JOINT IMPLEMENTATION AND ITS ALTERNATIVES: Choosing Systems to Distribute Global Emissions Abatement and Finance

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TABLE OF CONTENTS

1. INTRODUCTION 1
2. THE TREATY CONTEXT 2
3. ESTIMATING THE SIZE OF AN EMISSION-SHIFTING SYSTEM'S JOB 4
4. JOINT IMPLEMENTATION 6
- **4.1. Background and Basic Characteristics** 6
- **4.2. Current JI Program and Project Experience** 6
- **4.3. Key JI Participants and their Interests** 11
  - **Investor-country governments** 11
  - **Host-country governments** 11
  - **The Investor** 12
- **4.4. An Expanded JI System: Requirements and Implications** 14
- **4.5. The Potential Contributions of JI** 20

5. ADMINISTRATIVE FINANCIAL MECHANISMS 22
- **5.1. Background and Basic Characteristics** 22
- **5.2. Key AFM Participants and their Interests** 22
- **5.3. Principal Institutional Issues and Problems** 24
- **5.4. The Potential Contribution of AFMs** 24

6. INTERNATIONAL TRADABLE-PERMITS MARKETS 25
- **6.1. Background and Basic Characteristics** 25
- **6.2. Key Tradable-Permit Participants and their Incentives** 26
- **6.3. Principal Institutional Issues and Problems** 38
- **6.4. The Potential Contribution of Tradable Permit Systems** 30

7. CONCLUSIONS 31
BIBLIOGRAPHY 35

1. INTRODUCTION:

Controlling global growth of greenhouse gas emissions, and hence attaining the central goal of the Framework Convention on Climate Change (FCCC),[1] is widely believed to require some system to shift emission-abatement effort among nations, with accompanying exchanges of money and technology. The reasons are three: large reductions in global emission trends will be expensive; distributing the abatement effort efficiently among nations, cutting more where cutting is cheaper, is projected to reduce cost drastically, perhaps by half or more;[2] and the cheapest abatement opportunities appear to reside at present in developing countries and transitional economies, which can ill afford too undertake them.[3]

Developing countries accepted no abatement obligation under the FCCC, and have strong arguments against being expected to bear any such burden soon. While their projected development is likely to make the largest contribution to global emissions growth, they have highly constrained resources and many priorities more urgent than climate change. Moreover, the present industrialized nations, through their past fossil-fuel use and greenhouse emissions, are most responsible for the present excess atmospheric burden of greenhouse gases. If developing countries grow rapidly enough, however, even the most extreme cuts in industrialized countries may be insufficient to attain a stringent global target. Developing-country participation in abatement is thus essential in two ways: to make stringent global abatement goals feasible; and to minimize the cost of attaining any global goal.

To attain such substantial participation of developing countries and transitional economies in global abatement goals, a cooperative system should create incentives to abate where it is cheapest, and dynamic incentives to invest in technologies that advance abatement possibilities, while transferring finance and/or technology as necessary to ensure that all parties to the exchange benefit.

While many such systems are possible, varying in many dimensions of institutional and policy detail, three broad classes of systems have been proposed. These three dominate current debate, differ from each other in basic respects, and have all accumulated at least modest relevant experience. They are Joint Implementation (JI); international tradable emissions permits (TPs); and administrative financial mechanisms (AFMs). Joint implementation and tradable permits are both familiar terms, while "administrative financial mechanisms" is a term we propose to denote politically negotiated, centrally administered systems that transfer public funds

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[1] The FCCC's central goal is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2).

[2] For example, the Intergovernmental Panel on Climate Change (IPCC [1996], WG 3, Ch. 10) estimated that for each country to hold its emissions at 1990 levels would cost 0.2 - 0.7 per cent of world product by 2010, rising to 3 - 7 per cent by late next century. Global costs of this target are projected to be 20 to 50 per lower if abatement is distributed among nations in the lowest-cost way. Such redistribution of abatement effort would not weaken the environmental goal, because where a ton of emissions occurs has no affect on its contribution to global climate change.

[3] The claim that the cheapest abatement opportunities are in developing countries has been disputed (e.g., Shukla, 1996), and need not remain true even if it presently is true. Some projections show that after 30 to 50 years of continued rapid growth in developing countries, the cheapest emission abatement opportunities may then reside in the present OECD. [Edmonds et al, 1995]

internationally, according to agreed criteria, in support of environmental projects. Prominent current examples of AFMs are the Global Environment Facility (GEF), and the Multilateral Fund of the Montreal Protocol on the Ozone Layer. Though AFMs are not market-based systems like JI and TPs, they pursue the same goals: shifting abatement effort among nations, with accompanying financial and technological support.

This paper seeks to clarify the basic differences among the three systems, to identify the major actors involved in the functioning of each system and their key interests, and to identify each system's most and least promising areas of application. In particular, because the job these systems must do may be large, while current international experience with each is very modest, we consider how each system would function, and what potential pitfalls or obstacles might arise, if its scale were greatly increased.

The paper devotes most attention to the potential contribution and limits of JI. For AFMs and TPs, the discussion is much more limited. We outline their basic defining characteristics, and identify key issues in their potential for expansion. A concluding section summarizes relative advantages and disadvantages of the three systems, and briefly explores the implications of more than one system co-existing: how they might interact, and how a practicable and effective combination of systems can be designed. Since experience with all three systems is limited, and since all three admit of many detailed design possibilities, our discussion of their potential and limits must be informed by general theoretical argument and analogy as well as empirical evidence, and is inevitably speculative.

Section 2 summarizes relevant provisions from the FCCC, arguing that it admits the possibility of any one or more of these systems, though full implementation of any would require substantial further negotiation of institutional detail. Section 3 estimates the size of job such a system must do, through order-of-magnitude estimates of how much emissions, and how much money, must shift between regions to move from a plausible simple negotiated allocation of emissions to a cost-minimizing distribution. Section 4 summarizes the basic characteristics, present experience, and potential for expansion of a JI system. Sections 5 and 6 present parallel, more limited discussions for administrative financial mechanisms (AFMs) and tradable permit systems (TPs) respectively, while Section 7 provides conclusions.

2. THE TREATY CONTEXT

Reflecting a recognition that high abatement costs could weaken its acceptability and sustainability, the Framework Convention (FCCC) includes language consistent with Several alternative systems to share abatement burden globally and make associated transfers.[4] In language carefully crafted to meet developing countries' concerns that they be compensated for any costly measures they may undertake, while meeting industrialized countries concerns not to commit to an open-ended transfer program they cannot control, the Convention explicitly provides for a "financial mechanism", assigns it to the Global Environment Facility (GEF) on an interim basis, and calls (a little ambiguously) for developed-country parties to bear the costs

[4] The Convention delineates two classes of national parties that undertake specific obligations. "Annex 1 parties", the industrialized countries plus Eastern Europe and the former Soviet Union, undertook the soft 2000 emissions target. "Annex 2 parties", the industrialized countries alone, also undertook to support the costs of developing-country parties meeting their obligations under the Convention. These costs are presently very modest, being limited to the preparation of national emissions inventories and reports, but the commitment would also (arguably) extend to more substantial future costs attendant on abatement obligations.

that developing countries incur in meeting their obligations under the convention. The relevant passages are as follows.

"A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined." (Article 11, Paragraph 1).

"The Global Environment Facility of the United Nations Development Programme, the United Nations Environment Programme and the International Bank for Reconstruction and Development shall be the international entity entrusted with the operation of the financial mechanism referred to in-Article 11on-an interim basis." (Article 21, Paragraph 3).

"The developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measures…"Article 4, Paragraph 3).

In other passages, addressing primarily industrialized countries' concerns about the potential cost of emission abatement, the Convention endorses the pursuit of its goals at minimum cost, and provides for "cooperative" and "joint" efforts to achieve abatement targets.

"The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects ... taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost." (Article 3, Paragraph 3).

"Efforts to address climate change may be carried out cooperatively by interested Parties." (Article 3, Paragraph 3).

"... developed country Parties and other Parties included in Annex I may implement such policies and measures jointly with other Parties and may assist other Parties in contributing to the achievement of the objective of the Convention ..." (Article 4, Paragraph 2a).

Emerging from careful balancing of not fully compatible concerns of industrialized and developing countries, this language admits multiple possibilities. It provides the possibility of either an Administrative Financial Mechanism (AFM) such as the GEF, or of Parties agreeing among themselves to share or exchange abatement effort, presumably with whatever accompanying provisions they agreed on. The language appears to be consistent with either JI or TP systems, though a full TP system would require substantial further elaboration. T e language also admits the possibility that more than one such system could operate.

Following negotiation of the Convention, supporters of JI moved quickly to develop national JI programs and individual projects. As these initiatives sought to make the vague concept of JI operational, they revealed two important ambiguities in the FCCC language: participation and credits. On participation, Article 4.2(a) clearly permits JI between Annex 1 parties, but the ambiguous reference to "other Parties" does not clearly determine whether or not the Convention also permits or encourages JI between Annex 1 and non-Annex 1 parties (Metz 1995). The Convention makes no explicit mention of whether JI activities should create credits against national abatement obligations, but many JI advocates argue that such credits are intrinsic to

the concept of two nations jointly meeting an aggregate abatement obligation. Both these matters were provisionally resolved at the first Conference of the Parties in of the Parties in Berlin (March 1995). The Berlin Decision established a pilot phase, known as “Activities Implemented Jointly” (AIJ), in which any countries may participate but for which no credits will be granted. An international abatement or t or sequestration project can gain official AIJ status if governments in both host and investor countries approve it and report it to the Convention secretariat. AIJ projects must represent both additional funding and additional emissions abatement, relative to what would otherwise have occurred. Still unresolved and contentious are the duration of the pilot phase and the future status of credits (FCCC/CP/1995/7/Add.1).

3. ESTIMATING THE SIZE OF AN EMISSION-SHIFTING SYSTEM'S JOB

The cost saving available from a system to re-distribute emissions, and the size of the required re-distribution, both depend on what international pattern of emissions would prevail without such redistribution. This cannot reliably be predicted, but a reasonable assumption would begin from current negotiating proposals. Among OECD countries, most proposals take the form of equal percentage changes from a historical baseline. For example, often-proposed targets include limiting each nation's emissions to their 1990 levels, or cutting them by 10 to 20 per cent from those levels.[5]

From any such starting point, redistributing emissions can reduce costs whenever participants' marginal costs of abatement differ. Global studies that compare "all nations freeze" to the lowest-cost way of meeting the same global target typically find savings of 20 to 50 per cent, roughly hundreds of billions to trillions of dollars per year by the middle of the next century (IPCC [1996], Manne [1993], Martins et al [1993], Edmonds et al [1995], Rose and Stevens [1994]).[6]

While in theory potential savings grow larger as more countries participate, even two countries can save by redistributing their abatement effort efficiently. Surprisingly, estimates of savings from emissions redistribution among relatively few industrialized countries are of the same

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[5] Parson and Zeckhauser (1995a, 1995b) present an argument why such simple targets are attractive and how they are likely to obstruct climate agreements, with a critique and alternatives. Australia's recent proposal that OECD countries' obligations should be based on equal fractional GDP loss supports their claims (Greenwire, November 3, 1996)

[6] There are also projected to be very large savings available from efficient shifting of emissions abatement effort over time. For example, Wigley, Richels and Edmonds [1996] compare alternative time-paths of CO_2 emissions to hold atmospheric concentration in the year 2100 below various target levels. Relative to policies requiring immediate reductions of emissions, alternative trajectories that allowed emissions to rise for a time, then drop sharply, reduced present-value abatement costs by half or more. While part of this saving came from discounting, much more came from avoiding premature scrappage of capital, technological change, and natural carbon uptake muting the long-term effect of early emissions increases. In contrast with the gains available from inter-regional shifting of emissions, no specific negotiating proposals have yet been advanced to capture these savings. In this paper, we consider only institutional arrangements to support more efficient distributions of abatement effort among countries, not over time.

order as those estimated from global redistribution.[7] While the size of these savings estimates are highly uncertain, such similar estimates of available gains from global cooperation and from north-north cooperation suggest two possibilities: the 200 to 50 per cent estimated savings from global cooperation may be low; or moving from Annex 1-only to global cooperation may yield little additional savings.[8]

These savings estimates represent the gains available from a system of emissions redistribution. The size of such a system's job is presented in the other side of the estimates: how many tons of abatement effort, and how much money, must move between nations to realize these savings. It is possible to calculate such an estimate from-one-published analysis, and the figures so obtained are very large. With world emissions held at 1990 levels, shifting from "every nation stabilizes emissions" to the optimal distribution requires shifting 15 to 20 per cent of world emissions between regions over the next 35 years (approximately 1 Billion tonnes of carbon emissions per year), with an associated financial transfer of about $250 Billion/year in 2035, growing to $1.2 trillion/year by the end of the century.[9] These estimates are lower bounds, since they reflect only movements between regions in a nine-region world model.

These are rough estimates, based on one study using one model. But even if the estimates are only correct to within an order of magnitude, the job facing any system of re-distributing emissions is large and difficult. The required financial flows are comparable to total net resource flows to developing countries in 1995 (roughly $240 Billion in 1995), and dwarf current ODA for environment, and for all purposes (a few billion, and $60 Billion respectively). Consequently, any of these systems must be evaluated with a view to its suitability for large-scale expansion.

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[7] Barrett [1992] estimated 50 per cent cost savings from efficient stabilization of CO_2 emissions (1990 levels) within the EU alone. One study, which considered a 20% CO_2 reduction by 2030 among only three countries -- Switzerland, the Netherlands, and Belgium - found that efficient allocation of abatement reduced costs by 18 per cent, or $3.2 billion (IEA [1994], Bahn [1996]). Wise and Edmonds [1996] calculate that optimal redistribution of an emission tabilization target among Annex 1 nations could reduce costs by 40 per cent.

[8] Of course, it could also be the case that the estimated savings for trading among Annex 1 countries are too high, but the models are likely more reliable in their representation of these economies than of the developing countries.

[9] Edmonds et al [1995] estimated regional costs of holding world emissions at 1990 levels under several alternative inter-regional distributions of emissions. The estimate presented here is derived from examining their total regional revenues from exchange of emissions when distributed according to a "grandfathered" allocation (each nation receives permits equal to its 1990 emissions), and dividing these by the carbon tax in each year (which equals the price of a ton of emissions at the margin). With a marginal permit price of $150/tonne in 2035, rising to $450 in 2100, their estimated inter-regional revenues yield an inter-regional emissions shift of 1 Billion tonnes/year. (All monetary figures are in 1990 dollars). All estimates are of movements among regions, with all regions except the USA much larger than an individual country. Consequently, movement of funds and emissions among nations, including intra-regional movements, would be higher.

4. JOINT IMPLEMENTATION:
4.1. Background and Basic Characteristics

While the Framework Convention does not precisely define JI, and there is significant difference of view over what it ought to be, the following characteristics capture most of current practice and advocacy (Mintzer 1994; Watt et al, 1995; Wexler, Mintzer, Miller 1994).

