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Stuart and Moura Costa

Policy that works for forests and people: Discussion paper

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DISCUSSION PAPER

Policy that works for forests and people series no. 8

Climate change mitigation by forestry: a review of international initiatives

Authors:
Marc D. Stuart and Pedro Moura Costa

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Preface

Forests and the "Clean Development Muddle"

The following paper by Marc Stuart and Pedro Moura Costa is a masterly review of the state of play with initiatives to mitigate the effects of greenhouse gas emissions through forestry. The authors have been keen observers of the forests and climate change debate, and sometimes players themselves in the drama that has unfolded on the international stage over the last few years. Focusing on case studies and issues of particular resonance in developing countries, they present a much-needed overview at a time when there is potential for both innovation and confusion. If ameliorating climate change and fostering good forest management are to be mutually supportive goals, a number of dilemmas in the current international policy framework will need to be thrashed out. In this brief preface, we aim to reinforce some of the dilemmas raised by the paper, plus a few others.

This paper is part of a series of reports: *Policy that works for forests and people* (see back cover and inside title page for further details). The kinds of issues presented here resonate in several of the country studies produced under this project.

The Kyoto Protocol of December 1997 addresses itself mainly to one part of the carbon cycle - not unnaturally it focuses on the effects of burning fossil fuels that have taken geological time to develop. Other segments of the carbon cycle, notably forest vegetation, are contemplated by the agreement but have not been thoroughly considered. The Kyoto protagonists can perhaps be forgiven for their avoidance of forests as carbon sinks and carbon sequestration given that intergovernmental forest agreements have been so hotly debated elsewhere, yet to date have proven weak in practice. However, the gaps in the Kyoto agreement mean that there is little guidance yet on how good local forestry can contribute to climate change mitigation.

Meanwhile, private sector actors and certain governments now have a significant record of experimentation with certain forms of forestry under various "Activities Implemented Jointly" (AIJ). However, the AIJ pilot phase,

to date, has precluded investors from benefiting from carbon credit transfer, thus preventing the emergence of real incentives for this type of activity. The new rubric of the Clean Development Mechanism paves the way for a full programme of AIJ-type projects with crediting. One of the big questions is whether such a programme will be able to combine environmental cleanup initiatives with other social and economic objectives of groups in the developing world.

There are also uncertainties about the relative strengths and weaknesses of different forest types as storers or fixers of carbon which were beyond the capabilities of the Kyoto number-crunchers to handle. There is a danger therefore that the resulting Clean Development Mechanism (which leaves the door open for consideration of forests as sinks, but is extremely vague as yet), once it yields to pressures to handle forest sinks, deals only with simple forestry models - afforestation/reforestation plantation programmes and set-aside of forests as protected areas (all of them in big, easy-to-measure blocks). Will it be able to handle natural forest management and farm forestry? Trees on farms, agroforestry, shifting cultivation and natural forest management may be difficult to measure in climate terms, but these are the types of forestry which sustain livelihoods. Furthermore, managed forests such as these can also store/sequester more carbon than simpler plantation or set-aside systems. Thus, there is a pressing need for effective analysis of carbon dynamics in such forestry models, and for consideration in carbon debates of good local forestry.

Some of the development banks anticipate pouring money into the CDM in order to prime it for private sector investment to take over (and possibly stock and commodity markets too). Will this give us better managed and more equitable forestry, or will it simply mean that corporations capture even more value than they do already, at the expense of others who, for example, get thrown off the land? Increased private sector backing for plantations and forest set-aside would have enormous implications for the siting and types of forests, the ownership and governance of forests and forestry, and the distribution of forest costs and benefits.

Key dilemmas which need addressing are:

- **How much sequestration and how much storage?** The relative merits of different forestry models need to be teased apart. Sequestration is a function of growing conditions, species growth and management, while storage is a function of area, total biomass and management. Much of this information is already available, but it needs to be well systematised and packaged for policy-makers.

- **Willingness to pay for carbon offset.** To a large degree, the current motivation of carbon buyers is green image, backed up by risk reduction strategies regarding possible imminent legislation. Will the CDM (likely to be a fund formed in part from fines for dirty development in the South) increase the willingness to pay for clean and productive horizontal integration of corporations, or will it merely stimulate more cosmetic image-shaping?

- **Additionality and the baseline.** Where can carbon storage be compensated, where good forestry might have been economic anyway, i.e. where is it a legitimate subsidy? If payments for carbon storage require a baseline of deforestation, will more forests become subject to deforestation in the pursuit of such payments?

- **Verification.** There are practical measurement problems in verifying offset as well as questions of the criteria to be assessed. SGS already certifies carbon offset (with an emphasis on risk) and Costa Rica has already sold US$2 million worth of Certified Tradeable Offsets. SGS includes social and other environmental factors in assessing the initial viability of the project, but these factors become more submerged when assessing ongoing implementation.

- **AIJ costs and benefits.** The cost of forestry AIJ projects ranges from US$2 to US$10 per tonne of carbon, averaging about US$8 (compared with the fuel-switch project cost average of about US$25/tC), whilst the marginal damage from climate change ranges from US$10 to US$1million/tC depending on the assumptions used. The pioneering, demonstration nature of some of the existing projects makes them expensive. The World Bank's international Carbon Fund apparently has $150 million to spend on carbon credits at $20-25/tC; the costs will include burden sharing with the host country. Meanwhile the future for some 90 existing AIJ projects is uncertain. There are areas in which it appears they might become "illegal".

- **An elite Southern club?** Countries in the South may polarise as only a few can demonstrate sufficient institutional resilience to play the carbon offset game. As with some other sectoral initiatives, such as the development of meaningful national forestry standards, the institutional capability needed at local and national level to cover the transaction costs of developing, guaranteeing and delivering current models of carbon offsets make it a pipedream in many countries as yet. Aid clearly has a role here. One of the stated objectives of the CDM is to ensure that countries with high potential costs of this nature receive funding if they are "high priority".

- **Ethical trade.** What can we learn from the ethical trade movement with regard to setting up an efficient and equitable carbon offset market?

- **Implications for aid.** Many developing countries will need assistance to take advantage of the CDM, and their voices (and especially those of local people) will need to be heard in the negotiations to develop CDM procedures. Existing stakeholder consultation processes in various sectors should be analysed with a view to building on the best of them.

To begin to address these dilemmas requires, at the very least:

1. Information on the diversity of forestry models - for politicians, diplomats and those in charge of forest sectors - so they don't just choose plantations and set-aside. Where is corporate investment in carbon storage most efficient, equitable, sustainable, and where is more local involvement crucial? What are the most attractive options to people of developing countries?

2. Social and environmental impact assessment of offset proposals will need to be made routine (as it should be in any other forestry project). This will help with establishing understanding of who gains the benefits and who bears the incremental costs of different models.

3. International agreement on Principles and Criteria (P&C) of good forestry - a basic "common language" that needs to be applied to operations that derive from the FCCC (as well as the Convention on Biodiversity)

4. Exploring the inter-nation equity implications for forestry of the "contraction and convergence" principle of Kyoto i.e. where rich nations contract emissions and poorer nations expand, until some point where (presumably) we all have similar ecological space.

5. Commitment to intra-nation equity as a basis for opening up discussion on the diversity of forestry options. Country to country dealings amongst small cabals of "the usual delegates" are unlikely to grapple with the implications of schemes which generate winners and losers, until they involve those engaged with on-the-ground realities.

The CDM muddle on forests needs urgent attention very soon to determine whether it becomes a massive further distortion of forest policy, or a huge incentive to tip the balance in favour of well managed, equitable forestry. We urge the reader to respond to IIED on these issues, and those raised by the paper's authors.

Stephen Bass and James Mayers
Forestry and Land Use programme, IIED. July 1998

Executive summary

Over the past ten years, scientific study of greenhouse gas (GHG) emissions and global warming has gradually moved towards the conclusion that human activities are having an inexorable effect on the world's climate system. While there remains a great deal of uncertainty in the details, most analysts believe that future climate shifts will have damaging environmental, social and economic impacts on a global scale. Posited effects include the rising of sea levels, dramatic changes in weather patterns, accentuation of tropical disease patterns and a wide variety of accelerated biodiversity losses. However, assessments of who would suffer what kind, and what levels, of damage remain conjectural, leaving policy with little definitive guidance.

These uncertainties are further compounded by a conundrum of relative responsibility. Developing country governments point, rightly, to the historic responsibilities of the OECD nations for dumping greenhouse gases in the atmosphere since the industrial revolution. Industrial countries counter with compelling evidence of an inexorable rise of emissions forthcoming from the developing world – a rise that will eventually dwarf industrial emissions if left unchecked. As carbon emissions have traditionally been a fairly good benchmark of economic development, few countries are willing to take unilateral restrictive actions that could hamper their future economic competitiveness.

A proposed policy solution, that might bridge the impasse, is emissions trading. In emissions trading, companies or countries with emissions liabilities would be free to seek out the most cost-effective means to reduce emissions. Groups likely to come under such liabilities are likely to be found in OECD nations. Under the widest proposed form of emissions trading, these parties could potentially leave their own country or industry in order to do so. Because GHG emissions mix uniformly in the atmosphere, it is argued that this would be economically efficient and environmentally appropriate. Investments in projects that prove they reduce emissions could earn "credits" that offset other liabilities by

lowering net emissions. Whether it is appropriate for developed countries to simply "buy" their way out of the need to immediately reduce emissions at home remains a major bone of contention. However, under the recent Kyoto protocol, steps towards official policy validation of these types of transactions have moved forward dramatically.

In participating in these transactions, developing countries could use their inherent ability to reduce emissions to finance a host of initiatives in pursuit of sustainability. These types of transactions, albeit on a small pilot scale, have already assisted in the implementation of energy efficiency, renewable energy, sustainable forestry (including varieties of reforestation, biodiversity-driven forest conservation and low impact logging techniques) and other innovative projects in more than a dozen countries around the world. This review describes the growing pains of this nascent business, the initiatives that have formed to support it, and the pilot projects that have been proposed and implemented, in order to demonstrate the emissions transaction paradigm.

In no sector is the concept more controversial than in forestry, where debates range from technical issues of whether increased carbon absorption can be measured accurately, to whether land-use projects are an eco-colonialist plot of industrial nations to gain control of rainforest resources. This paper examines the various forestry projects that have emerged in these early years, to evaluate whether early returns lead us to conclude that emissions transactions are likely to be a boon, or a bane, in the sought-after transition to sustainable forestry in the tropics. We conclude that despite potential for abuses, the overall benefits from these types of investment transfers are worth pursuing, provided that policies and institutions emerge sufficient to foster the effectiveness and equity of these transactions.

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About the authors

Marc Stuart and Pedro Moura Costa are two of the founding directors of EcoSecurities Ltd (ESL) a UK based company specialised in various aspects of the fields of forestry, energy and GHG mitigation, including policy formulation, financial structures and project management. Dr. Moura Costa spent four years as the project director for the FACE Foundation's forest rehabilitation project in Sabah, Malaysia, one of the first substantial carbon offset projects in the forestry sector. Together, the authors have had more than 12 years involvement in emissions transaction work, with forestry project development field experience in more than ten developing countries.

ESL developed the world's first carbon offset certification service for SGS Forestry and acted as lead contractor to SGS in undertaking the verification of Costa Rica's national GHG mitigation programme. ESL has acted as advisors to the governments of Australia and Brazil in regards to financial and technical aspects of carbon mitigation and has worked as policy advisors to a wide variety of public and private concerns. With support from the Rockefeller Brothers Fund, ESL recently developed a groundbreaking greenhouse gas securitisation mechanism for use in renewable energy portfolios. Among other projects, ESL currently is developing integrated carbon investment funds, to be used to finance more sustainable forestry in tropical developing countries.

Acronyms

AAs	Assigned Amounts, the Kyoto Protocol terminology for the allowed emissions of individual industrial countries. Synonymous with QELROs
ACOPE	Costa Rican Association of Independent Power Producers
Annex 1	Annex of the FCCC, which lists industrialised countries and economies in transition that committed to emission reductions in accordance with the FCCC
AIJ	Activities Implemented Jointly
APEC	Asia Pacific Economic Cooperation Forum
BAT	Best Available Technology
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CIFOR	Centre for International Forestry Research
CINDE	Costa Rican Investment and Trade Development Board
CJII	Canadian Joint Implementation Initiative
CO_2	carbon dioxide
CoP	Conference of Parties (to the Framework Convention on Climate Change)
CTO	Certified Tradeable Offsets
EA	Environmental Agency (Japan)
EEI	Edison Electric Institute
EIT	Economies in transition (generally comprising the former Soviet Bloc)
ERU	Emission Reduction Unit
FACE	Forests Absorbing CO_2 Emissions
FCCC	Framework Convention on Climate Change
FONAFIFO	Fondo Nacional de Financiamento Forestal - Forestry Financing Fund, Costa Rica
FSC	Forest Stewardship Council
G-77	Group of 77 (generally referencing the developing world in international negotiations)
GHG	Greenhouse Gas
GIS	Geographic information system
GNP	Gross National Product
ICAD	Integrated Conservation and Development Programme
ICE	Instituto Costaricense de Electricidad
ICSB	Innoprise Corporation (Sabah, Malaysia)
INBio	National Institute of Biodiversity (Costa Rica)
INC/FCCC	International Negotiating Committee (of the Framework Convention on Climate Change)
INFAPRO	Innoprise-FACE Foundation Forest Rehabilitation Project
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standards

ITTO	International Tropical Timber Organisation
IUEP	International Utility Efficiency Partnership of the EEI
JI	Joint Implementation
MINAE	Ministerio del Ambiente y Energia - Ministry of Energy and Environment, Costa Rica
MITI	Ministry of International Trade and Industry (Japan)
MW	megawatt
NEP	New England Power
NGO	non-governmental organisation
OCIC	Oficina Costa Ricence de Implementacion Conjunta – Costa Rica's Joint Implementation Office
ODA	Official development assistance
OECD	Organisation for Economic Cooperation and Development
PAP	Protected Areas Programme (Costa Rica)
PfB	Programme for Belize
PFP	Private Forestry Programme (Costa Rica)
PNG	Papua New Guinea
PPP	Pilot Project Programme (Netherlands)
QELRO	Quantified Emission Limitation and Reduction Obligations
RBCMA	Rio Bravo Conservation and Management Area
RIL	Reduced Impact Logging
SEP	Dutch Electricity Board
SGS	Société Générale de Surveillance
SO_2	sulphur dioxide
tC	tonnes of Carbon
TNC	The Nature Conservancy
UNCED	United Nations Conference on Environment and Development (Rio, 1992)
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USIJI	United States Initiative for Joint Implementation
VCR	Voluntary Challenge and Registry (Canada)
WBCSD	World Business Council for Sustainable Development
WEPCO	Wisconsin Electric Power Company

Contents

1 Introduction

The emergence of environmental, social, economic and political concern regarding potential climate change has generated one of the defining global debates of the 1990s. In many ways, the climate change debate has become the arena in which various protagonists have shaped their own interpretations of how the world should allocate resources and responsibilities within the global commons. Whereas some see tremendous opportunity for true international co-operation and technology transfer from industrial to developing countries, others see a new type of domination, in the form of eco-colonialism. In theory, international policy can develop frameworks in which the former can flourish, while curbing the negative potential of the latter.

These contending attitudes are most clearly reflected in the idea that actions to lower greenhouse gas emissions can be efficiently undertaken across international borders. Economic theory informs us that industrial countries could undertake a portion of their own emission reduction requirements most efficiently, by investing in greenhouse gas-friendly projects in developing countries. To some, this is a win-win scenario, by which everybody benefits from economic transactions on a pathway to sustainable development. To others, such transactions represent a fraudulent way for industrialised nations to avoid paying for their historic responsibilities for oversaturating the atmosphere with greenhouse gases (GHGs).

These issues dominate many journals and Internet sites, and have captured the imagination of many economists, policy analysts and scientists. Innumerable papers, monographs and books have been written on the subject. A variety of consulting "experts" now works with different clients, developing projects, products, positions, strategies and services. Justifying this cottage industry is the sizeable number of policy, project and investment initiatives which have emerged, sponsored by countries, development organisations and industry; each trying to promote a favoured model of the future.

