tradeable permit system, the "complementary" instrument must:

– meet a legitimate policy objective which can not be met more efficiently through the tradeable permit system itself;

– be the best instrument available to the regulatory authority if it is to meet that policy objective;

– preserve the benefits of the tradeable permit system (i.e. abatement cost reduction, dynamic incentives, environmental certainty) to the greatest extent possible; and

– be administratively feasible at reasonable cost.

These conditions are by no means easy to fulfill. As such, designing an efficient and effective combination of environmental policy instruments is one of the great challenges facing policy makers today.

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TURNING AN EARLY START INTO A FALSE START: IMPLICATIONS OF THE EU EMISSIONS TRADING DIRECTIVE FOR THE UK CLIMATE CHANGE LEVY AND CLIMATE CHANGE AGREEMENTS

by

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1. Introduction

The recent agreement by European environment ministers on the ground rules for an EU Emissions Trading Scheme (EU ETS) represents a landmark in the evolution of EU climate policy. The proposed scheme will initially cover some 45% of EU CO_2 emissions and is expected to expand over time to cover more sectors and greenhouse gases (GHGs). As the EU is enlarged, the scheme will cover an increasingly large proportion of total Annex I emissions under the Kyoto Protocol.

In parallel with the development of this scheme, individual Member States have introduced a range of national climate policies, including carbon/energy taxes, negotiated agreements, regulatory standards and support schemes for renewable electricity. The result is a very crowded 'policy space' in which complex interactions between the EU ETS and existing instruments appear unavoidable (Majone, 1989, p158-161). These interactions could be complementary and mutually reinforcing but there is also the risk that the instruments will interfere with one another and undermine the overall efficiency and effectiveness of the policy mix.

The problem of policy interaction applies in a particularly acute form to the UK, which has established a complex, elaborate and interdependent mix of climate policies over the last four years (DETR, 2000). These policies are operational and are delivering real emission reductions, but a range of conflicts with the EU ETS may lead to substantial changes being made (Sorrell, 2003a). None of

1 The author would like to acknowledge that this research has been supported by the European Commission under the project *Interaction in EU Climate Policy (EVK2-2000-00613)*. The author would like to thank Catherine Boemare and Phillipe Quirion of the Centre International de Recherche sur l'Environnement et le Développement (CIRED) for collaborating on an earlier version of this paper, and also Jos Sijm of the Energy Research Centre of the Netherlands (ECN) whose insights into policy interaction have been extensively employed. Thanks also to other colleagues on the INTERACT project and to the many individuals from UK government and industry who gave up their valuable time to be interviewed. The usual disclaimers apply.

this was anticipated when the UK Climate Programme (UKCP) was developed and the future shape of that Programme remains uncertain.[2]

This paper explores one aspect of the problems created by the EU ETS — namely the potential interactions with the UK Climate Change Levy (CCL) and associated Climate Change Agreements (CCAs). The former is an energy tax for the business and public sector, while the latter is a system of negotiated agreements with energy intensive industry that provide participants with partial exemption from the CCL. An important feature of the CCAs is that they incorporate baseline and credit trading arrangements as part of the wider UK emissions trading scheme (UK ETS). While the primary objective of the CCL/CCA package is to reduce CO_2 emissions, the design of the package reflects wider objectives such as avoiding energy price increases for low income consumers.

The paper first describes the proposed EU Directive, outlines the main features of the CCL and CCAs and introduces the concepts of 'direct', 'indirect' and 'trading' interaction. It then explores the potential interactions between the EU ETS and the UK instruments by comparing in turn their scope, timing, objectives and operation. The coexistence of the EU ETS with the CCL/CCA package is shown to raise four important issues, namely double regulation, double counting of emission reductions, equivalence of effort and the fungibility of trading commodities. The paper concludes with some general recommendations for the future development of UK climate policy.

2. The EU emissions trading scheme

On the 23rd October 2001, the European Commission issued a proposal for an EU-wide scheme for greenhouse gas emissions trading (European Commission, 2001). This was approved, although in different terms, by the European Parliament on the 10th October 2002 and European Council on the 9th December 2002. The proposed Directive will be sent to the European Parliament for a second reading in 2003, with remaining differences to be resolved through conciliation between the Council and the Parliament. The Directive should be adopted in late 2003, which means that there is a good chance that the scheme will come into force in 2005 as planned.

The design of the EU ETS represents a pragmatic compromise between economic efficiency and political acceptability. The Council text accommodates the concerns of key Member States such as Germany and has won the broad support of both industry lobbyists and mainstream environmental groups. There is much work still to be done, notably in devising acceptable allocation rules at the national level (Harrison and Radov, 2002). But the key elements are now in place for a historic leap forward in the implementation of market-based environmental instruments.

The EU ETS is a downstream 'cap and trade' scheme along the lines of the US Acid Rain Program. The ~5000 participants in the scheme include electricity generators, oil refineries and energy intensive manufacturing installations in sectors such as iron and steel, paper and minerals. Estimates made on behalf of the Commission suggest that the scheme will reduce total abatement costs by some 24%, leading to cost savings of some EUR 2.1billion/year by 2010 (Capros and Mantzos, 2000). Table 1 summarises the main features of the December 2002 Environment Council agreement (Council of the European Union, 2002) and compares it to the European Parliament proposals (European Parliament, 2002).

2 The recent Energy White Paper (DTI, 2003) acknowledged the central importance of the EU ETS for future UK climate policy, but provided few details on how the existing policy mix could evolve. In April 2003 the government set up an interdepartmental working group to examine this question.

Table 1. Key elements of the EU ETS — comparing Council and Parliament proposals

Feature	EU ETS proposals
Compliance periods	Phase 1: 2005-2007 Phase 2: 2008-2012 (i.e. the first Kyoto Protocol commitment period)
Type of target	Absolute targets (Council) Mixture of absolute and relative targets (Parliament). New entrants and extending installations to receive allowances in the same way as other participants. Closing plants will not continue to receive allowances
Allocation of allowances	Phase 1: Free (Council); 15% auctioning (Parliament). National allocation plans subject to approval by the Commission Phase 2: maximum 10% auctioning (Council); 15% auctioning (Parliament)
Sectors included	All combustion plant >20MW thermal input, including electricity generators Oil refineries, coke ovens, ferrous metals, cement clinker, pulp from timber, glass and ceramics. Parliament: also Chemicals Based on IPPC, but some IPPC sectors excluded (e.g. food and drink, waste incineration) Sites below IPPC size thresholds in eligible sectors may also be included
Size of market foreseen	4000-5000 installations 45% of all EU carbon dioxide emissions
Basis	Phase 1: only direct CO_2 emissions (Council); other gases may be included (Parliament) Phase 2: other gases may be included, provided adequate monitoring and reporting systems are available and provided there is no damage to environmental integrity or distortion to competition
Links with JI/CDM	Emission credits from JI and CDM projects to be recognised from 2005 (Council) or 2008 (Parliament), subject to 'modalities' to be adopted by the EU by 2005
Links with other schemes	Agreements with third parties listed in Annex B of the Kyoto Protocol may provide for the mutual recognition of allowances between the EU ETS and other schemes
Monitoring, Reporting & Verification	Common monitoring, verification and reporting obligations to be elaborated Verification through third-party or government authority
Allowance tracking	Linked/harmonised national registries with independent transaction log
Sanctions	Phase 1: EUR 40/tCO_2 penalty (Council), EUR 50/tCO_2 (Parliament) + restoration in next period Phase 2: EUR 100/tCO_2 penalty + restoration in next period
Banking	Banking across years within each compliance period Member States can determine banking from Phase 1 to Phase 2 (Council) Banking allowed (Parliament)

Source: European Parliament (2002), Council of the European Union (2002).

The Directive was the subject of intense negotiation and the Commission found it necessary to compromise in several areas in order to secure political agreement. Four particularly contentious issues were:

i. *Opt-outs (Article 23a-Parliament, 25a-Council)*: The Commission proposed a mandatory scheme, but this was opposed by the UK and Germany. The Parliament text allows installations to opt-out during Phase 1 (2005-2007), but participation is mandatory during Phase 2 (2008-2012). The Council text extends this temporary exemption to 'activities' (sectors). According to both texts, opt-outs will only be permitted if installations/activities can demonstrate equivalence in terms of emission reductions, monitoring, reporting and verification requirements and the penalties for non-compliance.

ii. *Opt-in and phase-in (Article 2a-Parliament, 23a Council)*: The Parliament text contains two provisions for an early extension of the ETS. First, Member States shall be able to extend the scheme to additional sectors, activities and installations (opt-in) from 2005, although the Commission may reject these proposals. Second, other gases shall be phased in as soon as methods of measurement, monitoring and calculation are developed by the Commission. The Council text allows unilateral extensions only from 2008, while harmonised extensions require an amendment to the Directive.

iii. *Allocation (Article 9 and Annex III)*: The Council text requires free allocation during Phase 1, while Member States are allowed (but not required) to auction up to 10% of allowances during Phase 2. The Parliament text demands 15% auctioning for both Phases. In both texts, national allocation plans are subject to approval by the Commission and must be consistent with national burden sharing targets, progress towards meeting those targets, national energy and climate change policies, the technological potential of the installation to reduce emissions and state aid and internal market rules. This mixture of top-down and bottom-up requirements will be difficult to interpret and disputes over allocation could lead to delays.

iv. *Interfaces (Article 26):* Another directive will develop 'modalities' governing links between the EU ETS and the Kyoto project-based mechanisms (JI and CDM) during 2003, while mutual recognition agreements may be signed between the EU ETS and trading schemes created by other Parties to the Kyoto Protocol. The prospect of such links could reopen the supplementarity debate, as there is a risk that the purchase of 'hot air' will substitute for domestic abatement (Climate Action Network Europe, 2003).

3. The UK Climate Change Levy and Climate Change Agreements

3.1 The Climate Change Levy

The Climate Change Levy (CCL) was introduced in April 2001 and is a downstream, revenue-neutral energy tax for business, commerce and the public sector. The CCL is levied at different rates on coal, gas and electricity use, with oil products, CHP fuel and renewable electricity being exempt. The government chose a downstream tax, combined with indirect treatment of electricity,[3] in order to avoid energy price increases for households living in 'fuel poverty' — defined as those spending more than 10% of their income of energy. Similarly, the government chose an energy tax rather than a carbon tax to protect what remains of the UK coal industry. These decisions have influenced the entire shape of the UKCP and have created serious compatibility problems with the EU ETS.

The size of the levy represents a compromise between climate and competition policy objectives, reached in the context of heavy industrial lobbying. Table 2 illustrates that the CCL corresponds

3 Downstream means the tax is applied to energy consumers, rather than upstream to suppliers of primary energy commodities. Indirect means that the tax is applied to electricity consumers, rather than directly to the fuel input to electricity generation.

approximately to a EUR 11.4/tCO_2 tax for natural gas, a EUR 6.4/tCO_2 tax for coal and a EUR 13.1/tCO_2 tax for the primary fuel input to electricity generation. Together with the exclusion of oil, these figures illustrate the variance of the CCL from a straightforward carbon tax and the disincentive it creates for switching to fuels with a low carbon content. Oil is subject to excise duties, which correspond to an equivalent carbon tax of EUR 12.5/tCO_2 for heavy fuel oil and EUR 16.2/tCO_2 for gasoil.[4] Excise duties are a legacy of policies imposed in the 1970s to reduce dependence upon imported oil, and have been retained despite the UK being a net exporter of oil for nearly two decades. While the CCL improves the competitiveness of oil compared to gas and coal, it still leaves it taxed at a higher rate on a carbon equivalent basis.

Table 2. CCL rates and equivalent carbon tax rates

Fuel	Rate c/kWh	Equivalent in EUR/tCO_2	Equivalent in EUR/tC
Gas	0.21	11.4	41.7
Coal	0.21	6.4	23.4
Delivered electricity	0.60	13.1	48.0

Notes:

1. Converted to EUR assuming GBP 1 = EUR 1.4.
2. Assumed emission factors: Gas = 51.3kgCO_2/GJ; Coal = 91.5kgCO_2/GJ. Assumed delivered to primary conversion factor = 2.60. Assumed average carbon emissions factor for primary electricity = 0.17kgCO_2/kWh. These assumptions correspond to those used for the CCAs.

The CCL increases average industrial coal, gas and electricity prices by 32%, 27% and 12% respectively compared to 1999 levels (DTI, 2002). The price impact of the Levy has been undermined, however, by trends in industrial electricity prices. These fell by 23% between 1995 and 2001 while the fall between 2000 and 2002 more than offset the increase from the CCL.

The CCL is intended to raise around GBP 1 billion each year, but overall revenue neutrality is achieved through a 0.3% reduction in employers national insurance contributions. Some 15% of the revenue is used to fund an R&D programme and a system of enhanced capital allowances for energy efficiency investment. The perception of revenue neutrality has been undermined by the subsequent increase in employers national insurance contributions in 2003. The fact that industry has been a net loser from the CCL while the service sector has been a net winner, coupled with the economic difficulties faced by UK manufacturing industry have ensured continuing opposition to the CCL from industry lobby groups (CBI, 2002).[5]

The price incentive of the CCL is anticipated to contribute a reduction of 7.3MtCO_2/year between 2000 and 2010, 'including the exemption for CHP and renewables', while the capital allowances are expected to contribute an additional 1.83MtC. The total figure of 9.2MtC/year corresponds to ~5.8% of emissions from the fuel and electricity use that is subject to the full CCL.

4 Current excise duties are EUR 38.7/tonne for HFO and EUR 51.1/tonne for gasoil. The combustion of one tonne of HFO leads to emissions of 3.11tCO_2, while the corresponding figure for gasoil is 3.14tCO_2.

5 In addition, many firms failed to connect the money saved on staff costs with the increased expenditure on energy (Ekins *et al.*, 2002).

3.2 The Climate Change Agreements

The Climate Change Agreements (CCAs) are negotiated agreements between energy intensive 'facilities'[6] and the government and cover the period 2001 to 2013. CCAs give facilities exemption from 80% of the CCL, provided they take on binding targets for energy use or CO_2 emissions. The targets are defined for two-yearly intervals up to 2010 and may be either absolute or relative. The penalty for non-compliance is a return to paying 100% of the CCL for the following two years. Eligible facilities are those located in sectors which are regulated under the Integrated Pollution Prevention and Control (IPPC) Directive and include many facilities which lie below the IPPC size threshold.[7] CCAs have been negotiated with 44 industrial sectors representing around 6000 industrial facilities, and the government initially estimated that these would reduce CO_2 emissions by 9.2 $MtCO_2$/year by 2010. This corresponds to ~12% of baseline emissions (DETR, 2000).

The CCAs vary widely in their choice of base year, the improvement required over a business as usual baseline, the assumptions used about production levels and product mix, and the provisions for 'risk management'.[8] In all cases, the targets are based upon a percentage of the 'cost effective' energy efficiency potential, identified through modelling work by AEA Technology (ETSU 2001). Several commentators have argued that the targets are weak, as a consequence of information asymmetry, limited sectoral and technology disaggregation in the AEA database, the restriction to currently available technology, the choice of simple paybacks rather than discounted cash flow for investment appraisal, the very short paybacks used (2 to 4 years) and the fact that only a percentage of cost effective improvements are required (Sorrell and Smith, 1999; Waller, 2001). In response, industry has emphasised the importance of hidden costs, such as management time and constraints on capital availability (ETSU, 2001). However, the ease with which most CCA facilities have met their first milestone targets in 2003 suggests that the perception of weak targets is correct.[9]

In addition to the basic agreements, the CCAs incorporate trading arrangements as part of the UK ETS. These arrangements allow individual CCA facilities to generate 'allowances' if they perform better than their target, and to use allowances for compliance if they perform worse than their target. Sale of allowances is only possible ex-post, once compliance with the milestone targets has been verified. Allowances can be traded with other CCA facilities and also with the 'direct participants' in the UK ETS. The latter have been subsidised to adopt absolute emission targets, thereby forming a cap and trade scheme in the UK (DEFRA, 2001). A third component of the UK ETS, for domestic emission reduction projects, is currently under development (Begg *et al.*, 2002).

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6 A facility comprises one or more IPPC installations and may also include other activities. For example, where an installation (or group of installations) consumes more than 90% of a site's energy use, then all of the energy use at the site will be covered by a CCA.

7 Regulation under IPPC is a poor proxy for energy intensive industry, but was chosen for administrative convenience. Some energy intensive sites in non-IPPC sectors (e.g. horticulture) are also included.

8 Some sectors are allowed to adjust their targets if there are changes in product mix or output level, while others have adopted a 'tolerance band' around their target.

9 Overall, CCA facilities reduced emissions by 15.8$MtCO_2$/year below the baseline, or 13.5$MtCO_2$/year below an 'equivalent' 2000 baseline (FES, 2003). This is more than three times the cumulative target for the first milestone and significantly greater than the final target for 2010. Some 70% (9.5 $MtCO_2$/year) of this was contributed by plant closures and output reductions in the steel industry, but the rest of industry reduced emissions by 4$MtCO_2$/year, or 25% more (1$MtCO_2$) than required by the first milestone target.

The inclusion of CCA trading arrangements is to the benefit of CCA facilities but has complicated the design of the UK ETS. Relative targets create problems as increases in output can lead to increases in emissions — although this is constrained in the short term by production capacity. To prevent any violation of the emissions cap for direct participants, a 'Gateway' had to be established to prevent the net sale of allowances from the CCA sector to the direct participant sector (Sorrell, 2001a).

Trading offers CCA facilities a highly cost effective route to avoiding non-compliance penalties, since the cost of purchasing allowances to cover marginal exceedances of the CCA target is much less than the cost of CCL payments on all fuel and electricity use over a two-year period.[10] This is especially the case in the oversupplied UK market, where 'hot air' surpluses from several of the direct participants have helped to push UK ETS allowance prices as low as EUR 4.2/MtCO_2. Trading also creates an incentive for overcomplying facilities to sell allowances outside their sector, rather than subsidise their competitors by contributing to overall sector compliance.[11] As a consequence, the incentive for individual facilities to free ride is much diminished. Overall the trading arrangements have both increased the incentive for individual facilities to comply with their targets, and provided a cheap mechanism with which to do so.

4. Problems of policy interaction

The existence of the CCL/CCA package will significantly complicate the implementation of the EU ETS in the UK and lead to complex problems of policy interaction. In exploring these interactions, a distinction should be made between directly and indirectly affected target groups. A directly affected target group has obligations and incentives imposed upon it directly by a policy instrument, while an indirectly affected target group is influenced in some way by the behavioural changes that are made by the directly affected group.[12] While indirect effects permeate throughout the economy, it is the first order impacts on electricity consumers that are of particular interest.

The potential interactions between the EU ETS and CCL/CCA package relate to both directly and indirectly affected target groups. *Direct interaction* occurs when a target group is directly affected by two of the policies, while *indirect interaction* occurs when a target group is indirectly affected by one policy and either directly or indirectly affected by a second. So, for example, there is indirect

10 As an illustration, assume a firm with an annual electricity consumption of 1GWh. Its CCL liability for electricity is EUR 6 020. Assume it agrees to a CCA with a target of 10% saving in electricity use (100MWh) in return for a CCL exemption worth EUR 4 816 (80% of EUR 6 020). Assume it only achieves a 5% improvement (50MWh). To make up the shortfall, the company needs to buy allowances for 50MWh or 21.5tCO_2 (assuming a carbon intensity of delivered electricity 0.43tCO_2/MWh). At an allowance price of EUR 5/tCO_2, that would cost EUR 108. In contrast, the cost of losing the exemption for two years would be 111 times greater at EUR 12 040.

11 This was reflected in the results for the first milestone period (FES, 2003), where most overcomplying facilities 'ring fenced' their surplus. Karen Gilbert of the National Farmers Union comments that: "Emissions trading moved the goalposts, and went against the ethos of collaboration which we'd used to sell the CCA idea to our members" (ENDS, 2003).

12 Of particular interest is the extent to which the additional costs imposed by a policy instrument on the business sector are indirectly borne by either consumers, suppliers or shareholders (Cramton and Kerr, 1998). So for example, electricity generators participating in the EU ETS may either increase wholesale electricity prices (pass to consumers), reduce the consumption or unit price paid for supply inputs (pass to suppliers) or reduce dividends and capital gains (pass to shareholders). In each case, the extent to which costs can be passed on will depend upon the market situation of the firm and the elasticities of demand and supply in each market.

interaction between the EU ETS and the CCL, since both will lead to higher electricity prices for all consumers.

The participation of the CCAs in the UK ETS creates the additional possibility of *trading interaction* or 'linking' (Haites and Mullins, 2001). Here, the two policies may influence one another by the exchange of a GHG allowance. Article 24 of the EU ETS allows for the exchange of GHG allowances with other national/regional GHG trading schemes, which may include the UK ETS. Any such links would need to be governed by transfer and exchange rules, which in combination would define the *fungibility* of the different commodities.

The direct, indirect and trading interactions between the EU ETS, CCL and CCAs can be explored by examining in turn:

i. the *scope* of each instrument, including the sectors, sites and emission sources but that are directly or indirectly affected;

ii. the *timing* of each instrument in relation to each other and the Kyoto commitment period;

iii. the *objectives* of each instrument and the extent to which these reinforce or conflict with one another; and

iv. the *operation* of each instrument and the manner in which obligations and incentives interact.

Issues of scope, timing and objectives are discussed briefly below, while the subsequent section provides a detailed examination of instrument operation.

4.1 Comparison of scope

The differences in the scope of the CCL, CCAs and EU ETS arise at four levels (Sorrell, 2002, p31-67):

i. *Sectoral coverage*: Differences in the sectoral coverage of the CCL, CCAs, IPPC and EU ETS suggest that individual sites in the public, commercial, manufacturing and energy sectors may face one of ten combinations of the four instruments (Figure 1). While the numbered regions in Figure 1 vary in size and importance, each represents real sites and real physical emissions.

ii. *Site coverage*: Differences in the coverage of individual technologies *within* an individual site expands the number of possible combinations of instrument coverage from ten to eighteen**.** The differences relate to the coverage of combustion plant and process plant emissions, the distinctions between core process and ancillary activities, the aggregate size of combustion plant, and the interpretation of regulatory terms such as 'directly associated'.[13] Of particular difficulty is the use of an aggregate 20MWth threshold for inclusion of combustion plant in the EU ETS, compared to a 50MWth threshold for IPPC. This brings in a portion of

[13] There are differences between the definition of an 'installation' under IPPC, a 'facility' under the CCAs, and the boundaries of a 'participant' under the EU ETS, with further complications associated with sites having more than one IPPC installation (Sorrell, 2002).

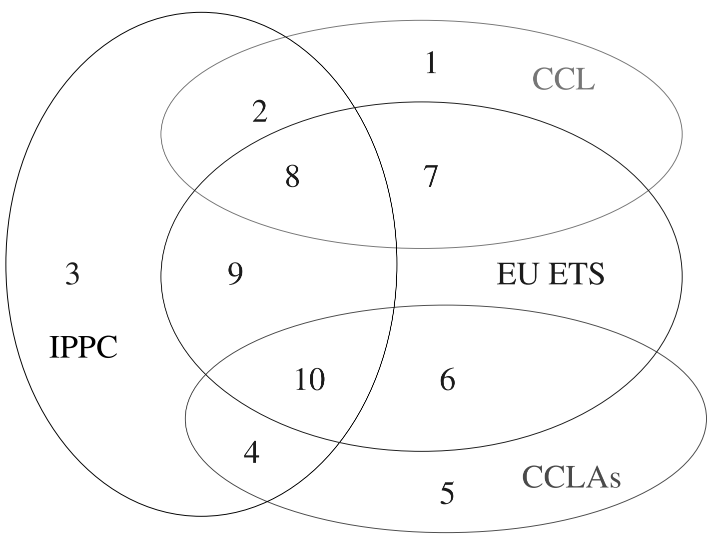
emissions from sectors which are excluded from Phase 1, such as chemicals,[14] together with many unregulated plant which national authorities will have difficulty in identifying.[15]

iii. *Emissions coverage*: Further complications are introduced by the differences in coverage of CO_2 versus other GHGs, combustion versus non-combustion CO_2 emissions, and combustion emissions from different fossil fuels. For example, the EU ETS covers non-combustion CO_2 but the CCAs do not. Similarly, the EU ETS covers all fossil fuels, but the CCL excludes oil products.

iv. *Electricity coverage*: A final layer of complexity is provided by the differing incentives each instrument creates for reducing emissions from electricity generation. Each instrument gives a different mix of direct and indirect incentives to both the supply and demand side of the electricity market, with the result that each instrument incentivises a different mix of abatement options (Table 3). Conflicting definitions of 'renewable' electricity (e.g. energy from waste) complicate this picture still further (Sorrell, 2003b).

Such differences create a complex set of boundary issues that could lead to substantial administrative costs. Also, differential treatment of competing sources could create distortions to competition.

Figure 1. Overlaps between the target groups for the EU ETS, IPPC, CCL and CCAs - showing ten potential combinations of the four policy instruments



[14] Combustion plant at these sites with an aggregate gross thermal input >20MW will be included in the EU ETS. In most cases, the associated process plant will *not* be included since (in UK law) they will not be considered as being 'directly associated' with the combustion plant and hence will not form part of the combustion plant installation. Conversely, if a process plant is included in the EU ETS – on the grounds of being regulated under IPPC in a sector which is eligible for Phase 1 - the associated combustion plant *will* be included in the process plant installation. These distinctions are subtle, require a judgement to be made at the site level, and hinge upon the interpretation of the term 'directly associated' in UK legislation (Environment Agency, 2002).