1. **Project-Centered:** JI promotes project-level international investment in emissions abatement or sequestration. The activity, monitoring, and accountability all lie at the level of an individual project. While this focus on projects is not evident in. the Convention language, it has emerged as the predominant interpretation of JI. Focusing on individual projects makes it possible to consider JI ltween two countries of which only one is bound by a national emission obligation.[10]

2. **Decentralized Project Identification**: Many decentralized actors may identify and promote projects, and negotiate deals.

3. **Private Funding:** While government funds may be provided, a primary focus is on encouraging private investment. JI pilot programs show variation on this; some fund projects directly while others provide minimal public funds and facilitate private investment. But all stress that the bulk of JI investment must ultimately come from private sources.

4. **Government-defined Criteria:** Governments define criteria for recognizing projects as JI, impose reporting and other requirements on projects to determine if they meet the criteria, and register projects that do.

5. **Credits Against a Regulatory Burden:** Successful JI projects will allow their investors to avoid a regulatory obligation -- a requirement to abate elsewhere or to pay a tax through the granting of credit. Credit has been highly contentious, and must be considered separately for the cases in which all countries participating in a JI project are, and are not, under national emission limits. In the former case, credit appears to be intrinsic to the concept of JI. Abatement projects without credits may be valuable and may be done, but could not reasonably be called the joint implementation of a shared abatement obligation. In the latter case, credit has been even more contentious and its definitional status is weaker. In the absence of two national commitments that can be added to yield a joint commitment, it is not obvious what a JI project is jointly implementing, or that the granting f credit is intrinsic to the concept of joint implementation (Government of Brazil 1996).[11] The voluntary inclusion of non-Annex I countries in transactions, and the absence of credit, are the two basic distinctions between JI and the present AIJ pilot phase.

4.2. Current JI Program and Project Experience

Several countries established national JI programs before the Berlin decision. By early 1997, seven industrialized countries interesting in supporting investment in JI abroad had established

[10] In the US "non-paper" tabled in Geneva in December 1996, JI was defined by its taking place between target and non-target countries.

[11] Later we argue that granting credit will be necessary to motivate a substantial increase in private investment in JI, but this argument is distinct from the assertion that credit is essential to the concept of JI.

national JI programs: Australia, Canada, Germany, Japan, the Netherlands, Norway, and the United States. In addition, several developing countries interested in hosting JI projects had designated national JI authorities.[12] All these programs define standards for certifying projects, maintain national project registries, and negotiate bilateral or multilateral umbrella agreements with other countries to facilitate project development. All also provide some government support, ranging from purely administrative support to government project financing. Beyond their broadly similar functions, JI programs in investor countries differ in several significant respects. They have substantial differences in scale and experience, and also differ in their relative emphasis on private and public funding, the extensiveness of their application process and monitoring requirements, and in their extent of regional or sectoral specialization.

The United States Initiative on Joint Implementation (USIJI) was the first national program, established in October 1993.[13] Launched before the Berlin decision to disallow credit in the pilot phase, USIJI has continued to promote projects since then, but it has become clear that funding them poses substantial difficulty. USIJI strongly emphasizes motivating and facilitating private-sector investment, rather than channeling public funds. While US government agencies have provided modest funding for a few projects, USIJI otherwise depends entirely on private financing from firms or NGOs. Through USIJI, the United States has negotiated ten "Statements of Intent" with non-Annex 1 countries, enabling documents to promote and facilitate negotiation of subsequent projects. USIJI has registered the largest umber of projects of any JI program, twenty-four projects in ten countries as of early 1997.[14] Nearly all USIJI projects involve a partnership between one or more US firms, a US environmental NGO, and an NGO or government agency in the host country. USIJI requires project proponents to demonstrate additionality of abatement, requires follow-up monitoring with replicable methodologies and independent audit, and puts the onus on the project proponent to estimate baseline emissions.

The Japanese AIJ/JI Initiative, established in January 1996, includes both publicly and privately funded projects. Each participating Ministry is responsible for evaluation and approval of projects initiated by members of its constituency. For example, MITI is responsible for projects initiated by industry, the Environment Ministry for projects initiated by environmental NGOs. Of eleven projects approved by the Japanese government in the initial round in 1996, one is funded entirely by the national government,[15] one by a municipal government, and the remainder by private firms and foundations. All projects but one are located in the Asia-Pacific region. Japan's program, alone among the investor-country programs, does not require host-country approval before approving the project. None of the initial eleven projects has yet completed negotiations with the host country to receive its approval, so none yet has the status of official AIJ (Suzuki 1996; Matsuo 1997)

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[12] While registering an AIJ project requires approval of both governments, a national program is not necessary. Costa Rica is the only host country with a national JI program and office, but several others actively promote JI, have signed bilateral or multilateral umbrella agreements, and have designated officials responsible for JI in their environment or foreign ministries. A list of national JI contacts is provided by the FCCC Secretariat at www.unfcc.de/fccc/ccinfo/aijcont.htm .

[13] USIJI is an interagency activity. The Department of State chairs the interagency working group, while EPA and DOE co-chair the evaluation panel and are lead agencies for the Secretariat. Other participating agencies include AID, USDA, Commerce, Interior, and Treasury.

[14] USUI accepted seven projects (of twenty-five proposals) in October 1995, eight (of twenty one proposals) in December 1995, seven in December 1996, and two in February 1997.

[15] The funding agency is the New Energy and Industrial Technology Development Organization (NEDO).

The Netherlands' Pilot Phase Program on AIJ was established in September 1995, though the government had been promoting JI as early as 1993. Early Dutch support of JI included sponsoring a conference, two published volumes, and a quarterly JI newsletter (Kuik, Peters, Schrijver 1994; Jepma 1995). The program has government funding of $29 million for projects in developing countries and $22 million for Central and Eastern Europe, over the period 1996-99. In an initial stage, a monitoring and analysis component was added to four small preexisting bilateral projects in Russia and Hungary, to make them serve as JI test projects. In addition, new forestry projects were developed in Ecuador. Uganda, and the Czech Republic, and a Micro-hydroelectric project in Bhutan (Netherlands Pilot Phase, 1995). While initial projects have mostly been publicly funded, the program also seeks to encourage private JI investment, which is expected to become dominant after the pilot phase. Verified All reductions may be considered in negotiations of future emissions agreements between industry and the Dutch government. This is the closest that any present program has come to granting national credits.

Norway participates in a joint JI program with the World Bank, which has funded efficient residential lighting in Mexico and coal-to-gas conversion in Poland. The Government of Norway provided modest co-financing to each project, while the GEF and the host-country government provided the bulk of the funding. [16] The Norwegian government has also developed bilateral. All projects with Costa Rica (JI Quarterly, December 1996) and Burkina Faso. Though the Norwegian JI program has been publicly funded so far, it endorses the necessity of ultimately moving to private finance (Anderson 1995; Nordic Council of Ministers 1995). In addition to Norway's national initiatives, the Nordic Council has conducted a study of five ongoing energy-related bilateral projects in Eastern Europe, to evaluate the suitability of such projects as JI (Ji Quarterly, December 1996).

The German JI program, established in 1996 in the Environment Ministry, emphasizes projects in energy efficiency and renewables. Seven projects in fuel-switching and efficiency are under development -- four in central and eastern Europe, one in Portugal, and two in non-Annex 1 countries. These last two, in Indonesia and Jordan, are being undertaken by the E-7 international consortium of electrical utilities (JI Quarterly, March 1996).

The Canadian JI Initiative, announced in July 1996, consists of a small office located within the Ministry of Natural Resources, operating under the guidance of an interdepartmental steering committee. The program supports Canadian private investment in JI projects, but provides no government funding for projects. Program documents stress export promotion benefits. To ensure additionality of financing, projects that are entirely funded from the Canadian International Development Agency (CIDA) are excluded, though those partially funded from ODA sources can be considered. While the program requests documentation similar to that required by USIJI, reporting requirements in practice are so flexible that no project will be excluded due to lack of information (Canadian Joint Implementation Initiative 1996; Hornung 1996). No projects have yet been reported under the Canadian initiative.

The Australian AIJ Pilot Initiative, located in the Department of Primary Industries and Energy, was also established in 1996. The program will facilitate and register private-sector

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[16] The $23 M cost of the Mexican (ILUMEX) project was provided by the Mexican Government ($10 M), GEF grants ($10 M), and Norway ($1 M). The $52 M cost of the Polish project was provided by the Polish government ($26 M), GEF grants ($25 M), and Norway ($3 M) (Anderson, 1995).

investment activity, and stresses commercial benefits to Australia (Australian AIJ Pilot Initiative, 1996). As of late 1996, the Australian initiative was in the early planning stage for two projects to be implemented in the South Pacific region.

The national programs reflect different views of what is most important in the early stage of JI. The Dutch and Norwegian programs acknowledge that private funding is needed in the longer term, but treat the immediate problem as getting demonstration projects in place. With these, one can experiment with methods of determining baselines, calculating and measuring emissions and sequestration effects, and identifying and mitigating potential sources of leakage. The programs regard these as things that must be learned whatever the funding source, and seek to move quickly by using public funding. USIJI, and the other programs that stress private participation, treat the immediate problem as mobilizing private activity and their role as support: technical assistance, training, identifying projects and identifying, recruiting, and educating private participants.

In additional to national JI programs, at least three private-sector initiatives also seek to promote profitable foreign investments to reduce or sequester GHG Emissions: one sponsored by the US electrical industry through the Edison Electric Institute; one sponsored by eight major electrical utilities from the G-7 countries; and one sponsored by the World Business Council on Sustainable Development (WBCSD).

The Edison Electric Institute supports two activities. Projects in energy efficiency and renewable energy are supported through the International Utility Efficiency Partnerships (IUEP), while projects in carbon sequestration through forestry are supported by the Utilitree Carbon Company. IUEP is supported by eight US utility companies. In turn, IUEP supports projects by US electrical utilities or their subsidiaries that abate emissions internationally, and yield financially attractive rates of return. Promotion of export opportunities for the industry is a central goal of the program. On the argument that JI projects are often small in scale, have significant transaction costs, and represent an investor's first entry into an unfamiliar market, IUEP provides seed money to support such activities as feasibility studies, host-country negotiations, and environmental impact assessments. IL1EP selected nine projects for support in 1996, while ten more are under development in 1997.[17] Host-country agreement is not required for a project to qualify for the program, but most IUEP projects are intended to qualify as USIJI projects, for which host-country approval is required (Edison Electric Institute 1996). The UtiliTree Carbon Company, sponsored by 40 US utility companies, announced its first five projects in August 1996, of which three support carbon sequestration in US forests and two, one of which has been approved and one of which will be submitted as a USIJI project, protect forest or improve forest management in non-Annex 1 countries (Utilitree Carbon Company, 1996).

Eight electrical utilities from the G-7 countries established E7, a non-profit organization to promote efficient generation and use of electricity and protect the global environment, in 1992. E7 members cooperate to pursue various environmental projects, and are developing three projects that may eventually be submitted as JI/AIJ projects: renewable electricity supply for remote communities in Indonesia; improving efficiency of thermal power plants in Jordan; and micro-hydroelectric development in Zimbabwe ("Electric utilities promote JI", 1996).

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[17] Activities selected for IUEP support in 1996 include biomass energy projects in Belize, Guatemala, and Nicaragua; a new combined-cycle natural gas plant in Colombia; a fluidized-bed coal plant in the Czech Republic; an efficient electric motors project in Ghana; efficient lighting projects in Bulgaria and Honduras; and a hydroelectric efficiency project in Brazil.

The World Business Council on Sustainable Development (WBCSD) launched a JI initiative "International Business Action on Climate Change" (IBACC) in January 1996. The program does not provide project support, but rather seeks to facilitate and showcase business actions to reduce net emissions and yield profitable returns. Proponents or developers submit project information in a standard format that includes description of provisions for monitoring, external review, and potential sources of emissions leakage. By early 1997, more than 100 proposals had been received. The project proposals are of highly diverse character. Some are fully implemented while others are at an extremely preliminary stage of development and seek listing in hope of obtaining financing. Some have gained or are pursuing registration under national JI programs. A few are located in industrialized countries, or even internal to the normal operations of the listing company. While many proposals were advanced by host-country bodies, the WBCSD does not require official host-country approval as a condition for listing ("International Business Action on Climate Change", 1996).

Table I summarizes the status, as of early 1997, of JI and AIJ projects that have been approved by both governments. Of the 40 projects listed, 24 are US and 16 are non-US. Sectorally, sixteen projects are in forestry and land use; thirteen are in electrical generation (renewable, geothermal, or biomass); three are in retrofit fuel switching; six in energy end-use efficiency; and two in methane capture from gas pipelines or landfills. All have some cost sharing with a host-country sponsor, whether the government, a firm, or an NGO. All involved either north-south or east-west partnerships (between OECD countries and either non-Annex 1 countries or Eastern Europe or Russia).[18]

At the project level, the JI landscape is a jumble of projects at various stages of development and official status. The FCCC Secretariat only records a project as official AIJ once a) all participating governments have designated a responsible JI authority, and b) all authorities have reported, separately or jointly, that they approve the project as AIJ. As of December 1996, 13 projects had met this requirement.[19] This status reflects only administrative and reporting/approval requirements, and implies nothing concerning a project's state of implementation or funding.[20]

Many more projects than these are under development, some with approval of one government, and are considering seeking official recognition as JI. In addition, a great many other bilateral development initiatives and private investments in energy or land-use could plausibly be characterized as JI. This is evident from some national programs' adding monitoring and analysis components to pre-existing projects to turn them into AIJ; and from the large number of profitable (or potentially profitable) private initiatives being developed under the IUEP and WBCSD programs.

Being fully funded is not required for approval as a JI project, and many projects are not. Rather, it was hoped that JI listing would help worthy projects secure financing. While the

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[18] More detailed discussions of AIJ projects can be found in Schmidt [1996], Figueres et al [1996], the Joint Implementation Quarterly (JIQ [1996]), and the Web-site JI Online (www.ji.org). One German project under development with Portugal will be the first JI project within the OECD.

[19] These include eight USIJI projects in Costa Rica, two USIJI projects in Russia, two Netherlands projects in Hungary, and one Norway-World Bank project in Mexico.

[20] (FCCC/SBSTA/1996/17; personal communication, Mr. Kai-Uwe Schmidt, FCCC Secretariat)

projects of the Dutch and Norwegian programs are fully funded, mostly by their sponsoring governments, most projects approved by USIJI, and by the other national programs that pursue private financing, are not. Assessing funding status if full of ambiguities: funding details are not publicly available, and projects may proceed in phases or with less than complete funding. Still, it appears that by early 1997, fewer than ten USIJI projects had attained funding levels sufficient to proceed with development, and two were completed and operational.[21]

In sum, current JI projects are few in number, small in scale, and hard to fund. Many projects are at early stages, so it is too soon to evaluate project effectiveness. Most claim substantial incidental benefits to the host country, and some claim profitability. Several projects have multiple participants with funding from more than country, suggesting the importance of careful accounting to avoid double-counting.