The December 1997 adoption of the Kyoto Protocol to the Framework Convention on Climate Change (see http://www.unced.de) has galvanised the debate. No longer is the idea of emissions trading far off. Indeed, it is possible that early transactions with actual transfers of credit from developing countries may begin as early as January 1, 2000. The inclusion of the Clean Development Mechanism (CDM) heralds the emergence of almost immediate emission transaction investments and the ability for investors to "bank" the savings over a number of years up until the first definite commitment period for emissions limitations: the years 2008-2012. The discussions that are occurring, and the decisions that emerge from these discussions, will have fairly immediate ramifications for potential capital flows to sustainable enterprises in developing countries. The challenge over the next few years is to adopt mechanisms that protect against the potential abuses that critics of emissions trading rightfully point out, while also achieving the efficiencies of a dynamic and innovative system.

This paper seeks to examine components of this debate mostly through the lens of 'on-the-ground' projects and the emergent policy frameworks that govern such projects. We specifically highlight a series of land-use projects and proposals that show the potential symbiosis between two vital global conventions: that of Biodiversity and that of Climate Change. The implementation of these projects, if successful over the long run, would demonstrate that transfers of funds and technologies can relieve pressure on the world's tropical forests and biodiversity. However, serious questions remain about the long-term commitment of all parties to ensure that such projects are appropriate and sustainable, and will remain in the control of the host government rather than external agencies.

2 Greenhouse science

The greenhouse effect refers to the warming of the Earth's climate that occurs when gases in the atmosphere trap heat near the planet's surface. Sunlight that is not absorbed at the planet's surface radiates away from the Earth as heat. Without the atmosphere, this heat would dissipate into space, leaving the Earth cold and uninhabitable. However, the atmospheric layer of water vapour and heat-absorbing gases retains a substantial portion of the radiated heat, in a process akin to the way a greenhouse traps heat. This process warms the surface to an overall average temperature of about 15 degrees Celsius (National Academy of Sciences 1991).

Since the beginning of the industrial age, atmospheric concentrations of heat absorbing gases (GHGs, which include carbon dioxide, methane, nitrous oxides and chlorofluorocarbons) have been rising. Atmospheric concentrations of carbon dioxide - by volume the most important GHG - have risen by 30 per cent since pre-industrial times. Mean global temperatures have risen concurrently by between 0.3 and 0.6 degrees C (IPCC 1995).

It has been estimated that approximately 75 per cent of the human contribution to GHG concentrations derives from the burning of fossil fuels. Deforestation is the next major contributor. Trees sequester atmospheric carbon dioxide through their growth process and retain substantial volumes of carbon as long as they are standing. Loss of forest cover means a lessened global capacity to absorb growing industrial emissions, at exactly the time when such absorption appears to be most needed. As a result of forest cover loss and energy utilisation, it has been predicted that by the year 2100 atmospheric concentrations of carbon dioxide alone will double the pre-industrial levels, unless substantial emission restriction measures are enacted (IPCC 1995).

The impact of changes in GHG concentrations on Earth's climatic system has proven more difficult to predict. The most recent report of the Intergovernmental Panel of Climate Change (IPCC) predicts a rise in

average surface temperatures between 1.0 to 3.5 degrees C, relative to 1990, over the next 100 years (IPCC 1995). This is substantially lower than the 1990 IPCC assessment, which projected average temperature rises of 3-10 degrees C over the same period. However, the 1995 IPCC assessment has simultaneously declared that "the balance of evidence suggests a discernible human influence on the climate" (IPCC 1995), a statement which the earlier panel was unwilling to make. This single statement has served to put greater pressure on policy makers and diplomats to achieve a meaningful environmental agreement on the climate issue.

Temperature changes in themselves are not the primary concern. It is the environmental, social and economic impacts of those changes that represents the more germane question. For coastal areas, potential impacts include rises in sea level, coastal erosion, increased salinisation, loss of protective coral reefs and increasing desertification, etc. Overall, there is the potential of increased prevalence of disease vectors, shifts in agricultural productivity and highly disruptive weather patterns. All of these will potentially affect human welfare and biodiversity with substantial social, economic and environmental costs. The relative capacity to adjust to such damages is far lower in the developing world. Quoting from the recent IPCC Summary Assessment for policy makers (IPCC 1995):

> *Given "best estimate" values of climate sensitivity and of ice melt sensitivity to warming, and including the effects of future changes in aerosols, models project an increase in mean sea level of about 50 cm from the present to the year 2100. This estimate is approximately 25% lower than the "best estimate" in 1990. Sea level would continue to rise at a similar rate in future centuries beyond 2100, even if concentrations of greenhouse gases were stabilised by that time, and would continue to do so even beyond the time of stabilisation of global mean temperature. Warmer temperatures will lead to a more vigorous hydrological cycle; this translates into prospects for more severe droughts and/or floods in some places and less severe droughts and/or floods in other places. Several models indicate an increase in precipitation intensity, suggesting a possibility for more extreme rainfall events. Knowledge is currently insufficient to say whether there will be any changes in the occurrence or geographical distribution of severe storms, e.g., tropical cyclones. Sustained rapid climate change could shift the competitive balance among species and even lead to forest dieback, altering the terrestrial uptake and release of carbon* (IPCC 1995).

In any event, at this time - a hundred years before the general time frame of the IPCC's predictions - the climate change issue remains extremely

complex, with few answers provided in either natural science or economic analysis. Despite the uncertainty, there has been mounting pressure to enact substantive GHG reduction policies, based on the precautionary principle. However, many parties also oppose such measures, emphasising the divisions in scientific consensus. Opponents to GHG reductions point out that there could be extraordinary economic costs in rapidly shifting the global economy away from fossil fuels. They point out that the best way to address the climate change issue is to do nothing now, allow economic growth and technological advances to flourish, and then replace the fossil fuel economy in the future, without causing so much potential dislocation. Proponents respond that it is possible that GHG concentrations could trigger threshold events to the global biosphere which would be irreversible for many generations; thus it is vital to begin the process now and create immediate incentives for those technology developments.

3 Global policy responses to GHG accumulation and climate change

No country is immune from the threat of climate change and all contribute in some manner to the problem. While the historical "dumping" of greenhouse gases into the atmosphere has been principally at the hands of the OECD and former Soviet block countries, it is the developing world - notably China, India, Indonesia and others - that will soon be responsible for a majority of global emissions. It is the challenge of international negotiators to bring such a range of disparate country perspectives into a reasonable consensus.

Several policy initiatives have emerged from international fora, national governments and the private sector. Chief among these is the UN Framework Convention on Climate Change (FCCC). This paper initially evaluates the pertinent parts of the FCCC and the 1997 Kyoto Protocol to the FCCC. We then review the outputs of a series of earlier national initiatives and private sector investment programmes aimed at stimulating international emissions reduction pilot projects. Due to the rapid evolution of policy and projects regarding international emissions reductions and trading, some of the details in this overview will become dated quite quickly. However, some of the themes and dilemmas highlighted are likely to have greater longevity.

3.1 Framework convention on climate change

On 11 December 1990, the 45th session of the UN General Assembly adopted a resolution establishing the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC/FCCC). The completed FCCC was presented at the United Nations Conference on

Environment and Development (UNCED) in Rio, 1992, and has since been ratified by over 160 countries. The treaty came into force in early 1995 and was followed by the first Conference of Parties, in Berlin, Germany, in the spring of that year.

Following the lead shown by the fairly successful Montreal protocol to control ozone-depleting substances, the negotiations sought a consensus that could be supported by a broad majority, rather than drafting a treaty of specific policies that might limit participation. As such, the FCCC itself has no particular policy mandate or enforcement mechanisms, but is rather a comprehensive framework of protocols that co-ordinate climate research and diplomacy in economic, environmental, social, financial and political terms. Within that framework, countries have disputed numerous contentious issues regarding binding commitments, targets and timetables for emissions reductions, financial and technology transfer mechanisms, and the "common but differentiated" responsibilities of developed and developing countries. The "meat" of the negotiating process is found in further adaptations and protocols to the FCCC, of which the Kyoto agreement (see below) is the most important to date.

Debate over "common but differentiated" responsibilities reflects the difficulties in formulating a globally comprehensive GHG strategy, given the range of national perspectives on GHG emissions. For industrial countries with relatively high gross emissions levels, high per capita emissions, but lower emissions per unit GNP (gross national product) and low projected growth of emissions, the accepted goal is to freeze, then lower, absolute emissions. On the other hand, most developing countries currently are characterised by low gross emissions levels, low per capita emissions, comparatively higher emissions per unit GNP and a projected strong growth of emissions in the future. For these countries, the convention seeks to flatten the emission growth curve and lower its apex before the down curve commences. Moreover, this must occur without impinging on the fundamental right to achieve economic development. Such a policy commitment would essentially seek to maximise GNP growth per unit of GHG growth.

3.2 Economic instruments, carbon offsets and joint implementation

A series of economic instruments to promote reductions in GHG emissions are being considered by countries to help meet the commitments required by the FCCC. These include taxes on emissions, subsidies for emission reduction projects, tradable emission permits, and direct regulation of emission sources. It is expected that different domestic instruments will be used in various countries, depending on circumstance and historical familiarity with different types of regulation.

However, no matter which policy instruments are utilised, there are likely to be substantial efficiency gains available from the use of "carbon offsets". Offsets are a mechanism by which companies, countries or financing entities undertake emission improvements outside of their direct operations or territory. The relative environmental improvements are substantially cheaper on a unit basis than could be achieved in the home territory. Offsets have been used for the past two decades within various components of US air and water pollution policy, leading to demonstrable gains in overall efficiency (Palmisano 1996). While offsets have never been used in a global trading context, it has been repeatedly estimated that GHG targets could be met at very substantial cost savings with the use of emissions trading and offsets (Barrett 1995).

In environmental economics terms, in order for an offset to be ecologically appropriate, the beneficial activity must occur within the same pollutant "catchment area" as the offending activity. As the catchment area for greenhouse gases is the global atmosphere, GHG reductions can theoretically occur anywhere in the world while producing precisely the same benefits. Though climate change will have global consequences, there is no correlation between specific emissions and specific damages. Any emission (or emissions reduction) is therefore equivalent, at least in regard to its marginal impact on climate.

This characteristic takes on importance when it is recognised that the cost of reducing GHG emissions varies greatly in different situations. Certain processes such as coal-fired electricity generation, cement manufacturing and material transformation are carbon intensive by their very nature. For these sectors, requirements to reduce emissions could cost hundreds of dollars per tonne of carbon dioxide avoided. At the other extreme, carbon sequestration through forest rehabilitation in some developing countries has been estimated to cost less than US$1.00 per tonne of additional CO_2

removed from the atmosphere. These differences support the economic argument that an efficient climate policy would encourage the broadest possible range of options, allowing for emissions improvements to occur in any country through any methodology. In this fashion, a Canadian utility could reduce its GHG responsibility by investing in energy efficiency improvements in India or an Australian cement manufacturer could help fund a sustainable forestry operation in Indonesia.

International carbon offset projects between countries have traditionally been referred to as "joint implementation" (JI) projects. In a JI project, the financing and/or expertise for the activity is sourced from a country different from where the project occurs. Just as businesses open manufacturing facilities in developing countries to lower costs and increase margins, Joint Implementation is based on comparative advantage. The relative GHG inefficiency (in emissions per unit of economic output) of many developing countries means that environmentally friendly investments can achieve greater relative greenhouse gas benefits than the same investment in an industrial country. What this means is that the same economic commitment can generate substantially greater environmental benefits or the same environmental benefits can occur through substantially lower costs. However, for this to be an attractive option for a prospective investor, the investor must be allowed to claim a substantial percentage of the "credits" created by the reduction or sequestration activity. JI proponents thus argue that investors should be allowed to use their investments to lower GHG-related liabilities (e.g. carbon taxes, emission caps, etc.) in their respective home countries.

While the JI mechanism has been part of the negotiations since before the Rio conference, it has been challenged by many developing countries for a number of reasons (see section 3.4). Following the first Conference of Parties (CoP) to the FCCC, in 1995 in Berlin, a compromise was reached by creating a pilot phase (until 1 January, 2000) during which projects are called Activities Implemented Jointly (AIJ). During the AIJ phase, pilot projects have been conducted with the objective to establish emission reduction calculation protocols and experiences, but without allowing actual carbon crediting between parties. Due to this lack of real incentive for participation from the buying side, the results of the AIJ pilots are generally considered disappointing.

Box 3.1 Terminology related to UNFCCC Climate Change Mitigation Mechanisms

Since the early 1990's, a variety of terms have been utilised to refer to different climate change mitigation mechanisms. The meaning of these terms has changed gradually. Below are some of the definitions used at different points in time. Unless stated otherwise, this paper refers to all international carbon offset projects between two countries as joint implementation (JI) and is not limited to the more specific definition of JI established by Article 6 of the Kyoto Protocol.

Early definitions

Joint Implementation (JI) The concept of joint implementation (JI) was introduced by Norway into pre-Rio UNCED negotiations in 1991. This was reflected in Article 4.2(a) of the UNFCCC, that provides Annex I parties (developed countries) the option of contributing to the convention's objectives by implementing policies and measures jointly with other parties. The investing participants in these projects could, in theory, claim emission reduction "credits" for the activities financed, and these credits could then be used to lower greenhouse gas (GHG) related liabilities (e.g. carbon taxes, emission caps, etc.) in their home countries.

Activities Implemented Jointly (AIJ) In the First Conference of Parties (CoP 1) in Berlin, March of 1995, developing country dissatisfaction about the JI model (see text) was voiced as a formal refusal of JI with crediting against objectives set by the Convention. Instead, a compromise was found in the form of a pilot phase, during which projects were called Activities Implemented Jointly (AIJ). During the AIJ Pilot Phase, projects were conducted with the objective to establish protocols and experiences, but without allowing carbon credit transfer between developed and developing countries.

Post Kyoto definitions

In December 1997, the Kyoto Protocol of the UNFCCC created three instruments to facilitate accomplishment of the objectives of the Convention, which were collectively called "flexibility mechanisms". A new terminology was adopted to refer to these mechanisms, as follows:

Joint Implementation (JI) Set forth in Article 6 of the Kyoto Protocol, JI refers to climate change mitigation projects implemented between two Annex B countries (emission-capped industrialised countries and countries with economies in transition). JI allows for the creation, acquisition and transfer of emission reduction units (ERUs). Note that according to the new terminology, JI only includes participation of Annex B countries.

The Clean Development Mechanism (CDM) The CDM was established by Article 12 of the Kyoto Protocol and refers to climate change mitigation projects undertaken between Annex B countries and non-Annex B countries (non emissions-capped developing countries). This new mechanism resembling JI allows Certified Emissions Reductions (CERs) to be banked from the year 2000, eight years before the first reporting period (2008-2012). Some AIJ projects may be renamed as CDM projects.

QUELRO (Quantified Emission Limitation and Reduction Obligations) trading Article 16 of the Kyoto Protocol allows for capped countries to transfer among themselves portions of their Assigned Amounts (AAs) of GHG emissions. Under this mechanism, countries that emit less than they are allowed under the Protocol can sell surplus "allowances" to Parties that have surpassed their Assigned Amount. Such transfers do not necessarily have to be directly linked to emission reductions from defined projects.

3.3 The Kyoto Protocol

The Kyoto Protocol appears to be a real first step in the GHG emissions mitigation arena, with substantially more stringent numerical targets for reductions than were generally expected by most observers before the conference in late 1997. The Protocol is liberal in allowing a variety of mechanisms for achieving those reductions, both technically, in the form of formally recognising forestry and agricultural emissions reductions, as well as structurally, through the trading of emissions quotas and various forms of "joint implementation" of emissions reduction projects. Nonetheless, it remains nothing more than a promising and highly symbolic first step, until ratification and subsequent domestic legislation "fill in the gaps".