[15] This provision looks set to create substantial administrative difficulties which are out of proportion to the environmental gain.

Table 3. Incentives for lower carbon emissions from electricity generation in the UK

	Measure	IPPC	EU ETS	CCL	CCA
Supply side incentives	Switch to generation from lower carbon fossil fuel	—	Direct via generator's emissions cap	—	—
	Improve thermal efficiency of generation	Direct via energy efficiency provisions	Direct via generator's emissions cap	—	—
	Invest in nuclear or large hydro	—	Direct via generator's emissions cap	—	—
	Invest in new renewable generation sources	—	Direct via generator's emissions cap	Indirect via increased demand from consumers who have switched to gain CCL exemption	—
Demand side incentives	Purchase electricity from new renewable sources	—	Indirect via price advantage of zero carbon electricity	Direct by exemptions for new renewable electricity	—
	Purchase electricity from nuclear, large hydro or lower carbon fossil sources	—	—	—	—
	Improve efficiency of electricity consumption	Direct via energy efficiency provisions	Indirect via electricity price increases from generators	Direct via CCL on electricity purchases	Direct via energy/carbon targets
	Invest in CHP	Direct via energy efficiency provisions and encouragement of CHP	Indirect via electricity price increases, offset by direct requirement for additional allowances for CHP fuel	Direct via exemptions for CHP fuel	Direct via energy/carbon targets and requirements to assess CHP potential

Note: The table shows the *additional* incentives created by the CCA targets. CCA sites still pay 20% of the CCL.

4.2 Comparison of timing

The EU ETS is in phase with the Kyoto commitment period, but is due to begin well before the CCAs end. In contrast, the CCAs extend beyond the end of the Kyoto commitment period, but targets are only negotiated up to 2010. The emissions trading provisions for the CCAs continue (in principle) up to 2013, but the UK market may diminish significantly in size after 2006 when the direct participant scheme comes to an end.

The timing problems will be reduced by the opt-out provisions of the EU ETS, since these may allow many of the existing CCAs to continue unchanged up to 2007. But, as described below, this may create problems in demonstrating equivalence of effort and the opt-out provisions are unlikely to be continued into Phase 2. Most importantly, the electricity generators and other sectors such as oil refineries will need to join the EU ETS in 2005 since these are not subject to 'equivalent' national regulations. The coexistence of direct treatment of electricity in the EU ETS with indirect treatment in the CCL/CCA package will lead inevitability to double regulation.

4.3 Comparison of objectives

The primary objective of the EU ETS, CCL and CCAs is to reduce CO_2 emissions. But they differ in terms of their relative stringency and the importance they give to various subsidiary objectives.

The stringency of the UK targets under the EU ETS will depend upon the UK government's interpretation of the allocation criteria, while allowance prices in the EU scheme will depend upon Member State interpretation of the allocation criteria and the resulting size of the EU cap relative to the overall abatement cost curve. Allocation should be consistent with both top-down criteria, such as national targets under the burden sharing agreement, and bottom-up criteria such as the technological potential to reduce emissions.[16] In contrast, the CCA targets are based upon a percentage of the 'cost effective' potential to reduce emissions within a sector. In principle, an EU ETS allocation consistent with 'technological potential' could be more stringent than the CCA targets, while an allocation guided by top-down criteria and allowing credit for early action could be less stringent. The situation is complicated, however, by the differences in scope between the instruments and the conversion from relative to absolute targets. In practice, the UK government may seek to use the EU ETS allocation to contribute towards its domestic 'goal' of a 20% reduction in CO_2 emissions by 2010, which may lead to the UK becoming a net buyer of allowances.

The design of the CCL/CCA package reflects multiple explicit and implicit objectives, including the desire to protect domestic consumers, energy intensive industry, and UK coal producers, together with promoting energy efficiency and avoiding a 'windfall' to nuclear generators (Sorrell, 2002). Each of these objectives is threatened by the introduction of the EU ETS. The Directive will disadvantage coal-fired electricity generation and accelerate its decline, raise electricity prices for household consumers, including the fuel poor, improve the economics of nuclear power and impose potentially significant costs on energy intensive industry. The political importance of each of these objectives has changed since the CCL was introduced and is likely to have changed further by 2005 or 2008.[17] But it is clear that the EU ETS is in direct conflict with several of the objectives which have shaped the design of the CCL/CCA package and wider UK climate policy.

5. Interactions in instrument operation

How the instruments interact in practice will depend upon how the EU ETS is finally framed and implemented, and whether and how the CCL and CCAs are modified. Coexistence of the EU ETS with an unchanged CCL/CCA package appears unlikely.[18] Instead, the main options for eligible CCA

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16 An earlier requirement (European Commission, 2001) that installations should not be allocated more allowances than they 'need' was dropped in the Council text in favour of a requirement to 'accommodate early action'. While rewarding early action may be a desirable objective, this does create a potential route for introducing 'hot air' into the scheme.

17 For example, falling wholesale electricity prices led the government to extend an emergency loan to the UK nuclear generator in 2002, in order to save it from insolvency. In this context, a price on carbon could be of benefit to government objectives.

18 This unlikely situation has been analysed in theoretical terms by Sorrell (2002) who examines two cases: first, where there is no trading in the CCAs; and second where there is trading. In the first

facilities during Phase 1 will be to join the EU ETS and terminate all or part of their CCAs, or to opt-out of the EU ETS and continue with their CCAs unchanged. Eligible facilities appear most likely to choose the second option (subject to a satisfactory demonstration of 'equivalence'), but this still leaves a large number of non-eligible facilities continuing with their CCAs and complex issues in relation to the treatment of electricity. These in turn may lead to additional options being considered such as removing the CCL from electricity, and modifying both the non-eligible and opted-out CCAs so that their targets refer to direct emissions only.

The choice of policy options will be shaped by the relative importance that is given to four issues:

i. double regulation;

ii. compliance obligations and double counting;

iii. differential treatment and equivalence of effort; and

iv. the fungibility of trading commodities.

The following sections discuss these issues in turn.

5.1 Double regulation

Double regulation may be loosely defined as a situation where a target group is directly or indirectly affected by two instruments that have very similar objectives. The existence of double regulation may be seen as imposing unfair burdens upon particular target groups. While 'double regulation' is a negative term, there may be instances where the interaction between policy instruments is either acceptable or positively beneficial (Johnstone, 2002).

In the present context, double regulation arises as a result of fossil-fuel electricity generators participating in the EU ETS. This will lead to price increases for electricity consumers, many of whom are either subject to the CCL on electricity, or signatories to CCAs that include targets for indirect emissions from electricity consumption. Price increases from the EU ETS should be independent of the method of allowance allocation,[19] but the absence of auctions means there is no revenue-neutral mechanism to compensate consumers. This could lead to pressure to remove the CCL from electricity or to modify the CCAs so that (as with the EU ETS) they cover direct emissions only (Sorrell, 2002).

Double regulation may also arise for non-CCA participants in the EU ETS who are subject to the full CCL on their fuel use, leading to pressure to exempt these participants from the CCL. In each case, the economic consequences of the double regulation will depend in part upon the allowance price

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situation, if the CCA target is binding relative to the EU ETS allocation, both marginal and total abatement costs are increased relative to a situation with no CCA target. In the second situation, marginal abatement costs for the affected installation are equal to the sum of the allowance prices in the two separate markets, while total abatement costs are less than in the non-trading scenario but higher than in the absence of the CCA. The only circumstances in which this situation would be beneficial for the affected installation is when the CCA provides exemption from the CCL, but membership of the EU ETS does not. To avoid such a situation, it appears sensible to extend exemption from the CCL to EU ETS participants.

19 Freely allocated allowances carry an opportunity cost, so they should be treated identically to real accounting costs in pricing decisions (Harrison and Radov, 2002).

in the EU ETS. High prices (from a stringent cap) could lead to substantial economic impacts for the affected groups, while low prices (from a weak cap) could lead to relatively small economic impacts. Low allowance prices could also result from trading links between the EU ETS and the international carbon market, since the latter is expected to be heavily oversupplied (den Elzen and de Moor, 2003).

The impact of the EU ETS on electricity prices will depend upon the carbon intensity of the marginal generating plant on the UK system. During Phase 1, this is expected to be coal fired. Under a number of simplifying assumptions,[20] an allowance price of EUR 7/tCO_2 could increase average electricity prices by some EUR 0.7 cents/kWh, approximately equivalent to the current level of the CCL on electricity (Table 1).

The Directive requires the EU ETS allowance allocation to be 'consistent' with the national climate programme, including the CCL and CCAs, and the UK government is proposing to use emission forecasts as a basis for allocation (DEFRA, 2003). The implications of this can be illustrated with reference to the emissions from electricity generation. Assume, first, that it is possible to forecast emissions from electricity generation with complete accuracy, including the emission reduction contributed by the CCL and CCAs. Assume further that the generators' allocation in each year of Phase 1 is based upon this forecast and that the sole objective of each instrument is to reduce CO_2 emissions. Then, once the EU ETS is in place, it should be possible to *remove* both the CCL on electricity and the indirect emissions from the CCA targets. This is because the expected CO_2 abatement from these instruments will be fully reflected in the allowance allocation to the generators (Sijm, 2003).[21] In meeting their obligations, the generators will equate their marginal abatement costs with the allowance price and either purchase additional allowances from UK or overseas participants or sell their surplus. In the aggregate, emissions from the UK generators, and from the UK overall, may either be greater or less than in the original forecast, but the total emissions covered by the EU ETS will remain unchanged. The UK will remain in compliance with its obligations, since all emissions will be covered by allowances.

If, however, the CCL on electricity and the indirect emissions in the CCA targets are *retained*, the generator's flexibility to trade allowances will be constrained and the overall cost to the UK of complying with the EU ETS will be increased. It follows that, if the allowance allocation reflects the forecast abatement from the CCL and CCAs, and if we assume perfect markets, accurate emission forecasts and the sole objective of least cost CO_2 abatement, both the electricity component of the CCL and the indirect emissions component of the CCA targets should be *removed* once the EU ETS is in place. This is because these contribute nothing to the *effectiveness* of CO_2 abatement (i.e. meeting the overall cap) and may potentially undermine the *efficiency* of abatement (i.e. achieving that cap at least cost) (Sijm, 2003).

An identical conclusion follows for other policy instruments which directly or indirectly affect emissions that are covered by the EU ETS cap (Sijm, 2003). This includes the CCL on fuel use by EU ETS participants and coexisting CCA targets for direct emissions. Again, using the above assumptions, these policies should no longer be applied to EU ETS participants. However, the same

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20 Namely: a) the trading scheme is introduced overnight without companies having the opportunity to change behaviour; b) the full costs of meeting the emission target are passed on to consumers through electricity price rises, with none being passed on to suppliers or absorbed through lower returns; c) the impact on electricity prices is independent of the method of allowance allocation; and d) the price impact is proportional to average carbon intensity of UK coal fired plant, which is ~1.0MtCO_2/TWh (Sorrell, 2002).

21 The author is indebted to Jos Sijm (Energy Research Centre of the Netherlands) for the discussion in this section.

conclusion does *not* apply to policy instruments which affect emissions that are outside the EU ETS cap. These include both the CCL on fuel use for non-participants and the CCA targets on direct emissions for non-participants. Both should be retained.

In practice, forecasts are inaccurate, allowance markets are imperfect and the CCL/CCA package has multiple objectives. The question then becomes whether these *additional* objectives can justify the retention of the CCL/CCA package for EU ETS participants, despite the resulting double regulation. As Sijm (2002) has argued, there are two broad circumstances where this may be the case:

i. the policies help overcome market failures other than CO_2 externalities, thereby improving the static or dynamic efficiency of the EU ETS; and,

ii. the policies achieve objectives other than efficiency, including equity and distributional objectives.

Both sets of arguments could potentially provide a rationale for retaining the CCL on electricity and the CCA targets on indirect emissions, particularly if fossil fuel and EU ETS allowance prices were expected to be low. This double regulation would not contribute further to CO_2 abatement within the EU,[22] but improvements in electricity efficiency may, for example: i) contribute to UK energy security by reducing overall energy needs; ii) contribute to mitigating the non-CO_2 externalities of electricity production; iii) mitigate the risk of 'lock-in' to environmentally damaging technologies in a context of uncertainty and ignorance about the risks of climate change; and, iv) put the UK on course for achieving much greater reductions in CO_2 over the next half century. Implicit in the last objective is a set of assumptions regarding the severity of climate threats, the inadequacy of the existing Kyoto and burden sharing targets and the consequent threat of high adjustment costs in the future. While these assumptions can be questioned, the 'pathways' objective is explicit within UK climate policy through both the UK 'goal' of reducing UK CO_2 emissions to 20% below 1990 levels by 2010 (DETR, 2000) (a target which goes beyond requirements under the EU building sharing agreement) and the 2003 Energy White Paper commitment of 'putting the UK on a path' to reducing CO_2 emissions by some 60% below current levels by 2050 (DTI, 2003). These domestic objectives could not be achieved solely through allocation under the EU ETS, since participants could simply purchase additional allowances from other Member States.

A second advantage of retaining the CCL on electricity is that this will fully maintain the *income* objectives of the CCL, together with the R&D and tax allowance programmes that the CCL supports (which in turn may improve both static and dynamic efficiency). Allowance auctioning in the EU ETS could provide an alternative source of revenue to the CCL, but neither the Council or Parliament texts foresee more than 15% auctioning in Phase 2. The absence of allowance auctions could be argued to violate the polluter pays principle, since polluters only pay for the marginal damage of CO_2 emissions, while residual emissions remain unpriced. Retaining the CCL provides partial compensation for this, while distorting the substitution objectives of the EU ETS at the margin.

The rationale for double regulation may also be understood in relation to risk. The EU ETS gives certainty in achieving the cap (subject to the use of penalty provisions), but uncertainty in the associated costs. The CCL does the opposite: providing an upper limit on the marginal cost of abatement but uncertainty in the environmental outcome. Hybrid schemes, along the lines proposed by Roberts and Spence (1976), provide a compromise between the two. Retaining the CCL on electricity has some analogies with a hybrid scheme, since it effectively imposes a floor on marginal abatement

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22 This could only be achieved through tightening the overall EU ETS cap or restricting the links between the EU ETS and the international carbon market.

costs, in order to meet objectives other than those represented by the emissions cap. A more common hybrid proposal is to impose a ceiling on marginal abatement costs, in order to improve the political acceptability of the cap (McKibbin and Wilcoxen, 2002). Both proposals mitigate the cost uncertainty of the emissions cap in order to achieve wider policy objectives, but at the expense of economic efficiency.

A final issue is the relative effectiveness of indirect electricity price increases versus direct targets in incentivising electricity efficiency. The UK government's view is that price signals alone are relatively ineffective, given the range of other barriers that inhibit energy efficiency. This view is backed up by modelling studies (ETSU, 2001) and was one reason for choosing an indirect treatment of electricity in the CCL/CCA package.[23] If correct, it means that replacing the CCA targets for indirect emissions with a cap on the electricity generators could lead to less improvement in electricity efficiency and consequently more abatement through fuel switching and other means. If this is considered undesirable, it may justify the retention of the CCA targets for indirect emissions. This argument relies on a mix of (questionable) behavioural assumptions and a judgement that electricity efficiency is more desirable than alternative forms of abatement. The latter, in turn, is based on wider objectives such as the promotion of energy security through fuel diversity and concerns about the risk of increasing UK dependence upon imported gas.

In sum, the acceptability of double regulation is likely to depend upon a range of factors, including: the clarity, legitimacy and relative importance of different policy objectives; the appropriateness of different policy instruments to meet those objectives; and contextual factors such as the expected allowance price in the EU ETS. These arguments raise both theoretical and empirical issues and are likely to prove highly contentious. But if the carbon benefits of the CCL on electricity and CCA targets for indirect emissions are largely accounted for when establishing the generator's allocation under the EU ETS, the justification for retaining the former must rely more heavily on their contribution to, first, policy objectives other than efficiency; and second, overcoming market failures other than carbon externalities. In turn, the attainment of these objectives needs to outweigh the higher abatement costs, distortions to the EU allowance market and additional administrative costs that double regulation creates.

5.2 Double counting

Double counting problems arise when compliance obligations for particular emission sources are disputed between two trading schemes. As with double regulation, this applies in particular to the treatment of emissions from electricity generation. The EU ETS gives compliance obligations for these emissions to power stations, while much of UK climate policy effectively gives obligations for a portion of these emissions to electricity consumers. The control that these two groups can exercise over these emissions is very different. For example, electricity generators have full and direct control over the carbon intensity of electricity generation but only indirect and partial control over electricity demand. In contrast, electricity consumers have full and direct control over their electricity demand

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23 ETSU (2001) estimate that the CCAs will deliver 9.2MtCO_2 annual reductions by 2010, compared to 14.6MtCO_2 if 'all cost effective measures' were adopted. In contrast, ETSU estimate that the reductions resulting from the price effect of the CCL on its own (i.e. with no agreements and no associated discounts) would be only 0.9MtCO_2. However, the behavioural assumptions that underlie these 'bottom-up' modelling results are open to question.

but, in the absence of disclosure[24] provisions, no control over the carbon intensity of electricity generation.

Disputes may arise where an individual source is simultaneously participating in two emissions trading schemes, or where fuel or electricity is being traded between participants in two separate trading schemes with different designs. In these situations, compliance obligations for the same physical emissions may be either given to two separate parties, or given to the same party under two separate terms. Such disputes may have two consequences (Zapfel and Vanio, 2001):

i. *double coverage:* where two separate carbon allowances or carbon credits are surrendered for a one-tonne increase in physical emissions; and

ii. *double crediting:* where two separate carbon allowances or carbon credits are generated from a one-tonne decrease in physical emissions.[25]

Such disputes introduce complexity into the regulatory situation. But it is important to distinguish between: a) situations where double coverage and double crediting are present simultaneously and where the first effectively cancels out the second; and b) situations where only double crediting is present and there is scope for inflation in the number of allowances. Both are possible, but the second is more important as it could threaten the environmental integrity of an emissions trading scheme.

The CCAs give compliance obligations for electricity emissions to industrial consumers, but the EU ETS gives compliance obligations for these emissions to electricity generators. The coexistence of the two creates double counting problems. If all the CCA facilities had absolute targets and all allowances were used to cover emissions, an emissions increase (decrease) in electricity-related emissions from CCA facilities would lead to a decrease (increase) of twice the size in the total emissions covered by the CCAs and EU ETS (Sorrell, 2002, pp 103-109). This is because allowances would be bought (sold) in *each* scheme to cover the increase (decrease) in CCA emissions. The final total of emissions covered by the CCAs and EU ETS may be greater or less than the initial total of emissions before the change. But it will always be less than or equal to the sum of the allowance cap in the EU ETS and the target emissions for the CCAs. This sum provides an overall cap on the total emissions from the combined schemes.

The double counting does not breach the cap in the EU ETS and if all the CCAs had absolute targets, total emissions from the CCA sector would remain below the target emissions. Environmental integrity would be maintained even if there were fungibility between EU ETS allowances and those in the national trading schemes. In effect, the double crediting is cancelled out by the double coverage.

In practice, most CCAs have relative targets so aggregate emissions in the CCA sector and hence the UK trading scheme overall could increase. But this is an inherent feature of a scheme with relative

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24 Carbon labelling of electricity, or disclosure, would allow consumers to discriminate between high and low carbon sources and to identify zero carbon and nuclear sources.

25 An example of double coverage is the export of electricity from country A, which has an emissions trading scheme with direct accountability (electricity generators hold allowances), to country B, which has an emissions trading scheme with indirect accountability (electricity consumers hold allowances). Both the seller of the electricity (generators) in country A and the purchaser of the electricity (consumers) in country B would need to surrender allowances to cover the emissions associated with this electricity, which means the emissions would be covered twice by two separate trading schemes. A primary motivation for introducing a harmonised EU trading scheme was to avoid such problems (Zapfel and Vanio, 2001).

targets and is not due to the double crediting. In the absence of Gateway arrangements, fungibility of UK and EU allowances would undermine the environmental integrity of the EU ETS. But again this is due to the relative targets and not the double crediting.

In sum, the double counting of electricity emissions creates some confusion, particularly in assessing the relative contribution of each instrument to UK carbon targets. But it does not threaten the environmental integrity of either the CCAs or the EU ETS. As Sorrell (2003a) argues, the same result does not apply to the coexistence of the EU ETS with the UK emission reduction project scheme. In this case, double crediting is not cancelled out by double coverage and any trading of project credits into the EU ETS could undermine the environmental integrity of the scheme.[26]

5.3 Equivalence of effort

Problems may arise when the economic impact of environmental regulation appears to be different for competing firms, or when the apparent differential treatment of non-competing firms is perceived to be inequitable. Differential treatment may be challenged on legal grounds through competition law at the national, EU and international level; on political grounds through rent seeking behaviour or challenging such behaviour; and on environmental grounds if there appears to be a risk of carbon leakage between installations, sectors or countries.

The demonstration of 'equivalence of effort' may be required in order to avoid differential treatment when an emission source, installation, company, sector or Member State is exempted from a particular policy instrument. But in practice, equivalence of effort may be extremely difficult to assess owing to differences in the scope of the instruments, the nature of the targets (e.g. relative or absolute), the provisions for modifying and updating those targets and the marginal abatement costs under each instrument. For many instruments, abatement costs may be difficult to estimate ex-ante or to observe ex-post. Industry has private information on abatement costs, together with an incentive to reduce the stringency of regulation by exaggerating cost estimates (Bailey and Haq, 2002). While trading schemes provide a clear signal of marginal abatement costs in the allowance price, there is no comparable signal from measures such as CCAs. At the same time, the importance of equivalence of effort may be overstated, given the large differences in factor prices, fiscal policies and other regulatory requirements that distort the level playing field (Sorrell, 2002, pp 28-29).

The opt-out provisions of the EU ETS raise these issues in a particularly acute form. For example, CCA facilities may choose to minimise the expected sum of abatement and transaction costs by opting-out of Phase 1. If by opting-out the CCA facility avoids a 'stringent'[27] target, this should lower allowance demand in the EU ETS, lower allowance prices and reduce overall marginal abatement costs. Conversely, if by opting out the CCA facility avoids a non-stringent target, this will lower allowance supply, increase allowance prices and increase marginal abatement costs. The choice to opt out will depend upon expectations regarding abatement and transaction costs in each scheme, the future evolution of the CCAs, UK ETS and EU ETS, and the fungibility of EU ETS and UK ETS allowances.

The opt-out provisions may have facilitated political consensus but they have reduced the environmental effectiveness of the EU ETS, reduced the market size in Phase 1, created additional

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26 In practice, the volume of double-crediting from this route is likely to be small and hence could be ignored.

27 Defined here as one which would make it a net buyer of allowances in the EU ETS.

administrative costs, and (arguably) distorted competition. Equivalence of effort will be very difficult to demonstrate owing to differences in:

i. *Scope*: The EU ETS and CCAs cover different emission sources in different ways. For example, the EU ETS covers process CO_2 emissions while the CCAs do not.

ii. *Form*: Relative targets are not equivalent to absolute targets because they give no certainty in the environmental outcome and lead to higher emissions for the same level of marginal abatement cost (Gielen *et al*., 2002). Furthermore they distort competition by creating an incentive to locate in Member States with relative rather than absolute targets.

iii. *Stringency*: The basis on which CCA and EU ETS targets are derived and the process through which they are developed is different. The CCA targets appear weak, but their stringency compared to the EU ETS will depend upon how the allocation criteria are interpreted.

The process of demonstrating equivalence of effort could be costly and time-consuming. One option would be to estimate the allocation to different installations under the EU scheme and to assess whether their existing targets are equivalent to this estimated allocation. But this implies considerable effort to assess bottom-up allocations, which seems unnecessary when the intention is not actually to allocate allowances. Conversely, if the UK chose to interpret equivalence in a loose way, this may leave it open to challenge under EU competition law.

The opt-out provisions of the EU ETS also require equivalence in the monitoring, verification and compliance provisions. The CCAs are much better in this regard, with high standards for monitoring and with verification by independent bodies accredited by the UK Accreditation Service (UKAS). While the penalty rate of the CCL (EUR 7 to 14/tCO_2) is lower than the penalty in the EU ETS, it applies to *all* emissions for a two year period and not only to missing tonnes.

In sum, many if not most CCA facilities may seek to use the opt-out provisions. A combination of severe information asymmetry, the tight time schedule for approving allocation plans and the desire of all parties to minimise the obstacles to implementing the EU ETS may allow such opt-outs to proceed unchallenged. But there is a risk that allowing opt-outs could lead to distortions of competition.

5.4 Linking and fungibility

The Directive allows for linking to third party schemes. Although the idea is to link the EU ETS to non-European schemes, there is also the possibility of linking the EU ETS to the UK ETS. This may create a number of problems (Essex, 2002).

If the CCAs chose to opt-out of the EU ETS, they will gain the advantage of (arguably weak) relative targets. In many cases these are denominated in energy use rather than carbon emissions and have generous ‘risk management’ provisions that allow targets to be adjusted if (for example) the product mix changes. Permitting these companies to secure the benefits of EU-wide trading as well may be seen as an unacceptable distortion to competition. In addition, the use of relative targets means that production increases could inflate the number of allowances in circulation and violate the emissions cap. Such problems could be avoided through the use of Gateway arrangements to interface the CCAs to the EU scheme, but this would add to administrative costs. In addition, the use of a fixed factor for the carbon intensity of electricity leads to a discrepancy between the estimated and actual emissions from electricity consumption, the size of which will increase over time.