4.3. Key JI Participants and their Interests

A JI project requires the participation of several actors, with different concerns and interests. Registration as AIJ, or as JI under most existing national programs, requires the approval of both host and investor-country governments. On the investor-country side, the investor may be the government, but is more often a private firm or firms; NGOs may also invest, and also (more often) act as project facilitators. On the host-country side, firms or NGOs may be involved as project investors, promoters, or implementers, and various local actors may have stakes in project design or effects. In this section we outline likely typical interests and incentives of each class of participants. Members of each class are diverse, of course, and will weigh different interests differently; the argument here seeks only to identify broad patterns of potential interaction in JI projects, not specify the details of any particular project or actor.

Investor-country governments: Several interests may draw investor-country governments into JI, at least at present small levels of activity. Even without concern Rbout climate change, JI programs can promote export and foreign investment opportunities. [22] More relevant to climate, if JI can in fact promote cost-effective global abatement, then developing a national program early can bring several benefits: gaining standing in international negotiations of future policy design; building goodwill in particular host countries; and demonstrating commitment, to persuade reluctant parties to join the climate regime. In a future JI system with international credits, investor-country governments would share the interest of investors: reducing the cost of meeting a regulatory burden by abating where it is cheaper.

Host-country governments: In host countries, governments and other actors may also act from several interests. For the host-country economy, JI projects can represent desirable increases in foreign investment (Sugandhy 1996; Government of Brazil, 1996; Kureya, 1996), and will have various local environmental or economic impacts. Descriptions of current all projects suggest that these local impacts are dominated by benefits: employment, local air-quality improvements, provision of electricity to unserved areas, habitat or watershed protection, building organizational capacity, etc.

But JI projects could also impose local costs, bid scarce resources away from other productive uses, or foreclose potential future development opportunities (Shukla, 1996; Gupta, 1996).

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[21] Interview with E. Holt, USIJI, June 1996, said three; Elizabeth Cook interview, Greenwire, October, said "at most four"; interview with E. Holt, April 1997, stressed that some can proceed in phases or with partial funding; "fewer than ten" is conservative estimate.

[22] The JI program documents of Australia, Canada, Japan, and the US all mention these benefits.

Among the central concerns of host-country representatives have been that JI projects would effectively be forced on them, so they would be unable to control such potentially harmful local impacts, or to negotiate satisfactory sharing of financial returns and credits. The Berlin decisions specifying that non-Annex 1 participation in AIJ was voluntary, and requiring prior government approval, were attempts to meet these concerns.

Potential hosts also express two reservations about the international political economy of JI. First JI may permit foreign investors to skim the cream - to claim a limited set of low-cost abatement options in a host country, leaving only more costly or otherwise less desirable options when the host comes under a future abatement obligation. Second, JI may inappropriately reduce the pressure on IC governments to make required changes in their own policies and emissions.[23] The largest potential host countries have been skeptical or hostile toward JI, reflecting some combination of these reservations. While some reports suggest slight recent diminution of this skepticism (Dower, 1996; Greenwire, Nov 1, 1996), the most enthusiastic JI hosts remain small developing countries whose potential impact on the global greenhouse problem can only be modest.[24]

The Investor: Present investors include governments and NGOs who seek to promote and demonstrate the benefits of JI, but a substantially expanded JI system will derive most of its finance from private, profit-motivated investors.[25] Their interests will likely be of four types, all related to the ultimate profitability of projects: financial return; credits and associated regulatory relief; public relations; and a cluster of strategic interests, principally concerned with developing operations in the host country.

Financial Return: Many JI projects yield a stream of financial returns. Negotiated details of project design and financial structure determine the size of financial flows, and the division of risk and return among participants. Some JI projects are expected to earn profitable rates of return though these are based on projections and detailed financial information is proprietary. [26] As discussed below, treatment of profitable projects under a JI credit system is contentious, for it is argued that profitable investments are not additional.

Regulatory Relief: The most widely proposed incentive for JI investors is the opportunity to avoid a regulatory obligation at home by investing in cheaper abatement abroad. Creating this" incentive requires some form of credits, which are not yet available. Even without international credits, any government could offer its nationals domestic credit for successful JI projects -- as relief from a domestically imposed emissions limit, or a rebate on a tax. If and when any major country enacts national emission controls with firm national credits for abatement" through JI, the credits will likely represent a substantial incentive for investors.

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[23] Here, most DC governments and most environmental NGOs are aligned, arguing that equity and the need to demonstrate leadership require ICs to abate domestically first, over-riding concerns of cost-effectiveness.

[24] See list of projects to date in Table 1.

[25] Even the Dutch and Norwegian JI programs, which have most stressed government funding in the pilot phase, state that after the pilot phase II will mostly be concerned with stimulating private investment (Government of the Netherlands 1995; "Netherlands' Policy Statement" 1995; "AIJ Pilot Project", 1996).

[26] Though detailed financial projections are not publicly available for any official JI project, USIJI literature asserts that some projects will earn commercial returns, while the private IUEP and WBCSD JI programs require both demonstrated abatement and profitable rates of return to register a project.

Until then, investors' regulatory incentives are vague and contingent, perhaps even of uncertain sign. Some current investor firms have asserted that they expect future regulatory benefits, and some national programs imply the possibility of such benefits.[27] Consequently, a current investor might attach some (small) probability to being spared a future burden for their far-sighted environmental conduct. Firms might also invest in JI for a collective benefit, to undermine political support for regulation by demonstrating industry leadership.

The contribution of such potential future regulatory advantages to investors' current incentives in JI is probably very small, though. Governments cannot readily bind themselves to offer future relief to individual firms (Rodrik, Zeckhauser 1988), and forestalling future regulation through industry leadership will be hampered by collective-action problems among firms. Indeed, it is ambiguous whether anticipatory industry action would more likely reduce or increase the probability of subsequent regulation, as plausible theoretical arguments are available on both sides. Consequently, the regulation-avoiding value of investing in JI before regulation is imminent is likely very small.

Public relations: Participating in JI projects, consequently building international harmony and protecting the environment, can gain investors public goodwill of some potential commercial value. Maximizing such gains requires visible partnership with governments and NGO's, and depends very little on the size of investment. Hence, firms seeking such benefits would likely invest modestly in high-profile, very environmentally attractive projects. Moreover, such benefits, unlike financial returns or credits, need not be divided among multiple participants; consequently, we would expect -- and we often see -- multiple firms in partnership with a single NGO on a JI project, dividing the cost while sharing fully in the credit. Certain strategic and learning interests could also account for this pattern of participation, though.

Strategic Advantages: JI investors may gain several kinds of potential long-term strategic benefits. In the international arena, early JI participation may grant standing in negotiations, or provide information about JI opportunities, pitfalls and problems. In the host country, investors may gain market access, favorable regulatory treatment, services of knowledgeable JI program officers, or relationships with senior decision-makers. Any of these can represent an important competitive advantage for future expansion in host-country markets, whether for further JI projects or for other business. The value of these benefits is greatest in large host countries with strong growth prospects. That most early JI activity is in small countries does not necessarily mean, though, that these interests are not salient, since the largest potential hosts are not yet participating.

For profit-motivated investors, public-relations and strategic benefits will much more readily motivate small initial participation than large investment, for they yield most of their benefit with very modest financial commitments. Attracting larger investments will require some combination of financial return and regulatory benefits. These two can substitute for each other;

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[27] "Without strong incentives we will see merely the continuation of the modest efforts of the recent past - small pilot projects, mostly government-funded, with limited business involvement. This is a recipe for no JI market growth, and no real learning and innovation." (Leslie, 1995); see also Government of the Netherlands, 1995.

higher regulatory benefits (i.e., more valuable emission credits) would be required to motivate investment in projects with lower financial returns.[28]

These sketches of the interests of major participants suggest the broad outline of JI project negotiations. Successfully implementing a project will require designing it to yield an attractive bundle of benefits (financial return, local benefits, and credits if available), and successfully negotiating the division of these benefits among the parties. If investor-country governments persist in not granting credits, there is one less dimension on which division must be negotiated, but projects will offer less total value to be divided.

Present JI projects appear to yield attractive economic and environmental benefits to the host country. The skepticism of major potential hosts, however, puts the onus on JI proponents to continue to demonstrate that such benefits will outweigh local costs. Whether such benefits can be sustained with substantial expansion of the scale of JI is an important empirical question. Since the projects pursued first are likely the most attractive on several dimensions, it is plausible that opportunities with such attractive combinations of benefits will grow harder to find if and when the scale of JI expands. If local benefits shift from being natural consequences of JI investments toward being costly add-ons in project design, then they will increasingly become another distributive aspect of project negotiations between host countries and investors.

4.4. An Expanded JI System: Requirements and Implications

This section considers JI's potential contribution to efficient global emissions abatement. While other indirect goals are sometimes claimed for JI, such as supporting learning or providing a transition to a tradable-permit system, we defer these to a brief discussion in the concluding section. Here, we consider only JI's direct potential to contribute to efficient abatement.

In the present pilot phase, JI's dominant problem is low participation. Few large host countries' are engaged, few projects are being developed, and most seriously, projects are having great difficulty attracting financing. One consequence is that current projects are likely quite unrepresentative of those that would occur under much larger mobilization of private finance, in their technical characteristics, the type of investor they attract, and the character of investors' motivations and involvement in implementation. Pilot phase experience alone may thus be a misleading guide to the functioning of a larger-scale JI system.

For JI to make a significant contribution to the global greenhouse problem, it must attract much greater participation from both major host countries and investors. Our argument concentrates on investors, for we contend that increased investor interest is a necessary condition for increased host-country interest. [29] Present investor interest in JI might be low for two reasons: potentially attractive projects might be obstructed by high transaction costs; or current opportunities might not be attractive enough in meeting investors' primary interests.

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[28] Published project examples in the WBCSD program illustrate potential flows of abatement and financial returns available for specified investments. It is straightforward to demonstrate that as the project's financial structure is varied to give smaller monetary returns to the investor, abatement credits must increase in value for the investor to receive their required aggregate return.

[29] Major hosts may have several sources of skepticism, as discussed above. Among them may be doubt that enough investment will be available to merit their attention. Currently engaged host countries could, though, absorb much more investment than is presently coming forward (Zollinger and Dower, 1996).

Transaction costs of JI can clearly be substantial, and are worth reducing. Several current JI programs are principally concerned with seeking to lower transaction costs, on the hypothesis that these are obstructing some substantial supply of intrinsically attractive (i.e., negative or low abatement cost) projects.[30] Whether or not this hypothesis is presently true, reducing transaction costs will also be important if future emissions regulation creates a larger potential market for JI.

Two classes of JI transaction costs appear to be particularly salient: those associated with market development, such as identifying and bundling-project opportunities, matching projects and investors, making markets, and allocating risk; and those associated with monitoring and oversight, such as registering projects, defining baselines, and monitoring and auditing performance. Approaches to performing these functions and lowering the associated costs have been extensively discussed elsewhere (e.g., Anderson 1995; Wexler, Mintzer, Miller 1994; Mintzer 1994; Watt, Sathaye, et al 1994). We do not discuss these here, except to note that the stringency of monitoring and oversight is a basic design decision for a JI system, reflecting a tradeoff between reducing transaction costs and defending the integrity of JI's claimed abatement contributions. Strict defense of II system integrity raises transaction costs, and will deter some worthy projects as it excludes some fraudulent ones. This tradeoff may become less strict, if increasing experience permits standardized oversight methods, or increases in project size reduce the fractional contribution of transaction costs.

But it is widely argued that JI is failing to attract investors because it is not adequately meeting their central interests. That is, the available strategic and public-relations benefits, plus highly uncertain future regulatory benefits, are insufficient to offset financial returns perceived to be low relative to project risk. If the pool of available project opportunities is presumed fixed, there are two ways to improve this balance: subsidies, or emission credits. Since overt public subsidy of corporate investment abroad ranks low on most nations' political priorities, and is tangential to the goal of mobilizing private capital, most JI proponents focus on credits. Many have argued that a firm commitment to credit is essential for a large increase in private JI investment (Dower, Zollinger 1996; Leslie, 1995). Moreover, if JI is expanded by creating market instruments to bundle projects and pool risk, this expansion will obscure or sever the direct relationships between investors and projects that are responsible for present public relations and strategic benefits. Hence, any attempt to expand JI by facilitating market development will create a self-reinforcing tendency for the system to depend on investors' interests in financial return and regulatory relief through credits.

If credits were offered for JI projects, their supply would be determined by available project opportunities. Some credits, derived from projects that are nearly viable in financial terms alone, would be available at low cost. If disequilibriums, reducible transaction costs, or lack of information are obstructing otherwise viable projects, some credits could even be available at negative cost. Additional abatement opportunities would be available at higher costs, yielding a conventional upward-sloping supply curve for credits.

In contrast, the demand for credits would contain two separate components. Some investors, including those now supporting sub-profitable JI projects, would be willing to buy abatement even if formal credits remained unavailable or had no value. These could include some NGOs

[30] Early analyses support the intuition that transaction costs for current JI projects are very high. One evaluation of two early projects suggests that transaction costs may exceed environmental benefits (Roland and Haugland, 1994).

or governments who value abatement for its own sake, and some private investors who buy abatement out of strategic or public-relations interests. This component of demand is present now without credit and could well persist, but would not grow much larger unless major governments decided to spend heavily on abatement abroad, which present positions suggest is unlikely. By far the larger component of demand would be driven by the value of credits to private investors. This second component would only appear with the enactment, or the Imminent threat, of a costly regulatory burden on emitters that they are permitted to avoid (or to meet at lower cost) by JI investments. Of these investors, those whose regulatory burden is most certain and whose marginal abatement cost in their own operations is highest would be willing to pay the most for JI credits. Others with lower abatement costs, .or facing a less certain regulatory burden, would offer less, yielding a conventional downward-sloping demand curve.

This second component of demand is entirely a creation of regulation. Until a major emitter nation announces regulation avoidable through JI credits, only the much weaker demand for pure abatement would exist. Such regulation, once created, would generate the stronger demand for some specific quantity of abatement; beyond this quantity, only the weaker demand for pure abatement would exist.

Credits could be granted either internationally or nationally. Credits granted under an international climate regime would reduce, or substitute for, national emission obligations; credits granted by a national authority would reduce, or substitute for, regulatory obligations of domestic emission sources. While the Berlin decision has suspended consideration of international credits through the pilot phase, any national government could choose to enact national credits as part of its domestic policy, even without international credits. Whether national or international, the value of credits will depend upon their representing real emission reductions.

Ensuring that credits for JI projects do represent real emission reductions poses serious conceptual and practical difficulties, which are subsumed into current policy debates on "additionality". Even in the pilot phase, with no credits and small stakes, determining additionality has been difficult and contentious. In a substantially expanded JI system with real credits, failing to ensure that JI projects make incremental contributions will both be a greater risk, and have higher consequences. The risk will be higher because in an expanded JI system there will be substantial incentives and opportunities to over-state project contributions, and many profit-seeking actors in the system will not share the environmental motivations of pilot-phase pioneers. Consequences will be higher because both the value of credits to investors, and the effectiveness of the entire endeavor in limiting emissions, will be at stake.

Under the AIJ pilot phase, and presumably under any subsequent JI regime, projects are required to be additional in two dimensions, finance and emissions. Each dimension embodies the concerns of one party to a JI transaction. Buyers of credits (including investors) want credits to have secure value, so will worry that projects really represent additional abatement; issuers of credits (including host-country governments) want to obtain secure value in return for the credits they relinquish, so will worry about additionality of finance. Pursuing additionality on two dimensions yields four possible outcomes: in the best, real new money finances real new abatement; in the worst, re-labeled investment flows are coupled with fictitious abatement, but nobody changes their behavior.