The protocol was opened for ratification on March 16, 1998 and will close one year later on March 15, 1999. It becomes legally binding ninety days after the fifty-fifth government ratifies it, assuming that those 55 countries account for at least 55 per cent of the emissions of the developed countries in 1990. This percentage threshold was chosen to ensure that a majority of the developed countries' emissions would be covered, but not so high a proportion that any one country — meaning the United States — could veto the protocol by refusing to approve it. However, it is highly unlikely that many of the major industrial economies will ratify this agreement unless the United States does, due to issues of economic competitiveness. Moreover, if the US indicates that it will remain on the sidelines, there is an increasing disincentive for others to ratify as the overall percentage grows towards putting the agreement into force. As of May 1998, the following 39 Parties had signed the Kyoto Protocol (in order of signature): Maldives, Samoa, Antigua and Barbuda, Switzerland, Saint Lucia, Argentina, Marshall Islands, Micronesia, St. Vincent and the Grenadines, Seychelles, the Philippines, Malta, Costa Rica, Japan, Austria, Germany, Finland, Portugal, France, Sweden, Belgium, Spain, Denmark, Greece, Italy, the Netherlands, Luxembourg, the UK, Brazil, Norway, Monaco, Australia, Canada, Ireland, New Zealand, China, Panama, El Salvador and Mexico. These Parties represent 39 per cent of Annex I countries' (developed countries and economies in transition) CO_2 emissions.

Emission-capped countries have accepted the principle of differentiation among themselves, with an overall reduction in emissions level among them that is calculated at 5.2 per cent below 1990 levels. Differentiation means that emission reduction targets are not uniform among all signing countries (Box 3.2). Some industrial countries (notably Australia, Norway, Iceland) successfully negotiated to increase their emissions, albeit representing substantially slower rates of increase than was otherwise

anticipated by conventional economic analysis. For developing countries, this acceptance of case-specific differentiation may be an important point in future iterations of the climate negotiations.

Box 3.2 Annex B of the Kyoto Protocol. The percentages of allowed emissions during the 2008-2012 commitment period

Australia 108%	Austria 92%	Belgium 92%	Bulgaria 92%
Canada 94%	Croatia 95%	Czech Republic 92%	Denmark 92%
Estonia 92%	EU 92%	Finland 92%	France 92%
Germany 92%	Greece 92%	Hungary 94%	Iceland 110%
Ireland 92%	Italy 92%	Japan 94%	Latvia 92%
Liechtenstein 92%	Lithuania 92%	Luxembourg 92%	Monaco 92%
Netherlands 92%	New Zealand 100%	Norway 101%	Poland 94%
Portugal 92%	Romania 92%	Russia 100%	Slovakia 92%
Slovenia 92%	Spain 92%	Sweden 92%	Switzerland 92%
Ukraine 100%	United Kingdom 92%	United States 93%	

Notes:
1. Reduction commitments are expressed as percentage emissions against a baseline year, generally 1990 for the three "natural" gases (CO_2, CH_4 and N_20) and 1995 for the CFC replacement gases that are covered under the protocol.
2. Any country with a percentage higher than 100% has been allowed an increase in emissions.

The Protocol also agreed to count net, not gross, emissions, thus allowing forestry sinks. This will require more research on the part of the Intergovernmental Panel on Climate Change, as well as political negotiation of what should be counted and how it can be verified. As it currently stands, the Protocol's loose language permits countries to count net changes in sinks "resulting from direct human-induced land use change and forestry activities" as have occurred since 1990. Since the conclusion of Kyoto, a great deal of work has gone into considering the implications of sink enhancements under the Protocol and it seems that more questions have been raised, than answers given. This is discussed further below.

The first "Commitment Period" for achieving the emissions levels suggested is from 2008 to 2012, during which countries need only maintain an *average* of the required level during those five years. While this is economically sound, because it allows for greater flexibility, it also raises the question of whether international pressure will actually be used against countries that remain demonstrably above their allowable average during the earlier years of the period and appear unlikely to meet their levels. Countries in such a position would then need to:

1. commit to immediate, radical (and expensive) internal emission reductions programmes;

2. purchase substantial amounts of credits from outside parties under the various mechanisms that will be discussed; or
3. face sanctions.

While Article 17 of the Kyoto Protocol does mention that sanctions may be used, it does not define what such sanctions may be. This is certain to be a major issue over the coming years.

What do the agreed emission limitations imply, in terms of required gross tonnage of emissions reductions? Consider the United States as an example. In 1990 (the baseline year), the US emitted approximately 1.6 billion tonnes of carbon equivalent (or nearly 6 billion tonnes of CO_2) of the three most prevalent radiative gases (CO_2, CH_4 and N_2O). A 7 per cent reduction from that level will require that the US reduce average emissions from the 2008-2012 commitment period to around 1.5 billion metric tonnes of carbon equivalent; a decrease of 100 million tonnes per year.

However, not only have US emissions risen consistently since 1990, but that steady rise has mutated into a veritable spiking since 1995, with emissions rising 3.4 per cent in 1996 alone. Because of this, the US is already 8.2 per cent over 1990 levels. This rapid rise has surprised many observers; for example, the US General Accounting Office estimated in early 1995 that the *total* 1990-2000 increase would only be 4.2 per cent. What this means is that the emissions reductions needed to meet the US mandate already require at least 200 million metric tonnes of carbon emissions diminished from their current emissions profile, in order to meet the required national budget. This said, it has yet to be determined how much of this may be mitigated by potential domestic forestry sequestration gains, as the rules for national calculations in the land-use sector have yet to be defined by the FCCC and the IPCC.

Given these trends, economists now calculate that under a "business as usual" scenario, the US would exceed 1990 levels by 30 per cent or more, by the time of the first commitment period. Indeed, this projection was a foundation of the US negotiation position. Even if the US managed to reduce those projected gains by 70 per cent, through various climate and energy policy initiatives, that would still indicate *yet another* 100 million tonnes of yearly emission reductions requirements, which will need to be available by the first commitment period. This sobering analysis, and similar conclusions in countries like Japan, Australia, Canada, Norway and New Zealand, was clearly the backdrop to the agreement that any substantive emissions reduction target should be accompanied by sufficient "flexibility mechanisms" to ensure that meeting the target was not

excessively onerous to a national economy. As such, alongside the agreement of the industrial countries to accept legally binding emission restriction, the most important outcome of the Kyoto talks was the approval of emissions trading.

3.3.1 Emissions trading and "flexibility mechanisms"

There are three separate components of the Kyoto Protocol that directly deal with emissions trading activities. They are: Quantified Emission Reduction and Limitation Obligation (QELRO) trading, joint implementation (JI) and the Clean Development Mechanism (CDM). These three mechanisms are generally lumped together under the rubric of "flexibility mechanisms", and are, as follows:

- QELRO Trading - allows the international transfer of national allotments of Assigned Amounts (AAs) of allowed emissions as denoted in the Protocol.

- JI - allows the creation of Emissions Reduction Units (ERUs) through trans-national investment between industrial countries with emissions caps

- CDM - allows for the creation of Certified Emission Reductions in developing countries, to be regulated by a newly formed central authority.

These mechanisms are described below in more detail.

QELRO Trading

Perhaps the most basic modality - and the easiest to understand - is the idea of direct emissions trading among capped countries (countries with emissions restrictions, listed in Box 3.2). Article 16 of the Kyoto Protocol allows for capped countries to transfer among themselves portions of their assigned amounts (AAs) of GHG emissions. Under this mechanism, countries that emit less than they are allowed under the Protocol during the first commitment period can sell surplus "allowances" to Parties that have surpassed their Assigned Amount. Such transfers do not necessarily have to be directly linked to emission reductions from defined projects. The final text of Article 16 reads:

> *"The Conference of Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in Annex B (see*

Box 3.2) may participate in emissions trading for the purposes of fulfilling their commitments under Article 3 of this protocol. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article."

Many commentators advocate as strong a role as possible for the private sector in achieving the Kyoto goals. Some go so far as to suggest that government should have little or no role in the emissions trading process. Despite such rhetoric, it is clear that there are great policy level complexities in distributing various rights and responsibilities of the trading process down to the "entity" level (generally private sector, but possibly including sub-national jurisdictions or even certain civil society agencies). Ultimately, only the Parties - National signatories to the Protocol - are responsible for achieving the performance of the Protocol. Perhaps recognising this, the Kyoto Protocol omits any substantial discussion in all of the following areas:

- Distribution of a national allocation to private sub-national entities
- Creating transaction mechanisms for trading national allocations and emission reductions
- Quantification and verification systems for emissions and emission reductions
- A standard providing principles and criteria for further development of any of the points above.

The Protocol currently has no mechanism for disciplining or rewarding private sub-national entities for performance, and it is unlikely that such would develop in the future. It is assumed that national governments will need to craft domestic legislation to pass the damages from international sanctions to those sub-entities deemed responsible for the performance shortfall. That said, efficient market theory suggests that more players is better than fewer and that the most logical participants are companies whose national government(s) have imposed emissions controls on them. The system will ultimately be most effective if entity-level trading can accommodate both governments (trading on the national behalf) and companies trading an allocated portion of the overall quota (Joshua, 1998).

Joint Implementation (JI)

The Government of Norway originally proposed Joint Implementation in 1991 in the negotiations leading up to the Rio UNCED Conference. Until the Kyoto Protocol, the terminology of JI (and Activities Implemented Jointly - AIJ) was virtually synonymous with the overall sweep of emissions trading possibilities. The Kyoto Protocol, however, narrows the scope of JI

considerably. Article 6 of the Protocol defines JI as the creation, acquisition and transfer of emission reduction units (ERUs) between Annex I parties (developed countries and economies in transition), that result from projects aimed at reducing emissions at sources or enhancing GHGs removals by sinks. Joint Implementation is specifically based on the idea of international investments in specific projects.

According to the Kyoto Protocol, JI projects must:

- be approved by the Parties involved;
- provide reduction in emissions or enhancement of removals that is *additional* to any otherwise occurring;
- be supplemental to domestic actions for meeting commitments which are required elsewhere in the Protocol (Article 3 - this principally refers to the removal of energy subsidies and other policies which run counter to the objectives of the FCCC).

Therefore, a JI project should simply cause the following parallel events – a lowering of the domestic emissions inventory and a corresponding (though not necessarily equivalent) reduction of the domestic assigned amount.

Article 6 requires that countries and the FCCC develop the mechanisms (legal structures, reporting guidelines, accounting procedures, etc) required to run a legitimate emissions transaction regime. These developments will, in return, face very similar issues as those raised by the creation of the Clean Development Mechanism (see below). In the coming years, Parties will need to:

- further elaborate guidelines for implementation, including for verification and reporting;
- establish rules for regulating legal entities under a Party's responsibility to participate in generation, transfer, or acquisition of ERUs; and
- begin transfers and acquisitions of ERUs, while questions of implementation are resolved, provided that ERUs are not used by a Party to meet commitments under Article 3 of the Kyoto Protocol until any issue of compliance is resolved.

Clean Development Mechanism (CDM)

The creation of the CDM is contemplated in Article 12 of the Kyoto Protocol.

The CDM evolved out of an idea presented by Brazil and Costa Rica called the Clean Development Fund. The CDF proposed to tax emissions non-compliance of industrial countries and use the proceeds to engage in sustainable development projects with emissions reduction capacity in developing countries. The CDM's purpose is to assist non-Annex I Parties (developing countries) in making progress towards sustainable development and contributing to the FCCC objective, and to assist Annex I Parties (developed countries and economies in transition) in achieving their QELROs. Non-Annex I Parties will gain the economic, developmental and environmental benefits from implemented projects that generate Certified Emission Reductions (CERs) for export. Annex I Parties may use the certified reductions to contribute to compliance with part of their emission reduction targets, as determined by the Convention. It has been proposed that there should be restrictions regarding the percentage of a national obligation that can be met through CDM credits as opposed to internal domestic actions.

The CDM will act as an international body to oversee emission reduction projects that take place in countries that are not under emission restrictions. Like joint implementation, projects must be shown to be additional to what would have occurred otherwise and to have the express approval of the host government. The investor/industrial countries, after the projects and their emission reductions are certified by the CDM, can use certified credits against their emission reduction targets. We therefore find a hybrid mechanism that brings together joint implementation and emissions trading with voluntary developing country participation.

A most important facet of the CDM is that its resulting CER credits will apparently be bankable from inception (probably 2000 or 2001). This is up to eight years before the first reporting period. What that means is that credits granted by CDM during the period before the first reporting period (2008-2012) will be cumulatively available for "spending" during the reporting period (though project credits may also continue throughout the reporting period). This creates a strong incentive to engage in CDM projects as early as possible, as each year of emissions reductions adds to the transaction value at the point of "spending" (i.e. 2008-2012). Other major components of the CDM include:

- Project activities must be additional to policy actions that may be causing the same outcomes,
- The CDM is open to participation by either private or public entities, or combinations of the two,
- The CDM also has a mandate to use a portion of its proceeds to assist countries particularly vulnerable to climate change.

A flexible CDM is important to future acceptance of the Kyoto Protocol by many countries. At this stage, however, the CDM remains poorly defined and it seems clear that a large number of countries and interest groups have their own interpretations of it. Developing country governments want to use it to improve financial flows in their direction. Certain social and environmental advocates see it as a redistribution mechanism against historical development inequity. Other environmental groups see it as a way to enhance capital flows to forest conservation and sustainable forest management.

A further question involves the operational structure of the CDM. While some see it as a fairly simple regulator of emission transaction projects, others view it as a direct financing participant in projects, much along the lines of the Global Environmental Facility, that would return CER dividends to its investor participants. While some industrial countries clearly prefer the former model, many developing countries prefer the latter, as it would seemingly give them far greater control in spending priorities. The nature of the institutions(s) or organisation(s) that will be in charge of the CDM is also under debate. As noted above, the CDM also has a mandate to use a portion of its proceeds to assist countries particularly vulnerable to climate change. However it remains to be seen how the CDM will make priorities, how the transfers will occur and the degree to which added transaction fees (the presumed source of proceeds for vulnerability abatement) may impair market efficiency.

3.4 Implications of the flexibility mechanisms for developing countries

Flexibility mechanisms provide a variety of opportunities for investments in pursuit of clean and sustainable development. Most estimates indicate that a global market in emissions trading could be in the tens of billions of dollars annually by the first commitment period. While a portion of such theoretical sums will be transfers between industrial countries, particularly those of the EITs of Eastern Europe, a substantial percentage will also flow to developing countries. How these sums are apportioned, which countries will be best positioned to take advantage of these new capital flows and the degree to which regulatory mechanisms can control emissions trading, remains to be determined. However it is vitally important that investment priorities be set by the developing countries themselves rather than by outside buying parties who are less likely to appreciate the secondary

positive (or negative) values which different investment tracks can bring in different socio-economic situations.

In this light, it is good to see that it has become a *de facto* requirement that emission transaction projects need to obtain the express approval of both the host and investor country governments in order for future emission credits to be granted. In industrial countries, that approval may well become devolved to an entity level, allowing private concerns to import or export their portion of the national quota, as they see fit. However, all emerging regulations from the AIJ phase for developing countries have consistently emphasised the need for projects to be supportive of national development objectives and to be socially positive. Many projects inherently provide further environmental benefits beyond the quantified greenhouse gas achievements. For example, energy projects which use renewable sources rather than fossil fuel simultaneously may avoid pollution problems from emissions of sulphur, nitrogen and particulates, as well as any incremental environmental degradation created by accessing, transporting, refining and storing the fuel in question.

For developing countries seeking more widely available electrification, avoided emissions value under the CDM could assist in accessing higher efficiency fossil fuel technologies or large scale renewable energy technologies. Given sufficient value, it could even impact the potential of village or house-scale electrification through the use of photovoltaics and micro-hydro, rather than diesel or kerosene. For remote areas in which fuel must be purchased and transported, the use of renewable energy resources may also bring financial benefits for local stakeholders, as well as the environmental benefits of clean generation.