The CCAs are already linked to the wider UK ETS, including the direct participant scheme and the project scheme. Interfacing these to the EU ETS raises further issues. First, there may be objections to trade with the direct participants, since these have been given a competitive advantage through subsidised abatement.[28] Second, several of the emission targets adopted by the direct participants are caught up in an ongoing controversy over 'hot air' (ENDS, 2002). Third, the inclusion of credits from the project scheme leads to a double crediting problem which may violate the environmental integrity of the EU scheme. And finally, over half the emission reductions in the UK scheme result from non-CO_2 GHGs which are not at present included in the EU scheme.

Some of these problems may be avoided by allowing sales from the EU ETS to the UK ETS, but not trades in the other direction. Alternatively, the Commission may decide to prevent any linking between the schemes. A likely consequence of this would be a decline in the liquidity of the UK scheme and a faster transition to the EU ETS. The rationale for linking – expanding emission coverage and reducing overall abatement costs - may best be achieved through opt-in provisions or by expanding the sectoral coverage of the EU ETS over time.

The fungibility problems become greater after 2008 when the interfaces with International Emissions Trading (IET) need to be addressed. For example, UK ETS participants that bank allowances into the commitment period may wish to convert them into either EU ETS allowances or Assigned Amount Units (AAUs). If UK ETS allowances are converted to AAUs and these are then sold into the EU ETS, the two schemes effectively become linked. In all cases, banking significant volumes of allowances into the commitment period may create difficulties for UK compliance with Kyoto commitments.

6. Summary and conclusions

While the UK government has welcomed the EU scheme, it has not provided details on how it will interact with existing instruments, or how this transition will be achieved. As this paper has demonstrated, this question now requires urgent consideration. While a number of scenarios are possible, each leads to complex problems of double regulation, double counting of emission reductions, equivalence of effort and fungibility of trading commodities.

The scale of these problems will depend upon a range of factors including the allowance price in the EU ETS. A combination of low electricity prices, generous allocation criteria and the strong desire of all parties to minimise the obstacles to implementing the EU ETS may allow these problems to be circumvented in the short term. But there is a risk that such expediency will add complexity to an already overcrowded policy mix.

While the opt-out provisions of the EU ETS allow some policy changes to be postponed, these provisions are only available up to 2008 and do not resolve core issues such as the double regulation of electricity emissions. Furthermore, such provisions create potential distortions to competition and undermine the environmental effectiveness of the EU scheme.

The allowance allocation under the EU ETS is required to be consistent with national energy and climate policy, including the CCL and CCAs. But if the 'carbon benefits' of these instruments are reflected in the number of allowances distributed, the rationale for maintaining these instruments must

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[28] On the other hand, the number of direct participants is relatively small, most do not complete with the sectors covered by the EU ETS and the UK scheme has been given state aid clearance by the Commission.

rely more heavily on either their contribution to policy objectives other than efficiency, or their ability to overcome market failures other than carbon externalities. These wider policy objectives are mentioned in government documents, but are rarely subject to critical scrutiny. The existence of the EU ETS requires more attention to be paid to such wider objectives and to the trade-offs between these objectives and the efficient operation of the EU ETS.

While the UK must inevitably face a range of complex transitional issues, it is likely that the CCAs will be progressively displaced as the EU ETS is extended to cover more sectors and gases. Similarly, it is likely that the CCL will eventually be modified to apply solely to direct emissions from non-participants - preferably as a carbon tax on all fuels. The speed with which this occurs will depend upon the final interpretation of the opt-in and phase-in provisions of the Directive. However, such displacement is only desirable from an environmental perspective if the EU ETS provides a real incentive for emission reduction. This incentive could potentially be threatened by over-generous links between the EU ETS and the Kyoto mechanisms. In this context, the UK may be reluctant to abandon national policy instruments that are potentially in conflict with the EU ETS, but which provide real incentives to reduce emissions.

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PART III

TRANSITION ISSUES AND AREAS FOR FURTHER WORK

ISBN 92-64-10576-X
GREENHOUSE GAS EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN OECD AND NON-OECD COUNTRIES

ON CARBON PRICES AND VOLUMES IN THE EVOLVING 'KYOTO MARKET'

by

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1. Introduction and overview

Projections of international carbon prices under the Kyoto system, generated by economic models, have fluctuated wildly over time and between models. Now, however, most models project very low prices due to the US pullout, the carbon sink agreements at Marrakech, and revised (much lower) projections of emissions especially in Russia and Ukraine. These factors together imply a large surplus of available allowances, leading to price collapse if all allowances potentially available are freely and competitively traded.

The real international system will not behave in the way projected in such models. Ultimately, emission units under the Kyoto system only have economic value to the extent that supplying governments are willing to issue and transfer them, and the governments of receiving countries are willing to recognize and use those units for compliance assessment under Kyoto. The Kyoto registries system requires the source of all units to be registered by a unique identifier, so that governments have the potential to be selective about the units they are willing to issue or to accept.

Governments will use this capacity to meet strategic concerns, and this will make the Kyoto 'market' vary widely from least-cost 'market' behaviour:

- Economies in Transition, and in particular Russia and Ukraine as dominant exporters, have a clear interest to restrain supply so as to raise prices (potentially retaining allowances for 'banking'), and have some limited market power with which to do so;

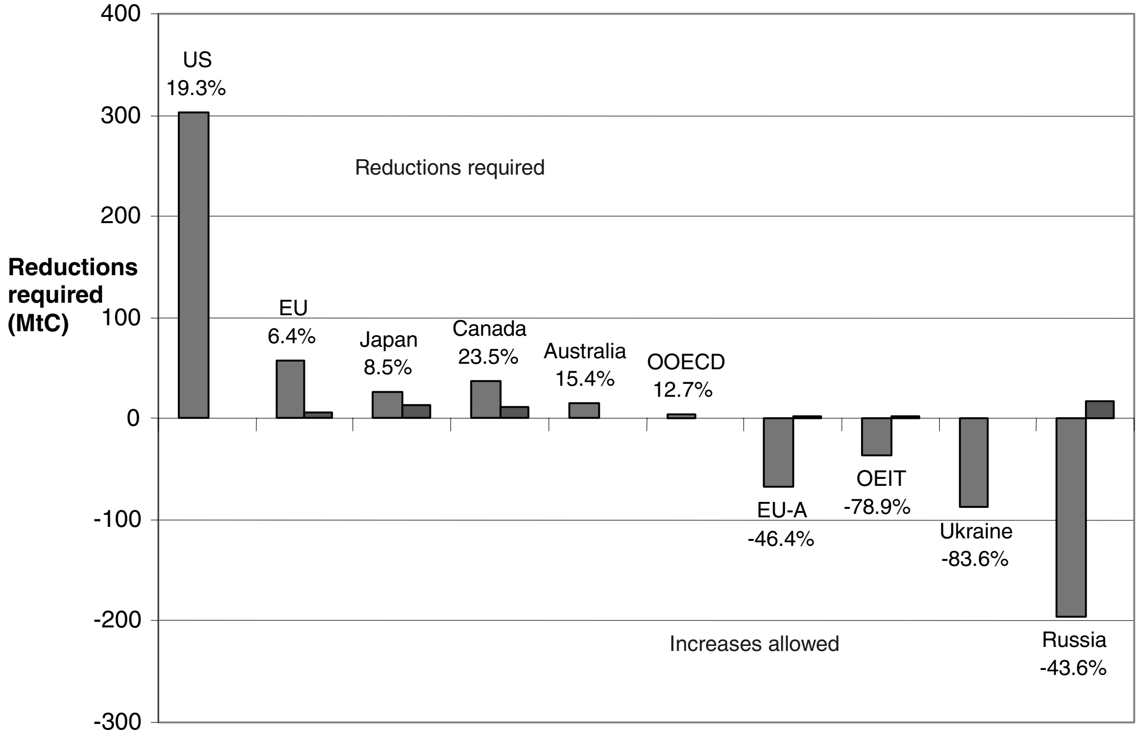
- Potential importing governments (predominantly the EU, Japan and Canada) will use the mechanisms selectively and strategically to support their interests and the political legitimacy of the Kyoto system overall, whilst protecting existing domestic legislation.

This paper presents analysis based on these observations, and offers some estimates of the prices and volumes that may be implied.

2. Survey of economic determinants and modeling results

The underpinnings of confusion about carbon prices under the Kyoto Protocol stem from the attempt to model the system in terms of a top-down equilibrium balance of supply and demand. Figure 1 represents the nearest thing to observable data on the potential supply-demand balance, using the most recent emissions for which comprehensive data are available (year 2000 emissions of industrial CO_2)[1]. The main bars show the gap between countries' emissions and their Kyoto allocation. For example, EU emissions had roughly stabilised at 1990 levels and the gap was 70MtC, whilst Canada faced a gap of c. 40MtC, the highest percentage of any due to its rapid growth since 1990.

Figure 1. Gap between present (yr 2000) emissions and Kyoto target, and managed forest allowances (MtC/yr)



Notes:

1. The main (single or larger) bars show the gap between 2000 emissions and Kyoto commitments for the principal countries / groups in Annex I. The smaller bars show the maximum allowance that each can claim for carbon absorbed from managed forests under the Marrakech Accords (excluding the US which is not included in that agreement), which can in effect be deducted. % numbers show the percent cut required to get from current levels to the Kyoto targets (-ve numbers indicate the corresponding % growth from current levels for EITs).
2. Key: EU-A = the 10 EU candidate countries heading for early accession. OEIT = the 5 other countries applying for EU membership. OOECD = all other OECD countries. Data represents CO_2 total national emissions from industrial activity.

Source: 2000 emission data: Energy Information Administration. USA.

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[1] Industrial CO_2 here refers to all CO_2 emissions from industrial activity, i.e. energy-related activities. Kyoto commitments are defined in terms of the basket of six greenhouse gases, of which CO_2 accounts for about 80% across all Annex I, and allows various sink activities to be included. For Figure 1 every effort has been made to set the base year and recent emissions on the same basis, to preserve comparability, and remaining discrepancies are too small to affect the main points of this analysis.

In stark contrast to the OECD, the bars on the right hand side of the graph illustrate that emissions in the Economies in Transition had declined since 1990 and are well below their Kyoto allowance. In particular, the EU Accession countries have a potential 'surplus' larger than the shortfall in the present EU countries: their emissions would have to rise 46% from current levels to reach their Kyoto allocation. Russia and Ukraine have potential surpluses far larger than any of the individual 'gaps' of OECD countries other than the US (respectively, 240MtC and over 100MtC). In total, in fact, the sum of all these data indicate that the aggregate emissions of Annex I countries in 2000 were already below the aggregate Kyoto cap of –5.2%, but with a huge east-west discrepancy in the distribution.

For two or three years after the Kyoto agreement, the usual economic perspective was that emissions in all these regions would rise substantially in the absence of strong action to limit domestic CO_2 emissions, so that models predicted that a high carbon price would be required if countries were to cut back emissions enough to comply, with the US and Japan facing the biggest gaps and bearing the biggest costs. Three factors have served to completely reverse this perspective:

– Emissions of most countries, but especially the Economies in Transition, have failed to grow as many models predicted. The only exceptions were the New World economies (US, Canada, Australia). Emissions in Europe and Japan remain roughly static, as have emissions from most of the EITs (see Table 2 below).

– The Marrakech Accords granted countries a certain allowance of carbon sinks from 'managed forests', the smaller bars shown in Figure 1 — essentially a windfall gain, since many forests in industrialised countries are in practice managed in one way or another - and also allowed inclusion of afforestation and reforestation projects in the CDM.

– The Bush administration's rejection of Kyoto removed by far the largest potential source of demand in the Kyoto system.

The result is to leave a large potential supply set against radically reduced demand. This has a dramatic impact on the results of economic models, as shown in Table 1 — in some cases, pushing the price close to zero [e.g. as in the MIT model, one of the few to include non-CO_2 gases and carbon sinks (Babiker *et al.,* 2002)]. Buchner *et al.,* (2002) reviewed studies and found the impact of US withdrawal alone to result in more than a halving of the permit price in all studies except their own.[2]

Furthermore, there are several reasons why even these models may over-predict 'equilibrium' prices. Most do not include the full set of Kyoto flexibilities including non-CO_2 gases and sinks (both managed forests, and others). Many neglect domestic abatement actions already being put in place, such as the European emissions trading system. And most still contain rather simplistic representations of the Economies in Transition, with built-in assumptions that economic recovery leads to emissions growth.

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2 Buchner *et al.*, model includes both cartelisation of the market, and a feedback between prices and technological change, with lower prices slowing down technical change and leading to higher emissions in the rest of Annex B. It is hard to see how such an impact of induced technical change could really operate so substantially on a timescale of just a few years, though the point, taken more generally, is pertinent.

Table 1. International carbon prices from Economic models of the Kyoto system without US: modelling results

Model / study	Includes		Equilibrium Carbon Price under Kyoto, USD/tCO_2e		Price impact of US withdrawal (% decline)
	Carbon Sinks (inc managed forests)	Non-CO_2 gases	With US	Without US	
Hagem and Holtsmark (2001)	N	N	15	5	66%
Kemfert (2001)	Y	N	52	8	84%
Eymans *et al.,*. (2001)	N	N	22	10	55%
Den Elzen and Manders (2001)	Y	Y	37	13.6	63%
Bohringer (2001)	Y ?	N		'Close to zero'	

Table 2. Emissions from Economies in Transition: base year and recent trends

EIT Countries		Industrial CO_2 emissions, MtC			
		Base year*	(1998)	(1999)	(2000)
EU Accession countries	Czech Republic	44.7	29.3	27.0	28.4
	Estonia	10.4	2.3	2.0	1.9
	Hungary (1985-7)*	22.2	16.0	15.8	14.9
	Latvia	6.4	2.1	1.8	1.9
	Lithuania	10.8	4.8	3.4	3.6
	Poland (1988)*	115.7	84.9	81.7	81.4
	Slovakia	16.3	10.4	10.7	10.4
	Slovenia	3.8	4.7	4.2	4.2
	Malta**	—	—	—	—
	Cyprus**	—	—	—	—
Total Accession		230.3	154.5	146.6	146.7
Other EU candidates	Bulgaria (1988)*	28.3	15.3	13.7	15.0
	Croatia	6.4	5.3	5.4	5.7
	Romania (1989)*	53.4	27.2	24.0	24.7
	Turkey**	—	—	—	—
Other Annex I EITs	Ukraine	191.9	100.0	105.0	104.5
	Russia	647.0	395.8	440.0	450.7

Note: Accession countries = the 10 countries officially accepted for EU Accession in 2004.

* Base year emissions are 1990 unless otherwise indicated. The data show the emissions of industrial CO_2 emissions in the base year for comparability, not the full GHG emissions. Emissions of the other GHGs collectively have generally declined by at least as much as CO_2 emissions, but full data for recent years are not available.

** Countries not in Kyoto Protocol Annex B, i.e. without emission targets, indicated by italics: no emissions data shown as these countries are not relevant to the Kyoto first-period trading system.

Source: (1) Base year emissions, UNFCCC (EIA for those with base years different to 1990). (2) Other emission years, Energy Information Administration, US DOE, Washington.

The latter point is important, because it is a source of considerable and genuine uncertainty. However, the most recent data on trends in the EITs — including those that have experienced rapid economic growth since the late 1990s - do not yet support the economy-emissions linkage that is implicit in most economic models (Table 2). Up to 2000 at least, there is no evidence of significant emissions growth in the region: economic recovery has instead been reflected in (and indeed been partly driven by) increased efficiency.

So from a perspective of supply-demand balance, the 'carbon price' under Kyoto might be projected to be virtually zero. There are three broad reasons why the reality of the carbon price facing companies is likely to be considerably more complex that this suggests:

i. **The prioritization of domestic action.** Most countries are concentrating first on domestic action. For example, the EU and its member countries are taking a range of measures in all sectors to limit GHG emissions, and even its emissions trading directive is carefully confined to domestic action: whilst states retain the right to international trade under Kyoto, the Directive is clear that companies cannot themselves engage in international trading under the Directive. Climate mitigation policy in the EU already forms a patchwork of measures implicitly at widely divergent marginal costs, and existing policies in many areas (notably transport, in which existing excise duties already typically equate to over EUR 50/tCO_2) will be insulated from competition with international carbon trading.

ii. **Market power and other constraints on the operation of Kyoto as a fully competitive international market.** The international carbon price could be considerably higher because Kyoto will not operate as a fully competitive market. The project-based mechanisms will be inhibited by transaction costs, and international trading may be affected by the potential for major exporters to withhold supply so as to raise prices; they also have the option for holding any unused allowances over for use in the subsequent period through Kyoto's banking provisions.

iii. **Buyer sovereignty**. Countries looking to import allowances have a sovereign right to choose from whom they buy and on what basis. For a whole variety of political and strategic reasons, elaborated below, countries are unlikely to seek to acquire allowances at least carbon cost.

These factors all involve considerations of political economy, concerning the likely behaviour of sovereign states engaged in the Kyoto system to which we now turn.

3. The Sellers

Russia and Ukraine will have a large surplus of allowances during the Kyoto period. However, executing their interest in Kyoto will be more complex than it appears, for the following reasons:

- The relationship between supply and price means that their revenue will be maximised not by selling as much as possible, but rather by holding back a substantial part of their allowances to raise the price.[3]

[3] Many different models have now been applied to show this. Estimates of the % sales that would maximize revenues are highly scenario dependent, but typically in the range 10-50% of their total surplus.

– Russia and Ukrainian energy projections are still very diverse and selling is likely to be cautious to avoid any possibility of having to buy back allowances if emissions growth is high.

– Many individual actors in these countries are more concerned with where the money goes than with the overall flows. Of most direct relevance here, the Ministries of Energy and of Economy in Russia are concerned to see that money flows into real investment to improve energy infrastructure.

– Related to this, the reduced volume of money without US participation increases the appeal of using the mechanisms primarily to try and leverage potentially much larger private sector flows.

The relationship between Ukraine and Russia, as the countries with by far the largest potential volumes of surplus to sell, may be particularly important. Clearly, this relationship is already complex not least because of the ongoing struggle over gas supplies and payments. Cartels are notoriously difficult to hold together. In this case, close collaboration between EU Accession countries and other EITs seems implausible because of the former's close ties to the EU and the likelihood that they will be included in an EU-wide emissions trading scheme. However notwithstanding their fractious relationship, the incentives may be big enough for some EITs to collaborate in some mutual restraint of sales.

This also sets the context for the Russian proposal on a 'Green Investment Scheme', whereby revenues from emissions trading would be invested in environmentally-oriented projects, principally aimed at improving the efficiency of the energy sector, an idea explored in considerable depth by a recent international study (Tangen *et al.,* 2002).

The developing countries do not have a ready 'surplus' available to sell, but they can generate emission credits through CDM projects. However, very low carbon prices are simply not big enough to make much difference to the economics of real projects; prices need to be several tens of USD/tC before they are likely to make material difference to investors decisions on whether to proceed with complex, potentially difficult and risky projects in developing countries.

4. The Buyers

4.1 The European Union

EU reservation about unlimited use of the international mechanisms has a long history. In addition to this, at least three other factors will shape the EU's approach to the international carbon market under Kyoto:

i. **The politics of EU enlargement**. Economic and political considerations smoothing the path of Accession are likely to take precedence, so the 'price' in intra-Europe trading is unlikely to be allowed to fall to near zero.

ii. **The EU-Russia energy dialogue**. Engagement with Russia and Ukraine will be set in an explicit context seeking political cooperation based largely around energy trade, and in particular east-west gas trade and the EU-Russia energy dialogue. Kyoto units are likely to be seen as a tool to be used in the context of this dialogue and its associated efforts to secure a stable basis for foreign investment in the Russian energy system.

iii. **Political investment in Kyoto.** The EU was at the centre of political efforts to rescue the Kyoto Protocol. This involved convincing both developing countries and the EITs not only that it was the 'right' thing to do, but that they stood to benefit from the system. In addition, the EU has relatively strong ties with many developing countries, partly through ex-colonial links. The result is that the EU is bound (in both senses of the word) to factor political and strategic considerations in to any international trading under the Protocol.

All this will take expression in a diverse willingness to pay. For example, the EU might be willing to pay 'over the odds' to encourage CDM projects in Africa, as compared to countries that are perceived to be less 'in need', or which are already attracting foreign investment. Indeed, the promise of international money flows form the glue behind the political consensus underpinning Kyoto. This implies a political need to do some international trading, but to avoid a price collapse. The EU may be a buyer, but it cannot aim to be a least cost / lowest price buyer.

4.2 Japan

Japan has been ideologically even further from regarding Kyoto as a 'free market' than was Europe. Japan needs the flexibility, but at the same time the mechanisms are regarded as an instrument, at the sovereign disposal of 'Japan inc.', not a market 'free for all.' As such, perhaps to an even greater extent than the EU, Japan will exercise buyer sovereignty over whom it wishes to trade with, and on what terms.

Against this background, the deep-rooted difficulties of Japanese relations with Russia — sustained since WWII by the continuing dispute over the Kurile Islands — are highly relevant. When in 1998 MITI announced 20 'AIJ projects' with Russia it was seen as a breakthrough; the subsequent failure of any of these projects to materialise has reinforced Japanese scepticism about Russia being a reliable source of supply, and Japanese plans do not formally include any use of Russian allowances. Japanese NGOs are also likely to demand, with influence, that emissions trading should be tied to environmentally legitimate investments — the only way in which transferring money to an old adversary is likely to be politically acceptable. Any Japan-Russia deals on JI or emissions trading will proceed cautiously, hesitantly, with conditions requiring monitorable environmental investments, and at a small scale as pilot programmes in building trust (Tangen *et al.*, 2002).

Insofar as Japan needs emission units, therefore, it is likely to seek the bulk in the form of CDM credits from developing countries, and it may be willing to pay substantial prices, using this in part as a political instrument for maintaining good relations with its Asian developing country neighbours — a far cry from a global least-cost market.

4.3 Canada

Of all the countries in Kyoto, Canada probably has both an interest and an ideology inclined to treat Kyoto as a competitive international carbon market. In percentage terms, Canada probably faces an 'emissions gap' larger than Japan; and it may have far less resistance to large-scale emissions trading with Russia.

Yet even for Canada, it is becoming apparent that reality will differ markedly from the models, for two big reasons. One is that environmental and international NGOs, which have a large influence in Canada (and the wider public), object strongly to the idea of giving Russia money for 'doing nothing', as indeed does the general public. In addition, Canadian industry has mixed interests. Those companies that have opposed Kyoto would nevertheless like to seek ways of benefiting from it, if Canada does go ahead. And the most obvious way they can do so is if foreign expenditure for emission units is directed primarily towards investments that involve Canadian companies — perhaps particularly for Russia, where the similar range of climatic conditions makes Canadian expertise potentially valuable. Albertan companies, which have so fiercely opposed Kyoto, could be the first to line up in favour of linking emissions trading with Russia to real investments in the Russian energy systems — and at as high a price as possible, if they have prospects of being the main contractors.

5. Analogies with the oil market

How exceptional is the Kyoto 'market'? The above discussion suggests, at first sight, that it will be so far from the economic ideal of a least-cost market as to scarcely justify the term 'market', and that little insight could be gained from expertise with other market operations. Whilst Kyoto undoubtedly has many unique features, the behaviour sketched is not really so exceptional.

Consider the oil markets. Despite a century of evolution, international oil prices are generally maintained well above USD 20/bbl, despite the fact that the marginal production cost in Saudi Arabia is probably less than USD 5/bbl. Saudi Arabia's main influence is wielded through the OPEC alliance of exporting countries, yet even OPEC overall does not exert anything like monopoly control on supplies, whilst its members themselves have widely divergent interests according to their fiscal and reserve situations.

For Kyoto's first period, it is not hard to see Russia as the Saudi Arabia of carbon permits, and the EITs overall, as OPEC. Nor is it hard to paint analogies with the 1980s oil price collapse, envisioning Russia trying to hold back supplies whilst the carbon price sinks lower and lower until it loses patience and threatens to flood the market. One potential feature of such markets certainly is their price instability, and dependence on political decisions and negotiations amongst suppliers. Similar features would hardly be surprising in the Kyoto first period system.

Yet a view of oil markets that focuses only on supply is also fundamentally misguided, or at least extremely dated. The oil price is maintained so far above its marginal production cost through processes that are to a large degree collaborative between producing and consuming nations and in collaboration with industry. To a large degree these are not formal collaborations, though the producer-consumer dialogue has made progress towards some common understandings — but even that is only possible because of a perceived common interest in maintaining prices that are stable, and at 'reasonable' levels, which is generally understood to mean in the range c. USD 20-25/bbl. Importing countries acquiesce (or even actively collaborate) to maintain prices an order of magnitude higher than marginal production costs, for a variety of complex reasons. These include the internal politics of their own oil industries, and long-term strategic calculations that oil is, ultimately, a highly valuable and (on strategic timescales) scarce resource. Higher prices do not only protect domestic investments in frontier non-OPEC production, and keep high-cost domestic oil companies in business; they also underpin efforts to reduce long-term dependence on imports through efficiency and diversification. Again, analogies with the carbon markets are not hard to draw.

Finally, much as the oil markets involve a high degree of government-industry interaction (though now somewhat less than formerly), the Kyoto system is bound to involve the same. Some governments at least wish to protect and support emergent industries that can deliver, and profit from, lower carbon futures.