Whether in finance or emissions, additionality can only have meaning relative to some alternative reference point. Since JI is intended to include activity in countries without emissions targets, and since there are no specific obligations to finance abatement abroad, no binding target will be available to provide this reference point for either emissions or finance. Rather,

"additional" is taken to mean that the abatement and finance exceed what would have happened without the project. Determining this requires constructing a hypothetical or "counter-factual" baseline (Vellinga, Heintz 1994; Jones 1994).

Two serious conceptual problems obstruct the attempt to construct such baselines and determine additionality. The first concerns indirect effects of projects, which arise because both the project, and the money spent on it, move resources from other uses to which they would otherwise have been put. Indirect effects can be small or large, near or far, obvious or subtle, and can occur through various markets (e.g., energy, land, labour, forest or agricultural products) or non-market pathways. The second problem concerns-opportunism and the possibility of deception. Because JI is organized around projects, many aspects of additionality will be determined in the negotiation, design and analysis of each particular project. All participants in a project are likely to benefit if the project is deemed to represent a large additional contribution. Consequently, while all JI investors have a collective interest in defending the credit system against excessive claims, all parties to a particular project - including the investor -- have an interest in inflating the benefits that project achieves. Since benefits are measured relative to what would have happened without the project, all parties have an interest in exaggerating the difference between what they are doing and what they would have done Investors can claim that they would not have invested without JI credits, while project developers can claim that without JI credits they would have built a technologically obsolete, highly polluting, coal-fired alternative. Particularly in their more nuanced forms, such claims cannot easily or decisively be refuted.[31]

Even in the pilot phase there has been some controversy over additionality of finance, perhaps anticipating struggles that will become serious if credits are adopted. The Berlin decision and national pilot-phase programs, have adopted a very simple definition of financial additionality based on the source of funds, excluding projects entirely financed from the GEF or other ODA sources.[32] Consequently, at present any private JI funding is deemed additional. Disagreement has arisen, however, over the profitability of projects. Some have argued that if a project returns a commercial profit, it should be deemed non-additional, as a rational investor would have made the investment in any case.

The attraction of this argument is precisely the attraction of seeking to define additionality relative to a consistent alternative: if an investment would have been made for its financial returns in any case, one would wish to avoid also granting a rent in the form of a valuable emission credit. The argument's weakness, though, lies in its assumption that any project that turns out profitable would have been made in any case. This neglects project risk, confuses ex ante with ex post profitability, and conflicts with empirical evidence that many profitable conservation investments are not made (Wilson, Swisher 1993). Moreover, attempting to reclaim all super-normal profits from investors is equivalent to seeking to reduce their permit value to zero -- the current value of permits, at which investors are not coming forward.

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[31] Other approaches for counting emission credits have been proposed, using other bases than "what would have happened without the project". Possibilities include setting an agreed project-level or national-level baseline, from which all departures are measured; and using benefit-cost analysis to determine what level of project effort would have been justified by national benefits alone, granting credits for abatement beyond that point. These approaches are as difficult, and as open to misrepresentation, as the approach discussed here, except for the agreed national baseline; but that approach assumes away the problem (no national target) that JI is intended to solve. See Tietenberg and Victor (1994).

[32] The criteria are summarized in FCCC/CP/1996/14/Add.1, Table 4.

While additionality of abatement has been less controversial in the pilot phase, early project experience demonstrates how difficult it is to establish additionality coherently. Both indirect effects, and the difficulty of establishing reliable, opportunism-proof baselines, are serious. Current JI programs use simple rules to determine additionality, and accept at face value claims that would be hard to police against exaggeration. For example, while emissions leakage may be particularly serious for forestry projects, only USUI requires project developers to identify potential sources of leakage and measures taken to avoid it, and they have established no reliable way of identifying all major sources and reliably preventing them. (Watt et al, 1996; Dower 1996). USIJI has also approved one project to protect forest land that was about to be sold for cutting, [33] an approach that in an expanded JI system would clearly be at risk of fabricated claims that particular tracts were about to be cut.

For new energy supply, the additionality problem involves identifying what generation, if any, is displaced. Some II projects provide renewable electricity to regions not presently served by the electrical grid. For such projects, the Japanese program endorses the convenient assumption that electricity would otherwise have been provided by diesel generation, while acknowledging that often the real alternative would be no electric supply for some time. Several USUI projects use the same assumption, and are subject to the same limitations. The Netherlands Bhutan project has sought to define a more accurate alternative by claiming credit for displacement of the fuelwood, kerosene, and dry batteries that villagers are presently using, but the required laborious and highly inexact village-scale estimation could not easily be replicated at an expanded scale. Determining the alternative is also ambiguous for projects providing new electricity on the grid. Generation that is supposedly displaced may not be retired, or may be only tem rarity retired, particularly where existing supply is highly limited or demand rapidly growing;[34] or may already be operating at very low capacity, due to reliability problems or fuel shortages.[35] Determining alternatives in all these races both poses real conceptual difficulties, and presents ample opportunities for exaggeration.

Specifics of the design of a credit system can affect these incentives to exaggerate. In any project the investor, project developer, and host government all share an incentive to exaggerate the abatement achieved, generating more valuable credits for them to share. Under an international credit system the investor-country government also has the same incentive, since credits also reduce their national obligation. Only the largest investor-country governments, big enough to capture a substantial share of the collective benefits of a sound credit currency, would be likely to have this incentive significantly reduced (Parson and Zeckhauser, 1995a). The international currency of credits would consequently be at risk of debasement through widespread opportunism, unless carefully defended by close third-party oversight and cheat-proof accounting rules on every project. In contrast, under a national crediting system the investor-country government would not share this incentive to exaggerate project credits. Rather, as the banker to a national credit system, its interest would be in defending the

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[33] The Rio Bravo project in Belize, in USIJI Round 1.

[34] Such non-displacement is a risk of any project that claims to displace existing fossil-generating capacity. USIJI examples include the Don Julia hydro, and Aeroenergia and Tierras Morenas wind projects in Costa Rica. An extreme illustration is the claim of the Malaysian government that its huge and controversial Bakun dam project in Sarawak is being undertaken to reduce greenhouse gas emissions. (CC:Info National page, http://www.kjc.gov.my/ccm.actresp.htm)

[35] E.g., Watt et al (1996) summarize an example in which the capacity claimed to be displaced was already shut down due to fuel shortages.

integrity of the system. It is possible that some appropriately designed system combining national and international credits could retain and exploit this investor-country interest in sound credits, but detailed consideration of such a design is beyond the scope of the present paper.

It is also possible that standardized methodologies for project design, monitoring, and credit accounting could limit the harm that exaggeration poses to the integrity of credits and the effectiveness of a JI system. In part, this would require defensible, standardized approximations for counting the emissions benefits of projects. Though such approximations would have to be sufficiently correlated with real abatement achieved, they would not need to be highly accurate; rather, their essential requirement woould be to restrain the magnitude of exaggeration, so the meaning of credits could not be debased without limit.

In practical terms, such inflation-resistant approximations are likely to be available for some types of projects. The clearest example might be certain kinds of energy retrofit projects. When a project replaces old energy production or conversion equipment with more efficient equipment serving the same demand, and the old equipment is dismantled, a simple comparison of recent pre-conversion operations with emissions from the new equipment would provide a defensible, and difficult to manipulate, approximation to the true emissions effect. Simple, uniformly applied accounting rules could accommodate cases in which the capacity of the new plant was larger than that of the old plant it replaced. Retrofits of existing energy-consuming equipment in which the old equipment is verifiably retired could use similarly simple accounting rules, as could projects to capture methane leaks from existing systems (e.g., gas pipelines, landfills, or coal mines). Among forestry and land-use projects, it is plausible that projects planting currently unforested land would more readily admit such approximations than projects to protect, or to change management practice on, currently forested land.

These proposals for approximate additionality-counting rules are obviously preliminary, and only illustrative. The purpose of such rules is not precise identification of true baselines and project effects, though they must represent defensible and acceptably accurate approximations to these. Rather, their purpose is to impose limits on exaggeration, and so limit the extent to which exaggeration can degrade the integrity and benefits of a JI system. Such approximations and rules would serve a purpose similar to that of the rules of financial accounting. If they performed this central function adequately, then modest over-statement of project abatement and hence over-awarding of credits would not represent a central threat to the integrity or effectiveness of a JI system. Whether such approximations can be constructed for various project types, how well they can approximate true abatement, and how effectively they can limit the extent of exaggerated abatement claims, are crucial empirical questions that analysis of pilot-phase projects should seek to resolve. Such simple rules could pose several problems, including the risk of adverse selection among heterogeneous project opportunities. They would in no way avoid the requirement for careful oversight of project implementation.

The most serious risk of such approximate counting rules would be a bias in the types of project pursued through JI. Such rules will likely be much easier to construct for some project types, sectors, or countries than for others. Consequently, JI projects will tend to concentrate in those areas where such rules are most readily available and most strongly defensible. This bias would be present even without official imposition of particular accounting rules, as long as claims of project abatement are much more likely to be denounced or threatened with revocation for some project types than for others.

This bias will likely be particularly severe in considering the potential contribution of JI to global abatement over several decades. Over this period, the largest piece of the global abate-

ment task will be deflecting future emissions growth trends, particularly in the rapidly growing developing countries. This is fundamentally a task of shifting the character of new capital investment toward less emitting forms. But because new investment will usually represent an emissions increase over the status quo, without national emission targets the problems of defining and defending acceptable baselines for such investments will be severe. For JI, the problem of coherently defining additionality in rapidly growing economies will likely shift JI investment toward sectors and project types whose effects are easiest to count and defend, which will most likely be retrofits of existing capital, emissions recapture, and perhaps reforestation. Investments in these areas may be important and valuable, but they are not where the largest contribution is required. If JI investment flows predominantly to these types of projects, then JI's potential contribution to limiting global emissions growth will be seriously constrained.

Moreover, it is also in these project types where host countries' concerns about cream-skimming may be most well founded. The pool of easy-to-count retrofit opportunities in the present capital stock is fixed, while the pool of abatement opportunities in a growing economy is not. If future abatement opportunities should turn out to be less attractive than presently available ones, then this concern will have been justified. Whether this is so, though, will depend on the trend in abatement costs over time, which cannot be predicted even as to its sign. If the marginal cost of abatement in India after 30 years of new investment and technological change is higher than it is now, then allowing industrialized countries to clai credit for current JI projects will deprive India of its best opportunities for future abatement; [36] if lower, then who received emissions credit for retrofitting a 1955 boiler in 1998 will be of no interest a few decades hence.

4.5. The Potential Contributions of JI

Joint Implementation can facilitate some level of efficiency-enhancing exchanges of abatement effort with financial transfers, even between nations that have not all accepted emissions targets. But current experience suggests that investors will not undertake JI, and hence these gains will not be available, without some form of regulatory credit. If more than symbolic investments are sought, then regulatory benefits stronger than the vague hope offered by the present system will be required. Indeed, without some form of credit even the learning benefits of the present JI system are limited, because current activity is so minimal and so likely unrepresentative of what would be undertaken under an expanded system.

The enactment of international credits is likely to be tightly linked to the negotiation of Annex 1 (industrialized country) emission limits. A JI system with international credits should offer Annex 1 nations more and cheaper ways to meet a near-term abatement obligation than if they were required to abate at home. Consequently, an international credit system should make nations more willing to accept emissions targets, for it would reduce both the cost of meeting them and the risk of failing to meet them, by making investment in abatement abroad a substitute for abatement at home. This advantage is the obverse of the common critique of JI, that it allows industrialized countries to avoid their obligation to abate domestically; it does so by letting them instead bear the financial burden of abating elsewhere, so abatement is cheaper and they are more likely to agree to it. This advantage would be lost if, as some NGOs advocate, JI were only allowed as additional voluntary abatement after each country has fully met its abatement obligation domestically (Horning 1996; Climate Action Network 1994).

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[36] This also assumes that the activity undertaken now as JI for credit would not have been done for other reasons between now and when India comes under an abatement obligation.

We will learn little about JI's potential and problems until credits are available, but credits may take more forms than are normally considered. Even without agreement on international credits, any nation willing to act first could establish a national credit system. These would have to be enacted with domestic emissions regulation, allowing nationals to avoid a costly regulatory obligation if they successfully abate emissions through JI. Criteria and procedures could be negotiated bilaterally with host countries. Alternatively, a government could grant contingent national credits even without national emissions controls. These would represent promises of exemption from specified future abatement obligations, to be honored if and when domestic controls are enacted. Even allowing for the difficulty-of making such contingent credits secure, they would represent a firmer commitment than any government is presently offering. National credits, whether certain or contingent, could be traded as financial instruments, and could support a market in which emitters, project investors, environmentalists, and speculators all participated.

Either national or international credit would likely bring a large and sudden expansion of JI activity. In this case, the price of JI's flexibility, which permits projects between target and non-target nations, is weak accounting of abatement benefits. Because accounting problems can likely be managed adequately for certain projects, particularly retrofits of existing capital and reforestation, we would expect JI investments to be drawn preferentially to those project types. In these sectors, the conceptual problems of defining additionality are as severe as elsewhere, but defensible approximations and expedients are likely attainable. Consequently, while developing such expedient, exaggeration-limiting approximations are highly valuable pursuit of refined or highly accurate measures of additionality is probably not warranted. On the other hand, granting of JI credits may have to be limited to project types that for which such defensible approximations can be developed. Such restrictions, while necessary to defend a viable JI system with credits, will seriously limit the aggregate contribution to global abatement that JI can make. The potential contribution may be much larger than present activity, but still a small fraction of the abatement that may be required.

In addition to its direct contribution to global abatement, which we are arguing is likely to be real but modest, JI may offer indirect benefits. JI could be used to motivate countries to join the convention, or, if paired with a system to control emissions under national targets, could motivate countries to adopt emission baselines. JI can help various actors learn about project and technology effects in various national contexts, and increase experience with potential pitfalls and modes of project failure. Further early experimentation in JI will be necessary even to identify and refine the robust estimation methods discussed above for project baselines and effects. The public benefits of such learning may well be large enough to justify financial subsidy of early JI projects; to maximize these benefits, the subsidy should require full public disclosure of project information. Learning any of these things will require variance among project types, structures, locations, sectors, and technologies, and a system that can accommodate project failure and learn from it.

To establish a JI system with credits is not to say where the projects will go. Much current controversy over JI reflects the presumption that most projects will involve OECD investment in developing countries, but it could be otherwise. Many current projects are in the former east bloc. More broadly, it has been argued that the presumption that JI's benefits will come from exploiting low abatement costs in developing countries reflects basic misunderstanding of their economies (Shukla, 1996). The benefit of JI's flexibility is that it does not matter whether this presumption is true or not, for the system will motivate pursuit of profitable abatement wherever it can be found. Indeed, the private WBCSD program already lists many offered abatement projects in the OECD countries.