For tropical countries rich in forest resources, altering non-sustainable land-use patterns is likely to be a prized greenhouse gas mitigation opportunity, if the FCCC process allows such transactions. The attractiveness of tropical forests for GHG-mitigation projects is based on lower factor costs for land and labour and higher biomass growth rates, compared to temperate forests. Because of better climate and faster tree growth rates, tropical forests are more efficient than temperate forests in absorbing CO_2 from the atmosphere. It has been estimated that any particular target for carbon sequestration through forestry would require 25 per cent less overall land area, if planting was concentrated in tropical rather than temperate areas (Marland 1988). This represents a direct comparative advantage for tropical forest countries. Tropical forestry carbon offsets can encompass a range of project-scale interventions, including direct preservation, reforestation, and reduction of the negative impacts of forest management and harvesting.

There is also the possibility of increasing the production efficiency of swidden agricultural systems or the end-use efficiency of fuelwood resources, both of which can help take pressure off standing forests with accompanying GHG benefits.

Considering the wider perspective, forestry carbon offset projects can dovetail support for the other major UNCED convention - the Biodiversity Convention. While there are a variety of financial mechanisms being explored to support biodiversity conservation, efforts like trust funds and pharmaceutical prospecting rights have yet to demonstrate that they are accepted by either policy or the marketplace. Forestry based carbon offsets - whether they promote direct preservation, sustainable forestry practices or reforestation - all have the potential to support the goals of the Biodiversity Convention.

While some developing countries see potential advantages from individual investments in CDM projects, others emphasise the potential disadvantages from an overall system of emissions transactions. The major advantage is that CDM transactions could represent a new source of capital which is targeted towards sustainable development ideals, but which is project specific. Potential capital flows to these types of projects could be very large, if industrial nations make a concerted effort on climate change. With the continuing decrease in official development assistance (ODA) from the OECD to the G-77, this could be an important facet in encouraging investments towards environmentally appropriate paths.

Besides representing a new source of capital, extensive utilisation of CDM mechanisms could lead to technological leapfrogging for developing countries. This could occur by accelerating the adoption of the clean and efficient technologies, particularly in the energy sector. The opportunity for an outside concern to earn Certified Emission Reductions (CERs) for providing or financing the best available technologies (BAT) - rather than outdated or used equipment - could help overcome the higher capital costs and lack of information which disadvantage such technologies in many developing countries. Once in place, developing countries could begin to establish their own competence with various new technologies or techniques, which could catalyse new service and trade opportunities in their own right.

If structured properly, CDM could be advantageous to both public and private sectors in developing countries. Public sector advantages could include:

- Injection of new capital, additional to current aid funding and traditional trade sources

- Access to new sources of funding, technology and expertise to assist in the implementation of national priorities

- In the forestry sector, CDM investment could be directed to: implementation of national land use plans, forest conservation efforts, consolidation of national parks, rehabilitation of degraded areas, development of plantations and farm forestry, strengthening of forestry sector institutions and systems for improved management

- Options for the industrial sector may include: renovation of industrial plant and infrastructure, replacement of obsolete machinery with less polluting and more efficient equipment, accelerated technology transfer, etc.

- In the energy sector, investment could be directed to reduce dependence on fossil fuels, finance technology transfer, and promote a shift to less polluting or renewable energy sources.

If such actions were carried out concertedly, increased employment generation and economic growth would result. Countries might gain better access to external markets through the use of BAT technologies, potentially associated with independent certification (through ISO, ITTO 2000 or FSC). Forestry initiatives to mitigate GHG emissions would also probably have positive effects on the objectives of other UNCED commitments, notably the Biodiversity Convention and Agenda 21.

Advantages for the private sector in developing countries could include:

- Trade advantages in a new commodity which is likely to become increasingly valuable to industrial countries as the restrictions from the FCCC come into force

- This trade could leverage further investments, by increasing the attractiveness of environmentally-friendly projects with marginal returns or high risks

- In the case of energy, there are opportunities to gain positions of market leadership (through increased experience and enhanced expertise), rather than being strictly dependent on technology downflow

- In the case of commercial forestry activities, carbon benefits provide early financial returns, before harvesting takes place

Despite these potential advantages, there are systemic objections legitimately raised against the concept of Joint Implementation. Chief among these objections is the fear, among developing countries, that agreeing to an emissions trading system will lead to mounting diplomatic and economic pressure to undertake emissions commitments themselves. Many developing countries would consider this to be unfair, given the historical responsibility of the industrialised countries for dumping CO_2 into the atmosphere. The main objections raised against the concept of JI/ CDM include (Stuart and Sekhran 1996):

- *Potential aid reduction*. There is a fear that CDM will provide industrial countries further excuses to reduce Official Development Assistance (ODA), replacing it with "emission reduction" aid. It is argued that ODA should not be replaced at all, and that emissions transaction funding should flow from the private sector sources in developed countries. However, reliance on such flows would potentially compromise a country's ability to control its own investment strategies.

- *Emissions slippage*. Currently, only industrial country emissions are likely to be restricted or "capped". Emissions trading between a capped country and an uncapped country creates the possibility that no net emissions reductions will actually occur. This is because high emission activities in a capped country can merely be transferred to an uncapped country without penalty. This type of activity is termed "leakage" (USIJI 1994) or "slippage" (Moura Costa and Stuart 1997); i.e. emissions are displaced to another location without any net positive effect. If leakage/ slippage in this manner becomes a severe problem, developing countries expect that industrial countries will pressure them greatly to undertake binding emissions commitments. They would then be responsible for the displaced emissions, to their competitive disadvantage.

- *Reduced inward investment from carbon-intensive industry*. Higher factor costs in industrial countries, caused by energy taxes or the costs of emissions permits, would make investment opportunities in developing countries more attractive to industrial concerns. This would create economic development opportunities. If extensive emissions trading is allowed to mitigate those costs, however, there will be less pressure to transfer profitable carbon intensive industries to developing countries, thus keeping such industries (and the concomitant economic benefits) in industrial countries.

- *Industrial countries cornering the offset market*. Industrial countries could lock up the most advantageous carbon offset options in developing countries. This would reduce the long-term capacity of these countries to reduce their net emissions when they need to take on commitments. In this situation, all that would be available would be the higher cost options that had not interested the industrial country participants.

- *Low offset prices*. Currently, the announced average price of offsets has been very low, usually representing a portion of the marginal cost of the intervention, without any rents accruing to the supplier. This overt lack of profitability provides no commercial incentive for developing countries to supply offsets and reinforces the notion that carbon offsets are "win-win" in name only.

- *Eco-colonialism in emission rights*. If emission targets are set for all countries in the future, emission rights could be viewed as a potential form of eco-colonialism, under the "terms of trade" argument. In this analysis, industrial countries could coordinate the purchase of emissions rights from developing countries, thus denying developing countries the right to industrialise using inexpensive fossil fuels.

- *Increased conditionality on investments*. Another form of this argument views CDM as a mechanism by which industrial countries could impinge upon the sovereign rights of developing countries by imposing various restrictive covenants on behaviour, by placing forms of conditionality on their investments. Since most analysts see CDM as being private sector driven, developing countries will have even less recourse to object to that type of conditionality.

- *Industrial countries should get their own house in order*. Many take the strong moral stand that OECD countries should not be allowed to avoid their own emission reduction responsibilities (and continue to use a disproportionate amount of the global atmospheric resource) through the low cost options promised by transnational mitigation programs.

These kinds of objections have been at the root of the continuous debate amongst the Parties of the Convention. Proponents of the CDM, as a developing country-run regulatory body, have high hopes that it will have an important role in avoiding abuses of the "joint implementation" concept, while enabling acceptable compromises to be reached in relation to these issues.

4 GHG mitigation options

As noted earlier, there are two principal areas in which the net rate of GHG accumulation in the atmosphere can be reduced; within the area of energy generation and utilisation (including transportation), and in the area of land use and forestry. While it is anticipated that a larger proportion of funds will be directed to energy projects, it is also expected that there will be a higher actual number of land-use projects.

4.1 Energy options

Energy projects are likely to comprise improvements in the efficiency of fossil fuel utilisation, and the promotion of fossil fuel-free energy from sustainable sources (solar, wind, geothermal, hydro and biofuels). The principal value of offsets in these is to accelerate the implementation of various new technologies. While many of these technologies are commonplace in the industrial world, others remain in development, or non-viable without the use of subsidies.

One of the fields with stronger potential for GHG emissions reduction is the electricity sector, both in terms of production and utilisation. GHG emissions from electricity production are increasing rapidly in the developing world, particularly in Asia, which it is predicted will increase overall electrical capacity by hundreds of thousands of megawatts over the coming two decades. Given the likelihood that a high percentage of that electrification will rely on coal and oil and will use inefficient technologies, there are innumerable areas for carbon offset investments to influence this investment track.

While still relying on fossil fuel utilisation, great opportunities exist for improvements of electricity production efficiency, thus extracting substantially more electricity per unit of emissions than is currently occurring. The government of Sweden, in a wide ranging JI effort, is

assisting in the upgrading of innumerable district heating boilers in the Baltic States, primarily Latvia, with substantial relative reductions in CO_2 emissions (Lofstedt *et al* 1996). The Netherlands, under a series of projects, has upgraded electricity efficiencies in areas as wide ranging as horticultural greenhouses, transportation, and energy generation.

Alternatively, it is possible to improve the end use of electricity, so that a certain amount of electrical input results in higher volumes of economical outputs. This can be achieved by a series of demand side management activities aiming at optimising transmission and utilisation of electricity. In one of the pioneering JI experiments, the World Bank and Norway jointly developed a programme of high efficiency lighting installation in Mexico City, thus potentially negating the need for additional economic output (Anderson 1995). Most electricity efficiency projects save comparatively little GHG emissions, but are economically beneficial for the parties involved.

For many developing countries, the issue is not the replacement or upgrading of current facilities, but first generation electrification. There remains a consistent global market in greenhouse-unfriendly items such as used oil-fired power stations, many of which have been decommissioned in the US and Europe since the 1970s oil crises. Meanwhile, newly installed power plants in the US or Europe often use as little as half the fuel (which can save on the current account if the fuel is imported) and emit only a fraction of hazardous pollutants like oxides of sulphur, nitrogen and particulates for an equivalent electricity output. There is thus tremendous potential for JI financing to help bridge this differential, even if the same fuel stock is used.

Another alternative for generating carbon offsets is to promote fuel switching. The principal fuel switch (while remaining in fossil fuels) which has been promoted is from either coal or diesel (which are approximately carbon equivalent) to natural gas, which delivers the same amount of energy with approximately half the GHG emissions. In Decin, Czech Republic, several US utilities became equity partners in a project to switch from coal to natural gas in an efficiency project. Fuel switching, from fossil to biomass fuels, may also play an important role in reducing GHG release, with plantation forests created for the sole objective of fuel production. Because the use of biomass fuel can occur through a fully cyclic system (planting, burning, re-planting, etc.), some authors believe it to be the most promising option for carbon sequestration in the long term (Grainger 1990).

One of the most exciting potentials of JI investments is to facilitate the

increased penetration of truly clean technologies, such as wind, solar, hydrogen fuel cells and biomass energy. Many of these technologies continue to show impressive gains in efficiency and several are close to being competitive with fossil fuels. A further alternative is increasing the utilisation of hydropower, particularly run-of-the-river hydropower, which does not have the negative environmental impacts of large dams (which include, in some cases, increased emissions of greenhouse gases from underwater methane production and release).

Historically, the primary model of electrification has been one of centralisation, with a spider's web of power lines extending from a single, large power plant. In regards to extending electrification, however, there is increasingly a case to be made for decentralised power sources, particularly in the remoter areas of the developing world. Whilst there are an estimated 2-3 billion people globally with no access to electricity, the costs of running transmission lines often makes conventional electrification uneconomic for many situations. One traditional compromise has been the use of small-scale electrification based on diesel generators, but these have often proven to be expensive, difficult to maintain and forces the users into continued reliance on importing diesel. Progress may be made through in the use of small-scale renewable energy sources, particularly solar photovoltaics and micro-hydro facilities. Despite higher costs (compared to diesel generators), such technologies demonstrably reduce GHG emissions, in comparison to the continued use of fossil fuels. If the overall value of carbon savings becomes high enough, or if policy initiatives begin to take overall GHG emissions more seriously, such value could be an additional driver promoting clean energy sources in rural situations.

4.2 Forestry options

The notion of compensating for rising atmospheric CO_2 concentrations through global scale afforestation was first put forward in the late 1970s (Dyson 1977). Since the beginning of the 1990's a variety of forestry-based carbon offset projects have been initiated (Moura Costa 1996; Moura Costa and Stuart, in press).

It is commonly argued that large expanses of under-utilised, degraded or deforested land with a low current value as carbon repositories that could be either afforested, reforested or rehabilitated are available throughout the world (e.g. Nilsson and Schopfhauser 1994). The combination of climatic conditions favourable for tree growth, land availability, and abundance of

labour favours the development of forestry schemes in tropical developing countries as opposed to temperate countries.

Carbon fixation through forestry is a function of biomass accumulation and storage. Therefore, any activity or management practice that changes the biomass in an area has an effect on its capacity to store or sequester carbon. A variety of forest management practices can be used to reduce the accumulation of greenhouse gases in the atmosphere, via two different approaches. One is by actively increasing the amount or rate of accumulation of carbon (i.e. "sink" creation or enhancement). The second is by preventing or reducing the rate of release of carbon already fixed in an existing carbon pool.

Any activity that involves tree-planting results in the creation of new carbon sinks, i.e., carbon fixation during tree growth in afforestation, reforestation, forest rehabilitation, or agroforestry schemes. Although carbon sequestration is often discussed in the context of the establishment of new forests, carbon fixation can also be achieved by improving the growth rates of existing forests. This can be achieved through silvicultural treatments such as thinning, liberation treatments, weeding or fertilisation. Since substantial amounts of carbon are stored in soils, management practices that promote an increase in soil organic matter can also have a positive carbon sequestration effect.

Traditional financial cost /benefit calculations weigh heavily against all types of reforestation. Carbon offset payments, however, could help change forest plantation economics. There is growing recognition that the economic challenges of plantations - which generally yield little in the way of cashflow for many years - have inhibited investment in this activity. Additionally, high capital costs and delayed returns tend to favour the establishment of high-yield species monocultures, short rotations, and minimal cost management policies, all of which can be environmentally problematic. Risky locales, without track records, are also negatively weighted in such financial calculations. While the wood products industry is already increasing its reliance on planted forests, most studies indicate that plantation development still comprises only a fraction of annual primary forest cut, leading to fears that there is insufficient present investment to ease market pressure on dwindling primary forests (FAO 1991). Joint Implementation investments can, theoretically, make lower growth areas financially viable, make it possible to choose longer rotations, or to use a wider range of species than the eucalyptus, pine and teak varieties which account for 85 per cent of all plantation investments in the tropics (FAO 1991).

Forest conservation can also serve as an efficient form of carbon offset. Despite substantial losses in overall forest cover, remaining primary forests, both tropical and temperate, represent huge pools of sequestered carbon. A large proportion of land under forest cover is threatened with conversion to other land uses that have lower value as carbon sinks (Dixon *et al* 1994). The avoidance and mitigation of carbon releases from these pools provides the quickest, forestry-based, opportunity to slow the accumulation of carbon dioxide into the atmosphere (Thailand Environment Institute 1995). Some of the main pressures are related to expansion of agriculture and pasturelands, logging operations, and urbanisation (World Resources Institute 1990). Conservation of forests plays a double role in relation to carbon sinks. Firstly, it prevents the emission of carbon that would be caused by decomposition of the forest biomass. It has been estimated that deforestation contributes to 30 per cent of the current global anthropogenic CO_2 emissions (Brown *et al* 1996). Secondly, conservation prevents the reduction in areas with potential for active carbon sequestration.

Forest conservation for carbon sequestration purposes can be either direct or indirect. Direct interventions essentially require the "locking up" of threatened land resources into untouchable preserves. Indirect interventions comprise a far wider range of possibilities, including increasing agricultural productivity (thus lowering the need for cyclical slash and burn cropping), the development of agroforestry to meet fuelwood needs, the opening of markets for indigenous forest products, and the promotion of wood waste and paper recycling.