6. Differentiation among the Kyoto units

The Protocol itself places no significant restrictions on the fungibility of the different units defined under Kyoto;[4] all can be added to bring a country into compliance.[5] Despite this effective lack of formal restrictions, the implication of this paper is that there will be considerable price discrimination. Some of this will come directly from the private sector in this nascent market. Especially in this formative stage, the value accorded to emission units by the private sector is strongly affected by both reputational and political risk considerations. Reputational considerations will make companies averse to large scale and potentially controversial projects, such as large scale agroforestry where land rights are disputed. Political risk considerations will include the risks associated with uncertainty about what kind of units home governments will ultimately accept.

With the Marrakech Accords establishing the fundamentals of project eligibility, the major governmental distinctions are likely to depend upon region — and corresponding mechanisms — but with important subdivisions according to project type (see Box 1).

Traded AAUs appear subject to the greatest political risk, and consequently the greatest discounting. Conversely however, AAU trading is likely to be an essential component of the compliance portfolio at least for Japan and Canada, simply because it is probably the only source large enough to ensure their compliance given the real-world constraints on project volumes. Within AAU trading, one can distinguish four possible components:

- 'Greened' trading, probably through something like the Russian Green Investment Scheme proposals, are likely to be the most widely favoured and attract the highest premium;

- trading from OECD countries that have exceeded their targets demonstrably due to domestic action may be considered next, and would provide a sense of diversity in the portfolio. The UK is one of few OECD countries likely to surpass its target, and international availability of such AAUs may depend in large measure upon the EU's wider progress towards compliance including Accession countries;

- AAUs could also be made available from EITs in a controlled manner through non-GIS-type routes: for example, EIT governments could develop some domestic trading schemes with allocation that is seen to have some degree of environmental credibility;

- Finally, wholesale transfers of AAUs without any such linkage would be legal under the Marrakech Accords, but for all the reasons discussed earlier in this report is likely to be the most heavily discounted.

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4 Namely Annex I carbon sink projects (RMUs); CDM projects (CERs, from investments in developing countries under Art. 12); JI projects (ERUs, from investments in other Annex I countries under Article 6); Trading of Assigned Amount Units (AAUs, acquired from another Annex I country through trading under Article 17).

5 There are restrictions on the volume of RMUs allowable (1% of initial Assigned Amounts), though Jotso and Forner (2002) make a persuasive case that this cap could not be reached anyway. RMUs cannot be banked for use in subsequent periods, but their allowable and likely volume is sufficiently small that they can readily be used in the first period for compliance and other units banked instead. Similar remarks apply to ERUs and CERs, of which a maximum of 2.5% of initial Assigned Amounts each can be banked.

Box 1. Differentiation among the Kyoto project mechanisms

Project mechanisms. Credits from project mechanisms may attract a premium over AAUs from trading, principally because they can be seen on all sides to be associated with real project investments — real action and measured environmental gain — as opposed to paper trading. Supplementary reasons include the interests of domestic actors (e.g. within Russia) to use project credits to attract and leverage much larger overall investment to specific sectors and projects, as well as the sheer political difficulty of developing domestic corporate emission trading systems. However there is likely to be discrimination even within the project mechanisms.

CERs may attract a premium over ERUs for three reasons: they are more likely to be perceived as contributing to developmental needs in poor regions; the crediting can begin immediately (as opposed to being a forward transfer of credits projected from 2008); and they will pass through a more rigorous international procedure for accreditation. Amongst CERs, there may be preference for those generated from small-scale, renewable energy projects under the 'fast track' procedures agreed at COP8, because of the general perception that renewable energy promotion is a good end in itself and because the COP8 decision removes much political risk.[6] Detailed rules for accrediting other CDM project types have yet to be determined by the Executive Board. Discounting may be particularly large for some forestry projects, given both greater potential land-use conflicts, and the longer timescales likely to be involved in resolving rules for these (which are not scheduled to be resolved until COP10, in 2004).

ERUs may be somewhat more homogenous, in part because of the smaller geographic and economic range of the source countries. However, there could clearly be a distinction between the 'mainstream' and 'track two' JI procedures. The former, for projects in countries that have fulfilled all relevant eligibility criteria, might give greater legal security about the credits, but for many EITs, full eligibility may imply a long delay, and the detailed project supervision is slight compared to CDM projects. 'Track two' procedures in principle could come onstream quicker, but uncertainty still exists about the exact form and functioning of the Supervisory Committee.

RMUs are perhaps more difficult to locate in the spectrum. However, the perception (to an important degree correct) that land-use projects are often somewhat more questionable in their quantification of incremental emission savings, and that they provide a temporary palliative rather than promise of strategic solutions, they may be seen as inherently less valuable than CERs and ERUs, especially those derived from energy sector investments (note however, that the perception that energy-sector investments are inherently more valuable than land-use projects is disputed as a general principal).[7]

All this of course makes price prediction extremely difficult. However, various approaches, or influences, can be considered.

– Expert prediction of those already engaged in real trading; these confirm strongly the hypothesis of wide price differentiation between projects and mechanisms.

– Sufficiency, i.e. prices required to significantly affect investment behaviour; this implies prices around USD/EUR 10-20/tCO_2 to be relevant in project economics.

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6 FCCC/CP/2002/L.5, Report of the Executive Board of the CDM, Decision CP8, Annex A: 'Draft simplified modalities and procedures for small-scale clean development mechanism project activities'. Such projects are defined as (i) renewable energy project activities with maximum output capacity equivalent of up to 15 megawatts; (ii) energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, by up to the equivalent of 15 gigawatt hours per year; and (iii) other project activities that both reduce anthropogenic emission by source and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.

7 e.g. Chomitz (2002) argues that from a carbon perspective the differences between energy and land-use projects are far less clear and systematic than often supposed, and Pandy (2002) makes a strong case that agroforestry in developing countries could have large ancillary benefits for host countries.

– Political constraints arising from the desire to protect existing domestic policies on the one hand, but to constrain intergovernmental transfers on the other.

The last of these relates mostly to Canada, because of its likely high demand. Table 3 shows implications for Japan and Canada under combinations of extreme cases. If the need for allowance imports is low, and it is considered acceptable for international carbon allowance expenditure to reach 20% of ODA expenditure, then Japan might accept international carbon prices about USD 20/tCO_2e, compatible with the other measures. Canada however, with a much higher proportion of carbon import needs relative to ODA expenditure, may find it hard to tolerate international AAU prices much above USD 5/tCO_2 even under relatively favourable conditions. Much more likely is that Canada will seek large volume international transfers of AAUs at prices well below this, and perhaps as low as USD 1/tCO_2e. Prices much above this are likely to run into varied political constraints: from the same domestic pressures that have curtailed ODA expenditure to the present levels; from domestic development aid constituencies, arguing that development is a far more pressing need for such large expenditures — and, indeed, from developing countries themselves, on the same grounds.

Table 3. International revenue flow constraints on carbon prices

	Current ODA expenditure (1998 data)		Likely volume of imports, $MtCO_2e$/yr		Price required for allowance trade to equal x% of ODA	
	USD bn/yr	% GNP	Low	High	20%	5%
Japan	1 0640	0.28	100	200	21.28	2.66
Canada	1 691	0.29	50	100	6.76	0.85

These considerations underline why price differentiation is probably inevitable in the Kyoto system. Prices for project-mechanism credits that are high enough to be effective, in terms of influence on discrete projects, are likely to lead to unacceptably high resource transfers if applied to wholesale AAU transfers. AAU transfers will generally be at much lower prices - but to avoid undermining the basic purpose of Kyoto and of domestic measures already in train, they will be contained in application to those cases where such transfers are deemed necessary and acceptable to enable countries to comply.

Table 4 summarises the specific price predictions derived from these varied perspectives. It suggests a wide range of prices, differentiated according to the nature of the source, project and mechanism. Prices for companies engaging in Kyoto-compliant projects in developing countries and EITs will be in the range GBP 10-25/tCO_2 for the smaller-scale, widely-approved projects such as renewable energy investments, and GBP 5-15/tCO_2 for more potentially controversial (and lower cost) projects including land-use, but also for example for large-scale boiler retrofitting or gas conversion. Prices for allowances themselves (AAUs) may be lower, but they may be seen as having lower value, and little or no co-benefits, except where they are visibly linked to environmental investments at prices that may push towards the level of project credits.

In turn, the prices for large-scale transfers of AAUs between governments may be lower still; but the private sector will not be given access to these. The reason for this, fundamentally, is that although emissions trading under Kyoto has been analysed as one instrument, in reality it will be used to fulfil two quite different functions. One is the traditional role of providing market flexibility and efficiency at the margin of project investments. The other is fundamentally a redistributional function, correcting the excessively lop-sided nature of the original Kyoto allocations. The cost of making such transfers at the 'market' price that would be required to sustain action effective action on climate change is politically tenable. Neither 'east nor west' has the market power to exact such a price, nor could the fledgling Kyoto institutions withstand the political pressures such transfers would generate. So, large-scale intergovernmental transfers, most notably for Canada, will occur at much lower prices — and domestic programmes, and the private sector, will be shielded from the malign influence that such low prices would otherwise exert on international efforts to initiate some real action under Kyoto.

Table 4. Probable prices ranges for different Kyoto-related units

Type of Unit	Location / mechanism	Project / source / procedure	Likely price range, GBP/ $MtCO_2$
(a) Kyoto compliance units available to private sector	Developing country projects: Certified Emission Reductions (CERS verified through the Clean Development Mechanism procedures)	(i) Renewable energy and energy efficiency projects under CDM fast-track procedures for small scale projects	10-25
		(ii) Land use and other CDM projects	5-15
	'Joint Implementation' projects in EITs: Emission Reduction Units (ERUs verified under Article 6).	(i) 'Track 1' projects from countries with full eligibility (reduced additionality governance)	5-15
		(ii) 'Track 2' projects under Supervisory Committee - Small scale, renewables - Larger conversion projects	10-20 5-15
	Assigned Amount Units transferred from EITs (Article 17)	(i) Accession country transfers within context of EU trading system	7-10
		(ii) Transfers from other EITs verified under 'green investment scheme' approach or approved domestic trading schemes	5-10
(b) Kyoto compliance units exchanged directly between governments	Assigned Amount Units transferred from EITs (Article 17)	(i) Accession country transfers to EU Cohesion countries within enlargement 'trading bubble'	3-8
		(ii) EIT transfers to other OECD countries (e.g. Canada)	2-8
		(iii) Large-scale possible Russia/Ukrainian transfer in context of hypothetical US re-entry	1-3
c) Compliance against domestic energy/power sector trading systems / levies		EU trading system	5-12
d) compliance or credits for transport sector projects — carbon component		EU - Other -	20-50 5-35

Source: Authors estimates.

Kyoto may evolve towards greater price consistency over time, but price instability and discrimination between different kinds of emission units may be fundamental features of the early stages especially. For Kyoto's first period, price convergence, stability and greater homogeneity could only realistically be expected if and when the US were to rejoin the system.

7. Volume flows and potential carry-over of Kyoto units

The previous analysis has emphasized that the international flexibility in Kyoto is unlikely to undermine the general impetus to domestic action in Kyoto countries. This differs from economic modelling assumptions where the slack nature of the international market leads to reduction (or complete loss) of incentives to domestic action. The fact that countries importing under Kyoto will still be taking domestic action has implications for the balance of supply and demand.

Table 5 shows two scenarios of the potential volumes of demand and supply, that probably represent limiting high and low cases for the degree of surplus. These are constructed in terms of emission trends from the latest year's data, the year 2000, and taking account of underlying trends (such as high population and economic growth rates in Canada).

Table 5. Supply-demand balance in Kyoto system (MtCeq./yr): limit scenarios

	Historical emissions		Low surplus (High demand, low supply)		High surplus (Low demand, high supply)	
	1990	2000	% change 2000-2010	Carbon balance	% change 2000-2010	Carbon balance
Gross Demand				**220**		**53**
EU Carbon	911.4	895.5	7%	120	-3%	30
Japan carbon	305.3	313.7	10%	58	-3%	17
Canada carbon	128.6	158.0	15%	61	0%	37
+ Net other GHGs (+5, -5%)				12		-2
- Managed forest allowance				-30		-30
Supply				**331**		**587**
Russia carbon	647	450.7	20%	106	0%	196
Ukraine carbon	191.9	104.5	20%	67	0%	87
Accession 10 carbon	245.2	146.6	25%	45	5%	75
Other EITs	87.8	45.4	25%	24	0%	36
Other GHGs (10, 20%)				24		79
+ Managed forest allowance				40		40
CDM (MtC/yr equiv in Kyoto period)				15		50
Net surplus				**101**		**509**

Under a 'low surplus' scenario that combines high demand with low supply, gross CO_2 emissions in the EU-15 might be about 120MtC above its Kyoto allocation, and those from Japan and Canada might each be about half that (60MtC/yr) in absolute terms. Assuming that Australia and the US remain outside the Protocol, and after taking account of other greenhouse gases and the managed forest allowance, the total demand from OECD countries might be about 220MtC/yr. Under 'low supply' assumptions, in which emissions from the EITs grow 20-25% from their levels in year 2000, the total supply from EITs might be about 330MtC/yr, to which a minimum level of CDM investment might add the equivalent of about 15MtC/yr. The result is a surplus of 100MtC/yr — or a total over the 5-year period of 500MtC presumably 'banked' into subsequent commitment periods. Under the ‘high surplus’ scenario, in which emissions from the EU and Japan decline 3% below current (2000) levels and Canada stabilizes at 2000 levels, the potential demand (after taking account of the Marrakech forest allowances) is shrunk to only just over 50MtC/yr. If emissions in the EITs follow their emission trend of the last three years — essentially flat at current levels in which economic growth is matched by equivalent gains in energy efficiency — then total availability of allowances from the EITs is likely to exceed 500MtC/yr. If there is also greater take-up of the CDM, then the potential net surplus could itself exceed 500MtC/yr.

These are limiting scenarios, that combine extremes in opposite directions, particularly concerning the ‘low surplus’. Far more likely is something more central; the actual surplus will probably be in the range 200-400MtC/yr, or 1 000-2 000MtC total unused from the first Kyoto period. For comparison, US CO_2 emissions in 2000 (and in 2001, in which emissions fell slightly) exceeded the US’ original Kyoto allowance by about 300MtC/yr.

8. Conclusions

The over-arching role of governments in the ‘Kyoto market’, and the varied interests and mechanisms as sketched, have several implications.

First, in reality, there will not be one uniform ‘price of carbon’, but many diverse prices at least in terms of implications for actual project economics. It may be that international trading facilities develop a marker ‘carbon price’ for Kyoto units, but not all sellers will make their units available at a flat price, nor will all governments recognise all types of Kyoto units without discrimination. Consequently, some units will trade at a discount, some at a premium, because their value to companies for complying with domestic legislation will vary correspondingly.

This is an observed characteristic of the nascent private sector carbon market at present. Companies are more willing to pay for emission credits from projects that are perceived as very high quality and uncontroversial — projects to which hardly anyone is likely to object, and which seem likely to attract the approval of both governments and NGOs. Emission units from other sources may be traded, but at a discount. The relationship of government interests to corporate investment will become more important, and more complex.

The implication is that the Kyoto Protocol, as elaborated in the Marrakech Accords, will not in itself define ‘the standard’. It may do so for CDM project credits (CERs), though even for this, credits from renewable energy projects in the poorer countries may well be given a premium compared, for example, to forestry projects in some others. The COP8 decision on expedited procedures for small-scale CDM projects, indeed, could help to define the first real international carbon market component, and renewable energy credits generated under the CDM fast track procedures could emerge to be the ‘marker’ commodity in the carbon market. The Marrakech Accords may also set market standards for JI project credits (ERUs), though differentiation is likely between the two tracks for JI.

In contrast, the Marrakech Accords simply cannot in themselves set a definitive standard for the international trading of all the AAUs potentially available, for the simple reason that this would lead the whole Kyoto system to collapse under a sea of meaningless paper transactions.

The surplus will not eclipse domestic action, but offers a strategic level for engaging supplier countries and a backstop of prices. The size of the surplus remains uncertain, and aggregated models with a price-equilibrium are too unrealistic to be useful in this respect. Scenarios sketched suggest that the overall surplus, averaged over the Kyoto period, is most likely to be in the range 200-400MtC/yr.

Given the reality of such numbers, the only circumstances in which a free and competitive market could emerge would be if the US rejoined Kyoto, with its original allocation (and probably in the context of a US-Russia deal on 'hot air' allowances) so as to bring back some semblance of balance between supply and demand - not a prospect that seems likely. Barring this, the Kyoto system will have to deal with carry forward of huge volumes into subsequent periods.

Finally, these observations are not so surprising in a historical context. No global markets have been created in one massive act. Most markets have evolved, starting with domestic trading, and expanding slowly as trading links build up and buyers gain confidence in the quality and 'legitimacy' of imports. Albeit within the context of a global system, the carbon market is likely similarly to evolve.

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POLITICAL ECONOMY OF TRADEABLE PERMITS – COMPETITIVENESS, CO-OPERATION AND MARKET POWER[1]

by

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1. Introduction

There is a consistent pre-occupation in the research literature on emissions trading with what configurations of trading arrangements are likely to be economically efficient both statically and dynamically, and — to a lesser extent — what is likely to be fair — who are the winners and the losers. Issues of environmental effectiveness are also addressed in this context.

Conversely, amongst the policy practitioners, there is little overt interest in economic efficiency, and not much treatment of fairness. There is a strong interest in implementability, and in environmental effectiveness. The presentations at the CATEP workshops reflected these parallel pre-occupations, and attempts were made by some to make a bridge between them. In this paper we review some of the papers and associated other literature that address these issues in political economy, with a particular emphasis on insights emerging as regards competitiveness, co-operation and market power.

Much of the relevant research emerging at the CATEP workshops was animated by either ex post analysis of existing programmes, or an ex ante analysis of 'new' emissions trading proposals, such as the proposal by the European Commission for a European Union (EU) wide scheme.[2] At our first workshop in Venice, in December 2001, Zapfel and Vainio (2001) presented a paper — 'Pathways to European Greenhouse Gas Emission Trading' — which mapped the at times surprising evolution of the emissions trading idea in Europe, the misconceptions that in the past and still to this day complicate progress, and concluded with a presentation of a coherent case for the creation of an EU wide greenhouse gas emissions trading scheme. They both work with the European Commission in DG Environment, and continue to be heavily involved in moving the emissions trading agenda

1 This paper is a synthesis of presentations and papers presented and discussed at Concerted Action on Tradeable Emissions Permits (CATEP) workshops in Venice (2001), London (2002), Kiel (2002) and Budapest (2003), on the theme: "Political Economy of Tradable Permits — Competitiveness, Co-operation and Market Power."

2 'Proposal for a directive establishing a framework for greenhouse gas emissions trading within the European Community, European Commission,' Brussels, October 23, 2001.

forward. The Commission had released its proposals just two months earlier, in October 2001, following an intensive consultation process. This co-incidence of occurrence of the initiation of our workshop series with publication of these proposals was fortuitous, and provided a continuing deliberative thread to our workshops as they unfolded. The formal withdrawal from the Kyoto Process by the US added another dimension which was incorporated into the research agenda. Our brief did not confine us to climate change or indeed to Europe, but inevitably much of our focus was shaped by these developments.

In Venice, Egenhofer (2001) provided a very comprehensive 'state of the art' as regards the theory and (especially) the practise of emissions trading, and its links with other policy instruments, notably taxation. As regards the latter, he notes that 'On a practical level, taxation increasingly is used as a stick to convince industry to accept cap and trade emissions trading programmes. Typically, firms accepting an absolute cap and participation in cap-and-trade programmes are exempted from environmental or carbon taxes as evidenced in the UK where companies accepting to participate in the ET scheme are exempted up to 80% of the UK climate change levy.' The criteria applied in the evaluation of emissions trading are typified by the paper by Boemare and Quirion (2001). They assess the Commission's proposal in some detail, and touch on 10 other schemes from a variety of perspectives, including number of participants and spatial coverage and permit allocation. For each theme, they set out the relevant theoretical framework and its implications, and then assess practise. The parts of their template which address competitiveness, co-operation and market power provides a convenient framework into which to incorporate some of the relevant political economy issues that were addressed in the research literature presented at the workshops.

2. Market power and competitiveness

Language is important. In considering 'competitiveness' the meaning of the word in different fora deserves some discussion. When it is used by those in business, they tend to understand it as the conditions that will allow their own enterprises to thrive in domestic and international markets. But when economists think of 'competitive conditions' they mean the combination of macro and micro policies that will allow an economy overall to prosper — and an important pre-requisite in this respect is that more efficient enterprises should be facilitated and encouraged to take over or replace those that are less efficient. This linguistic distinction is important when we turn to this issue as regards emissions trading.

When permits are allocated, it is important that no one entity hold sufficient quantity to influence the price, and that no combination of permit holders combine with sufficient market power to influence price. As regards number of participants in the proposed EU scheme, Boemare and Quirion (2001) observe that 'Standard theory suggests that, providing administrative and monitoring costs are not disproportionate, as many emitters as possible should be covered by the permit scheme' on the basis that such numbers enhance the prospects of diversity in marginal abatement costs, and lowers the risk of excessive market power. But Sartzetakis (2002) points out that as we often live in a second best world; contrary to the typical presumption of economists and policy makers that competitive markets allocate emission permits efficiency, competition in the emission permits market cannot assure efficiency when the product market is oligopolistic.

Boemare and Quirion (2001) judge that the Commission proposals score well as regards number of participants and ensuing competitiveness. However, they note that coverage is partial — i.e. confined to a limited number of sectors, and that this requires that they go 'downstream' to the energy users, rather than 'upstream' to the energy producers and importers, and that there is no provision for voluntary 'opt in' by firms below the size thresholds and/or other sectors not initially included. Such 'opt in' could help further dilute any emerging market power. Note however that this proposition that the larger and more diverse the number of potential abaters the better is only true where the benefit yielded by each unit of abatement — e.g. one tonne of CO_2 equivalent — is the same without regard to where it is achieved, as is the case with greenhouse gas emissions. Morton and Atkinson (2002) model the expansion of regions to abate NO_x emissions and deposition in the Chesapeake region in the US. They conclude that — because abatement in the extended part of the region yields much lower benefits than those in the 'original' region — such expansion can reduce net benefits, as abatement migrates to the lower cost but less beneficial new areas.

It is interesting to note that, as the Commission's proposal was considered by the Council of Ministers (representatives of Member States) the effective dilution of market power approved of by Boemare and Quirion was compromised in order to secure the agreement of the Member States. Specifically, in the scheme agreed by the Council of Ministers - but not yet (March 2003) approved by the European Parliament - there is a provision which allows for 'opt out' by installations or sectors, provided they meet their obligations otherwise, and 'pooling' whereby groups of installations can come together and be represented by a trustee who acts on their behalf. This typifies the tension between the idealised scheme as argued for by the research community, and the compromises which stakeholders perceive as being necessary to secure progress. This conflict is even more acute in regard to the manners in which permits are allocated.

3. Carbon leakage and competitiveness

The issue of 'carbon leakage' — the increase in carbon or other greenhouse gas emissions in jurisdictions not 'capped' by the Kyoto Protocol or other provisions — received relatively little treatment in the workshops. Albrecht and Schoors (2002) note that when energy-intensive industries shift from developed countries to developing countries without emissions reduction obligations, this can facilitate some developed countries to realise their Kyoto targets. However, global greenhouse gas emissions and the threat of climate change remain unchanged. When relatively less efficient production technologies are used in developing countries, global emissions can even increase. This potential 'competitive effect' was an important underlying issue in shaping Canada's decisions re whether to ratify the Kyoto Protocol, and in the design and implementation of its abatement programmes. Drexhage (2003) notes in this context that grandfathering is proposed for the Canadian emissions trading scheme, associated with commitments by the Canadian government to the oil and gas sectors that prices will not rise to more than CND 15/tonne of CO_2 equivalent, and they will not have to improve energy intensity by more than 15%. The rationale for such concessions are fears that, in their absence, utilities may migrate to the US.

Fischer (2001) addresses a related issue, namely the influence of different corporate tax regimes and transfer pricing arrangements on the decisions of multi-national countries as to where to concentrate their reductions. On the basis that their decisions are guided by where to maximise net profits, she concludes that: 'For emissions policies between developed countries, taxes will certainly be an issue. Multinational firms will tend to locate their abatement activities in higher tax countries, repatriating profits to the lower-tax home countries (or shifting income to lower tax jurisdictions among subsidiaries). Without explicit and appropriate transfer pricing rules, as well as a clear price for emissions, many of the efficiency gains from flexible abatement location mechanisms may be lost to inefficient tax shifting.' The influence of differential tax rates on decisions will become an issue for multi-nationals in the EU, as its trading scheme comes into effect in 2005.

4. Allocation and competitiveness

Boemare and Quirion (2001) posit the distinction between auctioning — selling emission permits to the highest bidder — and giving them away for free, either on the basis of share of output, e.g. x permits per kWh for power plants (after first deciding on the allocation to each sector), or on the basis of an exogenous criterion such as share of historic emissions ('grandfathering'). They note that 'general equilibrium modelling has shown that the most cost-efficient way to allocate permits is to auction them and to use the revenue to cut pre-existing distortionary taxes,' citing Goulder *et al.* (1999) in this regard.

But Tietenberg (2001) takes a more sanguine view, following in the tradition of Coase (1960). In effect he discounts the double dividend impact by arguing as follows: 'Whatever the initial allocation, the transferability of the permits allows them to ultimately flow to their highest valued uses. Since those uses do not depend on the initial allocation, all initial allocations result in the same outcome and that outcome is cost-effective…..It implies that with tradable permits the resource manager can use the initial allocation to solve other goals such as political feasibility or ethical concerns without sacrificing cost effectiveness.'