In sum, JI's contribution to global abatement can grow much larger than the present pilot phase, but is unlikely to represent more than a small fraction of proposed levels of global abatement. More effective deflection of global emission growth trends will require a system that can motivate changes in the character of future capital expansion, particularly in the rapidly growing developing countries.

5. ADMINISTRATIVE FINANCIAL MECHANISMS

5.1. Background and Basic Characteristics

Of the three systems considered here, Administrative Financial Mechanisms (AFMs) have the most experience. Several moderate-scale examples are currently implemented, including the Global Environment Facility (GEF) and the Montreal Protocol Multilateral Fund. These, and proposals for future AFM's, are similar in their broad thrust. Their principal characteristics are as follows.

1. **Project Support from Public Funds:** The system disburses public funds internationally, to support specific projects.

2. **Politically Negotiated Criteria:** International negotiations establish the environmental goals to be pursued, and other criteria that define acceptable projects and levels of support.

3. **Assessed National Contributions**: National governments contribute funds to the system, following negotiated agreement of aggregate funding levels and national contribution shares.

4. **Decentralized Project Identification:** Many actors can develop and bring forward project proposals, including private actors, host-country governments, international agencies, and various partnerships among these.

5. **Direct and Indirect Projects**: Projects may be direct investments, but may also be activities to support the environmental goal indirectly, such as training, information dissemination, research and development, or building institutional capacity.

6. **Implementing Agencies:** International bodies, normally including both an executive body and an international secretariat or bureaucracy, oversee the implementation of programs and projects. In present AFMs, designated international agencies implement projects, sometimes further sub-contracting to private bodies. In principle, AFMs could include various governmental, intergovernmental, or non-governmental bodies as implementers.

5.2. Key AFM Participants and their Interests

As the largest current AFM, the GEF potentially holds the strongest lessons for potential future AFMs. In its initial three-year pilot phase from 1991-1994, the GEF disbursed a total of $712 million to 112 projects in 63 countries, addressing four designated global environmental issues.[37] During this phase three agencies -- UNEP, UNDP, and the World Bank (Chair) --

[37] The four designated issues are global warming, biodiversity conservation, pollution of international waters, and ozone depletion. Of this funding, 43% went to biodiversity projects, 40% to global warming, 16% to water, and 1% to ozone (UNDP.UNEP. the World Bank, 1994).

shared implementation responsibilities. A 1994 restructuring revised the GEF's governance structure, re-financed, a second three-year period at roughly $2 Billion total, and passed the chairmanship to a newly established, independent GEF Secretariat.

Many actors have the opportunity to influence the activities of an AFM, at both political and bureaucratic levels. Relative to systems like JI and TPs that rely on market activity by decentralized actors, AFMs are likely to involve multiple stages of administrative and political review, retain continuing political oversight of decisions once the system is established, and include more actors in program and project decisions.[38]

For example, the basic design of the GEF reflects broad multilateral negotiations in 1991 and 1994, which sought to balance the contending, and sometimes incompatible, interests of donor and recipient countries. Industrialized countries recognized that a financial mechanism like the GEF was necessary to bring developing countries into the climate and biodiversity conventions, but sought to achieve this with limited financial commitment and donor control (one-dollar, one-vote). Developing countries sought to maximize donors' financial contributions while retaining broad (one-nation, one-vote) control over governance and operations. Both sides possessed credible threats - to refuse to fund the GEF, and to refuse to join the conventions, respectively. The 1995 agreement on re-financing and a revised governance structure, with its carefully crafted double-majority voting rules, reflected the agreed compromise between these two views (Fairman 1996).

Multiple contending interests of various political and bureaucratic actors have shaped GEF policy, operations, and project criteria, in ways that have not always advanced the attainment of GEF's environmental goals. The three implementing agencies, predictably, fight over turf. An early agreement that assigned project domains to each agency in accord with their supposed "comparative advantage" [39] did not avoid these battles, since the agencies did not agree on where their comparative advantages lay, and real projects do not divide neatly into such domains.

In addition, project criteria have reflected a confused collection of goals, not all compatible with cost-effective environmental protection or with each other. For example, GEF pays only the "incremental costs" of a project, the calculated cost increase required to advance a global environmental goal. This rule, reflecting donors' interest in not paying economic rents, has two important effects. Projects with negative calculated incremental costs are excluded n the presumption that private capital markets should fund them, even if they in fact do not.[40] And

[38] Again, the GEF provides an example. In addition to the three implementing agencies, bodies with influence over GEF operations, program and project decisions include the following: the GEF Council, which approves work programs, policies, final project proposals (political representatives of 32 countries: 16 developing, 14 developed, 2 economies in transition); the Scientific and Technical Advisory Panel (STAP), which reviews scientific and technical aspects of project proposals (a panel of experts chosen by the implementing agencies); the GEF CEO and Secretariat, who review proposals and prepare annual reports and guidelines; the GEF Operations Committee, which is involved in project and grant review (the STAP chair, reps of the implementing agencies, FCCC Secretariat, and GEF Secretariat, chaired by the GEF CEO); and the recipient countries, which work with implementing agencies at the operational level in project identification, proposal preparation, and implementation.

[39] UNEP oversees "research projects", UNDP oversees "technical assistance projects", and the World Bank oversees "investment projects".

[40] This restriction principally affects certain energy efficiency and demand-side management projects.

because incremental costs are hard to calculate and defend, support tends to go to projects for which the calculation is easier. As we argued above for JI credits, this bias is likely to favor retrofits over new capital investments, even though new investments are more important for attaining substantial emission reductions. In addition, GEF seeks to distribute funds broadly across many developing countries; restricts eligibility to states with very low GNP per capita; and favors "innovative" projects that introduce a new technology or process to the host country, hence discouraging replication of successful projects within a country.

5.3. Principal Institutional Issues and Problems

In AFMs, many stakeholders are involved in negotiations and able to influence, delay, or obstruct projects or decisions. They may be able to do so even if they do not have a direct substantive connection to a project, and may choose to do so for a variety of substantive, bargaining, or ideological reasons, which in aggregate may conflict with each other or with the overall goal of cost-effective greenhouse-gas reduction. As resources and stakes rise, the obstructive effect of this accumulation of multiple objectives becomes more severe. Fairman (1996) argues that GEF's early history illustrates this phenomenon. When GEF was first established, he contends that the prominence of environmental concerns raised actors' perceived stakes in its design, and moved them to load it with many desired political objectives - understandable behavior when a new institution is being richly endowed on a high-priority issue. He argues that GEF's effectiveness has improved since 1994 precisely because the political salience of global environmental issues has declined, reducing parties' expectations of how rich and powerful an instrument GEF will be in advancing their broader political goals.

This early history has sobering implications for the, prospect of vastly expanded AFMs. As the perceived job, stakes, and financial resources in an AFM increase, at least two factors are likely to obstruct its effectiveness. First, donors would be more reluctant to pay the higher assessments and more likely to impose conditions on their payments. Even at GEF's present modest scale, securing payment has been difficult: the US, for example, contributed nothing during the pilot phase, and has so far paid only roughly 60 per cent of the $107 million/year pledged for the second phase.[41] Moreover, since donors' financial commitment to an AFM is an addition, not an alternative, to their domestic emissions abatement, increasing AFM levies may also limit donors' willingness to abate.

Second, big money means big fights. In a greatly expanded AFM, parties would increasingly seek to make the system serve numerous, disparate, and potentially conflicting policy priorities. At the political level, the system would risk becoming a forum for negotiation over the broadest political, social, and environmental conflicts. At the administrative level, increasing numbers of multiple, conflicting criteria for project funding, coupled with pressure to spend available funds, would be expected to give more discretion to administrators, and to b' projects toward the innocuous, or those with powerful proponents.

5.4. The Potential Contribution of AFMs

Because the details of AFM priorities and criteria can be politically negotiated, and because AFMs can remain under continuing political oversight, they can embed a broader collection

[41] In March 1994, as part of the GEF replenishment, the US pledged $430M over four fiscal years (94-95, 95-96, 96-97, 97-98), or $107M per year. Their payments to April 1997 total $190 Million. Other donor countries, in particular France, are beginning to invoke a clause that suspends their obligation to pay if other countries do not, posing a risk of the funding unraveling. (personal communication, F. Van Bolhuis, GEF Secretariat).

values than can market-based systems. For example, AFMs could be structured to reflect a comprehensive politically negotiated view of the relative importance of multiple environmental problems or a conception of sustainable development, or could explicitly include redistributive goals.[42] Alternatively, AFMs could support initiatives expected to bring broad, multiple benefits that are indirect or hard to measure, or to compensate for local harms imposed by broad policy reform. Multilateral AFMs can be more legitimate instruments for such goals than conventional bilateral ODA, because they reflect broader negotiation of values to be represented and are less subject to shifting political priorities of individual donors. To pursue such goals effectively, AFMs must be managed according to guidelines broader than the cost-effective pursuit of a single environmental benefit. While market-based systems normally embed a single environmental goal in the design of their instrument (credits or permits for a single type of emission, or multiple emissions contributing to a single environmental harm) and so are less well suited for pursuing such diffuse, multiple benefits, AFMs are likely to be less effective than market systems in the cost-effective pursuit of a single goal.

But the advantages of AFMs are likely only available at a modest aggregate scale of activity. At small scales, donors are willing to contribute, and both donors and recipients to participate in pursuit of a widely agreed set of environmental and related benefits. At much larger scales of activity, funds are likely to grow harder to obtain and operations likely to be hampered by increasingly contentious application of multiple and conflicting objectives.

In sum, AFMs can be and are implemented now. At current or moderately expanded scales, they are likely able to serve certain objectives better than market-based systems. These may include supporting initiatives whose likely environmental benefits are substantial, but indirect or difficult to measure; integrating multiple environmental issues; and transferring resources to the poorest nations or regions. But large expansion of their scale of activity, of the order necessary to address a substantial fraction of the global greenhouse abatement-shifting problem, would risk seriously hampering their ability to serve these goals, and are unlikely to be feasible due to donor resistance.

6. INTERNATIONAL TRADABLE-PERMITS MARKETS

6.1. Background and Basic Characteristics

We have argued that both JI and AFMs, for different reasons, are likely to be severely limited in the size of contribution they can make to the global climate problem: JI, because difficulties in measuring project-level abatement would debase a credit system at large scales, unless credits were restricted to those rather few project types for which defensible, inflation-proof accounting heuristics are available; AFMs, because large expansion would drive away donors, and would obstruct effective operations as parties sought to make projects and programs serve multiple, conflicting goals.

The third system we consider for shifting abatement effort among nations, with accompanying financial transfers, is an international market in tradable emissions permits. International experience with such systems to date has been very minor, only the exchange of CFC production permits during the phasedown period under the Montreal Protocol.[43] There does exist growing

[42] Both redistributive goals and broadly defined sustainable development goals have been carefully avoided, though, in the early operations of the GEF.

[43] International exchange of production limits was permitted under the Protocol's "industrial rationalization" provision. Both the number of international trades, and the volume of material traded, were very small (Lee, 1996). These estimates exclude trade within the EU, which is not reported. At present, no international exchange of HCFC production quotas is permitted under the Protocol.

domestic experience in the United States, most significantly the system of tradable sulfur-emission allowances established under the 1990 Clean Air Act.

The principal features that define an international tradable-permits system for greenhouse gas emissions are as follows:

1. **National Accountability:** The system focuses on national emission totals. While the system would seek to promote abatement activity at all levels from individual projects to national policies, monitoring and accountability lie with the national government.

2. **Aggregate Emissions Limit:** Participating nations would create a pool of emission permits, equal in total to an aggregate emission limit they agree to meet.

3. **Allocated Permits:** Some portion of this permit pool would be allocated to each participating nation. National allocations could be negotiated directly, or granted on the basis of some negotiated principle, such as population or historical emissions.

4. **National Obligations:** Each participating nation would be obliged to emit no more than the quantity of permits it holds. Various terms and definitions would be possible for the permits, and the form and period of the obligations: e.g., multiple greenhouse gases or only CO_2; emitted from all activities, or only certain classes; annually, or in total over some longer period.

5. **Exchange of Permits:** Nations may exchange permits, to ensure that they hold enough to cover their emissions. It is assumed that a permit market will form, similar to markets in other international financial instruments, possibly including forward, future, and option markets.

6.2. Key Tradable-Permit Participants and their Incentives

Beyond these essential features, variants are possible in many aspects of the design of a tradable emission-permit system. These can include the meaning of a permit (i.e., what activities and emissions are included; over what time; and is exchange permitted among different emissions and times, or only within each); the set of actors who can hold and trade permits; and the relationship between the international market in permits, and national regulation of the sub-national actors whose emissions the system is ultimately intended to change.

These details of system design can make large changes in the identity and interests of major system participants, and the potential contribution, pitfalls, and limits of the system. Here we seek only to elaborate a few key implications of any TP system, identify a few central design questions not yet adequately addressed, and sketch a few salient design variants.

The major classes of actors involved in an international tradable emissions permit system would include national governments; major emitters within each nation, some of whom are organized trans-nationally; other potential investors in permits; and various inter-governmental or other actors who might be involved in system implementation and oversight, depending on the particular design chosen. We discuss only the likely interests of national governments and emitters.

National governments would have several components of interest, concerning the initial permit allocation, and the operation and integrity of the system. Any government would prefer a larger allocation of permits, ceteris paribus, and allocation negotiations are likely to be diffi-

cult, but we do not consider approaches to the allocation negotiations here.[44] If few enough permits were allocated that global emissions were constrained, some nations would initially be under-endowed with permits, while others might be over-endowed. Nations interests in the operation of the system would likely depend on which of these groups they were in, or expected to be in (i.e., sellers or buyers of permits). Those expecting to have excess permits relative to immediate needs would want the system to maximize and protect permit value, so would be more inclined to favor such measures as strong monitoring and enforcement, and costly restrictive provisions for retrospective settling of emission exceedences. Those expecting to be short would prefer the reverse. All would likely prefer that monitoring of their own activities be deferential and non-intrusive.

Governments will prefer to reduce the cost of, obligations bearing on their emitters. In part, this preference will incline them to seek or grant special exemptions for their largest and most concentrated emitters. It may also lead them to favor systems with high flexibility in the location, timing, and kind of abatement undertaken, for the expected efficiency gains. Aggressive pursuit of such flexibility may lead nations to extend the domain of a permit system, in terms of the gases and activities included, beyond what can be reliably assessed or monitored (Victor 1991).

Like any system in which national obligations are defined only as national emission totals, international tradable emission permit systems grant substantial discretion in national implementation. If the permits, and the associated obligations to limit emissions, are held at the level of national governments, then governments can meet their obligation through whatever form of domestic regulation they prefer, and with whatever level of stringency.[45] National governments could use broad policies like direct regulation, taxes, or domestic tradable permits; alternatively, they could alter the form of a policy instrument or the allocation of permits to favor politically powerful sectors or regions; or they could integrate various non-greenhouse criteria (e.g., other environmental, economic, or social goals) into their policy. While any government would likely prefer to have this flexibility, exercising it would introduce disparities between the costs faced by individual emitters and the price of permits in the international market. Hence, while such discretion is clearly within the authority of sovereign governments, its exercise weakens the efficiency claims of tradable permit systems.