Assessing how much deforestation is being "avoided" can be a complex and controversial endeavour, which relates to social and economic aspects of a particular region. Often, government policies induce pressure on standing forests by specifically encouraging forest utilisation. Some countries view conservation as patrimonial and an affront against a nation's sovereignty. As such, there has been some negative bias among potential funders against the idea of resource "lock-ups", although several programmes have combined conservation with sustainable utilisation and other economic activities.

Interventions that reduce ongoing rates of carbon emissions from forestry practices can also be important. These include reduction in rates of deforestation, and the introduction of techniques for controlled logging and improved fire prevention. It is estimated that 15 million hectares of tropical forests are logged yearly throughout the world (Singh 1993), and the majority of logging operations in tropical countries are considered unsustainable and damaging (Poore 1989). Implementation of reduced

impact logging techniques that avoid unnecessary destruction of biomass and release of carbon has great potential as a carbon offset technique (Marsh 1993).

Low impact logging is an attractive forestry offset option because approximately half of the eventual greenhouse gains are realised over the first few years and are basically irreversible. This lessens the risk factor of failure for carbon offset investments. Simultaneously, biodiversity values are maintained, fire risks are lowered and topsoil integrity is maintained. Furthermore, a fundamental feature of this option is that forests continue to provide economic potential through continued production of timber resources in an environmentally sustainable manner.

The suppression of forest fires is another option to reduce unnecessary carbon emissions. In the last decade, fire outbreaks have destroyed millions of hectares of rainforests in Kalimantan and Sumatra alone, and the incidence of forest fires is expected to increase in the next decade (ITTO 1994). In 1997, another massive series of fires began in Indonesia, releasing hundreds of millions of tonnes of greenhouse gases. Along with the crucial need to address the policy causes, a combination of ground-based practices of fire prevention and control, and available remote sensing monitoring systems (Malingreau *et al* 1989, DSE 1991) has great potential for reducing the frequency and extent of forest fires.

Finally, forestry can also be used to prevent carbon released by fossil fuels elsewhere. This can be achieved through fuel or material substitution. Fuel wood can be used to replace fossil fuels, and wood-based materials could be used to replace materials that require high levels of energy and/or fossil fuels for their production (e.g. steel, cement, plastics).

Table 4.1 Forestry JI projects initiated to date

Project name	Date proposed/ Initiated	Carbon offset (1000 t C)	Area (ha)	Host country	Investor country	Project description
AES – Care	1990	10,500	186,000	Guatemala	USA	Agroforestry
Face Malaysia	1992	4,250	25,000	Malaysia	Netherlands	Enrichment planting
Face-Kroknose	1992	3,080	16,000	Czech R.	Netherlands	Park rehabilitation
Face Netherlands	1992	885	5,000	Netherlands	Netherlands	Urban forestry
ICSB-NEP 1	1992	56	1,400	Malaysia	USA	Reduced Impact Logging
AES – Oxfam–Coica	1992	15,000	1,500,000	South America	USA	Forest protection
AES – Nature Conservancy	1992	15,380	58,000	Paraguay	USA	Forest protection
Face-Profafor	1993	9,660	75,000	Ecuador	Netherlands	Small farmers plantation forestry
RUSAFOR-SAP	1993	79	450	Russia	USA	Plantation forestry
Face Uganda	1994	6,750	27,000	Uganda	Netherlands	Forest rehabilitation
Rio Bravo	1994	1,300	87,000	Belize	USA	Forest protection and management
Carfix	1994	2,000	91,000	Costa Rica	USA	Forest protection and management
Ecoland/Tenaska	1995	350	2,500	Costa Rica	USA	Forest conservation
ICSB-NEP 2	1996	39	980	Malaysia	USA	Reduced Impact Logging
Noel Kempff M.	1996	14,000	1,000,000	Bolivia	UK/USA	Forest conservation and management

Project name	Date proposed/ Initiated	Carbon offset (1000 t C)	Area (ha)	Host country	Investor country	Project description
Klinki forestry	1997	1,600	87,000	Costa Rica	USA	Reforestation with klinki
Burkina Faso	1997	67	300,000	Burkina Faso	Denmark	Fire wood community forestry
Scolel Te	1997	15	13,000	Mexico	UK/France	Community forestry
PAP OCIC	1997	18,000	570,000	Costa Rica	Norway, USA	Forest conservation
Norway-Costa Rica	1997	230	4,000	Costa Rica	Norway	Forest rehabilitation and conservation
Tesco "green petrol"	1998	n.a.	n.a.	Undefined	UK	Forestry
Green fleet initiative	1997	n.a.	n.a.	Australia	Australia	Reforestation
AES - Ilha Bananal	1998	n.a.	n.a.	Brazil	USA	Forest rehabilitation
NSW + Pacific Power + Delta Electricity	1998	69	1,041	Australia	Australia	Reforestation
World Bank Prototype Carbon Fund	1998	n.a.	n.a.	International	International	Renewable energy and forestry
Totals/average	**-**	**103,310**	**3,970,171**	**-**	**-**	**-**

n.a. = not available
It should be noted that the sources for this data are varied and figures may be inaccurate

Source: Moura Costa and Stuart (in press)

5

Evolution of GHG mitigation initiatives

5.1 Industrial countries' initiatives

By early 1988, at least ten industrialised countries, including the United States, Canada, Australia, Germany, Japan, the Netherlands, Norway, Sweden, Denmark, Switzerland and France had developed, or announced intentions to develop, regulatory bodies to oversee GHG-mitigation claims for activities carried out internationally. At the domestic level, programmes now exist in the US, Australia and Canada. There are questions about how these emerging institutions will either mesh with, or be displaced by, the emergence of the CDM.

The United States Initiative on Joint Implementation (USIJI) was the first JI dedicated office in the world (USIJI 1994). The USIJI is an inter-agency panel chaired by the Environmental Protection Agency and the Department of Energy, with membership drawn from the Departments of State, Treasury, Agriculture, Interior, and Commerce, as well as the US Agency for International Development (USAID). To date, about thirty out of over 100 projects submitted to the USIJI have been "accepted" by the programme. Accepted projects have cumulative capitalisation requirements in the hundreds of millions and it is reported that approximately one half of those requirements have been actually raised and implemented to date (Ken Andrasko, personal communication). Of the accepted projects, approximately one half are in the energy sector while the remainder involve forestry and other biomass interventions. Of the forestry projects, preservation, reforestation and low impact logging are all represented, often in combination within single projects. Countries with USIJI accepted projects include Costa Rica, Russia, Mexico, Honduras, Indonesia, Poland, Czech Republic, Nicaragua, Belize and others. At the domestic level, in 1992 the US initiated the Voluntary Reporting of Greenhouse Gases programme under the auspices of the US Department of Energy. That reporting body has included over 900 GHG reduction projects in its

database to date. These projects have been undertaken by US companies, agencies and individuals and are both domestic and international in scope (EIA 1996).

Parallel to the United States initiatives, the Netherlands has consistently supported cooperative international ventures to mitigate GHG emissions. The Dutch government has developed a JI modelling initiative. The Pilot Project Programme (PPP) represents a testing regime for the development of organisational models and GHG reduction calculation methodologies. PPP participants are selected from ongoing Dutch bilateral aid projects with characteristics which, if replicated, could make them suitable JI candidates in the future. Presently, the PPP initiative is modelling eight projects. As of early 1998, they included:

- three forestry projects of the Forests Absorbing CO_2 Emissions (FACE) Foundation (in Ecuador, Uganda and the Czech Republic),
- a landfill methane extraction project in Moscow,
- a horticultural efficiency project in Western Siberia,
- a municipal energy efficiency project in Hungary,
- a compressed natural gas retrofitting for buses, also in Hungary,
- a micro-hydro project in Bhutan (Peelen 1996).

In early 1998, following Kyoto, the Dutch government entered into its first formal emissions transaction from an energy retrofit project in Romania. Under the terms of that transaction, the Netherlands will be able to claim 65 per cent of the emission reductions from the improvements during the 2008-2012 commitment period. For further details on this project, see Section 6.

The Canadian government has initiated the Voluntary Challenge and Registry (VCR) run by Canada's Ministry of Natural Resources to register domestic emission reductions. Initiated in February 1995, the VCR had already registered over 475 participants by November, 1995. To date, 100 per cent of all Canadian refiners, 95 per cent of the electric utility industry, 95 per cent of the chemical industry, 88 per cent of natural gas distribution companies, 60 per cent of the mining industry and 50 per cent of the forestry, pulp and paper industry are participating in the VCR. Canada also formed the Canadian Joint Implementation Initiative (CJII), a sub-programme within the VCR. The stated objectives of CJII are to contribute to global efforts to reduce net emissions of GHGs through voluntary partnerships between Canadian and foreign entities, to encourage private sector initiatives to develop and to disseminate technologies and build capacities in other countries. Furthermore, it will test and evaluate

methodologies for initiating JI and gain early, practical experience that can be used to develop a longer-term JI programme both domestically and internationally.

Australia's AIJ programme is designed to encourage major Australian companies to redirect capital towards projects that return a competitive rate on capital as well as achieve positive GHG benefits. The plan includes an effort to develop bilateral agreements with APEC and South Pacific countries, much along the lines of the US agreements in Latin America. The plan will include the development and implementation of co-operative projects with other countries, initiatives to enhance the export of Australian technologies and services with greenhouse benefits, and greenhouse specific development assistance to countries in the Asia-Pacific region. Australia has signed a JI co-operation agreement with Indonesia. At the domestic level, Australia established the Greenhouse Challenge in 1995 as a joint initiative of industry and government. It encourages voluntary action by companies through co-operative agreements with the government, and has enlisted the co-operation and support of more than 160 industry associations and Australian companies. Some of these companies currently include carbon sequestration projects in their Greenhouse Challenge co-operative agreements.

The Japanese AIJ initiative began in late 1995. The lead agencies for the Japan AIJ initiative are the Environmental Agency (EA) and the Ministry of International Trade and Industry (MITI). The initiative emphasises monitoring and evaluating a number of existing development assistance projects as if they were JI-designed projects. The programme has already included 11 project proposals put forth by Japanese private firms, municipalities and environmental NGOs. Projects are in the fields of renewable energy, energy efficiency and sustainable forestry, and are located in Indonesia, Malaysia, Thailand, and China. To date, none of these proposals appears to have been approved by the relevant host governments, which has meant that no accomplishments have been reported to the FCCC (JIQ 1996a).

A JI collaboration has been established between the Kingdom of Norway and the World Bank. Because Norway is extremely dependent on hydroelectricity and also has a major oil/gas production and export complex, relative costs for reducing GHG emissions internally are projected to be extremely high. This may explain why Norway has consistently been among the intellectual leaders of the JI concept, having introduced the idea with Germany into the FCCC process in 1991. Norway has helped finance two early international emission reduction projects - in Poland and Mexico

(Anderson 1995) - and also bought the first 20,000 units of the Costa Rican CTOs (see Section 6). The Polish project involved a fuel switch from lignite to natural gas and the Mexican project was to install millions of highly efficient light bulbs throughout Mexico City.

A third project involving these partners, as well as Denmark and the Netherlands, is currently taking place in Burkina Faso. This project will manage 300,000 hectares of community based forest, promote more efficient charcoal making technologies and introduce solar photovoltaic systems for household lighting and water pumping. More efficient kerosene cooking stoves - to lessen reliance on fuelwood - will also be introduced. Over 30 years, the World Bank estimates that the Burkina Faso project is projected to save more than 7 million tonnes of carbon.

Germany's AIJ effort emerged in late 1995. To date, there appear to be two concrete examples of German participation in the AIJ pilot phase, both involving renewable energy, in Latvia and Indonesia. A coordinating office in the Ministry of Environment, Nature Conservation and Nuclear Safety runs the AIJ programme. The most recent AIJ offices are the ones of France and Switzerland, and still do not support any project. France's programme is still undefined.

All these regulatory bodies review, accept or reject projects according to a series of criteria developed by the countries themselves. While, in general, criteria aim at reflecting the main tenets of the FCCC (see Box 5.1), nations adapt their criteria according to the areas in which they would like to promote (or not) investment. For example, while the USIJI's programme is broad and comprehensive, US Climate policy encourages projects leading to the adoption of American technology, particularly in renewables. Switzerland's programme, for example, does not yet accept forestry projects. While there is no internationally agreed standard for regulating JI/AIJ projects yet, this role may be partially fulfilled by private sector companies, with initiatives such as the SGS Forestry's newly created Carbon Offset Verification Service (Moura Costa *et al* 1997), the first of its kind in the world.

Box 5.1 Criteria for defining carbon offset projects

While each of the industrial country JI programmes has slightly altered priorities, they mostly reflect similar goals and ideals. The following criteria are from Germany's JI programme:

- AIJ pilot projects should be compatible with and supportive of national and development priorities;
- AIJ activities require prior acceptance, approval and endorsement by the parties' governments;

- AIJ projects should bring about real, measurable and long term environmental benefits related to the mitigation of climate change;
- the financing of AIJ projects should be additional to the financial obligations of developed countries under the FCCC's financial mechanism as well as to current foreign aid;
- during the pilot phase, credits to commitments shall not accrue to any Party from AIJ initiatives;
- the focus of the German pilot programme will be on emission avoidance. The main emphasis will be on projects that stimulate the use of modern technology or renewable energy. Building up biomass for emission reductions or the creation of CO_2 sinks is also possible; in such cases, the emphasis will be on reduction measures;
- the AIJ projects can be related to all GHGs covered by the FCCC or combinations of anthropogenic GHGs as well as the creation of reservoirs and sinks. The projects should contribute to the low cost achievement of global ecological advantages;
- the AIJ pilot projects should be accompanied by appropriate scientific research and will have to be documented.

For the industrial countries, these new JI institutions were expected to play several, perhaps contradictory, roles. Agencies like the USIJI were partially designed to promote the overall idea of joint implementation, as well as evaluating specific investments. Over its first several years, the USIJI held dozens of stakeholder meetings, in countries such as Indonesia, China, Egypt, Costa Rica, Mexico, and the Czech Republic. While a substantial aim of these meetings was the dissemination of information, they were also designed as facilitation mechanisms to help promote US goods in key strategic markets. Of the 12 emerging economies specifically targeted by the Department of Commerce for US export promotion, at least half have hosted meetings that were in part sponsored by the USIJI or the associated US Country Studies Programme.

As part of its initiatives, the USIJI has taken a leading role in establishing diplomatic accords oriented towards facilitating JI investment. This is done through bilateral Statements of Intent, signed jointly with potential host country governments. These Statements of Intent provide a framework to promote private sector investment in projects that fuel economic growth and benefit the environment, as denoted through GHG mitigation capacity. Key provisions in each of these statements include: the intention of the parties to cooperate in the development of criteria for JI projects, the identification and provision of support for projects, the monitoring of methodologies, outreach and, in some cases, the support of JI in international negotiations (Stowell 1996). The US has signed Statements of Intent with Pakistan, Costa Rica, Chile and Bolivia, as well as a regional agreement with the seven Central American countries.

The USIJI thus acts as advocate, information conduit and matchmaker for project proponents and investors. While these roles are not inherently contradictory, one anticipated role could be more problematic. The USIJI evaluates, approves and regulates any project with US participation. During the current phase - in which all projects are voluntary and during which there is no credit transaction - this is not a problem. However, if CDM gives emission reduction economic value, the dual role of promoter and domestic regulator could lead to apparent conflicts of interest.

5.2 International organisations' initiatives

Since 1991, the United Nations Conference on Trade and Development (UNCTAD) has sponsored a series of respected studies on aspects of a global emissions trading system (e.g. UNCTAD 1992). These works have focused on areas like market architecture, legal issues, policy requirements and economic issues. In 1997, UNCTAD began the process of transforming these theoretical works into real applications. Working with the Earth Council (which is headed by Maurice Strong, the Canadian industrialist who chaired both the 1972 Stockholm and 1992 Rio Conferences on the Global Environment) and Centre Financial Products (the company responsible for the creation of the SO_2 trading instruments used in the US), UNCTAD has sketched a three-year plan to develop a full market architecture by the year 2000. In order to develop these ideas, UNCTAD and its partners have convened a GHG Policy Forum, which will be meeting regularly over the coming two and a half years and includes substantial financial and other business interests. Under the UNCTAD scheme, industrial and transition countries will ration among themselves a series of emission allowances and then trade amongst themselves. Joint Implementation of project investments with countries outside the emissions block - such as most developing countries - presumably would be allowed under strict guidelines.