In addition to losing the double dividend, 'grandfathering' would provide incumbents — those in business at the time trading was initiated who qualified for an allocation — with an advantage over new entrants who would have to buy. While this would probably enhance the ability of the former to stay in business and indeed expand, it would damage an economy's overall competitiveness, as it could inhibit some potentially more efficient companies from entering the market. Where the free allocation is on the basis of a share of total output, then presumably new entrants get their allocation permit in effect at the expense of incumbents, as new slices are taken from the existing 'permit pie.' In sectors and economies that are growing rapidly, this could be a source of considerable uncertainty for firms.

In the European Union, the Competition DG has judged that the allocation method must treat all firms equally, including new entrants. This means that if incumbents get allocations for free, then new entrants must likewise get free allocation. There has been concern expressed that the existing EU States might suffer 'unfair competition' from Accession States some of whom will have greenhouse gas surplus to their requirements and might subsidise inward investment or domestic firms. The competition rules imply that it will be impossible legally for such discrimination to take place.

Boemare and Quirion (2001) argue that 'The choice of grandfathering in most systems is a direct consequence of the political influence of regulated firms in the policy process….indeed a lesson from positive political economy is that firms which risk an important loss are more likely to incur the costs of lobbying than households or firms which could benefit from a reduction in pre-existing taxes….' There appears therefore to be a conflict between the economic efficiency ideal on the one hand, and the political 'reality' on the other that encourages policy systems to provide free allocation.

Pezzey (2002) argues that three variables — cost minimisation (traditional economic efficiency), information efficiency (incorporating transactions costs) and political acceptability — must all be considered in the design and implementation of emission trading schemes. In his terminology, maximum 'efficiency' means achieving a given carbon reduction goal at minimum total cost to a country, 'informational efficiency', is minimising a scheme's costs of administration, transactions, monitoring and enforcement, and 'sufficiently acceptable' means commanding enough political support to be passed into law by a country's legislature.

The three goals — (total) efficiency, acceptability and equity — can obviously conflict. Acceptability differs from equity, because welfare losses concentrated among a few firms result in far more political pressure than the same dollar losses spread over millions of people as consumers.

The principle of acceptability — which is subject to test in the political marketplace — is to compensate roughly for the net costs of carbon control. In practice, Pezzey (2002) conjectures that acceptability probably requires a political principle of approximately compensating for the profit that an industry loses because of carbon control. Grandfathering to fossil fuel industries while reducing total carbon use would give these industries large monopoly profits which would overcompensate for their losses. Pezzey recommends a hybrid system, with compensation requiring much less than half of total carbon permits to be free. He proposes that the remaining auction revenues should be partly recycled as lower rates of conventional taxation and partly given as lump sums to households. He argues that consumers also deserve compensation for higher prices of fuel and carbon-intensive products. As regards new entrants, he makes the case that free permits do not significantly distort competition by creating barriers to entry as long as the proportion of free permits is chosen to compensate for the costs of carbon control, and if this proportion is not altered to discriminate against foreign rather than domestic ownership of firms, or in favour of public rather than private ownership.

Quirion (2002) provides the first quantitative assessment of competitiveness impacts from a unilateral implementation of the European Commission allowance trading directive proposal for the iron and steel industry, and concludes that the impact of the Directive on competitiveness in this sector is minor. Under the Directive the author estimates that production drops by in the range of 0.1% to 4% (5% with the opt-out clause) and that profits undergo a significant loss only when the permits are auctioned. He estimates that the opt-out clause, if widely acted upon, could harm production and profit in the iron and steel sector.

5. Equity and competitiveness

The fairness or equity issues associated with allocation are also a subject of considerable research. The work of Bovenberg and Goulder (2000), US Congressional Office (2000) and Burtraw *et al*. (2001) all support Pezzey's view noted above that firms benefiting from 100 per cent free allocation will be better off than before the trading scheme was introduced. The fact that industry associations in a number of countries, e.g. the UK, have led the argument for the introduction of emissions trading with free allocation supports the view that they can see a range of merits in emissions trading, including perhaps some rent capture. But why then do some firms and industry associations oppose the introduction of emissions trading? This issue has come to the fore in the European Union where much of industry in Germany was antagonistic to the emissions trading scheme as proposed by the European Commission, although it included free allocation.

One explanation is the following: There can be a dichotomy between the predicted benefits likely to accrue to industry as a whole, and individual firms. The latter are typically risk adverse. They may agree that total benefits to industry in aggregate will be positive, but — until the allocations are made to individual firms — there is no guarantee that any individual firm will be better off. Another reason expressed by industry for antagonism to auctioning is the high degree of uncertainty about likely permit prices prevailing before the first auction takes place (Wrigglesworth, 2003). The relative incentive effects that lead firms individually and in aggregate to oppose the introduction of trading, and/or the auctioning of permits, deserves more research.

Where allocation is free, and this results in windfall gains to producers, there can be a policy response. The Montreal Protocol on Substances that Deplete the Ozone Layer called for a cap on chlorofluorocarbon (CFC) and halon consumption at 1986 levels, with reductions in the cap scheduled for 1993 and 1998, and full phase out by 2000. Consumption was defined as production plus imports minus exports. In the US, the EPA distributed permits to companies that produced or imported CFCs and halons, based on 1986 market shares, and they were allowed to trade. The latter provision produced substantial savings, relative to the costs that would have been incurred with command and control regulation. Congress coupled the marketable permit scheme with excise taxes on CFC production designed to capture the ensuing 'windfall gains.' The revenues were not earmarked to compensate households or other affected parties (from: 'The US Experience with Economic Incentives for Protecting the Environment,' US Environmental Protection Agency web site, 2002). This form of 'policy evolution' led some industry representatives at our workshops to think more positively about auctioning, on the basis that a 'windfall tax' could prove much more financially onerous, and create more corporate uncertainty, than the auction. However, such views were 'not for attribution.'

6. Baseline and credit and competitiveness

Our discussion thus far has focussed on 'cap and trade' or allowance schemes, whereby an absolute ceiling is set and allowances allocated. In some jurisdictions, it is argued that for the sectors exposed to international competition, a 'baseline and credit' system should apply. Under the latter, a standard is set, e.g. amount of greenhouse gas emissions per unit of electricity produced, and as long as a firm does not exceed this standard, it is not required to hold permits. Tietenberg (2001) summarises the situation thus: 'Despite their apparent similarity, the difference between credit and allowance-based trading schemes should not be overlooked. Credit trading depends upon the existence of a previously determined set of regulatory standards. Allowance trading does not. Once the aggregate number of allowances is defined, they can, in principle, be allocated among sources in an infinite number of ways. The practical implication is that allowances can be used even in circumstances: (1) where a technology-based baseline either has not been, or cannot be, established or (2) where the reduction is short-lived (such as when a standard is met early) rather than permanent.'

The Committee established to advice the Netherlands government on emissions trading proposed that a baseline and credit scheme — which they styled Performance Standard Rates (PSRs) - should apply to firms in the sectors exposed to international competition.

The Netherlands Committee distinguishes between firms in an exposed sector and firms in a sheltered sector. While the sheltered sector would be faced with an absolute cap on emissions, firms in the exposed sector would be subject to relative standards or PSRs (Performance Standard Rates). In this, they follow the practise followed in the UK, where this distinction characterises their domestic trading scheme.

In their assessment of the Netherlands Committee proposal, Kuik *et al*. (2002) note that emissions trading between the exposed and sheltered sectors is possible. They posit that the exposed sectors will profit from selling allowances to the sheltered sectors. Energy-intensive, export-oriented sectors could face a deterioration of their competitiveness, with a possible incentive for relocation of such production activity abroad.

The Committee concludes that the extension of coverage to include small firms and private households would result in administrative burdens of monitoring and enforcing that would be excessive with millions of small end users. This latter argument was often made at the workshops, but the costs of not involving the public directly in the trading scheme were not quantified. A key limitation of emissions trading is that the public have little understanding of what it is and how it works, and in the longer term, this could prove to be an important limitation. We are perhaps a little too glib in dismissing the possibility of engaging the public directly on the basis that the costs will exceed the benefits, when the latter have not been quantified.

Kuik *et al.* (Ibid) conclude that the incompatibility of the proposed Dutch scheme with that proposed by the EU - including the division between the exposed and sheltered sectors, the trading system itself, the initial allocation of allowances and the role of electricity within the scheme — limit its value.

Koustaal *et al*. (2002) observe that one reason to explain the different approach taken in the UK and the Netherlands as compared with the EU is the fear of loss of competitiveness if industries are confronted with an absolute cap while these sectors in neighbouring countries are not. The Dutch proposal states explicitly that emission trading should not reduce the competitiveness of the Dutch industry, which is the main reason for the choice for relative targets in those sectors which are exposed to competition from abroad. In the reactions to the draft EU Directive on emissions trading, the UK has stated a preference for their own initiative while the Netherlands has indicated that they would prefer relative targets. This illustrates how uncoordinated local policy initiatives can result in a lock-in, even though there is an alternative co-ordinated policy at the international level. Their main conclusion is that trading with a relative cap is less efficient than trading with an absolute cap because a relative cap is a combination of a price on emissions and a production subsidy.

They also advert to the issue of double counting, if electricity emissions were to be addressed directly in some member states, and indirectly in member states which advocate relative targets, e.g. the UK and the Netherlands. Wrigglesworth (2003) strongly advocates the use of direct emissions as the charge point, on the basis that signals to producers and consumers need to be as direct as possible (market forces), longer term signals are very important for investment decisions and markets need the freedom to work efficiently and to gain critical mass — i.e. fungibility is essential.

7. Competitiveness and transactions costs

If the costs of 'doing the business' - finding out what the prevailing price is, identifying possible buyers and sellers, making the transaction — are high as regards outlays of time and money, any trading scheme will be seriously and perhaps fatally weakened. And if it is, the efficiency and overall competitive advantages that a well functioning market yields will not accrue. Borregaard *et al*. (2001) noted that high transactions costs in the case of the particulates emissions trading market in Santiago Chile seriously undermined its potential effectiveness. Boom and Nentjes (2002) evaluate blueprints for two international emissions trading schemes between private parties, with a focus on minimising transactions costs. They note that these costs rise as permit allocation is shifted downstream from energy producers and importers (very few) to users. They discuss the administrative burden and observe that intricate systems increase the costs of setting up and maintaining the trading scheme. They cite Hargrave (1998) on the factors shaping the administrative burden:

- The number of regulated sources. The larger the number of sources the more information is needed in setting up the system.

- The availability of needed data. If the data is readily available, the previous point becomes less important.

- The level of reporting requirements and the level of monitoring needed. If reporting requirements are very intricate, the costs for the regulated sources are high. High levels of monitoring mean high costs for the monitoring authority.

– Proper accounting. Ideally, firms are only required to hold emission quotas for emissions of greenhouse gases, and only for domestic emissions.

They suggest that allocating the permits downstream — to achieve political acceptability — with monitoring upstream is a hybrid that reduces transactions costs.

It was noted by many researchers that the requirement in the Commission's trading scheme for each Member State to allocate permits via a 'National Allocation Plan' was likely to engender very high costs, a proposition that is supported by some US experience, notably that associated with the RECLAIM scheme in Southern California. In this scheme, the allocating authority considered dozens of alternative allocation formulas. The final allocations were based upon complicated formulas in which each facility received three sets of allocations of tons of NO_x and/or SO_2; a starting allocation for 1994: a mid-point allocation for 2000; and an ending allocation for 2003. The basic ton allocations are based upon multiplying an appropriate emissions factor, i.e. pounds per million Btu of energy input for each of the three years by a single value for historic throughput or usage that is determined by each facility's peak activity over the period from 1989 to 1992. The emission rates for each of the allocation years are based upon adopted rules, as of December 1993, for each facility. The 1994 allocations are supplemented by the offsets which facilities had obtained to comply with new source review requirements. In addition, facilities were given non-tradable credits for the first three years of the program if they reported 1987, 1988 or 1993 emissions were greater than their starting emissions (Harrison, 1999).

In his very interesting exploration of the California water market, Hanneman (2001) concludes that the (modest) successes achieved — for example as regards water transfers involving Colorado River water - are a consequence of clear property rights assignment, a relatively small number of water users operating in a closed system, and few third party effects. He attributes failures in other areas to inadequate property right assignment, which in turn is at least in part a product of government failure. The State Water Resources Control Board has been captured by vested interests and fails in its primary task to clarify water rights.

8. Competitiveness and supply and demand for permits

The equilibrium price of permits is perceived by many firms as a key variable influencing their competitiveness. Where firms have been given their permit allocation for free, the higher the price, the greater the asset value of their permit holdings, but also the more they have to spend if they have to purchase permits. For firms in those countries widely perceived as being likely purchasers, this issue is of some moment. Pretel (2003) calculated the emission 'headroom' in the EU in terms of quantities likely to be available for sale, and the quantity that countries were likely to need to 'import', using EU data from 3rd National Communications to the United Framework Convention on Climate Change. These data show that requirements from the 'existing' EU countries for emission credits (scenario 'with measures') is approximately equal to the quantity in excess of domestic requirements that could be supplied from EU-A1 (Annex I countries soon to be EU). In the scenario 'with additional measures' the EU including accession countries could be a net supplier of credits. If accession goes as planned, this means that by the time trading starts in the European Union scheme post January 2005, the equilibrium price could be quite low. However, this depends on the range and extent of marginal abatement costs, the extent to which opt out and pooling inhibits market development, and the willingness of 'surplus' countries to supply credits.

Haites (2003) addresses the issue as to whether non-Kyoto Protocol (KP) parties should be allowed to trade with those Annex 1 countries that have accepted a cap on emissions. This is very relevant as regards the equilibrium price that will emerge from trading, and in turn affects the position of firms faced with competition from countries such as the US who are non-ratifiers.

He argues that non-Kyoto Protocol parties can't be prevented from buying Kyoto Protocol permits, but Kyoto Parties can't buy non-Kyoto party permits. The McCain-Liebermann bill in the US Senate — to take effect in 2010 if enacted - proposes that 15 per cent of total emission permits be purchased from Kyoto Parties. This is only likely to happen if the Kyoto Protocol price is lower than the domestic price in the US. Non Kyoto Protocol parties will need to have an account in the Kyoto Protocol registry so that KP units can be transferred and cancelled. Khatib (2002) makes the familiar point that exclusion of developing countries from trading in the longer term is likely to prove fatal to the prospects for success in addressing global warming. He focuses on electricity generation in developing countries and documents the fact that much of it is coal based, and relatively inefficient, that it will account for 50 per cent of global electricity originating CO_2 by 2020, and that emissions trading extended to the developing countries is a pre-requisite for abating emissions from that source.

Borregaard *et al.* (2001) evaluate the record of Chile in mobilising markets to achieve resource and environmental objectives, including the use of emissions trading, a theme which is also addressed by Sancha (2003). They note that Chile is exceptional amongst developing countries in its use of markets to conserve environmental endowments, and ask: 'Does it matter that developing countries are hardly using market based instruments in managing their environmental endowments? To the extent that their absence encourages inefficiency and ineffectualness, the answer is 'yes'. To the extent that they give developed countries users of these instruments an advantage over developing countries, the answer is also 'yes'; it becomes one more disability to be overcome.'

Baron and Bygrave (2002) make the point that the major payoff to linking systems is to widen and deepen the market. However where there are cap and trade and baseline and credit (relative) schemes to be linked there are competitiveness issues for firms operating across systems; those firms covered by a relative target will be more competitive than those covered by an absolute target, and this could result in some movement of investment and production across countries.

An issue not much addressed at the workshops was the extension of emissions trading schemes to incorporate sequestration or offsets, and the renting of permits. An exception was the contribution by Sedjo *et al.* (2002) who advocate the integration of sinks into trading schemes, and provision for the short term renting of permits. These two measures would enhance competitiveness by improving flexibility, extending the range of opportunities for abatement and thereby reduce its cost.

van Steenberghe (2002) concludes that the non ratification by the US and the entry of Russia and the Ukraine into the supply market will not in fact result in low or zero prices for permits, because banking between commitment periods is allowed, and firms will seize the opportunity to buy up permits for the future, thereby supporting the price. The fact that the market is inter temporal will in his view prevent hot air suppliers from dominating the market. In this context, he assumes that the US will join Kyoto in the second commitment period.

9. Issues and implications re US withdrawal from Kyoto

Since the decision by the US not to ratify the Kyoto Protocol, an emerging field of research focuses on how to induce its engagement.

Kemfert *et al.* (2002) examine different strategies the Kyoto Protocol Parties could use to induce the United States to adopt a more stringent greenhouse gas target, on the basis that larger emissions reductions by the United States would lead to larger environmental benefits and smaller adverse impacts on firms in Annex B countries. Strategies to induce the United States to adopt a more stringent target might impose a cost on Annex B Parties, but as long as the cost of so doing is less than the cost of a comparable emission reduction for Annex B Parties, the strategy is viable.

They assess three strategies which could be employed to induce the United States to adopt a more stringent emission reduction, including a) possible trade measures b) Co-operative Research & Development c) Developing Country commitments. Of these, they conclude that co-operative R&D and getting developing countries to adopt national emissions limitation commitments equal to their business as usual emissions beginning in 2020 could prove to be useful strategies.

Klepper and Peterson (2002) analyse the impacts of the interaction between different participation structures, institutional set ups and strategic supply of hot air in international emission trading. Russia and the Ukraine have been allocated most of the hot air in the Kyoto Protocol; the permit allocation within the hot air countries is an important determinant of hot air supplies. Three institutional scenarios appear to be most realistic:

– The governments in these countries give emission permits to the domestic firms for free and isolate them from the international permit market while the governments themselves trade a certain percentage of the hot air on the world market.

– The governments sell a fixed amount of permits to foreign and domestic firms.

– The governments grandfather all emission permits to local firms that participate in international emissions trading.

The decision has considerable implications for the equilibrium price of permits. If governments control the supply, they are likely to act as a cartel and restrict supply in order to generate more revenue. If all permits are allocated to local firms, then - unless they also act as a cartel - the price could approach zero. However, there are also energy price effects and implications for intensive industry for the hot air exporting countries; a government that wishes to maximise welfare may make different allocation decisions, generally selling more hot air than would maximise revenues from this source. The impact of the US withdrawal is also addressed — the ensuing reduction in demand for tradable permits drives down the price, but the reduced abatement effort in the US drives up energy prices, and these spill over to affect behaviour globally. These insights are consistent with findings by Carraro *et al*. (2003) on the consequences of the US withdrawal from the Kyoto Protocol who conclude that this reduces the demand for emission permits and consequently induces a decline in the permit price, thus lowering the incentives to abate emissions and invest in climate friendly technologies in all countries. The lower permit prices after the US defection reduces Russia's benefits from participating in the Kyoto agreement. This provides additional incentives for Russia to use its increased bargaining power in climate negotiations. Co-operative R&D directed at reduced cost abatement and diffusion are discussed as strategies in this context.

With the withdrawal of the US from Kyoto, Quirion (2002) argues that the European Union allowances should be kept separate from Kyoto units, at least for the first commitment period, on the basis that if Russia and the Ukraine do not exercise monopoly power on the permit market, the equilibrium permit price may well fall to zero. He argues that, in such a situation, if European industries were allowed to fulfil their commitments by buying permits from foreign firms or governments, then the environmental effectiveness of the European Directive would most likely turn out to be insignificant.

If Russia ratifies, it is difficult to see it behaving in a manner that would see permit prices approach zero, so this apprehension may be over stated.

10. Co-operation and competitiveness

The issue of co-operation between government and firms is raised by Takamura (2003). She notes that Japan is at an early stage in the development of an emissions trading scheme, and that there are two schemes being considered, one promoted by the Ministry of Environment, the other by the Ministry of industry (METI) Under the latter proposal, METI would subsidise half the investment needed by the companies to meet set targets, if such targets were achieved. This provision is driven also in part by concerns about competition from the US. She notes that the private sector is already starting to buy credits from Australia.

Salmons (2002) documents an interesting case of inter-firm collaboration in the 'bottom up' creation of a trading scheme by firms required to meet re-use and recycling targets vis a vis packaging. In the UK, the Environment Agency introduced Packaging Waste Recovery Notes (PRNS) as a standard form of evidence that recovery and recycle targets had been met, where the PRN specifies in effect what the amount of packaging delivered to reprocessors. To introduce flexibility, those obligated to meet targets started to trade these notes amongst themselves, an activity which was facilitated by the existence of a web based Environment Exchange which matches potential buyers and sellers, and executes transactions. This demonstrates that where there is an incentive to trade, and where a market can be created at low cost, it will happen, and the efficiency and convenience benefits are substantial. It also shows that a baseline and credit scheme — which this is — need not incur very high transactions costs.

11. Conclusions and future work

A general conclusion is that there is a lively, committed and rapidly growing community of researchers focusing on emissions trading, who are responsive to emerging needs and realities. A few key conclusions and themes that emerged as regards political economy, co-operation and market power are the following:

– The importance of scope and scale in reducing costs and enhancing effectiveness. As individual country schemes in Europe — actual or proposed - were analysed in the context of an EU wide scheme, the benefits of the latter become clear.

– The tensions between key and typically very influential stakeholders, who generally prefer: voluntary schemes, with 'opt out' provisions; baseline and credit (relative targets) vs. cap-and-trade (absolute targets); and free allocation of permits, and the literature on economic efficiency which emphasises the merits of cap and trade, obligatory participation, and auctioning of permits. An important merit of research is to highlight the tradeoffs and costs involved in meeting the 'realities' of stakeholder interests. In the context of the proposed EU scheme, Council of Ministers agreed to opt out, but only for the pilot phase, the scheme is cap and trade, and allocation is free, but this is being challenged by the European Parliament.

– The non-participation of the US in the Kyoto process casts the shadow of 'carbon leakage' over the actions of all the Kyoto participants, but it is especially evident in the case of Canada and Japan. How to engage with the US to limit the damage was a focus of a number of contributors. The continuing engagement of US scholars in the network is an important contribution to maintaining links and mutual awareness.

- Permit allocation is a preoccupation of many researchers. The costs of free allocation are systematically documented, as follows:

    - lack of comprehensiveness in coverage, as to include all carbon sources, notably transport and households, would make the price rises and associated rent capture overt, and this would cost politically, i.e. a second best design, excluding these consumers, is imposed from the outset;

    - secondly, the revenues generated by auctioning are foregone, and these could be used to reduce other distorting taxes, thereby yielding a double dividend, and/or used to help those who are adversely affected;

    - thirdly, new entrants may be disadvantaged relative to incumbents, if they have to pay for permits;

    - fourthly, since free allocation involves distributing valuable assets, substantial transactions costs must be incurred in deciding on who is to get the allocations.

- But it is also acknowledged that once the permits are allocated, the trading system thereafter 'identifies' the most cost effective abatement combinations, unless there are other distortions in the market place. There is an emerging research field, which is likely to grow, which focuses on 'hybrid' systems that capture some of the rent yielded by the allocation process which can be used to compensate losers etc., but allows sufficient value to stay with participating stakeholders to encourage them to engage.

- There is a seeming paradox here: if the financial benefits of free allocation are so manifest and potentially substantial, why do some firms and industry groups - notably in the EU context, in Germany — oppose emissions trading? There is here also an emerging research agenda.

- 'Fairness' is an important public value, and perceptions are as important as reality. Research has made good progress in painting the broad picture as regards permit allocation, but there is a much wider and in some ways richer agenda that deserves researching.

- The case for cap and trade instead of baseline and credit is convincingly made by many researchers, but it is also clear that the latter is both efficient and appropriate if some conditions are met. There is a need for more research to examine these nuances, and clarify under what circumstances such baseline and credit has comparative advantage.

- The human impulse to trade is ever present. The emergence of 'unofficial' trading markets — as for example the trade in packaging waste recovery notes in the UK, which emerged spontaneously but was then sanctioned and encouraged officially - are important straws in the wind of an idea that could have ever widening application. This also deserves further research.

- Transactions costs — the costs of 'doing the trading business' broadly defined — are an important and valuable research preoccupation. It was very high transactions costs that thwarted many of the initial US trading schemes, hindered the full development of water markets in California (associated with inadequate assignment of property rights and institutional failures in this regard) and particulates trading in Santiago Chile. The lessons of these experiences seems to have been internalised at both research and policy level in Europe. But the 'high transactions cost' case is used also to support 'upstream' allocation of permits, and against distribution of same downstream to householders, without relevant documentation of the potential costs and benefits involved, an area where research could elucidate.

- Clearly the price of permits is a product of supply and demand, and this in turn is an important competitiveness consideration. The impact of the US opting out, and of hot air from Russia and the Ukraine, on price is the subject of considerable research, with a debate ongoing between partial equilibrium advocates who focus exclusively on permit markets, and general equilibrium analysts who incorporate the effects of changing energy prices and other variables. There is also some gaming work of varying formality, which focuses on the strategic options facing all participants but especially Russia. This issue is so crucial that it warrants continuing research.

- The need to engage effectively with those developing countries that have not accepted a 'cap' is well documented — unless it happens, the attempts to address climate change will fail. A separate paper is devoted to the linkage of trading with the other flexible mechanisms, but the potential for expanding trading itself, so that, for example, China and India are inside the trading tent, deserves specific attention. A number of researchers conclude that, notwithstanding the implementation of the other flexible mechanisms, unless this is achieved, we will fail. This is a crucially important topic for research.