Emitters' interests will depend on how national governments act under a tradable permit system. If emitters face a true, competitively determined permit price with effective enforcement, then the standard arguments for the efficiency of a permit system hold. Emitters will have incentives to make abatements that cost less at the margin than the price of a permit, and to invest efficiently in technological development so as to abate more cheaply in the future.

If emitters do riot face a competitive permit price with strict enforcement (or might be able to avoid it), then various rent-seeking incentives will arise. These are the converse of governments' flexibility in implementation. Emitters may seek exemption from obligations, maximal flexibility, sensitive and deferential monitoring and enforcement, and subsidy for any costly efforts they undertake. If disequilibrium in permit markets or disparities in governments' domestic enforcement create disparities in effective permit cost between nations,

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[44] For discussions of the problems of negotiating an allocation of emission permits, see Parson and Zeckhauser (1995a, 1995b).

[45] This discretion even includes, as an extreme case, avoiding the political costs of domestic regulation entirely by buying excess permits in the international market, and issuing government bonds to pay for them.

major emitters may consider this factor in deciding where to make new investments. Governments that valued the domestic implementation flexibility of an international permit system may find their discretion restricted by domestic political forces, competition among jurisdictions for major investments, and maneuvering by major emitters.

6.3. Principal Institutional Issues and Problems

Several major issues must be resolved to implement a feasible and effective international tradable emission permit system. Among these are allocating permits; measuring and projecting national emissions; identifying and responding to exceedances; and connecting domestic regulatory systems to the international permit system, so actual emitters face the marginal abatement cost established by the international permit market. Of these, the problem of allocating permits has been extensively discussed elsewhere and we do not revisit it here, except to note that negotiating an acceptable allocation is likely to be a less severe, though still difficult, problem among richer industrialized nations than among a larger and more dissimilar group. For discussions of allocating emissions, see Parson and Zeckhauser (1995a, 1995b); Rose (1992); Barrett (1992); and Grubb and Sebenius (1992).

Any international tradable emissions permit system will require projecting and measuring national emission totals for all participating nations. Only national totals matter, not emissions created or avoided by individual projects, because permits authorize emissions anywhere within national territory and the national government bears the obligation not to exceed its permits. Both projection and measurement are required: projection, for governments to plan their domestic policies and their purchase or sale or permits in international markets; measurement, to establish baselines and to determine how realized national emissions compare to permits held.

Under the FCCC, nations are already required to report current and projected national emissions, as well as any policies and measures they are enacting with their projected effects on emissions.[46] The IPCC and OECD have collaborated to develop common methodologies for conducting national emission inventories, and have estimated the uncertainty associated with measuring particular kinds of emissions. These uncertainties span a wide range, from as low as 5 - 10 per cent for energy-related CO_2 emissions in countries with reliable energy statistics, to an order of magnitude or more for emissions from biomass burning, agricultural soils, rice cultivation, and landfills (IPCC 1995; Leggett 1994). Serious conceptual and methodological problems with some emissions and sources, as well as capacity limitations in many countries, may preclude substantial early reduction of these uncertainties. Consequently, while broadly defined permit systems that allow trading among multiple emissions and activities offer larger savings in principle, they risk including emissions that can be only poorly monitored, or whose contribution to the climate problem is not well known (Stewart and Wiener, 1990; Victor 1991; Dudek and Tietenberg, 1992; Dudek and LeBlanc 1992). Recent discussions of permit systems presume that permits would initially be defined narrowly, perhaps broadening in the future as advances in knowledge, monitoring capability, and institutional capacity allow (UNCTAD 1994).

An international tradable permit system will also require some means of verifying that national emissions have not exceeded the quantity of permits held, and of responding to and correcting

[46] The first round of emission inventories, as well as reports of policies and measures with their projected effects, were only required of Annex 1 nations. Other nations are presently required to submit only emission inventories, the first of which is due in 1997.

exceedances. In part, this will depend upon sufficiently accurate and credible measurement of national emissions, as discussed above. Because emissions, and the effects of national policies and measures, cannot be predicted with certainty, this process of verification and correction must take place retrospectively, implying certain conditions on the vintaging and fungibility of permits. When emissions inventories are completed for participating nations in a specified year, some may have emitted more and some less than the permits they held for that year, and aggregate emissions may have been above, below, or equal to the total quantity of permits. Allowing over-emitting nations to buy old unused permits from under-emitting ones would achieve part of the required reconciliation; but the possibility of monopoly power, and the possibility of aggregate global over- or under-emitting, both appear-to require that it also be possible to move vintaged permits forward or backward in time. Years with emissions less than permits would generate surplus permits that could be used in the future, equivalent to emissions banking; years with excess emissions would have to correct the exceedance by transferring permits back from the future, equivalent to emissions borrowing. While permitting both such directions of transfer through time enhance cost-effectiveness, concerns about compliance could suggest imposing extra charges or limits on the magnitude of either kind of transfer.[47] There must be some provision for ensuring eventual compliance, though, that provides credible and sufficiently strong incentives.

Finally, any international tradable permit system must include some means of linking domestic regulation in participating countries with the international permit system. Attaining the cost-effectiveness advantages claimed for tradable-permit systems requires that the actual emitters face the correct incentives, as determined by the marginal permit price in the international market, to abate in their own operations, search for lower-cost abatement opportunities abroad, and invest in research and technology. But if national governments hold permits and bear the responsibility for national compliance, then it is the governments, not the ultimate emitters, who face the international permit price, and they cannot reasonably be expected to experience the same effective incentives, or to respond in the same way, as a profit-maximizing firm.

Linking the domestic regulatory systems that determine incentives faced by emitters, and the international permit market, is a crucial aspect of any international permit system, and one that is essentially ignored in current discussions of international tradable permit systems. Current discussions effectively ignore this two-level character of the problem through one of two assumptions, which we call the "all-state" and "no-state" assumptions.

To make the all-state assumption is to ignore domestic policy entirely and assume that states will respond to a permit system as if they were profit-maximizing firms, exchanging permits internationally until aggregate national marginal abatement costs are equalized. This assumption was prominent in early discussions of tradable permit systems that stressed potential efficiency gains, or that concentrated on the problem of allocating national emission totals. It ignores the problems of disaggregating the state: how an aggregate national marginal abatement cost would be perceived by state decision-makers; and why the politic and bureaucratic forces shaping state behavior would lead it to the cost-minimizing response.[48]

To make the no-state assumption is to err in the opposite direction, unpacking the state so completely that the incentives created by international permit prices pass directly to the

[47] The US position calls for borrowing, but with a penalty.

[48] Discussions of tradable permit systems that appear to make this assumption include Swisher and Masters 1989; Grubb and Sebenius 1992; Rose, 1992; and Barrett, 1992. Hahn and Stavins (1995) recognize and avoid the problem, by focusing on two "prototype" systems, purely international trading, and purely domestic tradable permits.

ultimate emitters within each nation. Facing incentives undistorted by any governmental intervention, emitters would be expected to find efficient solutions, just as they (arguably) do under domestic tradable-permit systems. The national government is reduced to the role of a functionary or accountant, reconciling the national and international systems to ensure that marginal incentives are passed through without distortion, perhaps signing off on trades by its nationals or maintaining a pool of permits to buy and sell so as to maintain liquidity and keep national and international marginal costs equal.[49]

The "all-state" assumption appears clearly false: states do not operate like profit-maximizing firms. The status of the "no-state" assumption is more complex, for it could be correct under extremely restrictive specifications of how national governments implement the international permit system. Two examples illustrate how this alignment of domestic emitters' incentives and the international permit price could be achieved. All participating nations might agree, for example, to implement the international system by issuing national tradable emission permits, and to establish a national clearinghouse to exchange national and international permits to keep their prices equal. Alternatively, participating nations might enact domestic emissions taxes whose level they continually revise to equal the price of permits in the international market.

But these, and other forms of implementation that fully equate emitters' incentives with international permit prices, are unlikely, perhaps infeasible. Domestically, they neglect the heterogeneity of national emission sources, the need of regulated entities for a stable planning environment, and legal, political, and institutional differences among participating nations. Moreover, they exclude national governments from any active role in shaping domestic policy.

Sensible discussion of tradable permit systems must consider both the domestic and international levels of policy-making, as well as complicating interactions between them introduced by, e.g., negotiations between major emitters and their national governments, and multinationals seeking to optimize their operations internationally. Realistic tradable permit systems are likely to involve complicated combinations of domestic and intentional measures, that will obtrude on national sovereignty (Tietenberg and Victor, 1994, p. 5), but not obtrude so far as to reduce states to mere accountants or clearinghouses. Options worth exploring might include allowing major emitters to negotiate with governments to opt out of national greenhouse regulation, in return for an enforceable (and revokable) pledge to comply directly with international permit requirements; or international trading in multiple national permits, whose relative prices would reflect the risk of revocation, based on international differences in the reliability of enforcement.

6.4. The Potential Contribution of Tradable Permit Systems

Tradable permit systems may have important advantages over either JI or AFM systems in supporting efficient distributions of international abatement effort. Like JI, permit systems can mobilize private capital, and can decentralize decision-making about individual projects and activities in pursuit of a single environmental goal, cost-effective global emissions abatement. Unlike JI, tradable permit systems avoid the problem of measuring counter-factual project baselines, by placing accountability at the level of national emission totals. Consequently, permit systems are unlikely to show the bias we have argued will hamper JI expansion, in favor of project types for which project-level baselines and effects are easiest to count and defend.

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[49] Discussions of tradable permit systems that appear to make this assumption include Dudek and Tietenberg 1992; Tietenberg and Victor, 1994; and Sandor, Cole, and Kelly 1994.

Tradable permit systems do depend on measurement of national emissions totals, which presently appear to be adequate only for energy-related CO_2 emissions. Consequently, any permit system must initially be limited to these. The problem of negotiating allocations is also likely to limit near-term use of permits to high-income industrialized countries, and may pose extreme difficulties even among them. Moreover, a permit system among these nations that significantly restricts emissions may shift emissions to non-participating countries, through movement of the most emissions-intensive investment to non-participating countries or reductions in world fossil-fuel prices, creating obstacles to the subsequent expansion of the system to wider participation.[50]

But any international tradable permit system depends on careful specification of the relationship between domestic regulation and the international permit system. No proposals have yet addressed this problem realistically, and it must be solved for a tradable permit system that actually restricts emissions to be feasible. This is the priority area for policy development work and research. Of course, if a permit system is initially enacted at a level that is only very slightly constraining, the urgency of defining the domestic-international boundary is reduced, just as is the concern about emissions leakage.

7. CONCLUSIONS:

We have reviewed characteristics of three systems for international shifting of abatement effort and finance, particularly with a view to their potential for expansion. Some institutional mechanism such as the three investigated here will be essential to solving the problem of abating global emissions. They will be the primary vehicle both for controlling costs, and for distributing abatement burdens fairly among nations. Though some experience exists with all these at present, any or all of them would be transformed, and would face a host of unprecedented challenges, if expanded to the scale necessary to make a substantial contribution to the global problem. Any one of them can start small and be expanded, but the problems that may arise when they are large should be considered when they are small.

Joint Implementation (JI) is a project-based system, principally directed at transactions between target and non-target countries. JI is presently feasible, and operating at a very small scale under the pilot phase. JI could be beneficially expanded to substantially greater scale, but doing so will require attracting private investment beyond present symbolic levels, which will depend on the enactment of some form of regulatory credit for successful abatement or sequestration through JI. If credit at the international level is not politically feasible, then any major investor nation could promote JI by enacting national-level credit. This represents a substantial opportunity for national leadership, which could greatly expand the data available on how to do JI and what pitfalls to avoid. Because granting such national credit to sub-national investors would not reduce a nation's aggregate emissions obligation internationally, granting national credits would represent over-compliance with that obligation. Consequently, a nation enacting national credits might only be willing to accept a less stringent national obligation than otherwise. While substantial expansion of JI from present levels is likely to be both feasible and beneficial, JI cannot address a large fraction of the overall global abatement problem, due to problems in the credible measurement of emission effects that are intrinsic to project-level accounting. These measurement problems are likely to shift JI investment into sectors and project types that are easiest to count, particularly retrofits, emissions recapture, and planting

[50] The problem of leakage is not unique to a permit system, but can arise whenever some subset of nations impose stringent limits on their emissions while others do not.

of unforested land. A bias toward such project types, and away from modifying the characteristics of new and expanded capital investment, will seriously limit JI's ultimate contribution, and may also make it vulnerable to the host-country concern that JI allows foreigners to claim the cheapest and best abatement opportunities.

Administrative Financial Mechanisms (AFMs), like JI, are feasible and valuable to undertake at their present modest scale, or significantly larger scales. Of the three systems we consider, only AFMs do not rely on decentralized market choices for implementation. Consequently, they are best able to reflect politically expressed tradeoffs among multiple environmental issues; to support activities believed highly beneficial, but whose benefits are-multiple, diffuse, or non-appropriable; or to incorporate redistributive objectives. With these as their strengths, though, AFM operations should not be strongly driven by cost-effectiveness criteria for narrowly defined environmental targets; to do so would neglect their areas of strength, instead pursuing narrow targets for which AFMs likely cannot equal the performance of market-based systems.

But AFMs are also likely, like JI, to be severely limited in the magnitude of their contribution to global emissions abatement. With increasing resources and scale of operations, AFMs will be increasingly obstructed by a) donor reluctance, b) multiple actors' opportunities to influence the character of projects and programs, and consequently c) the sclerotic effects of increasing conflict over multiple contending criteria and goals, and over control of the system, that will likely become debilitating as large resource transfers are instituted or expected.

Unlike JI and AFMs, tradable permit systems do not appear intrinsically limited in the scale at which they could operate. Consequently, of the three systems considered here, they appear to be the only one that could contribute a substantial fraction of the required job of shift global abatement effort and resources. They face serious unresolved difficulties of negotiation and implementation -- e.g., negotiating national allocations, developing acceptably reliable emissions inventories, and monitoring - but these may be rendered manageable by starting small and expanding. The most serious presently unaddressed problem in the design of an international permit system concerns the relationship between national obligations and domestic regulation. Very simple and restrictive implementations may be feasible in the near term, between similarly situated nations and with controls enacted at very gentle levels. Any attempt to extend tradable permit systems further - in the diversity of nations or domestic implementation modes included, or in the stringency of aggregate controls -- will require substantial progress on elaborating the border between domestic regulation and international obligations.

Two of these systems presently co-exist, JI and AFMs, albeit at small scale. If the scale of abatement effort, and attempts to distribute it internationally, are expanded, multiple systems will likely continue to co-exist. To consider the implications of expansion, it is important to think in advance, even if speculatively, about how multiple systems might interact.

Multiple systems might be administratively separated, with particular systems restricted to certain nations or certain classes of projects. For example, one current proposal would establish a tradable permits program among Annex-i countries only. Other countries would be allowed to opt into the permits system, subject to agreement on a national baseline, a permit allocation, and a system for monitoring and verification. JI would be retained for projects in countries that do not opt into the permit system.