In June of 1997, the World Bank announced its intention to create a carbon investment fund targeting energy project opportunities in the Economies in Transition (EITs) of Eastern Europe. This fund will go well beyond the World Bank's current experimental project in conjunction with Norway. Preliminary indications were that fund capitalisation would actually occur after the Third Conference of Parties of the FCCC (CoP 3) in Kyoto (December 1997), would involve subscriptions from both governments and the private sector, and would involve initial capital of US$100 million. The World Bank sees its competitive advantage as its ability to offer evaluation of projects and its ability to lower transaction costs. The World Bank has

developed a sophisticated evaluation system, the Global Overlay (World Bank 1997), to assess GHG benefits from particular projects, and is applying it to all prospective investments to ascertain those in which carbon benefits could make the difference between investing and not investing. Those that are marginal are presumably candidates for this and future JI investment funds.

5.3 Private sector initiatives

The private sector has been active in exploring methods of GHG reduction programmes. While several individual companies have been pro-active in the field, industry associations have ultimately been more visible participants. This seems to be because it is in no company's direct interest to undertake substantial expenditures under policy uncertainty, but there is an interest of industry as a whole to learn about options for the future. These association programmes include participation from the following:

- Edison Electric Institute (an association of American electricity generation companies)
- The World Business Council for Sustainable Development
- The E-7, a global association of mega-sized electric utilities
- The FACE Foundation (created by the Dutch Electricity Generating Board)
- International Automobile Association.

The Edison Electric Institute (EEI) is the US utility trade association of private electricity generation utilities. The EEI membership has a combined annual revenue of US$170 billion. In voluntary cooperation with the US Department of Energy, EEI is coordinating the US electricity industry's commitments to GHG reductions. Individual utilities sign commitments of intent with the Department of Energy to reduce emissions by either a percentage or a gross amount. Through the end of 1995, 113 commitments had been signed representing annual reductions of 47 million tonnes of carbon equivalent (or 185 million tonnes of $C0_2$) by the year 2000.

To further support the goals of the Climate Challenge, the EEI developed five initiatives. These include the Utility Forest Carbon Management Program (biomass sequestration), the International Utility Efficiency Partnership (energy management and renewable energy), the National Earth Comfort Program (geothermal heat pumps), EV America (electric vehicles) and Envirotech (developing electro-technologies). Each of the programmes

has subscribing member utilities who pay a fee to be among the review committee for generating investment. The Carbon Management programme and the Efficiency Partnership both include international investments within their portfolios.

The World Business Council for Sustainable Development (WBCSD) supports pro-active business involvement to address areas of environmental efficiency. The WBCSD comprises many of the largest multinationals in the world. Through its working group on climate and energy, the WBCSD has launched a project to promote GHG mitigation projects. As of late 1996, the WBCSD has posted well over 100 proposals on its World Wide Web page, which is designed to be a project clearing house for project developers and financiers to look for potential cooperative opportunities. The WBCSD will not invest as a consortium; however, individual members may participate in particular investment opportunities which are attractive, in accordance with their own standard business efforts. Public information is lacking regarding the actual investment status of any of the proposals submitted to the programme.

The E-7 is a non-profit international network of eight of the largest electric utilities in the world, including EDF of France, RWE of Germany, ENRI of Italy, Tokyo Electric and Kansai Electric of Japan, Ontario Hydro and Hydro Quebec of Canada and Southern California Edison of the United States. The E-7 is providing assistance for GHG mitigation efforts under its, "E-7 Network of Expertise for Global Environment" and the E-7 Working Group on Greenhouse Gases and Joint Implementation. The E-7 is focusing its programme on providing in-kind services to the energy sector in developing countries. As yet, the E-7 is not committed to directly investing in formal mitigation projects, but rather is using its accumulated expertise to make certain greenhouse friendly investment opportunities more attractive.

The E-7 is participating in at least three JI type projects. In Indonesia, the E-7 has contributed US$1.5 million in in-kind technical services and plans to participate in up to another US$1.8 million in hardware, training and local infrastructure for a distributed renewable energy system. The Government of Indonesia is responsible for the purchase of US$1 million in photovoltaic modules, which will be integrated with back-up generation and a micro-hydro facility. In Jordan, the E-7 is assisting the Jordan Electricity Authority to increase the efficiency of several older thermal-generating stations, with a cumulative capacity of just over 500 megawatts. Lastly, in Zimbabwe, the E-7 is helping develop a demonstration micro-hydro project (Rentz 1996).

Forests Absorbing CO_2 Emissions (FACE) is a foundation set up in 1991 by the Dutch Electricity Generating Board (SEP) to promote the planting of

forests to absorb CO_2 from the atmosphere to partially offset the emissions of their power stations (Dijk *et al* 1994, Verweij 1997). FACE has an internal mandate of financing tree reforestation in the tropics, Eastern Europe and at home in the Netherlands over the next twenty-five years. FACE will devote 85 per cent of its capital to developing world projects, 10 per cent to Eastern Europe and 5 per cent within the Netherlands. FACE is fully-funded by SEP which has reserved a budget of Dfl 20 million (US$ 12.4 million) annually (current expenditure has reached Dfl 12 million per year) for the organisation, whose goal is to restore around 150,000 hectares of forest throughout the world within 25 years. Funding is provided by channelling one Dutch guilder per year (approximately US$0.55) from each household's electricity bill into the foundation.

The initial impetus behind the creation of FACE was the desire of SEP to demonstrate that the proposed EU carbon tax would not be the most effective or reliable way to lower overall carbon emissions. SEP argues that the tightening of emissions standards for sulphur and nitrogen oxide emissions in the Netherlands had already forced some coal burning Dutch utilities to make investments in clean coal technologies, to reduce acid rain precursors. While working towards using sustainable resources, SEP points out that around 90 per cent of Dutch electricity is currently generated by burning fossil fuel and admits that it will be decades before the industry can convert to a system which produces less CO_2 emissions. It is claimed that any addition of a carbon tax would negate the cost-effectiveness of those investment decisions, if offset options were not allowed. Given that Europe is moving towards a deregulated electricity market, such *post-facto* regulations would be disadvantageous to SEP's competitive position.

To date, the FACE Foundation has already launched afforestation schemes in the Netherlands, Central Europe, South East Asia, Central Africa and South America and is reportedly preparing similar schemes in Central Asia and Central America. All contracts are for 99 years but may be revised every ten years. SEP is currently lobbying with the Dutch government to ensure that its carbon savings are credited in the future.

Various private sector companies or associations have also initiated voluntary emission reduction commitments. The International Automobile Association, for example, has committed itself to finance the sequestration of equivalent volumes of CO_2 as those emitted by the Formula 1 automobile competitions. Similar initiatives to sequester the emissions of private vehicles are being created in Australia, Brazil and United Kingdom. At a larger scale, British Petroleum has recently announced its commitment to curb their net GHG emissions, possibly by promoting the adoption of energy efficiency technologies, renewable energy and the increased use of natural gas.

6

Case studies in developing countries

Few developing countries yet have dedicated offices dealing with joint implementation issues. The list, however, is rapidly growing. The current list of developing countries with existing or planned JI programmes includes Costa Rica, Sri Lanka, Poland, the Czech Republic, Mexico, Vietnam and the Russian Federation. Other countries, such as Pakistan, Chile and the Central American countries, have signed statements of intent to promote the idea with specific trading partners.

A key challenge for developing countries is to find the appropriate role for JI and to regulate JI investments in order to foster national development priorities. While in the past, JI initiatives have been initiated by the investors, and only submitted to host countries for final approval, some host countries are already developing priority lists for JI investments. For example, the following areas for development of JI projects have been prepared by the Sri Lankan JI pilot programme:

- Reforestation of new and unproductive land
- Conservation of natural forests and forest soils
- Management of plantations and forests to optimise sequestration
- Rehabilitation of degraded agriculture land to improve soil carbon content
- Management of livestock to minimise emissions
- Wind-energy farms
- Rural electrification with photo-voltaic systems
- Micro/mini hydro-power plants
- Efficiency improvement of thermal power plants
- Demand-side management in power systems
- Vehicle fleet maintenance programme
- Rehabilitation of high-energy consuming industrial equipment
- Gas collection in sanitary land fills
- Low-emission waste-water treatment

While carbon offset projects to date have relied on the catalytic finance from developed country investors, this is not the most effective way for a developing country to attract JI investment. One notable exception to this is found in Costa Rica. This country has established a national level GHG sequestration programme administered by a dedicated office, the Costa Rican Office of Joint Implementation (Oficina Costa Ricence de Implementacion Conjunta - OCIC). This Office aims to generate offsets from a national programme of forest conservation and reforestation, and to sell these certificates of carbon offsets internationally, with the trade name CTOs - Certified Tradable Offsets (Tattenbach 1996; OCIC 1996). A longer description of the Costa Rican programme is found in Section 6.

The Costa Rican programme has also been a pioneer in the creation of a new emissions-trading mechanism. Together with Centre Financial Products, the Earth Council and the World Bank, Costa Rica is launching CTOs into a variety of corporate and government markets. It seems likely that if this mechanism is successful, pressure will rapidly build to spread this form of joint implementation further afield.

Despite having few dedicated offices for JI/AIJ, developing countries have been able to make their positions on this debate known through the Group of 77. The G77's position has focused on issues related to the implementation of the FCCC, in relation to developing countries. Central to their concerns is that JI/AIJ must not replace existing ODA flows, and that developing countries should not be pushed into accepting targets for emission limitations for the foreseeable future. The G77 has, generally, been much less supportive of JI/AIJ than industrialised countries. Examples of well co-ordinated JI models, such as the one from Costa Rica, have played a role in changing this position. If JI becomes a more permanent part of the environmental and development landscape of G77 countries, Costa Rica's system will likely serve as a model.

To date, between 30 and 100 potential carbon offset projects appear to be circulating through various levels of regulatory approval at the national and at the FCCC level. The number of projects that are "real"; i.e. actually operational and producing relative GHG benefits is extraordinarily difficult to ascertain (Michaelowa 1997). Moreover, there are probably innumerable projects which fulfil most JI requirements, but which have not been registered as such for the reason that there was no direct intent to lower carbon emissions - it simply was a secondary by-product of the investment undertaken at a time when GHG reductions were not considered to have economic value. There are several projects which have been funded on a carbon offset basis, and successfully implemented, but which have not been

officially registered because of political reasons. The most notable of these, two in Sabah, Malaysia, are described in the next section. Lastly, there are some excellent project concepts which either have yet to be fully accepted or fully funded, but which exemplify how JI could foster sustainable development and other parallel values.

In this section we briefly profile projects from Bhutan, Romania, Nicaragua, Burkina Faso, and Honduras. What is included below is perhaps a representative sample of the hundreds of projects which are conceptual, in the pipeline or operational. In the following section, we examine in more detail projects from Malaysia, Belize and Costa Rica, as well as a failed project proposal from Papua New Guinea.

Bhutan micro-hydro for avoiding fuelwood over-exploitation

In Bhutan, Netherlands JI investment is engaged in the development of a micro-hydro electricity generation project in the Bumthang district. This project is based on run-of-the-river hydro generation which does not entail the negative impacts of large dam projects. The project is only a 100 kW and its intent is to supply electricity to approximately 100 households of a small village. While there is some minimal savings of emissions in the avoidance of diesel for similar types of electrification, the substantial GHG savings are expected to be found in the avoidance of fuelwood deforestation. It is difficult to predict what the ultimate GHG savings will be, so the Netherlands will be undertaking a substantial socio-economic impact assessment of the project over a period of time (i.e. many years). Impacts which will be assessed also include the positive/negative impacts of electrification on areas like health, education, drinking water and general quality of life issues.

Romania assisted by Netherlands to improve power plants

In Romania, the Netherlands is engaged in a substantially larger project to significantly reduce the CO_2 emissions of six selected power plants (JIQ 1997b). Romanian power stations produce, on average, about 1.2 kg CO_2/kWh electricity, which is more than double the emissions-energy ratio of plants in the Netherlands. The main causes for this are low efficiency combined with a high carbon-energy ratio of the fuels used. In 1996, low quality coal, oil and gas were the main fuels in both electricity and heat production. For most of the power and heat stations, the energy content that is effectively turned into electricity or heat is between 25 and 40 per cent, while the Netherlands, on average, achieves approximately 55 per cent. The main elements of this project are: taking measurements, analysing the data, implementing improvements, monitoring performance, and reporting on progress. The project started on 1 January 1997 with a three month inception

phase followed by a nine month phase in which a mobile laboratory operated at the six power plants, and analysed the results. The mobile laboratory was constructed by the Dutch and is to be given to Romania at the end of the project, to assist the country in building technical capacity in air pollution research. The third phase consists of a two-year period of carrying out an emission-reduction programme, monitoring progress and if necessary improving the tuning. The estimates of emission-reduction costs are less that US$1.00 per tonne of CO_2 emissions avoided (US$ 3.5/t C). It is also noted that the fuel savings could help with the country's balance of trade.

Nicaragua developing geo-thermal power to avoid diesel-based emissions

In Nicaragua, JI could help develop the country's indigenous geothermal resources with the implementation of a USIJI approved programme (JIQ 1996a). The area of El Hoyo - Monte Galán is part of a highly active volcanic region, known as the Marabios Range. In this region, there is already an established 70 MW geothermal plant which provides around one fifth of total Nicaraguan electrical capacity, near Volcan Momotombo. The El Hoyo - Monte Galán geothermal JI project is due to be developed in two stages. The first one, to generate 50 MW, is scheduled to start operation in the year 2000. The second stage, of another 55 MW, is planned for completion in 2003. Without implementation of geothermal resources, Nicaragua would have to develop additional diesel-based power plants. In Nicaragua, diesel-based power generation causes around 0.6 tonnes of CO_2 per MW hour of electricity produced. Hence, a 105 MW geothermal plant, with zero-CO_2 emissions, operating at 95 per cent availability, would displace about 18.5 million tonnes of CO_2 over a 35-year project life (or some 528,000 tonnes per year). In addition, some 400,000 tonnes of nitrous oxides and 60,000 tonnes of sulphur oxides will be avoided. It is estimated that the total cost of a 50 MW geothermal project, including all capital costs, interest during construction, insurance, start-up costs, and contingencies, will amount to US$ 135 million. For the total 105 MW project, the costs would be US$ 260 million. This implies that the cost per tonne of CO_2 emissions avoided are around US$ 14 (US$ 51/ tC).

To date, the project has only secured finance for the geotechnical feasibility study. Thus, the project partners are presently searching for potential partners in the implementation of this project. Renewable energy projects such as hydropower and geothermal power projects, start out with higher capital investment than fossil-fuel based power plants, but are less expensive in their operation and maintenance. Furthermore, the use of this domestic energy source would reduce the dependence on imports of fossil fuels. The construction of a geothermal plant requires a substantial amount of contract work, which will somewhat reduce the high unemployment in the country.

These tasks include civil engineering in roads and plant building construction; drilling; mechanical work (welding, pipe fitting); and other forms of economic support. It is estimated that US$ 60 million worth of products and services can be provided for by local contractors. During the construction phase, 1,500 jobs per year will be generated, and it is estimated that another 200 permanent jobs will be created over the 35 years of project lifetime.

Burkina Faso integrating community fuelwood production and solar energy

In Burkina Faso, West Africa, a sustainable energy management project is being conducted with the participation of the World Bank and Norway (JIQ 1997a). This project will manage 300,000 hectares of community-based forestry, promote more efficient charcoal making technologies, and introduce solar photovoltaic systems for household lighting and water pumping. More efficient kerosene cooking stoves - to lessen reliance on fuelwood - will also be introduced. Over 30 years, the World Bank has estimated that the Burkina Faso project will save more than 7 million tonnes of carbon (25.6 m t CO_2). The JI investment is made in addition to a US$18 million rural development project which is already being financed by Denmark, the Netherlands and Burkina Faso itself.