- There was relatively little treatment in our meetings of multi pollutant policies — e.g. linking greenhouse gas, particulate and acid precursor trading schemes.

- Likewise the issue of linking of trading with sequestration, offsets etc is a research agenda that deserves attention.

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MONITORING, ACCOUNTING AND ENFORCEMENT IN EMISSIONS TRADING REGIMES[1]

by

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1. Introduction

In the past few years permit trading has become a popular policy instrument to achieve emissions reductions or other environmental goals at minimal cost. There are already a number of existing regimes at the firm as well as national levels in which permits for SO_2, NO_X and CO_2 emissions but also fishing quotas or water rights are traded. In addition European CO_2 emissions trading is expected to start in 2005 and international emissions trading is also planned for the Annex B countries of the Kyoto Protocol. Experience has shown that permit trading can only be an efficient instrument if emissions[3] and permit trades are monitored and accounted appropriately and if compliance is enforced by those running the programs. Or, as Tietenberg (2001) puts it: "regardless of how well any tradable permit system is designed, non-compliance can prevent attainment of its economic, social and environmental objectives".

The compliance in a permit system depends on the technical ability to detect violations and the legal ability to deal with the violations (Boemare and Quirion 2001). Figure 1 shows the relevant emission and permit flows that are part of any emissions trading regime and the information that is needed to assure compliance.

As the basis for an emissions trading regime are the actual emissions of the participants (which can be individual firms or countries, but also operational parts of firms), there have to be techniques, devices, instruments and methods available and in place to measure or at least estimate these emissions appropriately. The difficulty in obtaining a reasonable accurate and continuous measure or

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1 This paper is a synthesis of presentations and papers presented and discussed at Concerted Action on Tradeable Emission Permits (CATEP) workshops in Venice (2001), London (2002), Kiel (2002), and Budapest (2003) on the theme: "Monitoring, Accounting and Enforcement in Emissions Trading Regimes".

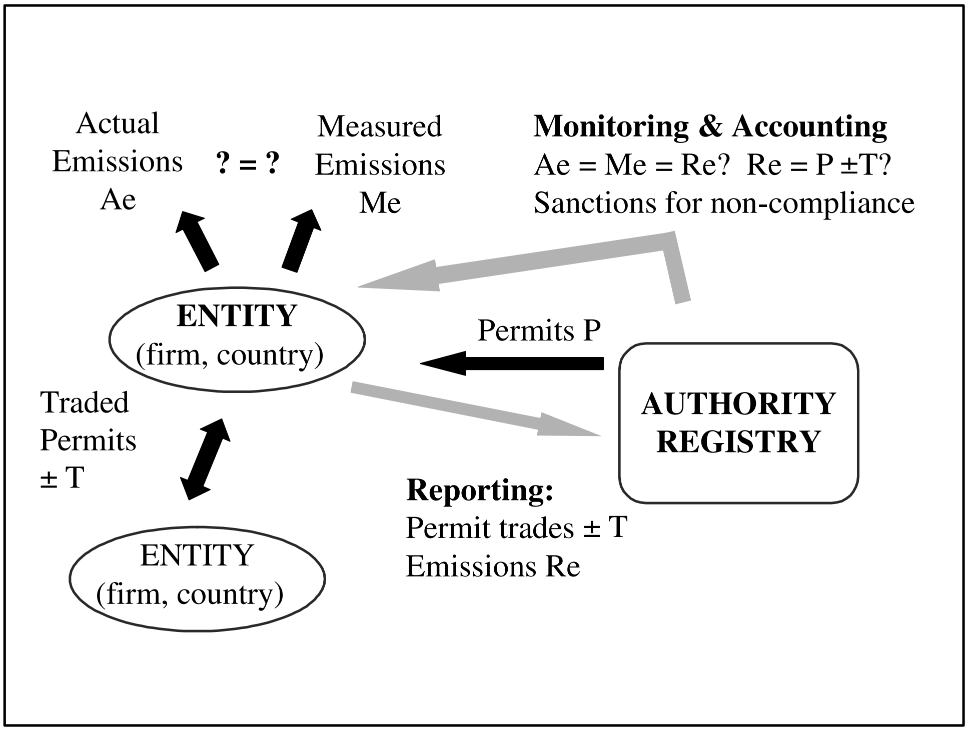
2 The author wants to thank Gernot Klepper, Stephen Bygrave and the discussants Chris McDermott and Erja Fagerlund as well as the participants of the OECD/CATEP Workshop on Emissions Trading, Paris 17-18 March 2003 for helpful comments and suggestions.

3 This paper will focus on emissions trading. In what follows the special characteristics and needs of other tradable permit regimes such as water rights and fishing quotas are not considered.

estimate of the emissions of each entity at reasonable cost is one reason why only some GHGs have been traded so far and why at the moment the international trading schemes are limited to CO_2 emissions. The measured (or estimated) emissions have to then be reported to the regulating authority. Detailed technological and process requirements in guidelines for inventories aim to minimise the inaccuracies in these first two steps that can be summarised as monitoring the emissions.

Compared for example to emission taxes, the regulators of emissions trading regimes face a more complex problem as they do not only have to focus on emissions but also on the behaviour of the participants in terms of their participation in the emission permit markets (Stranlund *et al*. 2002). The participants of the trading regime receive their permits from the regulating authority and can then trade them with other participants. In order to be able to detect non-compliance, it is essential to keep track of the permits. This can be achieved by a registry to which all trades have to be reported. The authority then has to make sure that every participant's emissions do not exceed the level allowed by the number of permits the participant holds. Keeping track of emissions and emission allowances for the purpose of assessing compliance is summarised under the term accounting (Anderson 2003). Finally, the authority must be able to enforce compliance and thus to penalise or sanction participants for misreporting or emitting in excess of their permit holding.

Figure 1. Monitoring, accounting and enforcement in tradable permit regimes



Monitoring, accounting and enforcement have been addressed in quite a number of presentations, papers and discussions in CATEP workshops. Besides drawing conclusions from the experiences with existing trading regimes, different aspects of compliance have been analysed in more detail and finally there has been a special focus on standardised accounting systems. This paper tries to summarise the diverse findings to get a comprehensive picture of what is needed to assure high compliance in emissions trading regimes and identify any specific problems. The paper proceeds as follows. The next section focuses on real trading regimes that are all local or at most national. It describes the monitoring, accounting and enforcement systems in existing and planned trading regimes to get an idea of what such systems include and to draw conclusions from experience. One focus is on enforcement mechanisms, as different from monitoring and accounting, which are basically a question of regulation and technology, penalties and compliance are a question of choices by participants and can be analysed with analytic tools. Section 3 deals with specific monitoring, accounting and enforcement problems in international emissions trading. It describes the development of internationally standardised systems and discusses the commitment period reserve as one instrument to avoid overselling of permits in international emission trading under the Kyoto Protocol. Section 5 provides a summary and conclusion.

2. Experience from local and national trading regimes

The elements of a (general) monitoring, accounting and enforcement system have already been outlined in the introduction. Meanwhile quite a number of local and national trading regimes do exist or are close to implementation so that lessons for future regimes can be derived. These regimes include the pioneer permit trading regimes in the USA (Acid rain program, Ozone Transport Commission (OTC), NO_X budget program, RECLAIM), the CO_2 trading in Denmark and the UK but also trading of CO_2 and CH_4 between operational parts of BP and Shell. CO_2 trading is also planned in Norway, the Czech Republic and Switzerland. The Netherlands are close to implementing NO_X trading and Chile plans a program to trade suspended particulates in the Santiago area. At the international level European emissions trading is expected to commence in 2005 and Kyoto trading is likely to start in this decade as well. Further countries such as Canada, France, Poland and Japan are currently considering their own programs for emissions trading. To get a more detailed idea of the elements of a monitoring, accounting and enforcement system, this section describes three programs in more detail and also summarises the methods used in other systems and various issues that have been raised. Tables 1 and 2 in the Appendix summarise the relevant information for all the trading regimes. Finally, Section 2.4 focuses on penalties, which, to a greater extent than monitoring and accounting, can be approached using analytical tools.

2.1 The SO2 and RECLAIM programs in the US

Two early examples of emissions trading regimes which are also the most prominent are the Sulphur Dioxide Allowance Trading Program (SO_2) and the Regional Clean Air Incentives Market (RECLAIM), both located in the USA[4]. These systems have been analysed by Stranlund *et al*. (2002) with respect to their monitoring, accounting and enforcement strategies.

The SO_2 trading program is part of the U.S. Acid Rain program implemented under the 1990 Clean Air Act Amendments and was designed to reduce annual SO_2 emissions from fossil-fuelled electric utility units by ca. 10 million tonnes, almost 50% of the 1980 emissions level. In the first phase that started in 1995, the program covered 445 units – this was extended to about 2100 units fired by coal, oil and gas in the second phase that started in 2000. The units receive emissions allowances that authorise the owner to emit one tonne of SO_2 during a given year. The allowances are fully tradable and bankable. Borrowing is not allowed. To achieve overall emissions reductions, the total amount of allocated permits is limited. During the second phase, permits are allocated for 8.95 million tonnes SO_2 per year.

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4 Further information on the programs can be found on the internet at www.epa.gpv/airmarkets/arp resp. www.aqmd.gov.

The RECLAIM program aims to achieve federal ambient standards for ozone and particulate matter in the Los Angeles airshed. It was designed to reduce Nitrogen Oxides (NO_X) and Sulphur Oxides (SO_X) from stationary sources of a certain size. The program started in 1993 and by the end of the 1999 compliance year covered 254 facilities. The program is expected to achieve reductions of 71% in NO_X and 60% in SO_2 emissions in 2003 relative to 1994 levels. RECLAIM facilities are allocated trading credits for each year until 2010 that allow the release of one pound of NO_X or SO_2. Banking and borrowing is not allowed. Again, the overall amount of allocated credits is restricted. Even though RECLAIM is an emissions trading program, it also includes emission fees that are based on each facility's total emissions and were used to help finance the program.

The monitoring, accounting and enforcement systems in both programs are essentially quite similar. Emissions monitoring relies heavily on self-reporting by the facilities themselves. To avoid mistakes and to minimise the opportunities for misreporting, both programs impose rather stringent technological and process requirements on all facilities. The facilities in the SO_2 program are required to install so-called continuous emissions monitoring systems (CEMS) or an equivalent device that provides a nearly continuous and very accurate account of the facility's SO_2 emissions. The 15 minute data and the data for 1-hour averages are collected and entered into the quarterly reports that are electronically submitted to the Environmental Protection Agency (EPA). The whole process of generating emissions reports and submitting them to the EPA is fully automated, thus minimising the opportunities for misreporting. The reports are the main basis for audits and are reviewed by the EPA. In addition, there may be in-site inspections. RECLAIM facilities also need to install specific monitoring and reporting equipment that differs among types of sources. Major sources have to install CEMS. In smaller facilities cheaper, less accurate systems are admitted. The estimated emissions have to be reported with additional equipment and specific software. Evaluations of the reported data at the end of each compliance year focus on ensuring the accuracy of the data and look for incidences of non-compliance. The audits include in-site visits and each report is audited every year.

In both trading regimes there are also systems in place to track the issuance, holding, deduction and transfer of allowances.

If non-compliance is detected in the SO_2 program, a penalty of USD 2 000 per tonne excess emissions in 1990 indexed with inflation (so that for example the penalty was USD 2 581 per tC in 1998) is automatically imposed on the non-compliant facility. This penalty is much higher than the allowance price, which varied between USD 65 and USD 220 per tonne SO_2. In addition, the facility must offset the excess emissions from its allowance allocation in some future year. If an audit reveals non-compliance in a RECLAIM facility, the facility is firstly provided an opportunity to review the audit and to present additional data. If it is still found to be non-compliant the facility's allocation for the subsequent year is automatically reduced by the total amount of excess emissions. In addition, the RECLAIM authorities can set a penalty of up to USD 500 for every 1000 pounds of excess emissions for every day it persists. This implies that roughly for one tonne of excess emissions per day the penalty could be up to USD 1 100 which would mean a penalty of roughly USD 400 000 for one tonne excess emissions that persists for the whole year. If the annual average price of credits reaches USD 8 000 per tonne the penalty of USD 500 can be applied to every 500 pounds (thus effectively doubling the penalty). The penalty is not automatic as in the SO_2 program but depends on the facts of the particular case. Permit prices in the RECLAIM program (which are also relevant for compliance — see Section 2.4) are high and increasing. Average prices for a tonne NO_X were below USD 250 in the first four years and rose to USD 451 during 1998 and to USD 1 827 during 1999. In 2000, the prices increased dramatically and reached USD 45 000 per tonne of NO_X. Average prices of one tonne SO_2 were under USD 150 during the first four years and rose to about USD 300 in 1998, USD 780 in 1999 and USD 2 400 in 2000. The average price for 2003 NO_X credits traded in 2000 was USD 13 800 while it was USD 3 000 for SO_2, thus prices can be expected to remain high. Effective prices for emissions were even higher due to the additional emission fees. These relatively strict enforcement strategies have been quite successful — one reason why they have been analysed in more detail. The compliance in the SO_2 program is apparently 100%. In the RECLAIM program compliance rates have ranged between 85% and 95%.

2.2 The planned Dutch NOX trading regime

Against the background that national and EU NO_X emissions targets seem to be out of reach with traditional types of regulation and that command and control measures are not fit for complex situations, the Netherlands are currently planning a national trading scheme for NO_X (Dekkers 2003). The program will cover the ca. 250 industrial facilities with installed total thermal capacity above 20 MWth that were responsible for 90 kt NO_X in 2000. The system will be a cap and trade system with a relative cap that declines from 65g NO_X per GJ fossil fuel use to 50g in 2010. This so-called performance standard rate is calculated by dividing the fixed NO_X target for 2010 by the projected 2010 fossil fuel use. The cap will be revised in 2006 to guarantee that the 2010 target is reached. Emission allowances are allocated to the facilities based on past performance. Banking and borrowing is restricted to 5% of one year's allowances. Bilateral and multilateral trade is allowed provided each transfer is accepted and registered at the bureau of registration that is part of the emissions authority.

Monitoring of the emissions is the responsibility of the companies. Based on "General Requirements for NO_X Monitoring" set by the emissions authority, the companies have to draft their own monitoring protocol that specifies for all installations all monitoring and reporting requirements. Again, the basis will be CEMS. The protocols are examined and approved by the emissions authority. The companies then have to monitor their emissions in line with the requirements in the approved monitoring protocol, and have to submit annual reports that are independently verified by the emissions authority for correctness. Fines for non-compliance have not been set at this stage.

2.3 Lessons learned from local and national trading regimes

The monitoring, accounting and enforcement mechanisms of the three trading regimes just described can be regarded as typical. Boemare and Quirion (2001) reviewed ten emissions trading regimes (including the three regimes just described) that either have been implemented or are at an advanced stage of implementation. They conclude that both reporting and registration of trades are key compliance mechanisms. Reporting should cover both emissions and emissions trading activities. Compared to the 15 minute emissions reporting of the SO_2 and RECLAIM trading, most national trading regimes require monthly emissions reporting. Even though the experience shows that bilateral trade without prior government approval favours trading and lowers transactions cost, mandatory registration is needed to account for the permit trading activities and to assess compliance. All reviewed systems include a registry, mostly established by the organisation that has the institutional governance and is responsible for recording the company's allowances. Boemare and Quirion (2001) also see a registry as a useful management tool because it creates an open public process for allowance recording which enhances compliance.

Tietenberg (2001) notes that integrated computer systems for reporting and permit trading are also a key to a smoothly implemented permit trading program. Such systems were also used in the three permit trading regimes described in the last section and are apparently also present in most other permit trading systems, especially as technology is progressing. For example, an internet-based monitoring system to submit CO_2 and energy data is being constructed for the CO_2 trading system being developed in Switzerland (Burkhardt 2003). This suggests that is would indeed be possible to make the information available on-line to the public, as advocated by Tietenberg (2001) for the reasons of increasing compliance, the possibilities for public pressure and even legal action from non-governmental environmental agencies and/or citizens.

Penalties are not only found in the SO_2 and RECLAIM programs but also in the trading systems in Denmark, Chile and the U.K. In the Danish case, the penalty is USD 6 per tonne CO_2. In the other cases Boemare and Quirion (2001) could not determine the penalty. The NO_X OTC budget program deducts allowances of three times the excess emissions in case of non-compliance from the subsequent year. In the BP trading scheme there is no penalty, and in the Shell system there is a fine equal to three times the average fourth quarter price for each permit short fall. In the EU trading scheme there will be a fine of EUR 50/t CO_2 in the first period until 2008 and EUR 100/t CO_2 afterwards plus restoration of excess tonnes in the following year.

There are also a number of other design elements of permit trading regimes that have been discussed in the CATEP papers and presentations and that also have an impact on monitoring, accounting and enforcement and thus on compliance. The most important are liability rules, upstream versus downstream regimes, absolute versus relative emission caps and linking of different trading regimes.

2.3.1 Liability rules

One question in permit trading regimes is who is liable. Seller liability means that if the emissions of the seller of permits exceed the reduced quantity of permits it possesses, the authority has to apply sanctions. Thus, regimes with seller liability rely on the effectiveness of the enforcement regime to ensure that participants meet their targets (Haites and Mullins 2001). In the case of buyer liability the buyer would have to assess the 'quality' of the permits s/he buys. If they are not covered by emissions reductions of the seller, they are returned to the seller to help bring him into compliance. Buyer liability makes sense if there are, for example in international Kyoto trading, sound reasons to distrust the capability or willingness of some national authorities to enforce their national schemes properly (Boom and Nentjes 2002). On the other hand, buyer liability would complicate the system and impede permit trades as potential buyers have to undertake efforts to assess whether offered permits will be covered by genuine emissions reductions or not which increases transaction costs. With an effective enforcement system in place, seller liability can be recommended and is indeed observed in most existing permit trading regimes[5].

2.3.2 Upstream versus downstream regimes

In a downstream regime all emission sources are required to hold emission permits. In the case of CO_2, trading it is also possible to install an upstream regime where the suppliers of fossil fuels have the obligation to cover the carbon content of their fuel sales with permits. Both systems have a number of advantages and disadvantages that have been discussed in length (Boom and Nentjes 2002; Haites and Mullins 2001; Baron and Bygrave 2002). Concerning monitoring, accounting and enforcement most effects stem from the fact that far fewer and much bigger firms would participate in trading in an upstream regime than in a downstream regime. Thus, upstream regimes are easier to manage and monitor while downstream systems are associated with higher administrative costs and expensive monitoring of the emissions at every source (Boom and Nentjes 2002; Baron and Bygrave 2002). Although an upstream regime is preferable with respect to monitoring, accounting and enforcement

5 Haites and Mullins (2001) mention some regimes with buyer liability.

and although it is also recommended by a large part of the literature, downstream regimes clearly dominate in practice. The reason is probably that upstream systems are not politically feasible. First, since there are almost no options for suppliers of fossil fuels to reduce the carbon content of the fuel, the carbon cap in an upstream regime is actually a fuel cap. And second, the distribution of the permits is also problematic. As fossil fuel suppliers can transfer the main part of the additional costs to end-users suppliers would capture large rents under grandfathering, which is not politically acceptable. If permits are auctioned, this will meet resistance from the affected sectors: the suppliers as well as the end-users (Boom and Nentjes 2002).

2.3.3 Absolute versus relative emissions caps

Monitoring and accounting also differs between regimes with absolute caps and regimes with relative caps. While an absolute cap fixes the total emissions during a specified period, a relative cap fixes a target for an emissions rate per unit of output or activity such as GDP or energy consumption (as for example in the planned Dutch NO_X trading regime). This metric has to be monitored in addition to emissions. Also, relative caps create problems of measuring and tracking emissions reductions across companies with different outputs or, within a company that changes its product mix or has varying degrees of vertical integration. Problems are also created through different production processes. All this implies additional administrative and monitoring requirements (Baron and Bygrave 2002). The UK permit trading regime features absolute and relative caps at the same time. This creates the problem that permit sales from the participants in the rate-based regime to participants in the absolute regime can cause overall emissions to increase. To avoid this, a so-called gateway has to restrict the net inflow from the rate-based regime to the absolute regime (Haites and Mullins 2001). This requires additional monitoring and surveying. The same is true whenever an absolute and a rate-based regime are linked. Overall, from a monitoring, accounting and enforcement perspective, absolute caps are thus clearly preferable.

2.3.4 Linking of different trading regimes

Problems not only occur when linking an absolute and a rate-based permit trading regime, but also when linking trading regimes that have different monitoring, accounting and enforcement systems. If, for example, one regime does not include adequate monitoring of emissions, a source could sell unqualified allowances resulting from inaccurate GHG monitoring to others, undermining the environmental integrity of the regime (Mullins and Haites 2001). Another problem that is often mentioned is, that if penalties are not comparable across linked systems, non-compliance is likely to be exported to the system with the lowest penalty level. But as Baron and Bygrave (2002) note there are also other factors such as certainty of penalties, other sanctions (e.g. loss of access to market) and registries that might not allow over-selling, so that such a problem may be less evident. Pressure toward harmonisation might stem from competitive disadvantages for firms in trading regimes with higher penalties. In addition, systems with high penalties may not be willing to link to those with low penalties. As both systems gain from linking though this can also be an incentive for penalties that are acceptable to all and for stringent compliance controls. Altogether, standardised monitoring, accounting and enforcement system simplify linking of different permit trading regimes. The standardisation of at least accounting rules is the subject of Section 3 below. Papers from the CATEP workshops have also shown that wherever new trading schemes are developed monitoring and accounting of emissions and tracking permits as well as the institutional requirements (registries etc.) are acknowledged as important issues that have to be solved (Blachowicz 2002, Burkhardt 2003, Jilkova *et al*. 2002). The features of the existing and planned different trading regimes are summarised in Table 1 in Annex A at the end of this paper.

2.4 Penalties revisited

While monitoring and accounting are to a large degree a question of regulation and technology, penalties and compliance create incentives for the participants in a trading scheme to comply with agreed targets. These incentives have been analysed in more detail.

A successful enforcement program requires a carefully constructed set of sanctions for non-compliance (Tietenberg 2001). In other words, effective penalties for non-compliance, particularly for holding insufficient allowances or having inadequate monitoring systems, are an essential component of the trading system (Palmer and Davies 2002). To enforce compliance, the regulating authority must in particular be able to enforce sanctions if they find that emissions are greater than allowance holdings. As we have seen in the last section, there are basically two possibilities for sanctions that can also be combined:

i. a financial penalty per tonne of excess emissions;

ii. a deduction of allowances from the next year's allowance holdings (or allocation) to make up the difference. These reductions can also be greater than the excess emissions as in the US NO_X OTC trading program.

Furthermore, there is the possibility to exclude participants that are non-compliant from the permit market (Tietenberg 2001). This is for example the case in the planned Kyoto trading regime.

Stranlund *et al.* (2002) focussed on the question of the optimal level of a penalty. They set up a simple model for compliance in which there is a certain possibility that each firm will be audited. The audit is assumed to be sufficient to discover a violation if one exists. There is then a per unit fine levied for emissions violators and a per unit fine for under-reported emissions. Transactions cost and banking are ignored. Firms will choose how much they will emit, how much they will report and how many permits to hold in order to minimise their expected costs. These expected costs are the sum of emissions controls cost, receipts or expenditures from permit trades and expected penalties from reporting and emissions violations. To guarantee that participants hold enough permits for their emissions, it is necessary that the expected penalty for emitting one tonne too much is above the permit price. Otherwise, it would be cheaper to buy a permit. To achieve complete compliance, (i.e. no excess emissions and accurate reporting), the expected overall penalties must be higher than the permit price. Thus, the model stresses the importance of the prevailing permit price that (in a reasonable competitive trading environment) summarises each facility's marginal benefit of non-compliance. Stranlund *et al*. (2002) extract a number of guiding principles from their study that also analyses the reasons for more or less compliance in the SO_2 and RECLAIM trading programs:

- There is no reason for an enforcement authority to differentiate the sanctions between heterogeneous facilities. As the prevailing permit price completely summarises each facility's marginal benefits of non-compliance, details about a facility's operations, like production and emissions-control technologies, are not important components of their compliance incentives.

- As permit prices are so important, unit penalties should be tied directly to prevailing permit prices.

- The penalties should be substantially higher than prevailing permit prices.

One reason for the high compliance in the SO_2 trading program is apparently that the fine for non-compliance is 10 times the costs of allowances. Another way to achieve the latter two objectives is, as mentioned above, to deduct more than the excess emissions from the permit holding in some future year.

A number of other elements of the compliance system also improve the effectiveness of the SO_2 trading program. One element is the certainty of the penalty and the size of the penalty. Other than for example in the RECLAIM program where the authority can decide on a case-by-case basis whether to apply a penalty at all (and also the size), it is recommended that fixed penalties are applied automatically in cases of non-compliance (Stranlund *et al.* 2002, Palmer and Davies 2002). Uncertainties for firms about the consequences of non-compliance would weaken the deterrence value of the enforcement strategy. If the regulator can use its discretion to determine the size or decide if the penalty is applied at all, penalties can become subject to manipulation. Especially when penalties are high, authorities may be reluctant to impose them and participants are aware of this reluctance. Unrealistic high penalties are also likely to consume excessive enforcement resources as those served with penalties seek redress through the appeal process (Tietenberg 2001). Stranlund *et al*. (2002) conclude that the certainty of penalties in the SO_2 program is one reason why compliance was almost 100%, while the uncertainty of penalties weakened the system in RECLAIM. In addition, Boemare and Quirion (2001) have set up a guideline that the smaller the probability of control is, the higher the non-compliance penalty should be (and inversely) which is in line with the model of Stranlund *et al*. (2002).