This proposal would renounce the immediate benefits of trading across a broader set of countries, emissions and activities in favor of enacting a small viable starting point, with the possibility of future expansion. Indeed, the starting point could be limited to only a few

enthusiastic nations, for any participant would surely have to accept the conditions specified for non-Annex 1 opt-in, and not all Annex 1 nations might be ready to do so. Allowing opt-ins from non-Annex 1 would mitigate the risk to long-term political sustainability of the system that might otherwise be posed by less than full participation.

But it is highly uncertain how many nations would wish to join. Gains from attracting emissions-intensive industry might motivate some nations to stay outside the system, unless it were accompanied by effective incentives to join. Retaining JI for countries outside the trading system might not mitigate this incentive since as we have argued, credited JI will be most feasible in projects that do not alter the characteristics of new investment.

If multiple systems overlap in their domains„project proponents and investors could potentially choose whether to propose particular activities for permit or JI credits, or seek funding from an AFM. The advantages of each system for a particular project or investor will likely depend on implementation details, but there may also be broad patterns that attract certain kinds of projects to particular systems.

From the investor's perspective, if their domestic regulatory system treats credits derived from JI projects and purchased tradable-permits equivalently, then the choice between the two will depend on the price and security of the instrument, which could vary depending on the degree of pooling underlying each, [51] and market conditions. From the project developer's side, the advantages of JI or tradable permits will also depend on implementation details, including the rigor and administrative burden of obtaining certification, whether at the national or international level. JI credits, even if pooled in a market, are ultimately generated by individual projects, while tradable permits are created and reconciled at the level of national aggregate emissions. Consequently, the host-country government would have to be more centrally involved in negotiations over a project to generate tradable permits than one being developed for JI credits. Which route the developer preferred may depend on domestic political and policy details, but it is likely that developing a project for tradable permits would shift a larger share of project risk onto the host-country government. Project developers who have a choice may consequently prefer to develop the riskiest projects for permits, and the less risky ones for JI credits.

It has often been proposed that a central purpose of JI is to serve as a transitional system to a full tradable permits system (Swisher, Masters 1992). This transitional role for JI has obvious advantages, in that JI can mobilize private activity and gain experience with project activities, emissions accounting, and monitoring, at an initially small scale.

But JI experience in project-level accounting and monitoring may be of limited relevance to problems of national monitoring and accounting posed by a grit system, which include assessing the emissions effect of aggregate national policies.[52] Moreover, the transition from an initial system of JI with credits to a full permit system would not be smooth, and could require negotiations with each joining nation essentially as difficult and complex as those required to establish a permit system from nothing. JI credits account for the abatement effect of individual projects, while tradable permits denominate accountability for all national emis-

[51] E.g., are JI credits associated with individual projects? If they represent pooled credits from multiple projects, then how many projects, of how many types, in how many locations?

[52] Some components of national inventories may involve monitoring individual activities, projects, or factories, but most will likely be based on aggregated national statistics or emission proxies.

sions. The negotiation of a baseline and allocation for a nation joining a permit system will have to account for total national emissions, including the large residual unrelated to JI projects. Having JI projects in a country in no way eases this negotiation, for however large their contribution to abatement may be, the remainder of national emissions may have been growing freely. There may well be a powerful and beneficial transitional role for JI, but it much more likely lies in disseminating knowledge about, and confidence in, abatement technologies that may increase national officials' willingness to undertake aggregate commitments, than in providing a seamless administrative transition to a full permit system.

Whether they choose to operate through JI or tradable permit markets, private investors are likely to find the most cost-effective projects, while AFMs are largely left with projects whose returns are lower, riskier, or harder to count. Since AFMs serve other purposes, including distributive ones, they should not be held to compete against market systems on narrow cost-effectiveness measures. Because they serve important functions that cannot well be provided by markets, they must be protected from the erroneous perception that their purpose is to abate emissions in the same way, and according to the same criteria, as market-like abatement systems.

Enacting and implementing any system, or combination of systems, to shift emissions and effort on the scale discussed, will be a serious challenge. Large-scale international tradable permit systems, or combined systems, will substantially affect economies, societies, and multiple environmental values, and must be designed so as to accommodate concern on these dimensions. All these systems seek to establish environmental incentives for sub-national actors independent of the state in which they take place. Consequently, all obtrude on sovereignty to at least some extent, shifting some control over the incentives of emitting actors from national authority to an international system, albeit one agreed collectively by states. Tradable permit systems presently appear to offer the best prospect for expanding, as political will and technical feasibility allow, to a scale able to address the global environmental goal. But the preferred system, or more likely the preferred combination of systems, must be worked out incrementally and dynamically, with experimentation at scales moderately expanded relative to the present and careful consideration of the range of environmental, developmental, and social values that such systems would affect.

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JOINT IMPLEMENTATION AND ITS ALTERNATIVES: CHOOSING SYSTEMS TO DISTRIBUTE GLOBAL EMISSIONS ABATEMENT AND FINANCE

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1. INTRODUCTION

Controlling global growth of greenhouse gas emissions, thereby attaining the central goal of the Framework Convention on Climate Change (FCCC), [1] is widely believed to require some system for shifting emission-abatement effort among nations with accompanying exchanges of money and technology. There are three reasons for this: large reductions in global emission trends will be expensive; distributing the abatement effort efficiently among nations, cutting more where cutting is cheaper, is projected to reduce cost drastically, perhaps by half or more;[2] and the cheapest abatement opportunities appear to reside at present in developing countries and transitional economies which can ill afford to undertake them.[3]

Developing countries accepted no abatement obligation under the FCCC and have strong arguments against being expected to bear any such burden soon. While their projected development is likely to make the largest contribution to global emissions growth, they have highly constrained resources and many more urgent priorities than climate change. Moreover, the present industrialized nations, through their past fossil-fuel use and greenhouse emissions, are most responsible for the present excess atmospheric burden of greenhouse gases. If developing countries grow rapidly enough, however, even the most extreme cuts in industrialized countries may be insufficient to attain a stringent global target. Developing-country participation in

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[1] The FCCC's central goal is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2).

[2] For example, the Intergovernmental Panel on Climate Change (IPCC [1996], WG 3, Ch. 10) estimated that for each country to hold its emissions at 1990 levels would cost 0.2 - 0.7 per cent of world product by 2010, rising to 3 - 7 per cent by late next century. Global costs of this target are projected to be 20 to 50 per lower if abatement is distributed among nations in the lowest-cost way. Such redistribution of abatement effort would not weaken the environmental goal, because where a ton of emissions occurs has no affect on its contribution to global climate change.

[3]The claim that the cheapest abatement opportunities are in developing countries has been disputed (e.g., Shukla, 1996), and need not remain true even if it presently is true. Some projections show that after 30 to 50 years of

abatement is thus essential in two ways: to make stringent global abatement goals feasible and to minimize the cost of attaining any global goal.

To attain such substantial participation of developing countries and transitional economies in global abatement goals, a cooperative system should create incentives to abate where it is cheapest to invest in technologies that advance abatement possibilities, while transferring finance and/or technology as necessary to ensure that all parties to the exchange benefit.

While many such systems are possible, varying in dimensions of institutional and policy detail, three broad classes of systems have been proposed which dominate current debate. These three systems, Joint Implementation (JI), international tradable emissions permits (TPs), and administrative financial mechanisms (AFMs), differ from each other in basic respects and have all accumulated at least modest relevant experience. Joint implementation and tradable permits are both familiar terms, while "administrative financial mechanisms" is a term we propose to denote politically negotiated, centrally administered systems that transfer public funds internationally, according to agreed criteria, in support of environmental projects. Prominent current examples of AFMs are the Global Environment Facility (GEF) and the Multilateral Fund of the Montreal Protocol on the Ozone Layer. Though AFMs are not market-based systems like JI and TPs, they pursue the same goals, shifting abatement effort among nations with accompanying financial and technological support.

This paper seeks to clarify the basic differences among the three systems, to identify the major actors involved in the functioning of each system and their key interests, and to identify each system's most and least promising areas of application. In particular, because the job these systems must do may be large while current international experience with each is very modest, we consider how each system would function, and what potential pitfalls or obstacles might arise, if its scale were greatly increased.

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continued rapid growth in developing countries, the cheapest emission abatement opportunities may then reside in the present OECD. [Edmonds et al, 1995]

The paper devotes most attention to the potential contribution and limits of JI. For AFMs and TPs, the discussion is much more limited. We outline their basic defining characteristics and identify key issues their potential for expansion. A concluding section summarizes relative advantages and disadvantages of the three systems and briefly explores the implications of more than one system co-existing, how they might interact, and how a practicable and effective combination of systems can be designed. Since experience with all three systems is limited, and since all three admit of many detailed design possibilities, our discussion of their potential and limits must be informed by general theoretical argument and analogy as well as empirical evidence and is inevitably speculative.

Section 2 summarizes relevant provisions from the FCCC, arguing that it admits the possibility of any one or more of these systems, though full implementation of any would require substantial further negotiation of institutional detail. Section 3 estimates the size of the job such a system must do, through order-of-magnitude estimates of how much emissions, and how much money, must shift between regions to move from a plausible simple negotiated allocation of emissions to a cost-minimizing distribution. Section 4 summarizes the basic characteristics, present experience, and potential for expansion of a JI system. Sections 5 and 6 present parallel, more limited discussions for administrative financial mechanisms (AFMs) and tradable permit systems (TPs) respectively, while Section 7 provides conclusions.

2. THE TREATY CONTEXT

Reflecting a recognition that high abatement costs could weaken its acceptability and sustainability, the Framework Convention (FCCC) includes language consistent with several alternative systems to share abatement burden globally and make associated transfers.[4] In

[4]The Convention delineates two classes of national parties that undertake specific obligations. "Annex 1 parties", the industrialized countries plus Eastern Europe and the former Soviet Union, undertook the soft 2000 emissions

language carefully crafted to meet developing countries' concerns that they be compensated for any costly measures they may undertake while meeting industrialized countries' concerns not to commit to an open-ended transfer program they cannot control, the Convention explicitly provides for a "financial mechanism", assigns it to the Global Environment Facility (GEF) on an interim basis, and calls (a little ambiguously) for developed-country parties to bear the costs that developing countries incur in meeting their obligations under the convention. The relevant passages are as follows.

> "A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined." (Article 11, Paragraph 1).
>
> "The Global Environment Facility of the United Nations Development Programme, the United Nations Environment Programme and the International Bank for Reconstruction and Development shall be the international entity entrusted with the operation of the financial mechanism referred to in Article 11 on an interim basis." (Article 21, Paragraph 3).
>
> "The developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measures…" (Article 4, Paragraph 3).

In other passages primarily addressing industrialized countries' concerns about the potential cost of emission abatement, the Convention endorses the pursuit of it goals at minimum cost and provides for "cooperative" and "joint" efforts to achieve abatement targets.

> "The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects…taking into account that

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Target. "Annex 2 parties", the industrialized countries alone, also undertook to support the costs of developing country parties meeting their obligations under the Convention. These costs are presently very modest, being limited to the preparation of national emissions inventories and reports, but the commitment would also (arguably) extend to more substantial future costs attendant on abatement obligations.

policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost." (Article 3, Paragraph 3).

"Efforts to address climate change may be carried out cooperatively by interested Parties." (Article 3. Paragraph 3).

"…developed country Parties and other Parties and the other Parties included in Annex I may implement such policies and measures jointly with other Parties and may assist other Parties in contributing to the achievement of the objective of the Convention." (Article 4, paragraph 2a).

Emerging from careful balancing of not fully compatible concerns of industrialized and developing countries, this language admits multiple possibilities. It provides the possibility of either an Administrative Financial Mechanism (AFM) such as the GEF, or of Parties agreeing among themselves to share or exchange abatement effort, presumably with whatever accompanying provisions they agreed on. The language appears to be consistent with either JI or TP systems, though a full tradable permit system would require substantial further elaboration. The language also admits the possibility that more than one such system could operate.

Following negotiations of the Convention, supporters of JI moved quickly o develop national JI programs and individual projects. As these initiatives sought to make thhe vague concept of JI operational, they revealed two important ambiguities in the FCCC language: participation and credits. On participation, Article 4.2(a) clearly permits JI between Annex 1 parties, but the ambiguous reference to "other Parties" does not clearly determine whether or not the Convention also permits or encourages JI between Annex I and non-Annex 1 parties (Metz 1995). The Convention makes no explicit mention of whether JI activities should create credits against national abatement obligations, but many JI advocates argue that such credits are intrinsic to the concept of two nations jointly meeting an aggregate abatement obligation.

Both these matters were provisionally resolved at the first Conference of the Parties in Berlin (March 1995). The Berlin Decision established a pilot phase known as "Activities Implemented Jointly" (ALT) in which any countries may participate but for which no credits will be granted. An international abatement or sequestration project can gain official AIJ status if governments in both host and

investor countries approve it and report it to the Convention secretariat. AIJ projects must represent both additional funding and additional emissions abatement relative to what would otherwise have occurred. Still unresolved and contentious are the duration of the pilot phase and the future status of credits (FCCC/CP/1995/7/Add.1).

3. ESTIMATING THE SIZE OF AN EMISSION-SHIFTING SYSTEM'S JOB

The cost saving available from a system to re-distribute emissions and the size of the required re-distribution both depend on what international pattern of emissions would prevail without such redistribution. This cannot reliably be predicted, but a reasonable assumption would begin from current negotiating proposals. Among OECD countries, most proposals take the form of equal percentage changes from a historical baseline. For example, often-proposed targets include limiting each nation's emissions to their 1990 levels or cutting them by 10 to 20 per cent from those levels.[5]

From any such starting point, redistributing emissions can reduce costs whenever participants' marginal costs of abatement differ. Global studies that compare "all nations freeze" to the lowest-cost way of meeting the same global target typically find savings of 20 to 50 per cent, roughly hundreds of billions to trillions of dollars per year by the middle of the next century (IPCC [1996], Manne [1993], Martins et al [1993], Edmonds et al [1995], Rose and Stevens [1994]).[6]

[5]Parson and Zeckhauser (1995a, 1995b) present an argument why such simple targets are attractive and how they are likely to obstruct climate agreements, with a critique and alternatives. Australia's recent proposal that OECD countries' obligations should be based on equal fractional GDP loss supports their claims (Greenwire, November 3, 1996)

[6]There are also projected to be very large savings available from efficient shifting of emissions abatement effort over time. For example, Wigley, Richels and Edmonds [1996] compare alternative time-paths of CO_2 emissions to hold atmospheric concentration in the year 2100 below various target levels. Relative to policies requiring immediate reductions of emissions, alternative trajectories that allowed emissions to rise for a time, then drop sharply, reduced present-value abatement costs by half or more. While part of this saving came from discounting, much more came from avoiding premature scrappage of capital, technological change, and natural carbon uptake

While theoretical potential savings grow larger as more countries participate, even two countries can save by redistributing their abatement effort efficiently. Surprisingly, estimates of savings from emissions redistribution among relatively few industrialized countries are of the same order as those estimated from global redistribution.[7] While the size of these savings estimates are highly uncertain, such similar estimates of available gains from global cooperation and from north-north cooperation suggest two possibilities: the 20 to 50 per cent estimated savings from global cooperation may be low, or moving from Annex 1-only to global cooperation may yield little additional savings.[8]

These savings estimates represent the gains available from a system of emissions redistribution. The size of such a system's job is presented in the other side of the estimates: how many tons of abatement effort, and how much money, must move between nations to realize these savings. It is possible to calculate such an estimate from one published analysis and the figures so obtained are very large. With world emissions held at 1990 levels, shifting from "every nation stabilizes emissions" to the optimal distribution requires shifting 15 to 20 per cent of world emissions between regions over the next 35 years (approximately 1 Billion tonnes of carbon emissions per year), with an associated financial transfer of about $250 Billion/year in 2035,

muting the long-term effect of early emissions increases. In contrast with the gains available from inter-regional shifting of emissions, no specific negotiating proposals have yet been advanced to capture these savings. In this paper, we consider only institutional arrangements to support more efficient distributions of abatement effort among countries, not over time.