Honduras utilising wood-wastes for electricity

The first major project selected by the Edison Electric Institute's International Utility Efficiency Partnership (IUEP) was in Honduras (JIQ 1996b). The Bio-Gen project is a 15 MW biomass waste-to-energy plant to be located near a large forest products processing region. The project will utilise wood wastes as the primary fuel for the power plant. Long-term contracts for the supply of wood wastes will ensure adequate fuel availability and stable fuel cost, and a Power Purchase Agreement between Bio-Gen and ENEE (the government's electricity board) will guarantee revenues through the purchase of electric energy. It is expected that the Bio-Gen project will reduce the emissions of 2.27 million tonnes of CO_2 over 20 years.

Beyond the reduction of GHG emissions (which are achieved through the displacement of fossil fuel with wood waste) the project will help reduce the power supply deficit in Honduras, increase the economic efficiency of one of the country's principal export industries (wood products), and utilise wood wastes which are often incinerated in open piles, disposed in nearby rivers, or dumped in low-lying areas. These wastes currently are a source of environmental contamination and a fuel for forest fires. The project will accelerate the investment of appropriate capital technology into Honduras and will also generate a degree of new rural employment. It might also be expected that if the project is successful, there will be opportunities for Hondurans to spread the technology elsewhere in Central America and beyond.

Table 6.1 Summary profile of developing country case studies

Case Study	Objectives/ Activities	Forest type and area (ha)	Partners	
1) INFAPRO – Innoprise-Face Foundation Project Malaysia	Enrichment planting and forest rehabilitation in Sabah	25,000 ha of selectively logged dipterocarp forests	Innoprise Corporation (forestry arm of the Sabah Foundation, Sabah, Malaysia) and the FACE (Forests Absorbing CO_2 Emissions) Foundation – a foundation of the Dutch Electricity Board, Netherlands	
2) ICSB-NEP Reduced Impact Logging Project Malaysia	Reduce the impacts of uncontrolled selective logging operations in Sabah	10,400 primary dipterocarp forests	Innoprise Corporation and New England Power, an American electricity power company	
3) Rio Bravo Conservation and Management Area Carbon Sequestration Pilot Project Belize	Forest conservation and sustainable forestry	87,000 ha of tropical forests (which will be protected) and degraded land (which will be reforested with broad leaf plantations)	Project implemented by Program for Belize (a private conservation and development organisation) and The Nature Conservancy, and financed by US electric utilities (Wisconsin Electric Power Company, CINergy, Detroit Edison, PacifiCorp and the EEI Utilitree Carbon Company).	
4) Lak Integrated Conservation and Development Project Papua New Guinea	Forest conservation selective logging, enrichment planting, and timber plantations	Over 100,000 ha of primary and logged-over tropical rain forests	UNDP, Government of Papua New Guinea, local partners	
5) Costa Rican Joint Implementation programme	Forest conservation, reforestation, and selective logging	Approximately 1.2 million ha of primary, secondary forest and pasture land	OCIC (Costa Rican Joint Implementation Office), other government agencies, local NGOs and farmers.	

	Investment committed and cost/ price of carbon	Impacts expected	Current status and future plans
	US$ 15 million, over 25 years (US$ 3.52/t C)	The project will fix 4.3 million t C, and generate US$ 800 million in timber, which will revert to the social programmes of the Sabah Foundation. At least 25,000 ha of degraded logged forests will be improved, apart from the indirect impacts of the project (training, information dissemination, etc.).	The project is in the 7th year of its implementation phase, which is planned to last 25 years. There is a threat that, if CDM legislation is not endorsed soon, the implementation of this project may be halted.
	US$ 3 million, over 8 years (US$ 7.6/t C)	The project will avoid the emission of 58,000 t C, and prevent unnecessary damage to 10,400 ha of forests. It has been expected that it will also have a catalytic effect in other operations in the region (including other operations of Innoprise), but this has not happened very effectively (if at all).	The project is in its last implementation year. It is not certain whether it will be renewed again. Long term monitoring and research of these logged areas will be done by CIFOR.
	US$ 2.6 million (US$ 1.90/t C)	The project will sequester 1.3 million t C. Additionally, it will have positive effects on biodiversity, soil stability, water and air quality, and will result in the creation of local jobs and long-term improvements in the local economy through the development of minor forest product industries.	The project is half way through its implementation phase, and will be continued for a total life time of 40 years.
	Expected cost US$ 1.5 million (US$ 1.60/t C)	This project could sequester a total of 950,000 t C, through activities that would protect biodiversity, water quality, and improve economics of local populations.	This project was classified as “in development” by the USIJI, but has never been implemented because of a shift in the priorities among local populations.
	Project costs not known, confidential to OCIC. Carbon offsets sold at US$ 10/ tC and higher	This programme will fix and/or avoid the emission of at least 30 million t C, and consolidate a forest estate of at least 1 million ha. It will also provide an important example of a Joint Implementation project totally conceived and implemented by the host country, in accordance with its national priorities.	The project is ongoing and the carbon savings of its forest protection component have already been independently certified. Costa Rica has already sold some carbon credits to Norway. If funds become available, the project will be continued for at least another 25 years.

6.1 Enrichment planting and forest rehabilitation in Sabah, Malaysia

The logging of dipterocarp forests accounts for about 50 to 70 per cent of Sabah's state revenue (Sabah Forestry Department 1989). In order to maintain the economic returns derived from this sector, forest regeneration must be managed for sustainable yields. The high densities of natural stands in Sabah allow extraction rates of up to 120 m^3 per ha (Silam Forest Products, timber extraction figures). However, this results in substantial disturbance to the residual stand (Nussbaum *et al* 1995; Appanah and Weinland 1990). In some areas the residual stocking and seedling bank of timber species is much reduced and artificial regeneration needs to be employed (Primack *et al* 1987; Appanah and Weinland 1990). Enrichment planting is a technique for promoting artificial regeneration in which seedlings of preferred timber trees are planted in the under-storey of existing logged-over forests and then given preferential treatment to encourage their growth (Lamprecht 1989). However, the costs involved in artificial regeneration are often prohibitive, and in some cases funds are not available from local sources.

Energy supply in the Netherlands is mainly provided by coal-fired power stations, leading to high levels of CO_2 emissions to the atmosphere. However, it is not possible to find large enough areas in the Netherlands to offset this level of emissions, since most of the land is already under agricultural or urban use. The problems faced by Malaysia and the Netherlands were combined to generate practical solutions for both parties.

The Innoprise-FACE Foundation Rainforest Rehabilitation Project (INFAPRO) is a cooperative venture between Innoprise Corporation, a semi-government forestry organisation which has the largest forest concession in the state of Sabah, Malaysia, and the FACE Foundation of the Netherlands. This was the first large scale forestry-based carbon offset project in the world. The objective of the project is to rehabilitate 25,000 ha of logged forests by enrichment planting and reclamation of degraded areas using indigenous tree species such as dipterocarps, fast growing pioneers, and forest fruit trees, over a period of 25 years (Moura Costa *et al* 1996). The total investment committed by the FACE Foundation amounts to US$ 15 million over 25 years.

In the pilot phase (1992-1994), 2,000 ha of logged-over forests were planted as an initial trial of the effectiveness of this system. The planting phase will

be extended for 25 years and the forests maintained for 99 years. The long term nature of the project should enable the maintenance and silvicultural treatments required to sustain growth rates during the project life. It is expected that at the end of the first 60-year growth cycle, these forests will be exploited for timber, which belongs exclusively to Innoprise. However, timber harvesting will have to be done in a careful way, so that a healthy residual stand can again regenerate a well-stocked forest in order to maintain a carbon pool for the FACE Foundation, which has the exclusive rights to the carbon sequestered through the 99 years of the project. It is expected that the project will sequester at least 4.25 million tonnes of carbon (15.6 million tonnes CO_2) during its life-time (Stibbe *et al* 1994) at an average cost of US$ 3.52 per tonne of carbon (US$ 0.95 per t CO_2).

It has been estimated that the project will also produce over 4 million m^3 of hardwood sawn timber, worth close to US$ 800 million, which belongs to Innoprise Corporation. Given that Innoprise is fully owned by the Sabah Foundation, a semi-government organisation with the mandate of improving people's welfare in the state of Sabah, it is expected that the project will generate considerable social spin-offs. Additionally, during its initial 25-year planting phase, the project will directly generate 230 jobs per year, for various activities such as field planting, silviculture, nursery work, mapping and GIS (geographical information systems), computing, financial control, and research. It is important to note that 90 per cent of the project's budget is spent on personnel.

A key feature of the project is the integration of a substantial research and training component with the main operation. Ten per cent of the total budget is to be directed towards research and training with the objective of developing strategies for rehabilitation of logged forests. Training is provided at all levels, from PhD level, to practical training provided to field crews. The project has also been very active in disseminating its findings through various means. During the last six years, it has yielded 53 research papers, 2 PhD theses, 3 BSc reports, 2 training videos, 10 journalistic reports (published in Malaysian and international magazines and newspapers) and more than 20 conference communications.

The project is in its sixth year and, to date, over 2 million seedlings have been planted on 5,000 ha of degraded rainforests. Seedling survival and growth rates have been satisfactory (Moura Costa *et al* 1996). The project has also generated general knowledge on a variety of subjects from plant propagation, silviculture, nutrition, large scale planting, and GIS. The contract for the next 5-year phase of the project has just been signed.

6.2 Reduced impact logging in Sabah, Malaysia

In the process of extracting 8-15 trees (80 m^3, with approximately 22 t carbon per ha) from a hectare of forest in East Malaysia, often as many as 50 per cent of the remaining trees are damaged and up to 40 per cent of the area is crushed by bulldozers (Sabah Forest Department 1989). The effects of uncontrolled logging on biodiversity and ecosystem function are also severe: soil erosion, weed infestations, and incidence of fire all increase in logged-over forests. These effects combine with the disruption of much of the pre-existing regeneration of commercially valuable trees to make such logging extremely detrimental to long-term ecological and economic productivity.

Damages incurred during conventional timber felling and extraction also result in reduced forest biomass and substantial releases of carbon dioxide (Houghton 1996) and possibly other radioactively important gases (e.g. methane). It is possible therefore, to reduce the release of CO_2 from logging by adoption of less destructive logging techniques. Carbon dioxide sequestration in tropical forests through controlled logging has a number of benefits. Immediate carbon benefits are realised at low expense as native species are maintained on site, and soils are less likely to be degraded or eroded. Post-logging carbon accumulation rates are also likely to be elevated and the future potential for production of timber and non-timber forest products enhanced. These benefits derive from the reduced likelihood of vine infestations as well as from the retention of many undamaged trees with the capacity to grow to be very large.

The ICSB-NEP Reduced Impact Logging (RIL) Project is a cooperative venture between Innoprise Corporation Sdn. Bhd. (ICSB), a semi-government organisation which has the largest forest concession in the state of Sabah, Malaysia, and the New England Power (NEP) Company, an American utility trying to address the challenge of reducing its net CO_2 emissions. The objective of the project is to introduce the use of reduced impact logging (RIL) techniques in order to lower the level of damage caused by selective harvesting operations, reducing the release of CO_2 from decomposing vegetation and soil loss.

In an initial phase, 1,400 ha of forests were logged according to the RIL techniques from 1992 to 1994. The project managed to reduce logging damage by 50 per cent, thus saving approximately 40 tonnes of carbon per ha and a total of 58,000 tonnes of carbon (212,860 t CO_2; Pinard and Putz 1996). Given the project cost of US$ 450,000, the cost of carbon saved was US$ 7.60 per tonne C (US$ 2.00 per ton CO_2) at 2 years after logging (Moura

Costa and Tay 1996, Moura Costa 1997). Higher savings are expected in the longer term. All the incremental costs of training and implementation of the project were paid by NEP, which has full rights to the carbon savings. At the same time, ICSB benefits from improved management of its forests, and a better residual stand after logging.

Apart from the direct benefits to the forest derived from RIL techniques, the project has had a broader impact. The initial phase of the project included a substantial training component aimed at all levels in the ICSB hierarchy, including the senior management, foresters, forest rangers, tree fellers and tractor operators. The training of a few logging crews has triggered positive attitudes amongst loggers around the region. Professional pride and competition has led to an unexpected improvement of the performance of other logging crews operating in the ICSB's concession, with an overall improvement in logging efficiency beyond the project's boundaries.

Another positive effect of the project is in the raising of awareness. The project has received substantial attention by local and international media, has served as a demonstration area for better logging practices, and attracted hundreds of local and international visitors since its inception. It has also been the target of research projects conducted by foreign and local scientists. The project has also attracted the attention of institutions such as CIFOR and ITTO, which became interested in using the project as a basis for spreading the use of RIL techniques throughout the region, and another similar JI project based on RIL has already been approved by the USIJI.

The first phase of the ICSB-NEP RIL project demonstrated that the technical impediments to better logging practices can be overcome without major difficulty. A second phase was initiated in early 1996, and consists of 9,000 ha of RIL during a 3-year period. In 1996, NEP placed the project into the EEI Utilitree Carbon Company (the financing entity of the Utility Forest Carbon Management Programme), which will pay for 1,000 hectares of RIL.

The Innoprise RIL CO_2 offset offerings are substantially different from those provided by the Project for Belize (see next case study). First of all, it is an explicitly commercial contract for services between two huge private sector entities. While there has been some modest assistance from third parties in developing the quantification methodologies, this project is comparatively "unleveraged"; the cost of the contract truly reflects the cost of the emissions savings. The project was initiated well before the development of the USIJI and other JI programs, and its contractual nature - involving arbitration, defined credit assignment, credit re-sale clauses, insurance and the like - points to a more business-like carbon offset arrangement. The

project also has great potential to be scaled up, given that Innoprise harvests between 10,000 and 20,000 hectares of its own concession holdings each year, and could easily transfer the techniques to other concessions which it is managing (though the costs and carbon estimates would clearly change). This is substantially different to project level investments, which tend to have much more defined parameters and are not necessarily able to expand quickly in the event of market demand for the CO_2 offset service.

6.3 Conservation areas and sustainable forestry programme, Belize

The Rio Bravo Conservation and Management Area Carbon Sequestration Pilot Project (RBCMA) located in north-west Belize, combines land acquisition with a sustainable forestry programme to achieve carbon sequestration. RBCMA is run by the Program for Belize (PfB), a private conservation and development organisation. The project is financed by various US electric utilities, namely the Wisconsin Electric Power Company (WEPCO), Cinergy, Detroit Edison, PacifiCorp and the EEI Utilitree Carbon Company. The participating utilities will contribute US$2.6 million to The Nature Conservancy (TNC) and PfB to fund the first component of the project (USIJI 1995).

PfB owns the RBCMA in perpetual trust for the people of Belize. PfB was established in 1988 by private citizens to promote conservation of the natural heritage of Belize and the wise use of the country's natural resources, and to conserve a representative area of natural forest. With 86,928 hectares of forest land, RBCMA is PfB's flagship project. The primary hardwood stock of the RBCMA and its environs had been seriously depleted through almost a century of non-sustainable harvesting. PfB has undertaken extensive biological surveys of RBCMA's lands and, by 1994, had developed a preliminary land use plan which included a sustainable forestry operation in the eastern part of the parcel while the western portion was to be set aside for conservation, scientific and educational purposes. Had it not been for PfB's acquisition of the land that is now the RBCMA, it is likely that the forested portions would have been converted to farm land.

RBCMA has two components. Component A involves the purchase of an area of endangered forest land, thereby expanding RBCMA's existing protected forest areas. Under Component A, PfB would exercise its option

to purchase 6,014 hectares of endangered forest land that intersects the eastern portion of the RBCMA. If not protected, this property will be converted to agricultural use, permanently dividing the RBCMA ecosystem. Component B involves the development of a sustainable forestry management programme that will increase the level and rate of carbon sequestered within approximately half of the RBCMA, including the purchased parcel. The remaining RBCMA lands will be left undisturbed as experimental control areas, as well as for conservation and research purposes. Component A is expected to yield 767,681 tC after 5 years. Component B is expected to yield 541,814 tC after 20 years. The cost estimates outlined in the proposal were US$1.91 per tonne of carbon (US$0.52 per tonne CO_2), with benefits projected over the 40-year life of the project (USIJI 1995).