One final thing to consider is, that even though theoretically arbitrarily high levels of penalties could guarantee full compliance even at low monitoring probabilities, there are sound theoretical and ethical reasons why very high penalties are not very practical (Stranlund *et al*. 2002)[6]. One reason is that penalties are limited by the assets of a firm. If the penalty is too high, it can lead to unintended bankruptcies. Further, if participation in a trading regime is optional or can not be enforced, high penalties increase the rates of non-participation.

3. Monitoring, accounting and enforcement in international emission trading regimes

So far, the analysis has focused on local or at least national trading schemes in which firms are the main participants. Meanwhile it is very likely that international emissions trading will take place in the near future: in the European trading scheme and probably also more or less world-wide under the framework of the Kyoto Protocol. The size of the market and also the role of national governments as additional actors in international trading imply new challenges for compliance mechanisms. One challenge is to develop internationally standardised monitoring and accounting systems. Another challenge is to avoid overselling in this special framework, for example using the Commitment Period Reserve.

3.1 International standardisation of monitoring and accounting systems

So far, each trading regime has basically developed its own monitoring, accounting and enforcement system. The need for standardised monitoring and accounting systems has grown with emissions trading under the EU Directive and especially the planned trading under the Kyoto Protocol. One source of standardisation is the Kyoto Protocol itself. The framework that is given in the Protocol can be seen as a basis for developing monitoring and accounting systems for domestic and regional

6 See Macauley (1998) for a discussion of the limits to setting arbitrarily high penalties.

emissions trading that also provide the flexibility for linkages. Though it is mainly aimed for the parties to the Protocol, thus nations, the common reporting framework can be developed at the installation level as well (Anderson 2003).

The Kyoto Protocol's accounting system[7] builds on the provisions for monitoring, reporting and review established under the United Nations Framework Convention on Climate Change (UNFCCC). To be eligible to participate in Kyoto emissions trading, the parties need to fulfil a number of requirements. The first requirement (Article 5.1) is a national system for the estimation of their emissions and removals of greenhouse gases. The UNFCCC reporting guidelines provide a common reporting format and e.g. list sources and sink categories, facilitate comparability and consistency and assure completeness. Every party has to submit an annual report, including a national inventory (Article 7.1) that has to be in line with these guidelines and consistent with previous recommendations. The reports will be subject to in-depth reviews under Article 8 and, when the monitoring methodologies are not followed or when the inventory data is found to be incomplete or inaccurate, adjusted to the methodologies accepted by the International Panel on Climate Change (IPCC) (Article 5.2). Annex 1 parties have to submit supplementary information as part of their national communications under the UNFCCC.

Parties that wish to take advantage of the flexibility mechanisms of the Kyoto Protocol such as emissions trading are obliged to establish national registries under Article 7.4. These registries will act like banks recording the issuance, transfer and cancellation of Kyoto units. Basically, these registries are standardised electronic databases with separate accounts for legal entities, retirements and cancellations that keep track of the units around the registry network. In addition, there will be an independent transaction log, which will record each transaction and check the eligibility of each actor in the transaction and for transaction "discrepancies". There will also be daily reconciliation checks for account inconsistencies. On the other hand, it is not yet clear which transfers could or should actually be stopped, who will be entitled to do so, and what will be the legal consequences for companies if a transaction is stopped. The technical standards for the transaction log are also still being elaborated but they should be ready for the next Conference of the Parties (COP9) in December 2003. A compliance regime with penalties for non-compliance is also being negotiated (Haites and Missfeldt 2002). Some agreements have already been reached at the COP7 in Bonn setting three principal consequences for the case that a Party is out of compliance (IEA 2001):

i. Tonnes in excess of permits must be restored at a rate of 1.3 to 1 (a country must make up its shortfall plus 30 percent in the next target period);

ii. Until full restitution is made, a country is ineligible to sell credits; and

iii. A country must develop a compliance action plan (CAP).

Installations and firms are the entities who are actually trading in existing permit regimes, and who will primarily be trading in the EU regime and participating in Kyoto trading. A standardisation of monitoring and accounting systems for firms would have a number of advantages. First, it would enhance the environmental integrity by promoting consistency, transparency and credibility in greenhouse gas monitoring. Second, there are direct advantages of a standardisation for firms participating in trading. Standardisation would enable the creation of credible, comparable GHG units that increase investor confidence and facilitate trading. It would also enable entities to identify and manage GHG-related liabilities and assets and thus lead to better risk management and market certainty (Cherp 2003).

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[7] This summary builds on Anderson (2002) and (2003).

One prominent initiative to develop a standardised system is the Greenhouse Gas Initiative (Cherp 2003). It is a partnership of government and non-governmental and inter-governmental organisations working together to share knowledge and experience on greenhouse gas accounting issues. The initiative operates under the umbrella of the World Resource Institute and the World Business Council for Sustainable Development and aims to develop and promote international GHG accounting standards for business through an inclusive and transparent multi-stakeholder process. It has two modules: corporate inventories and GHG projects. A corporate standard was published in 2001 and tested by over 30 firms in nine countries. A second revised edition is scheduled for mid-2003. The project standard aims to identify project reduction opportunities and project typologies, to ensure eligibility, to identify GHG impacts, to quantify GHG reductions and to ensure adequate monitoring and verification. At the moment, the standard is undergoing revisions and reviews. The goal is to release it for COP9 in December 2003.

Another initiative is being undertaken by the International Organisation for Standardisation (ISO). The ISO was established in 1946 to develop voluntary international standards. Its members are 143 national standards bodies from around the world. After the ISO followed the international climate change negotiations for three years, a special working group on climate change was formed in 2002. This group is now developing guidelines for measuring, reporting and verifying entity- and project level GHG emissions that are hoped to become ”best practice” for industry and to be incorporated into climate change laws in many countries (ECOLOGIA 2003; Cherp 2003).

There are at least 10 to 15 different governmental, international and voluntary initiatives that develop standardised systems and all these initiatives work more or less parallel to each other without much interaction. At the moment, a single international standard can not be expected to be forthcoming (Cherp 2003). In addition, there are still many open questions of how to integrate monitoring, accounting and trading at company level (as in the national trading regimes and also the upcoming EU emissions trading) with the Kyoto trading requirements. How, for example, should the site level monitoring systems be linked to national inventory data to ensure the consistency of entity level monitoring with national inventory methodologies? And what should be the relationship between entity level allowances and permit accounting with the national registries? Thus, to ensure accurate national and entity level monitoring, accounting and enforcement, further harmonisation is an important future task.

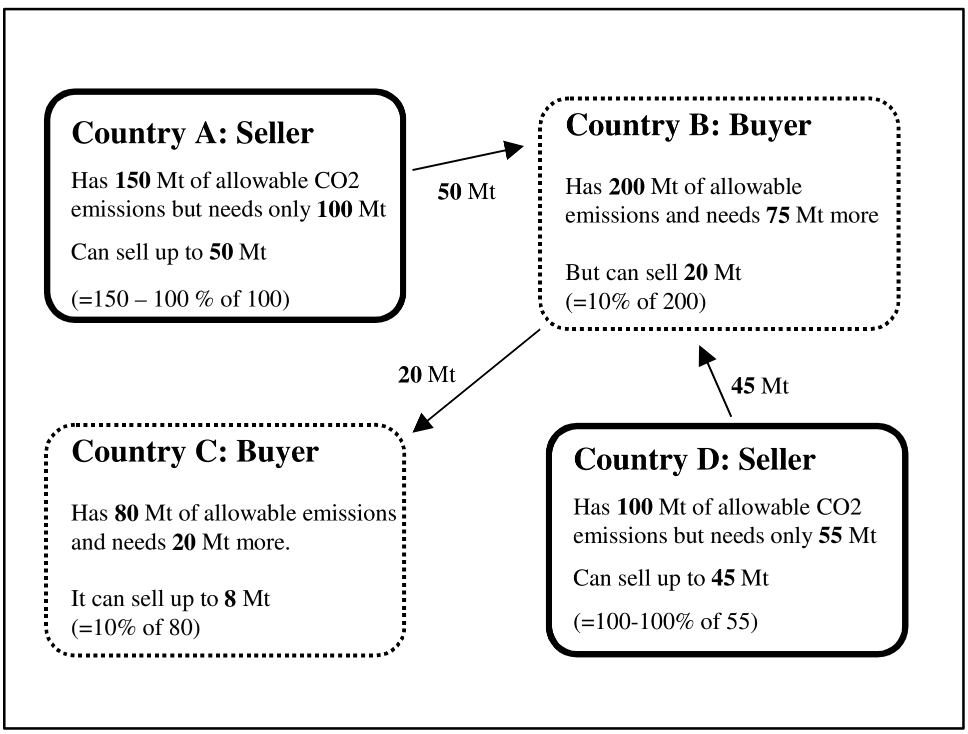
3.2 Compliance in international trading regimes: The commitment period reserve

Enforcing compliance in international emissions trading is more difficult than in local and national trading regimes where one single authority is able to impose sanctions on non-compliant participants. Responsibility for compliance at international level will reside with the participating sovereign nations. Haites and Missfeldt (2002) cite Chayes and Chayes (1998) who note that under existing international agreements, sanctioning authority is rarely granted by treaty, rarely used when granted, and likely to be ineffective when used. In emissions trading regimes where emissions and permits have to be accounted for, the potential for non-compliance becomes even greater than under commitments without trading (Haites and Missfeldt 2002). Even though a penalty system for Kyoto trading is being negotiated and has been partly agreed, a party that finds a penalty to be too high could simply withdraw from the Protocol and avoid the penalties.

Concern that the enforcement regime under the Kyoto Protocol may be too weak has lead to a number of so-called ”liability” proposals which seek to reduce overselling of permits by limiting permit sales in different ways. Haites and Missfeldt (2001a) evaluate fourteen different liability proposals using a highly aggregated model with a single Annex B buyer, a single Annex B seller and a single Non-Annex B seller. They find that indeed several of the liability proposals are able to avoid non-compliance at negligible cost in terms of excess emissions or extra compliance costs. The only proposal that was able to meet all their evaluation criteria is a permanent reserve. After further considerations Haites and Missfeldt (2001b) proposed what is now called the Commitment Period Reserve as the best mechanism to avoid abuse of international permit trading.

The Commitment Period Reserve requires each Annex B Party to set aside part of their 2008-2012 allowable emissions in a reserve. The reserve is the lower of (a) X% of five times the Party's most recently reviewed emissions inventory[8] and (b) Y% of the Party's initial assigned amount. At COP6 X was agreed to be 100% and Y to be 90% for all Annex B countries. For potential sellers of emission permits, X is typically the lower quantity (they have more assigned units than emissions) while Y is lower for net buyers of permits. Figure 2 illustrates one example where the numbers are combined for the 5 year commitment period and where it is assumed that "what is needed" is also the inventory. Countries A and D are net sellers of permits. Their reserve has to be X= 100% of their inventories. Thus, they are allowed to sell their assigned units minus this reserve (150 Mt - 100 Mt = 50 Mt resp. 100 Mt - 55 Mt = 45 Mt). Countries B and C are net buyers. Their reserve has to be Y = 90% of their assigned units. Thus, they are allowed 10% of 200 resp. 80 Mt. One possible scheme of trades is sketched in the figure, where country A sells 50 Mt to country B, country B sells 20 Mt to country C and country D sells 45 Mt to country B. Thus, country B, even though a net buyer, is also selling some permits.

Figure 2. Illustration of the commitment Period Reserve Rule, Following IEA (2001)



One problem of the Commitment Period Reserve that limits sales is that it might reduce the ease with which a permit can be bought or sold, in other words, the liquidity of the permit market. Haites

[8] Note that the commitment period from 2008 – 2012 covers 5 years so that five times the latest inventory is an estimate for the overall emissions in the commitment period.

and Missfeldt (2002) analyse this issue in detail. They find that sufficient liquidity should be available in the international market regardless of the specification of X and Y. However, in the domestic permit markets their analysis suggests that only a value of X close to 90% and a value of Y between 95 and 98% will maximise the effectiveness of the Commitment Period Reserve in limiting possible non-compliance due to overselling while minimising the number of Annex B countries subjected to restricted sales of surplus quota or low international liquidity for domestic emissions trading programs (Haites and Missfeldt 2002). The actual higher value for X can in some circumstances restrict sales of quota surplus to a country's compliance needs. The lower value of Y allows higher level of potential non-compliance.

4. Conclusions

For an emissions trading regime to operate efficiently and to meet environmental targets, a strong monitoring, accounting and enforcement system is a key pre-requisite. The system has to be able to record emissions and emission permits and to detect and sanction non-compliance in the sense of misreporting or emitting more than the permits allow. In addition, it should be accurate, transparent, comprehensive and efficient.

Monitoring of emissions is the first module of such a comprehensive system. The attainable accuracy depends mainly on available technical methods that are already highly developed for some greenhouse gases on a facility level (e.g. SO_2 and NO_X) and less accurate for example for the estimation of national CO_2 emissions.

Regular reporting is the next key compliance mechanism and covers both emissions monitoring results and emissions trading activities. For the latter, a registry that tracks permit holding, reduction and transfers is indispensable. Today, automated monitoring and reporting systems that submit the data electronically are state of the art. The existing local and national systems require at least quarterly reporting, whereas in the international systems we will see annual reporting.

The enforcement of compliance does not only depend on the technical ability to detect non-compliance but also on the legal ability to deal with it. If violations are detected there is optimally an automatic, fixed penalty per tonne of excess emissions that should be: (1) the higher the smaller the possibility of control or detection; (2) well in excess of the expected permit price; and, (3) not extensively high so that it reduces the participation in the trading regime or leads to bankruptcy. In addition, all existing penalty systems deduct at least the excess emissions from the allowances of the next compliance period, also to ensure environmental integrity. One way to ensure that the penalty is always higher than the permit price is to deduct more than the shortfall of permits from the permit holding in some future year.

The upcoming schemes for international emissions trading impose new challenges for monitoring, accounting and enforcement. As opposed to national systems, there is no single authority that can enforce compliance - instead the participants are countries that are sovereign nations. The first challenge is to establish standardised monitoring and accounting systems at a business level as well as at a country level. Such standardisation would have a number of advantages. It would increase transparency and credibility of greenhouse gas measurement, reporting and verification and also enhance the certainty for investors as well as facilitate emissions trading. Different initiatives are presently developing different standards for emissions accounting at firm and project level in anticipation of CDM and JI projects under the Kyoto Protocol. Two main initiatives are the Green House Gas Protocol Initiative and the ISO standard. The Kyoto Protocol itself also sets a framework for a standardised system providing flexibility for linkages.

The Commitment Period Reserve agreed at COP6 restricts permits sales to avoid overselling in international emissions trading. Even though it is regarded as a good mechanism to assure compliance, it has the potential of imposing inadequate liquidity constraints leading to a non-efficient permit market.

Future tasks include improving the techniques for monitoring emissions and developing standardised methods that can be applied to any new system. Even though the Kyoto framework is a step in the right direction, significant uncertainties on inventories, especially for non-energy related emissions still raise concern about the ability of the Parties to appropriately monitor emissions (Baron and Bygrave 2002). Boemare and Quirion (2001) conclude that even for industrial CO_2 emissions, calculations using activity data, emission factor and oxidation factor are not without problems and the accuracy of current national inventories based on this method falls short of what is needed for a trading scheme. Furthermore, it is not yet clear how to link monitoring and accounting on entity level with national inventory methodologies and national registries that are part of Kyoto trading.

Another open question is the cost of the required monitoring and accounting systems. In the SO_2 and RECLAIM programs there is for example some evidence that the very costly CEMS would not have been necessary to ensure compliance. There are not yet any cost benefit estimates of certain monitoring and accounting techniques.

Further, research has mainly focused on the issue of non-compliance in the sense of not holding enough permits to cover all emissions and has more or less neglected non-compliance in monitoring and reporting. This is especially problematic, as the main problem at the moment is getting accurate information on emissions, required in order to assess whether a participant holds enough permits. Finally, the dynamics of compliance and the enforcement problems associated with implementing emissions trading in a wider variety of environmental policy problems are still under-exposed.

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Annex A: Tables

Table 1. Design features of existing emissions trading regimes

	Substance	Special features	Sanctions	Liability	Reference period	Bilateral trade	Registry
1. US Acid rain program	SO_2		penalty USD 2000 per ton of excess SO_2	seller	annual budgeting	yes	yes
2. US OTC NO_X budget program	NO_X		allowance deducted from the subsequent year at the rate 3:1	seller	seasonal (May to September)	yes	yes
3. RECLAIM (USA)	NO_X/ SO_2	additional emission fees	penalty up to USD 500 per 1000 or 500 pound excess emissions per day (not automatic)	seller	annual	yes	yes
4. Denmark	CO_2	downstream	USD 6 per ton of excess CO_2	seller	annual	yes	yes
5. UK Emissions trading Scheme	CO_2 equiv.	downstream absolute and relative targets	negotiated agreement source loose 80% tax reduction, absolute cap participants must repay incentive with penalty	seller	annual allowances	yes	yes
6. BP	CO_2 equiv. (CH_4, CO_2)	downstream	no	seller	annual allowances	through central broker	yes
7. Shell (STEPS)	CO_2 equiv (CH_4, CO_2)	downstream	fine of three times average fourth quarter trade for each permit shortfall	seller	3 years	through central broker	yes

Sources: Boemare and Quirion (2001), Haites and Mullins (2001), Stranlund *et al.* (2001).

Table 2. Design features of planned emissions trading regimes

	Substance	Special features	Sanctions	Liability	Reference period	Bilateral trade	Registry
8. Dutch NO_X trading	NO_X	relative targets	to be worked out	seller	annual	with approval	yes
9. Norway	CO_2 equiv.		to be worked out	?	2008 - 2012	yes	yes
10. Santiago Area, Chile	CO_2		penalty fee	seller	daily permits	with approval	yes
11. Czech Republic	CO_2		?	?	?	yes	yes
12. Switzerland	CO_2.	downstream	Tax on all emission since introduction of tax of max USD 150/t CO_2 (depends on projected gap to overall target)	group liability of pool of firms	annual	yes	yes
13. EU directive	CO_2	downstream	EUR 50 (1^{st} period) resp. EUR 100 per ton CO_2 + restoration	seller	2005 – 2007 then 2008 - 2012	through central broker	yes
14. Kyoto trading	CO_2	reserve rule	Ineligibility to sell permits until restoration at rate of 1.3:1 Compliance action plan to be negotiated	seller	2008 - 2012	through national registries	yes
Further regimes planned in France, Canada, Poland, Japan							

Sources: Boemare and Quirion (2001), Burkhardt (2003), Jilkova *et al.* (2002).

PART IV

SUMMARY

ISBN 92-64-10576-X
GREENHOUSE GAS EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN OECD AND NON-OECD COUNTRIES

EXPERIENCE WITH GREENHOUSE GAS EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN OECD AND NON-OECD COUNTRIES

by

***Stephen Bygrave,* (OECD Environment Directorate, Paris)[1]**

1. Introduction

Emissions trading, Joint Implementation (JI) and the Clean Development Mechanism (CDM) are relatively recent additions to the suite of possible policy instruments to reduce greenhouse gas (GHG) emissions in OECD and non-OECD countries. They join other market-based instruments, such as taxes, charges/fees, deposit-refund systems and environmental subsidies that have been used to address environmental policy issues in these countries. Economic instruments are becoming more widespread in both OECD and non-OECD countries, replacing in many areas traditional command-and-control regulatory approaches. These instruments have significant potential to improve the efficiency and effectiveness of environmental policy. Emissions trading and project-based mechanisms (JI and CDM) provide flexibility for the polluter to reduce GHG emissions in the most cost-effective way, provide incentives for innovation in pollution prevention and control technologies, and lead to other benefits including improved decision-making at a decentralised rather than centralised level (Kruger *et al.,* 2003).

Given the increasing interest in emissions trading and project-based mechanisms, it is timely to reflect on the range of experiences with these instruments to date in a climate change context, and in particular to examine issues of significance for their future application. Experience to date highlights some of the barriers or challenges to the implementation of these instruments, what are potential solutions to these barriers, and what institutional support is required for their effective operation. Short term challenges relate to the creation of new markets, how these markets link in the short to medium term, and how emissions trading interacts with other environmental policy instruments in the policy mix. As OECD countries have had more experience with GHG emissions trading than non-OECD countries, this experience can provide valuable lessons for developing and transition countries.

This paper draws together key themes and discussions relating to the experience of GHG emissions trading and project-based mechanisms (including JI and the CDM), the intention being to cover emerging areas of research on GHG emissions trading and project-based mechanisms. The

1 The author is grateful for comments on the paper by Tom Jones, Jan Corfee-Morlot and Remy Paris (OECD), and Rosario Bent (EC).

discussion draws mostly from the papers presented at the Global Forum on Sustainable Development: Emissions Trading at the OECD in Paris in March 2003, as well as on recent literature on this topic. The aim is to highlight important outcomes and conclusions, identify possible lessons for the future design and application of these instruments, the specific needs of policy makers in their design and implementation, as well as opportunities for targeted analysis and research.

The structure of this paper is as follows. After a brief summary of the experience with emissions trading and project-based mechanisms in various countries, the paper examines issues relating to emissions trading in the policy mix. It then looks at challenges, lessons and success factors relating to the application of emissions trading, JI and CDM in developing countries, including institutional capacities required for the effective implementation of these instruments. The last section outlines important transition issues given the emerging nature of these instruments, as well as areas for possible future analysis.

2. Experience to date with emissions trading and project-based mechanisms

Several OECD countries are quite advanced in developing and implementing both emissions trading schemes and JI and CDM projects, as important components of their strategies to meet their GHG commitments. The EU, Denmark and UK are most advanced in the development and implementation of greenhouse gas emissions trading schemes, while Canada, Norway, Switzerland and Japan are considering design options for emissions trading (Drexhage 2003, Niizawa *et al.,* 2003, Ogushi and Kure 2003). Table 1 provides a summary of emissions trading schemes currently in place or being considered in various OECD countries. The Netherlands has also been proactive in pursuing JI and CDM projects under several programs including ERUPT (Emission Reduction Unit Procurement Tender) and CERUPT (Certified Emission Reduction Unit Procurement Tender). The World Bank's Prototype Carbon Fund (PCF) is another important scheme driving activity in this area. The EU Emissions Trading Directive, including the recently announced draft proposal to amend that Directive to include project-based mechanisms, is expected to stimulate further activity. In terms of OECD country involvement in JI and CDM, activities include the Government of Finland's small-scale CDM scheme and a recent Danish initiative to invest in CDM and JI. Austria, Canada, Japan, Germany, Italy and Sweden are also actively exploring JI and CDM opportunities. Switzerland has recently invested in the Climate Investment Partnership, a private fund mainly directed at CDM investments. As a result of this experience with emissions trading, JI and CDM, as well as with the former Activities Implemented Jointly schemes[2], institutional capacities for utilising these instruments in OECD countries have developed substantially over the past few years.

In transition and developing countries, experiences with emissions trading and project-based mechanisms build on the brief history of these countries implementing economic instruments more broadly – for example, many charges have been defined to help control air pollutants in countries in Eastern Europe, Caucasus and Central Asia (see OECD 2003). Developing countries have also implemented a number of recent economic reforms, for example reforming subsidies such as in the energy sector, and implementing user and pollution charges across a number of sectors.

2 Activities Implemented Jointly (AIJ) commenced in 1995 and was the precursor to JI and the CDM. AIJ lead to the development of a number of pilot programs in OECD countries that built experience with greenhouse gas reduction projects in transition and developing countries.

Table 1. Status of domestic emissions trading schemes

Country	Coverage	Initial Permit Allocation	Interface with other instruments
Canada	Large industrial emitters including thermal electricity, oil and gas, mining, pulp and paper, chemicals, iron and steel, smelting and refining, cement, lime, and glass. Start-up pre-2008 possible. Links to other trading schemes envisaged.	Government initially committed to gratis allocation determined through sector specific Covenants with regulatory or financial backstop.	Possible integration of previous voluntary domestic credit based systems with the rate-based system. Development of an offsets system, involving initially forestry and agriculture, and possibly landfill gas, is underway.
Denmark	Emissions trading scheme introduced in 2001. CO_2 from electricity production only, about 30% of 1997 CO_2 emissions.	Grandfathering.	Trading covers electricity generation, supplementing the CO_2 tax which covers other sectors.
EU	Emissions trading scheme (ETS) to commence in 2005. Initially CO_2 only, then all Kyoto gases after 2008. Approx. 46% of EU's estimated CO_2 emissions, covering more than 10 000sites. Sectors include electricity and heat; iron and steel; refining, glass and building material; and pulp and paper.	During 2005-7, free allocation by Member states, which will be required to apply common criteria for their national allocation. Up to 5 % auctioning allowed during 2005-7. Up to 10% auctioning allowed 2008-12.	A draft proposal was released on 23 July 2003 to amend the Emissions Trading Directive to include project-based mechanisms. The ETS Directive foresees also the possibility to link the EU ETS with other domestic GHG ET schemes.
Japan	To be determined. Trial project with participants from chemical, oil refinery, car manufacturing, semiconductor and food industry.	To be determined.	
Norway	Startup in 2005, to cover sectors without CO_2-tax.[1] From 2008: all Kyoto gases and all sectors possible, with over 80% covered in the system.	2005: grandfathered. 2008: partial auctioning, partial grandfathering (to be determined)	Tax and quotas 2005-07 in parallel, each source one instrument.
Switzerland	Large emitters, companies and energy intensive producers can exempt themselves from the CO_2 law by adopting absolute CO_2 limits, with possibility to trade. Pilot phase 2005 – 2007. Interested in links to EU ETS.	Based on voluntary agreements. Free allocation.	Tax on fossil fuels will be imposed from 2004 if voluntary measures insufficient.
UK	Emission trading scheme launched in April 2002. On voluntary basis for any firms that commit to binding targets, with the choice of CO_2 only or all Kyoto gases. Scheme will operate until the end of 2006.	Free allocation of allowances. Direct participants bid for reduction commitments in an auction for incentive monies.	Firms that negotiate Climate Change Agreements qualify for 80% discount on Climate Change Levy and eligibility for baseline and credit trading. This is integrated into cap-and-trading by the direct participants in the ETS.

Sources: updated from Baron and Bygrave (2002), based on Drexhage (2003), EC (2003), Government of Canada (2003), Ogushi and Kure (2003).

Note:

1. It is, however, not yet decided how the Norwegian domestic emission scheme will be integrated with the EU ETS.

There is a large variation in the individual circumstances of developing countries, so different economic instruments will be appropriate in some circumstances in developing and transition countries, but not in others. For example, pollution charges are generally appropriate for more middle income developing countries, where industrial pollution is a problem and administration of the charges is possible. Similarly, it is difficult to refer to the applicability of emissions trading across all developing and transition countries in the same context.

Nevertheless, several transition and developing countries are actively developing emissions trading schemes. Various pilot SO_2 trading schemes have commenced in China; Chile introduced an offsets scheme for total suspended particulates in Santiago in 1998 and has recently introduced legislation to Parliament for a domestic emissions trading scheme for air pollutants; and Petróleos Mexicanos (PEMEX) has introduced a voluntary private GHG emissions trading scheme in Mexico. Table 2 provides a summary of emissions trading schemes, as well as other relevant economic instruments already being applied in selected developing countries. Whilst not all emissions trading programmes noted in the Table relate to GHG emissions, they are relevant to the extent that they reflect an increasing use of market instruments to address environmental policy in these countries. Those emissions trading schemes directed at air pollution control will also have "secondary" greenhouse gas benefits.

Table 2. Use of economic instruments - including emissions trading and project-based mechanisms – to reduce greenhouse gas emissions in selected developing countries

Country	Status
Brazil	Strong focus on CDM (6 CDM projects under the PCF and CERUPT schemes). 1993 tax incentive to encourage cars with engines less than 1 litre in size. Tax incentives for landowners to protect forest cover on their property. Tax incentives for use of ethanol as transportation fuel..
Chile	Offset scheme introduced in 1998 for air pollution in Santiago, covering PM_{10}, NO_x, SO_x and CO. Emissions Trading Scheme Bill of Law presented to Parliament in July 2003, expected to come into force 2005. To apply to large stationary sources and transportation. Initially PM_{10} and NO_x. Includes linkage to Kyoto. 1 CDM project under PCF scheme.
China	Pilot SO_2 emissions trading schemes underway in seven Provinces. 1 CDM project under CERUPT scheme. Fuel tax for transportation expected to be introduced soon.
Costa Rica	Strong focus on CDM (6 CDM projects under the PCF and CERUPT schemes).
India	Strong focus on CDM (7 CDM projects under CERUPT scheme). Reduction in subsidies for coal production. Subsidies and tax concessions for renewable energy technologies. Any GHG emissions trading scheme would need to be focused on large emitters only.
Mexico	Petróleos Mexicanos (PEMEX) voluntary internal GHG emissions trading system commenced 2001. Participation of 25 PEMEX business units.
Philippines	Emissions trading included in recent amendments to the Filipino Clean Air Act.

Sources: Chandler *et al.,* (2002), de Coninck and van der Linden (2003), Gupta (2003a, 2003b), Kruger *et al.,* (2003), Sancha (2003a), Yang (2003).

In terms of the project-based mechanisms, many transition countries in Eastern Europe have implemented JI projects. Twelve JI projects in six Eastern European countries have been approved by PCF/ERUPT, including three projects in Poland and four in Romania. As of March 2003, JI projects under the ERUPT and PCF schemes were dominated by hydro, biomass and cogeneration. Carbon sequestration, gas capture, energy efficiency, wind and geothermal projects make up the remainder. A few transition countries (e.g. Slovakia) are actively looking at emissions trading, and those that are accession countries to the EU will be covered by the EU emissions trading scheme when they join the Union.

Interest in the CDM in developing countries is also growing rapidly, and there are significant opportunities for developing countries to use Certified Emission Reduction units (CERs) from CDM projects both as an additional revenue stream[3] and as a means to assist in project financing through forward selling of units to reduce borrowing requirements (see Drummond 2003). Proposed CDM projects to date being developed under either the CERUPT or PCF schemes and submitted to the CDM's Executive Board[4] have not been evenly distributed across countries. Table 3 highlights the dominance of proposed projects in Latin America and the Caribbean. So far, around thirty-seven proposed CDM projects in seventeen non Annex I countries have been approved under the PCF and CERUPT schemes, including six projects in Costa Rica, seven in India, six in Brazil and three in Panama. Thus far, proposed CDM projects approved under the PCF and CERUPT schemes are mostly gas capture, hydro, and fuel switch projects, with these project types constituting almost 25% each of the total CDM emission reductions. Some 71% of total emission reductions from these projects are in Latin America, 23% in Africa and 6% in Asia. Despite the fact that there are a relatively small number of projects in Africa, these projects have a high proportion of projected emission reductions as a share of the total. The limited number of proposed projects in Africa could reflect the lack of involvement of African countries in Activities Implemented Jointly, where experience and institutional capacities for CDM projects would have been built (Karani *et al.*, 2003).

Table 3. Breakdown of PCF/ERUPT/CERUPT proposed JI and CDM projects

Geographic region	Number of Projects	Greenhouse gas reductions	
		$MtCO_2$-eq	%
CDM total	37	90.4	
Latin America	*21*	*64.3*	*71.2*
Africa	*6*	*20.6*	*22.7*
Asia	*10*	*5.5*	*6.1*
JI	16	12.2	
Total	53	102.6	

Source: de Coninck and van der Linden (2003).

3. Transitioning over time from project-based mechanisms to emissions trading

The experience above highlights the currently different levels of involvement in GHG emissions trading and project-based mechanisms in OECD and developing/transition countries. Most experience with emissions trading is currently based in OECD countries, however this is likely to change over time, as transition and developing countries consider more closely the benefits associated with emissions trading. As a result, for transition countries, there will be a decreasing role for JI as emissions trading regimes develop (Lefevre 2003). For those countries likely to accede at some stage to the European Union, this is even more the case, as these countries will automatically be required to comply with EU environmental directives such as the new Directive on emissions trading.

Should developing countries agree to greenhouse gas emission reduction targets at some stage in the future, there is also the possibility of a transition from project-based mechanisms to emissions

3 Assuming a sharing of CERs between donor and host countries.

4 Some methodologies submitted to the CDM's Executive Board are still to be approved.

trading in some countries over the longer term. For example, Gupta (2003) suggests that CDM could play only a short term role in India, particularly when looking beyond the first commitment period of the Kyoto Protocol. Developing countries may eventually face the dilemma of whether to engage in project-based mechanisms such as CDM, knowing that participation in emissions trading is a likely future scenario. For example, Gupta (2003b) suggests that participation in CDM in the short term could erode possibilities for low cost emission reductions, making emission reductions more costly under a future emissions trading regime. Under such a scenario, one option could be for developing countries to bank emission reductions from CDM projects for later use in an emissions trading scheme, when the price for emission units may be higher.

4. Challenges and lessons

Various authors note the particular challenges associated with implementing emissions trading, JI and CDM in developing countries (e.g. Bell 2003, Morera *et al.,* 2003, Kruger *et al.,* 2003). Assigning a high priority to climate change and instruments to deal with climate change can be difficult in developing countries where the main focus is often on poverty alleviation, basic human and social development (Mangotra 2003). In addition, line departments (forestry, energy etc) are usually more concerned about routine operations, rather than about climate change policies, which typically require cross sectoral and interdisciplinary approaches. Delays can be caused from changes within governments and uncertainty over whether transition countries should start with Joint Implementation or wait for emissions trading (Henkemans 2003). The poor climate for investment is also a problem in some countries. Another challenge is hesitance to adopt new technologies and new approaches.

Kruger *et al.,* (2003) acknowledge the difficulties in building effective environmental institutions to manage the implementation of market-based instruments in developing countries, as well as the problems of limited resources, lack of well-trained personnel, weak and unpredictable systems of environmental enforcement, lack of respect for the rule of law by industrial emitters, corruption, and even simple lack of equipment. Other barriers include a low understanding of basic Kyoto markets, lack of institutional finance, lack of private sector awareness, absence of stable legislation, limited access to monitoring and control equipment, and the existence of often informal relationships between regulators and industry. Institutions that are required for monitoring compliance of tradeable permit schemes, establishing registries, establishing legal and regulatory procedures, are also often lacking. In addition, continuous political and financial commitments are needed for data collection, data management, emissions monitoring, reporting, and registry maintenance (Baumert *et al.,* 2003).

Given the above challenges, several authors have highlighted whether emissions trading, and market-based instruments more broadly, are appropriate in a transition and developing country context at all, and whether it is premature for these countries to consider market-based tools such as emissions trading. For example, Bell (2003) points to the lack of legal and market structures, human capital on-the-ground, corruption and the lack of independence of those managing compliance and enforcement in transition and developing countries as issues that raise questions about the validity of market based instruments in these countries.

In this context, a key question for further analysis is whether the above barriers to emissions trading and project-based mechanisms in developing and transition countries are unique to these instruments, or whether they also apply to non-market environmental policy instruments and to other market-based instruments. Further, are these challenges unique to developing and transition countries or do they also apply in developed countries? In particular, an important issue is whether the institutional capacities required for market-based instruments, such as emissions trading, are more significant than for other policy instruments.

Kruger *et al.,* (2003) note that the challenge of implementing successful environmental programs in developing countries is significant, whether the environmental program is market-based or not. A useful conceptual framework to analyse these questions is through distinguishing "climate-relevant" from "climate-specific" institutional capacities (Willems and Baumert 2003). Climate-relevant capacity is defined as capacity developed for other reasons than climate change, whereas climate-specific capacity is that entirely or mainly devoted to climate change policy. Thus, while some developing countries will have climate-relevant capacities to implement environmental actions broadly, they may not have climate-specific capacities to implement market-based instruments such as GHG emissions trading.

Environmental policy infrastructure generally is weaker in developing countries, with climate-specific capacity lacking in many developing countries. That said, Kruger *et al.,* (2003) observe that "there is little empirical evidence that the resources or expertise necessary to implement cap and trade programs is greater than those for other types of environmental programs". They also comment that the compliance infrastructure needed for cap and trade schemes may be both more effective and less resource intensive than the compliance infrastructure necessary to implement an effective command-and-control program in developing countries.

Several authors also note that monitoring and verification requirements for emissions trading and other market-based mechanisms are similar to requirements for regulatory command-and-control approaches in developing countries. For example, Gupta (2003b) observes that monitoring of discharges is not a problem unique to market-based instruments, and a well functioning command-and-control regime may require almost as much monitoring and enforcement effort as market-based instruments. Gupta also concludes that monitoring greenhouse gas emissions (and particularly CO_2) is relatively straightforward, as the consumption of fossil fuels (and their carbon content) such as coal, oil and gas are easily verifiable at an aggregate level, and that systems are already in place for this in India. Given the early stage of development of many emissions trading schemes, it is too early to draw strong conclusions on the relative costs of monitoring and reporting across instruments. This could be an area for further analysis as schemes develop further.

Whilst many of the challenges highlighted above are likely to remain over time in some developing countries, the application of emissions trading and other market-based instruments will nevertheless still be appropriate for others. Clearly, as the national circumstances in developing countries vary widely, so will the individual capacity of developing countries to apply these instruments. It should also be remembered that the history of emissions trading is relatively recent, and even more so for the use of project-based mechanisms. However, it is also true that, in some developing countries, emissions trading is a suitable policy instrument. For example, Yang *et al.,* (2003) notes the basis for emissions trading in China. China has had an air pollution charge system in place since 1982 (Jinnan and Xinyuan 1999), and is now implementing several SO_2 emissions trading scheme pilots in various provinces (Yang *et al.,* 2003). The approach in China is to trial different elements of emissions trading schemes into different pilots around the country, find what works and what does not, then roll all of the successful elements into a national design (Kruger *et al.,* 2003). The approach here is "learning by doing", varying the overall design subject to mesh with individual country circumstances.

Similarly, Gupta (2003a) notes the advantage of emissions trading and project-based mechanisms in terms of the diversity of abatement costs. In addition, he notes that in India the "situation is amenable to the implementation of well-designed market-based instruments" and that tradeable permits could be appropriate for large sources in thermal power generation and industrial sectors (Gupta 2003b). However, extending any tradeable permits scheme to the 3 million widely dispersed small and medium enterprises would be administratively difficult and expensive, not just with respect to allocating permits but also to tracking permit holdings. Strong regulations are already in place in India to deal with local pollution issues, providing some existing climate-relevant institutional capacity.

5. Success factors

Kruger *et al.,* (2003) suggest five successful factors for the design and implementation of environmental programs (including both market and non-market approaches) in both developed and developing countries:

- administrative and legal institutions;
- emission inventories;
- option and cost analysis;
- control technologies;
- government "champions".

Appropriate regulatory and legislative frameworks are required for the effective application of market-based mechanisms such as emissions trading and project mechanisms. In some developing countries, it should be possible to build these on to existing institutions. A key success factor in the Chilean emissions trading scheme has been through the utilisation of existing institutions wherever possible (Sancha 2003b). In India, the central and state pollution control boards are the institutions responsible for air pollution, with a mandate is to implement and enforce the major pollution control laws, monitor ambient air quality and develop emission standards (Gupta 2003b). It may thus be possible in this context to build climate-specific capacity on to climate-relevant institutional capacity.

Ensuring that the right policy, legal and regulatory frameworks are in place is another important consideration. Legal issues such as the taxation treatment of Certified Emission Reduction units and foreign investment, will be especially important in both developed and developing countries. Future analysis in this area could focus on which existing environmental laws should be amended and/or new ones enacted to empower governments to prescribe market-based instruments (Gupta 2003b). It is also necessary to establish appropriate legal foundations relating to emissions trading, and to create clear rules that are clear and consistent, providing stakeholders with sufficient investment certainty, and only requiring modification with adequate process and notification.

In terms of options and cost analysis, there is a need to undertake further analysis on the relative administrative costs of establishing emissions trading schemes, as opposed to project-based mechanisms. Developing countries would also find it useful to have access to information on best practices with respect to the application of these instruments around the world (see Gupta 2003b). Analysis specific to developing countries would be required, including careful analysis/estimation of abatement costs across sectors/sources, impact of alternative allocation rules (auctions, grandfathering, etc.), likely permit prices and market structure. Future analysis could also focus on those larger countries which have greater institutional capacities to utilise these instruments. It would be helpful to improve understanding of the circumstances in which these instruments should be used, as well as any design changes that have been required to ensure systems actually work. Analysis should be undertaken on which sectors are likely to be best suited to emissions trading in developing economies, with sufficient information to provide all stakeholders with a good understanding of the various options and costs. There are many lessons that developing countries can learn from growing experience in developed countries in the establishment of markets for emissions trading and project-based mechanisms, but that there is also an opportunity for developing countries to learn from each others' experiences in this area and share expertise and knowledge (Kelkar 2003).

The OECD has undertaken work on the use of market-based instruments for environmental policy in OECD countries (e.g. OECD 1997) and has extended this work to transition countries in central and eastern Europe (OECD 2003). OECD is also reviewing issues relating to environmental fiscal reform for poverty reduction in developing countries. As part of this work, it is examining a range of instruments such as taxes on natural resource extraction, removal of environmentally damaging product subsidies, taxes on polluting emissions, and user charges/fees across a range of sectors in developing countries including commercial forestry, commercial fisheries, fossil fuel, electricity, industry and water sectors. In future this work programme has the potential to extend to more general analysis of the implications for developing countries of mechanisms such as the CDM and emissions trading, and on ways for developing countries to take maximum advantage of such mechanisms.

Full time "champions" from within government are also important to the success of project-based mechanisms in developing countries (Manso 2003). Increasing stakeholder awareness of market-based instruments is also necessary as there is an inadequate understanding of these instruments among industry, NGOs, government and the general public (Gupta 2003b). It is also important to ensure the effective integration across government, private sector and non-government organisations (Mangotra 2003).

The development of an integrated climate policy in developing countries must also build directly on sustainable development policy goals. For example, a key factor contributing to the success of CDM in developing countries is consistency with national development and sustainable development goals (Manso 2003, Sancha 2003b). Developing countries also need to consider questions as to what extent developing countries should focus on adaptation vs mitigation (Mangotra 2003). In terms of mitigation, questions relate to where market-based instruments fit into the policy mix and how JI and CDM could best be integrated with host country priorities and policies.

There are also questions concerning a suitable timeframe for the implementation of emissions trading, relative to project-based mechanisms. As discussed above, project-based mechanisms may be relatively short-term instruments, eventually being replaced by more efficient emissions trading over the medium- to long-term. This leads to some uncertainty for some economies in transition and developing countries (for example, about the extent to which they should engage in joint implementation or CDM, or wait for emissions trading). This is particularly the case for a transition country that is an accession country to the European Union and that will be covered under the EU emissions trading scheme (which will commence in 2005). However, in the short term JI and CDM can be effective financial instruments for enhancing access to project finance and bringing equity investment into country, providing a boost to local industries (Drummond 2003).

6. A word on policy mixes

As tradeable permit schemes and project-based mechanisms are relatively new policy instruments they will need to interface with an already existing suite of environmental policy instruments being used in various country contexts to reduce GHG emissions. In doing so they could, for example, replace the existing set of instruments completely, substitute for one or two instruments, form a minor but complementary component of the mix, or overlap to differing extents with other instruments. For example, in Norway it is proposed that the GHG emissions trading scheme will cover those sectors currently exempt from the carbon tax, such as energy- and emissions-intensive manufacturing industries (for example metals and chemicals). Alternatively, emissions trading could be phased in to replace other instruments over time – for example in Denmark, the domestic emissions trading scheme currently works in parallel with the CO_2 tax but will completely replace the tax over time.

With an increasingly wide array of policy instruments available, it is important to ensure that the effectiveness of individual instruments is not weakened, or that various combinations of instruments do not undermine the coherence of policies. As outlined by Sorrell (2003), an increasing number of policy instruments can lead to complexity and a 'congested policy space'. For example, he observes the potential for an overlap of coverage and double counting of emissions when several policy instruments are used, as well as the potential for differential treatment of sectors, entities, and sites, referring to the example of the UK and EU emissions trading schemes. Johnstone (2003) notes that when using different instruments in the policy mix, there is a tradeoff between environmental certainty and compliance cost certainty. What seems most important in choosing the right policy instrument is ensuring the complementarity of the policy instrument with the environmental objective.

Others note that while using tradeable permit schemes with other instruments can lead to overlap, some policy overlap can also be appropriate to ensure that emissions are effectively targeted (e.g. Mullins 2003). Synergies between tradeable permit schemes and other instruments can also be utilised. For example, voluntary agreements can assist in the design and development of emission trading schemes, helping to resolve problems associated with determining base year emissions, and putting in place systems to collate verified data, as well as serving as a possible basis for allocations and through encouraging early action (Mullins 2003). In addition, there are certain conditions where it may be efficient and effective to combine tradeable permits with other policy instruments, in particular where there is significant abatement cost uncertainty, technological market failures, long lags in behavioural responses, and local environmental impacts (Johnstone 2003).

There are also important interactions between emissions trading schemes and climate policies, energy policies, and other environmental policies. For example, the implementation of a domestic emissions trading scheme will impact on the broader set of climate policies. Policy-makers will therefore be required to make decisions about the extent to which emissions trading will substitute for other climate policies, which policies should remain, and which should be eliminated or phased out once an emissions trading scheme is in place. In addition, the introduction of an emissions trading scheme will impact the prices of energy commodities. Many note the strong complementarity of emissions trading with other environmental policy objectives, such as improving air quality (e.g. Lazowski 2003). As with other policy instruments, it is therefore important to ensure that emissions trading is coherent with other government policy objectives, and does not conflict with other major policy goals. The degree of complementarity with other policies is especially important in developing countries, where integration with sustainable development and poverty reduction objectives will likely enhance the effectiveness of these instruments.

7. Transition issues

As GHG emission trading schemes make the transition from a few national schemes to more regional and international schemes, and as these and project markets emerge more fully in OECD, transition and developing countries, several other issues will need to be addressed and managed. These concern market fragmentation and price differentiation across markets as a result of the existence of different markets, as well as how the different markets will interact in the short- to medium-term. In the short-term there will be a number of discrete markets, leading to complexities in relation to how individual schemes and markets interact. In addition, in the short-term when markets are new and very fragile, it will be important to ensure that appropriate and transparent rules and procedures are established to give investors confidence in the quality of projects and operations of the markets. Managing the transition from existing policies to GHG emissions trading regimes will be another area requiring further analysis (Waller-Hunter 2003).

There are only a handful of existing emissions trading schemes at the domestic level, and the EU Emissions Trading Directive, will be the first 'supra-national' GHG emissions trading scheme that will be developed. Those countries that have already implemented domestic trading schemes are therefore examining how domestic schemes will interact with other emerging schemes such as the EU system. There are many different designs being contemplated and implemented at the national level, which might cause challenges as markets link and interact (Baron and Bygrave 2002, Bygrave and Bosi 2003). Different design elements include whether participation is voluntary or mandatory, the mode of allocation (e.g. grandfathering or auctioning), which entities and sectors are covered, accounting for direct and indirect emissions, whether a design is upstream or downstream, whether targets are absolute or relative, and differences in provisions for banking and borrowing. A key issue for the United Kingdom is how the current UK emissions trading scheme with interact with the EU emissions trading Directive (Hamid 2003) given their different designs. This is also an important issue for Norway, which is outside the EU trading scheme, but which is developing a domestic emissions trading scheme that could eventually be linked with the EU scheme (Stiansen 2003). With the evolution of project-based mechanisms toward emissions trading, there is also likely to be change in stakeholder participation in the various mechanisms, will an evolution from government to government schemes to industry based systems (Baron 2003). These are key issues for policy-makers in the design and implementation of emissions trading, joint implementation and the CDM.

Grubb (2003) highlights some of the issues in making the transition from separate emissions trading schemes and project markets to a fully fledged international emissions trading system. Grubb notes the likely fragmentation of markets in the short-term, with a wide variation in costs across these markets, as well as imperfections in the supply market resulting from transaction costs and market power. He also notes the likely differences in preferences between the different mechanisms, potentially leading to a hierarchy of the mechanisms with project-based mechanisms (particularly CDM and small scale projects, such as renewable energy projects) at the top because these projects result in "real action" on the ground as well as in benefits for developing countries. These preferences will in turn lead to strong price differentiation between credits from projects vs emissions trading units.

A question for policy-makers will be whether to "manage" for this market fragmentation in the short term, or whether to let the situation resolve itself over time. Discussions at the OECD Global Forum suggested that the market could effectively manage any resulting fragmentation and differentiation in prices, arbitrage against these differences, and ensure a level of transparency across systems. As discussed above, a focus on project-based mechanisms such as JI and CDM may also be relevant for the short- to medium-term only, with a gradual merging of instruments into emissions trading schemes at the domestic, regional and international levels over time.

8. Conclusions

To date, only a small number of OECD countries have implemented domestic GHG emissions trading schemes, and the EU emissions trading scheme is due to commence in 2005. Non-OECD countries are active in implementing the Joint Implementation and Clean Development Mechanisms. A few developing countries are either applying pilot emission trading schemes for air pollutants or implementing GHG emissions trading in the private sector. As such, it is relatively early at this stage to draw any detailed conclusions from experiences to date. Nevertheless, the clear shift from theory to fact-based analysis should be noted. One conclusion that can be drawn is the wide variation in national circumstances and conditions across countries, and the importance of considering market mechanisms in the context of pre-existing sectoral and other policies, as well as the long term evolution of commitments.

There are a number of challenges to the implementation of these instruments in both OECD and non-OECD countries, while capacities and resources to manage these issues are considerably lower in developing and transition countries. Nevertheless, there is significant potential for these instruments to develop in different national contexts. Despite the institutional capacities needed to establish and operate emissions trading schemes and project-based mechanisms there is likely to be a large benefit from the increased use of economic instruments such as emissions trading, as well as broader gains to the economy with more efficient instruments. Once investments in market-based mechanisms such as emissions trading are made, these systems can be more efficient with the relative cost of implementation being quite low. There are also economies of scale in establishing emissions trading schemes across countries. Further, the institutional capacity required for these market-based instruments is similar to those required for effective environmental policy frameworks generally.

Examples to date indicate that it is possible to implement successful emissions trading schemes, as well as JI and CDM projects. Emissions trading and project-based mechanisms are also compatible with broader objectives of achieving market reforms and improving investment environments in transition and developing countries (e.g. Chandler *et al.,* 2002). More analysis is required on when it is most suitable to introduce these instruments, how to utilise existing institutional and regulatory frameworks in this context, and how to develop stronger synergies between climate policies and other development priorities.

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OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 2004 01 1 P) ISBN 92-64-10576-X – No. 53307 2004