The project was designed from the outset as a USIJI project. It also conforms to requirements for carbon offset registration under Section 1605(b) of the 1992 US Energy Policy Act and to PfB's sustainable development mandate. The RBCMA project was developed in conjunction with the Wisconsin Electric Power Company (WEPCO), to demonstrate a model carbon offset project case. After screening more than 20 potential projects being planned by The Nature Conservancy's (TNC) Latin American and Caribbean partner organisations, TNC presented five candidate projects to WEPCO, of which it was agreed that the Rio Bravo in Northwest Belize was the most suitable. TNC and WEPCO approached PfB to sign a Memorandum of Understanding agreeing "to develop a joint proposal for a pilot carbon sequestration project" for submission to the USIJI.

The Memorandum includes the participants' explicit intent to develop a model project that conforms to the requirements of the USIJI, the FCCC, and the US Department of Energy Section 1605(b) offset registry requirements. When approved by the USIJI Evaluation Panel, WEPCO pledged to fund up to 25 per cent of the project costs and to seek the additional financial participation from other private concerns, a task which it has completed with the inclusion of Cinergy, Detroit Edison and PacifiCorp. On 17 October 1994, in response to the Rio Bravo Pilot Project, the Government of Belize ratified the FCCC and issued a letter endorsing the project and the concept of carbon offset trading (USIJI 1995).

One of the goals of the Rio Bravo Pilot Project is to demonstrate that environmentally sustainable forest management practices can become more economically sustainable when the value of carbon offsets is factored into the equation. If successful, the project will demonstrate the optimal balance between conservation, economic development and environmental

protection. A total of 25,866 hectares of the RBCMA eastern area is zoned for forestry development. The land in this zone has a limestone base with a broadleaf forest cover. It has no slope, soil moisture, biodiversity or cultural characteristics warranting special conservation considerations. This development programme would require a 40-year annual rotation regime, with the annual working area of the broadleaf forest limited to 640 hectares. To be economically sustainable, the programme would have to integrate forest extraction with milling and woodworking capabilities, the latter being used to add value to the logged timber before sale.

An additional 10,010 hectares of the total area has poor, sandy soils with open woodland savannahs. The area has been damaged by uncontrolled seasonal wildfires and fires set by poachers. Some 2,500 hectares of this area will be managed to improve pine stocks through regeneration. The remainder of the area is zoned as protected for environmental and conservation management reasons. Forested portions of the area, totalling 5,308 hectares, will be allowed to regenerate (USIJI 1995).

In addition to GHG, the project can potentially generate a number of other benefits. These include the protection of biodiversity, improvements in soil stability, water and air quality, the creation of local jobs, and long-term improvements in the local economy through the development of minor forest product industries.

6.4 Attempting to dislodge destructive logging with a plan for conservation, Papua New Guinea

While potential successes provide much useful guidance for others, lessons can also be derived from some failures. An example of the latter is the comprehensive attempt to establish a carbon offset project to support biodiversity preservation objectives in Papua New Guinea. Threatened by a variety of land uses with complex social and economic antecedents, PNG's biological endowment is conservatively believed to comprise 5 per cent of the world's species total (see Miller *et al* 1994). The endowment provides a range of ecological goods and services, many of which are public, indivisible and non monetary. Carbon sequestration services clearly fall into this category. The inability of key stakeholders to gain monetarily from these values leads to an incentive for forest land to be dedicated to a single use, such as logging or agricultural development, with adverse ecological costs (Sekhran 1994).

Land in PNG remains largely un-alienated. Some 97 per cent of land is held and controlled by traditional communities. This situation has its parallels elsewhere in Melanesia, Polynesia and Micronesia, but otherwise is unique in the developing world. In general, land is held by corporate kinship groups, with membership largely determined, though not solely, through descent. In general, the Government's ability to intervene in local affairs and delimit private rights in the broader public interest is circumscribed. A challenge for PNG then, is to reconcile the private interests of local communities, with the public interest, including the broader global interest in species conservation.

From 1993 until 1995, the UNDP worked with a local landowner group in Lak, New Ireland, to develop an alternative to a large industrial logging concern which was mining the forest in a clearly unsustainable manner. A detailed Integrated Conservation and Development (ICAD) plan was put together, which emphasised low impact logging techniques, enrichment plantings of logged over areas, the development of a small timber plantation, and sawmilling and nursery facilities, all surrounding a 100,000 hectare core conservation area (McCallum and Sekhran, 1997). The Lak area is one of the most biologically important in all of PNG and it was the intent of UNDP and its local partners to demonstrate a viable economic alternative to destructive industrial logging.

Unfortunately, the relative capital costs of undertaking such a venture weighed heavily against making such an operation financially viable; the initial costs were too high and the cash flows from traditional wood outputs were too low. To help cover some of those upfront costs, it was decided to develop the original ICAD proposal into a carbon offset prospectus. While the prospectus was beginning to move forward in the process and had been put into "development status" by the USIJI, the financial pressures on the residents of the area caused local groups to remove their support for the ICAD process and return to industrial logging. Thus, the experiment to see if carbon payments could help change forestry practices in Papua New Guinea could not be implemented (Stuart and Sekhran 1996; McCallum and Sekhran, 1997; Filer with Sekhran, 1998).

A key lesson learned from this experience is that projects may always have difficulty in displacing an existing damaging activity, but may be more successful in targeting areas which are on the verge of participating in the industrial economy. Such a lesson is likely equally valuable for both energy and land use projects in the developing world.

6.5 Direct payment to farmers for environmental services, Costa Rica

Costa Rica has a history of innovative approaches to development. In the fifties, in the middle of the cold war, the army was abolished releasing 15 per cent of the country's gross national product for use in development and social programs. In the eighties, Costa Rica was the first country to carry out a "debt for nature" transaction, which has subsequently attracted tens of millions dollars for conservation of its forests (Watson *et al* 1998).

Costa Rica is now launching three national level carbon sequestration programmes, two in forestry and a third in renewable energy. Commercialisation of CO_2 reduction credits is achieved through the system of Certified Tradable Offsets (CTOs), which are issued by the recently created Costa Rican Office on Joint Implementation (OCIC - Executive Decree N. 25066 Minae, 1996). These CTOs are credits of carbon fixation based on the amount of CO_2 fixed in forests. The first batch of CTOs (200,000 tons of carbon) was sold to a Norwegian consortium at US$ 10/ton C (US$ 2.70/t CO_2), for a total of US$ 2,000,000.

The Private Forestry Programme (PFP) encourages land owners to opt for forestry-related land uses by providing direct payment for environmental services. Environmental services include CO_2 fixation, water quality, biodiversity, and landscape beauty (Forestry Law N. 7575, April 1996; La Gaceta [1996]). The monetary incentives aim at increasing the attractiveness of forestry compared to higher impact forms of land use. Incentives are paid to land owners over a period of 5 years following the signing of a contract to keep their land under a specified type of utilisation for a minimum period of 20 years. Farmers who receive these incentives assign the rights to the environmental services to the government, which bundles them for potential sale. The resources for initiating the PFP programme were raised by a domestic 15 per cent tax on fossil fuels, which is expected to raise US$ 21 million per year (Franz Tattenbach, personal communication). It is hoped that future payments to farmers will be based upon successful sales of resultant CTOs.

The value of PFP incentives varies. There are three main areas of interest: conservation of existing forests, selective harvesting for sustainable wood production, and reforestation or natural regeneration of degraded pasture or agricultural land. In the case of private forest conservation, farmers receive US$ 56/ha/year up to a total of US$ 280/ha. They are also waived payment of land tax. Those opting for natural forest management receive

US$ 47/ha/year, up to a total of US$ 235/ha, in addition to the revenue derived from timber harvesting. In order to enforce compliance with low impact logging guidelines, the law requires that any harvesting operation must be supervised by a trained forester. Farmers who choose to reforest part of their agricultural land receive a series of payments related to the costs of plantation establishment, to a total of US$ 558/ha.

Beyond CTOs, Costa Rica is also working on ways to charge the economic sectors which most benefit from these services. One example is the creation of a system to charge hydroelectric plants for the conservation of their water catchments, at a rate of US$10/ha/year. A similar mechanism is being created for remunerating farmers in eco-tourism regions. In the case of biodiversity, genetic prospecting contracts have been signed between INBio (the Costa Rica institute of genetic resources) and international chemical companies. The first of these contracts was signed with Merck, the large American pharmaceutical company, and stipulates that Merck will pay the Costa Rican government 10 per cent of the profits from any product derived from Costa Rican forests.

The institution co-ordinating the administration of the private sector incentives is called FONAFIFO (Fondo Nacional de Financiamento Forestal - Forestry Financing Fund), an office created by the MINAE (Ministerio del Ambiente y Energia - Ministry of Energy and Environment). FONAFIFO has the role of receiving and analysing applications, conducting field verifications, carrying out the payments, and monitoring field implementation of forestry projects.

Costa Rica is also working on a second national level land use project, called Protected Areas Programme (PAP), with the objective of reducing deforestation rates by consolidation of its national parks network. The programme aims to consolidate 570,000 ha within 28 national parks, and claim the carbon savings derived from avoided deforestation, which historically has averaged 3 per cent per year. Costa Rica expects to avoid the release of about 18 million tonnes of carbon (66 m t CO_2) through the implementation of the PAP. These savings will be independently verified by the international certification company SGS Forestry, and CTOs will be issued accordingly. At a projected price of US$ 10 per tonne of carbon, Costa Rica expects to raise US$ 180 million through the Protected Areas Programme. The sale of CTOs from the PAP will be done with the assistance of the Centre Financial Products, possibly through the Chicago Board of Trade transactions. In conjunction with the Earth Council, which is providing some of the catalytic finance for the PAP, Costa Rica will use a portion of those proceeds to finance construction of the Earth Centre, which

is envisioned as a research/demonstration project highlighting various aspects of sustainable development and environmental values.

The Costa Rican Renewable Energy Export Programme bundles together a group of geothermal, hydroelectric, biomass and wind electricity generation projects to export energy to neighbouring countries in Central America that would otherwise use electricity generated from fossil fuels. Money from the Greenhouse Gas Fund will contribute to the renewable energy projects' overall profitability, to regional marketing and to benefit sharing within Central America.

Project participants are the Costa Rican Association of Independent Power Producers (ACOPE); the Costa Rican Investment and Trade Development Board (CINDE); the Free Zone Corporation and ICE (Instituto Costaricense de Electricidad). The projects are a 50 MW geothermal plant; a 5 MW electricity plant that burns biomass from a sugar mill; a 20 MW wind facility; and 7 hydroelectric facilities of 20 MW each. These projects will generate a total of 215 MW of capacity to offset 1,300 Gigawatt hours of fossil fuel generation in the importing countries for an estimated saving of 1.3 million tons of CO_2 per year. OCIC will certify that the GHG savings have occurred - using external verification - and bundle those savings into CTOs to be assigned to the external financing participants.

All of these Costa Rican programmes provide good examples of how JI could be utilised by developing countries to attract international investment. The whole programme has been conceived by the Costa Rican government and, consequently, conforms to government priorities. While Costa Rica managed to secure catalytic funding for the initial phase of the PAP (provided by the Earth Council and the World Bank), all other costs will be borne by Costa Rica itself, which is also responsible for determining the sale price of CTOs. In this way Costa Rica maintains full control of the production costs and profits associated with the commercialisation of CTOs, which, it is hoped, will be redirected into priority areas within the country.

7 Conclusions

There is some truth to the general rule of thumb that if a process emits less carbon dioxide emissions than an alternative, that process is likely to be more "sustainable". The difficulty has always been in financing those activities which have higher capital costs - and slower payback times - than less sustainable alternatives.

The Kyoto Protocol and the CDM are not a panacea and are not money from the sky, but rather are potential tools of commerce which allow developing countries to take advantage of their comparative advantage in providing an environmental service for industrial countries. There are a sizeable number of small, developing countries - in Africa, Central America and the Pacific in particular - with significant opportunities to make material gain from CDM transfers in the forestry sector. If international policy were to disallow such land-use options as allowable CDM investment tracks, such countries would forfeit potential capital flows from a carbon trading regime. Carbon offset funding has the potential to accelerate the dissemination of a variety of appropriate techniques and technologies into these situations, which would have positive multiplier effects.

While the need for industrial countries to take painful emission reduction policies and measures is indisputable, it should equally be recognised that each dollar of private joint implementation funding to a developing country is one which otherwise would not be transferred to the developing country in question. It should also be recognised that no country will be forced to participate - indeed the technical complexities of establishing a forestry offset regime are so substantial as to deter immediate market entry for many developing countries. Establishing this type of capacity area will likely be an important area for multilateral and development aid for the foreseeable future.

Most carbon offset projects can engender a range of positive externalities, environmentally, socially and developmentally. Local benefits can include

enhanced employment opportunities, downstream processing options, the dissemination of new technologies, water and air cleansing and maintenance of soil resources. The ongoing participation of NGOs and multilateral agencies in various aspects of project development, implementation and monitoring have aided in ensuring that projects are consistent with local environment and development objectives. The emergent JI/AIJ regulatory bodies, led by the USIJI, have tailored their application procedures to ensure that only the most positive projects are included during the pilot phase. We assume that CDM will do the same. Lastly, the emergence of developing country regulatory bodies, such as Costa Rica's OCIC, would seemingly promise to ensure that any projects emerging from host countries will be vetted at appropriate internal levels.

In carbon offsets, the role of regulation is unique. The carbon offset does not exist, functionally, without regulatory approval. This makes it fundamentally different to any conventional commodity. It is important to recognise that any of the governmental bodies described in this report have the ultimate power to decide whether any carbon offset can be utilised for commercial purposes within their areas of jurisdiction. A project whose direct or indirect outcomes go beyond acceptable norms is certain to have its achieved GHG credit reduced or eliminated. Furthermore, it is likely that a variety of NGOs will continue to keep governments on their toes, acting as system watchguards throughout the early years.

Nonetheless, as carbon offsets move from being a series of good deeds with public relations value to being financial hedges with bottom line value, the temptations to engage in marginal practices will become more apparent (Stuart 1997). It is vital that the regulatory systems that have emerged over the past five years be maintained and further developed to ensure that potentially abusive projects are not allowed to profit from participation in the commercial system. Independent third party verifiers, operating along the lines of environmental accountancies and auditors will also support this need. The emergence of at least one commercial forestry carbon offset certification system (Moura Costa *et al* 1997), from SGS Forestry (a company with extensive experience with sustainable forest management under Forest Stewardship Council guidelines) may be an early demonstration of how the private sector will contribute to a system of checks and balances.

Lastly, it should be remembered that, as with any type of trade, trade in carbon credits and the opening of internal markets to environmental investment is voluntary. For example, in order to obtain Costa Rica's CTOs, a buyer must go to the Costa Rican government or its agents and pay the asking price, not the marginal cost of the production investment. The actual

costs of production, and therefore per-unit profit margins, remain the confidential information of the producer (the Costa Rican government). This more accurately reflects the manner of conventional transactions and allows for profit to be made from proper environmental stewardship. Costa Rican citizens, in theory at least, then enjoy all the financial and local environmental benefits of programme implementation, and the global community enjoys the range of environmental values associated with good forestry practices and forest conservation.

Joint Implementation cannot substitute entirely for emission reduction efforts in the industrial world. However, nobody has ever seriously suggested that it will. For developing countries, JI promises a means to access new streams of capital for a variety of projects which reflect the ideals of sustainable development. Moreover, unlike traditional aid funding, the capital comes with a caveat - that actual performance along very distinct criteria must be accomplished and measured. Just as in business, failure to achieve performance will be reflected in the market discounting future project offerings. In this way, carbon offsets promote the transfer of funds from industrialised countries to tropical countries as a commercial transaction, based on global sharing of the financial burden of environmental protection, as opposed to charity. As events move fast over the next few years, we will be able to discern whether this promise is likely to be realised in practice.

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