[7] Barrett [1992] estimated 50 per cent cost savings from efficient stabilization of CO_2 emissions (1990 levels) within the EU alone. One study, which considered a 20% CO_2 reduction by 2030 among only three countries - Switzerland, the Netherlands, and Belgium - found that efficient allocation of abatement reduced costs by 18 per cent, or $3.2 billion (TEA [19941, Balm [1996]). Wise and Edmonds [1996] calculate that optimal redistribution of an emission stabilization target among Annex 1 nations could reduce costs by 40 per cent.

[8] Of course, it could also be the case that the estimated savings for trading among Annex 1 countries are too high, but the models are likely more reliable in their representation of these economies than of the developing countries.

growing to $1.2 trillion/year by the end of the century.[9] These estimates are lower bounds since they reflect only movements between regions in a nine-region world model.

These are rough estimates, based on one study using one model. But even if the estimates are only correct to within an order of magnitude, the job facing any system of re-distributing emissions is large and difficult. The required financial flows are comparable to total net resource flows to developing countries in 1995 (roughly $240 Billion in 1995), and dwarf current ODA for environment, and for all purposes (a few billion, and $60 Billion respectively). Consequently, any of these systems must be evaluated with a view to its suitability for large-scale expansion.

4. JOINT IMPLEMENTATION:

4.1. Background and Basic Characteristics

While the Framework Convention does not precisely define JI (there is significant difference of view over what it ought to be), the following characteristics capture most of current practice and advocacy (Mintzer 1994; Watt et al, 1995; Wexler, Mintzer, Miller 1994).

1. **Project-Centered**: JI promotes project-level international investment in emissions abatement or sequestration. The activity, monitoring, and accountability all lie at the level of an individual project. While this focus on projects is not evident in the Convention language, it has emerged as the predominant interpretation of JI. Focusing on individual

[9] Edmonds et al [1995] estimated regional costs of holding world emissions at 1990 levels under several alternative inter-regional distributions of emissions. The estimate presented here is derived from examining their total regional revenues from exchange of emissions when distributed according to a "grandfathered" allocation (each nation receives permits equal to its 1990 emissions), and dividing these by the carbon tax in each year (which equals the price of a ton of emissions at the margin). With a marginal permit price of $150/tonne in 2035, rising to $450 in 2100, their estimated inter-regional revenues yield an inter-regional emissions shift of 1 Billion tonnes/year. (All monetary figures are in 1990 dollars). All estimates are of movements among regions, with all regions except the USA much larger than an individual country. Consequently, movement of funds and emissions among nations, including intra-regional movements, would be higher.

projects makes it possible to consider JI between two countries when only one is bound by a national emission obligation.[10]

2. **Decentralized Project Identification**: Many decentralized actors may identify and promote projects and negotiate deals.

3. **Private Funding:** While government funds may be provided, a primary focus is on encouraging private investment. JI pilot programs show variation on this; some fund projects directly while others provide minimal public funds and facilitate private investment. However, all stress that the bulk of JI investment must ultimately come from private sources.

4. **Government-defined Criteria**: Governments define criteria for recognizing projects as JI, impose reporting and other requirements on projects to determine if they meet the criteria and register projects that do.

5. **Credits Against a Regulatory Burden:** Successful JI projects will allow their investors to avoid a regulatory obligation -- a requirement to abate elsewhere or to pay a tax -- through the granting of credit. Credit has been highly contentious and must be considered separately for the cases in which all countries participating in a JI project are, and are not, under national emission limits. In the former case, credit appears to be intrinsic to the concept of JI. Abatement projects without credits may be valuable and may be done, but could not reasonably be called the joint implementation of a shared abatement obligation. In the latter case, credit has been even more contentious and its definitional status is weaker. In the absence of two national commitments that can be added to yield a joint commitment, it is not obvious what a JI project is jointly implementing or that the granting of credit is intrinsic to the concept of joint implementation (Government of Brazil 1996). [11] The voluntary inclusion of non-Annex I countries in transactions and the absence of credit are the two basic distinctions between JI and the present AIJ pilot phase.

[10] In the US "non-paper" tabled in Geneva in December 1996, JI was defined by its taking place between target and non-target countries.

[11] Later we argue that granting credit will be necessary to motivate a substantial increase in private investment in JI, but this argument is distinct from the assertion that credit is essential to the concept of JI.

4.2. Current JI Program and Project Experience

Several countries established national JI programs before the Berlin decision. By early 1997, seven industrialized countries interested in supporting investment in JI abroad had established national JI programs: Australia, Canada, Germany, Japan, the Netherlands, Norway, and the United States. In addition, several developing countries interested in hosting JI projects had designated national JI authorities.[12] These programs all define standards for certifying projects, maintaining national project registries and negotiating bilateral or multilateral umbrella agreements with other countries to facilitate project development. All also provide some government support, ranging from purely administrative support to government project financing. Beyond their broadly similar functions, JI programs in investor countries differ in several significant respects. They have substantial differences in scale and experience, and in their relative emphasis on private and public funding, the extensiveness of their application process and monitoring requirements and in their extent of regional or sectoral specialization.

The United States Initiative on Joint Implementation (USIJI) was the first national program, established in October 1993.[13] Launched before the Berlin decision to disallow credit in the pilot phase, USIJI has continued to promote projects since then, but it has become clear that funding them poses substantial difficulty. USIJI strongly emphasizes motivating and facilitating private-sector investment rather than channeling public funds. While US government agencies have provided modest funding for a few projects, USIJI otherwise depends entirely on private financing from firms or NGOs. Through USIJI, the United States has negotiated ten "Statements

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[12] While registering an AU project requires approval of both governments, a national program is not necessary. Costa Rica is the only host country with a national JI program and office, but several others actively promote JI, have signed bilateral or multilateral umbrella agreements, and have designated officials responsible for JI in their environment or foreign ministries. A list of national JI contacts is provided by the FCCC Secretariat at www.unfccc.de/fccc/ccinfolaijcont.htm.

[13] USIJI is an interagency activity. The Department of State chairs the interagency working group while EPA and DOE co-chair the evaluation panel and are lead agencies for the Secretariat. Other participating agencies include AID, USDA, Commerce, Interior, and Treasury.

of Intent" with non-Annex I countries, enabling documents to promote,and facilitate negotiation of subsequent projects. USIJI has registered the largest number of projects of any JI program, twenty-four projects in ten countries as of early 1997.[14] Nearly all USIJI projects involve a partnership between one or more US firms, a US environmental NGO, and an NGO or government agency in the host country. USIJI requires project proponents to demonstrate additionality of abatement, requires follow-up monitoring with replicable methodologies and independent audit, and puts the onus on the project proponent to estimate baseline emissions.

The Japanese AIJ/JI Initiative, established in January 1996, includes both publicly and privately funded projects. Each participaling Ministry is responsible for evaluation and approval of projects initiated by members of its constituency. For example, MITI is responsible for projects initiated by industry whereas the Environment Ministry is responsible for projects initiated by environmental NGOs. Of eleven projects approved by the Japanese government in the initial round in 1996, one is funded entirely by the national government,[15] one by a municipal government, and the remainder by private firms and foundations. All projects but one are located in the Asia-Pacific region. Japan's program, alone among the investor-country programs, does not require host-country approval before approving the project. None of the initial eleven projects has yet completed negotiations with the host country to receive its approval, so none has yet attained the status of official AIJ (Suzuki 1996; Matsuo 1997)

The Netherlands' Pilot Phase Program on AIJ was established in September 1995, though the government had been promoting JI as early as 1993. Early Dutch support of JI included a conference, two published volumes and a quarterly JI newsletter (Kuik, Peters, Schrijver 1994; Jepma 1995). The program has government funding of $29 million for projects in developing countries and $22 million for Central and Eastern Europe over the period 1996-99. In an initial

[14]USIJI accepted seven projects (of twenty-five proposals) in October 1995, eight (of twenty-one proposals) in December 1995, seven in December 1996 and two in February 1997.

[15]The funding agency is the New Energy and Industrial Technology Development Organization (NEDO).

stage, a monitoring and analysis component was added to four small pre-existing bilateral projects in Russia and Hungary to make them serve as JI test projects. In addition, new forestry projects were developed in Ecuador, Uganda, and the Czech Republic and a Micro-hydroelectric project was developed in Bhutan (Netherlands Pilot Phase, 1995). While initial projects have mostly been publicly funded, the program also seeks to encourage private JI investment, which is expected to become dominant after the pilot phase. Verified AIJ reductions may be considered in negotiations of future emissions agreements between industry and the Dutch-government. This is the closest that any present program has come to granting national credits.

Norway participates in a joint JI program with the World Bank, which has funded efficient residential lighting in Mexico and coal-to-gas conversion in Poland. The Government of Norway provided modest co-financing to each project while the GEF and the host-country government provided the bulk of the funding. [16] The Norwegian government has also developed bilateral AU projects with Costa Rica (JI Quarterly, December 1996) and Burkina Faso. Though the Norwegian JI program has been publicly funded so far, it endorses the necessity of ultimately moving to private finance (Anderson 1995; Nordic Council of Ministers 1995). In addition to Norway's national initiatives, the Nordic Council has conducted a study of five ongoing energy related bilateral projects in Eastern Europe to evaluate the suitability of such projects as JI (JI Quarterly, December 1996).

The German JI program, established in 1996 in the Environment Ministry, emphasizes projects in energy efficiency and renewables. Seven projects in fuel-switching and efficiency are under development -- four in central and eastern Europe, one in Portugal, and two in non-Annex I countries. These last two, in Indonesia and Jordan, are being undertaken by the E-7 international consortium of electrical utilities (JI Quarterly, March 1996).

[16]The $23 M cost of the Mexican. (ILUMEX) project was provided by the Mexican Government ($10 M), GEF grants ($10 M), and Norway ($1 M). The $52 M cost of the Polish project was provided by the Polish government ($26 M), GEF grants ($25 M), and Norway ($3 M) (Anderson, 1995).

The Canadian JI Initiative, announced in July 1996, consists of a small office located within the Ministry of Natural Resources operating under the guidance of an interdepartmental steering committee. The program supports Canadian private investment in JI projects but provides no government funding for projects. Program documents stress export promotion benefits. To ensure additionality of financing, projects that are entirely funded from the Canadian International Development Agency (CIDA) are excluded, though those partially funded from ODA sources can be considered. While the program requests documentation similar to that required by, USIJI, in practice reporting requirements are so flexible that no project will be excluded due to lack of information (Canadian Joint Implementation Initiative 1996; Hornung 1996). No projects have yet been reported under the Canadian initiative.

The Australian AIJ Pilot Initiative, located in the Department of Primary Industries and Energy, was also established in 1996. The program will facilitate and register private-sector investment activity, and stresses commercial benefits to Australia (Australian AIJ Pilot Initiative, 1996). As of late 1996, the Australian initiative was in the early planning stage for two projects to be implemented in the South Pacific region.

The national programs reflect different views as to what is most important in the early stage of JI. The Dutch and Norwegian programs acknowledge that private funding is needed in the longer term, but treat the immediate problem as getting demonstration projects in place. With these, one can experiment with methods of determining baselines, calculating and measuring emissions and sequestration effects, and identifying and mitigating potential sources of leakage. The programs regard these as things that must be learned whatever the funding source and seek to move quickly by using public funding. USIJI, and the other programs that stress private participation, treat the immediate problem as mobilizing private activity and their role as support: technical assistance, training, identifying projects and identifying, recruiting, and educating private participants.

In additional to national JI programs, at least three private-sector initiatives also seek to promote profitable foreign investments to reduce or sequester GHG Emissions. One of these

programs is sponsored by the US electrical industry through the Edison Electric Institute, one is sponsored by eight major electrical utilities from the G-7 countries, and one is sponsored by the World Business Council on Sustainable Development (WBCSD).

The Edison Electric Institute supports two activities: projects in energy efficiency and renewable energy are supported through the international Utility Efficiency Partnerships (IUEP), while projects in carbon sequestration through forestry are supported by the Utilitree Carbon company. IUEP is supported by eight US utility companies. In turn, IUEP supports projects by US electrical utilities or their subsidiaries that abate emissions internationally and yield financially attractive rates of return. Promotion of export opportunities for the industry is a central goal of the program. On the argument that JI projects are often small in scale, have significant transaction costs, and represent an investor's first entry into an unfamiliar market, IUEP provides seed money to support such activities as feasibility studies, host-country negotiations, and environmental impact assessments. IUEP selected nine projects for support in 1996 while ten more are under development in 1997.[17] Host-country agreement is not required for a project to qualify for the program, but most IUEP projects are intended to qualify as USIJI projects, for which host-country approval is required (Edison Electric Institute 1996). The Utilitree Carbon Company, sponsored by 40 US utility companies, announced its first five projects in August 1996, of which three support carbon sequestration in US forests and two, one of which has been approved and one of which will be submitted as a USIJI project, protect forest or improve forest management in non-Annex 1 countries (Utilitree Carbon Company, 1996).

Eight electrical utilities from the G-7 countries established E7, a non-profit organization to promote efficient generation and use of electricity and protect the global environment, in 1992. E7 members cooperate to pursue various environmental projects and are developing three projects

[17]Activities selected for IUEP support in 1996 include biomass energy projects in Belize, Guatemala, and Nicaragua; a new combined-cycle natural gas plant in Colombia; a fluidized-bed coal plant in the Czech Republic; an efficient electric motors project in Ghana; efficient lighting projects in Bulgaria and Honduras, and a hydroelectric efficiency project in Brazil.

that may eventually be submitted as JI/AIJ projects: renewable electricity supply for remote communities in Indonesia, improved efficiency of thermal power plants in Jordan, and micro-hydroelectric development in Zimbabwe ("Electric utilities promote JI", 1996).

The World Business Council on Sustainable Development (WBCSD) launched a JI initiative "International Business Action on Climate Change" (IBACC) in January 1996. The program does not provide project support, but rather seeks to facilitate and showcase business actions to reduce net emissions and yield profitable returns. Proponents or developers submit project information in a standard format that includes provisions for monitoring, external review, and potential sources of emissions leakage. By early 1997, more than 100 proposals had been received. The project proposals are of highly diverse character. Some are fully implemented while others are at an extremely preliminary stage of development and seek listing in hope of obtaining financing. Some have gained or are pursuing registration under national JI programs. A few are located in industrialized countries, or even internal to the normal operations of the listing company. While many proposals were advanced by host-country bodies, the WBCSD does not require official host-country approval as a condition for listing ("International Business Action on Climate Change", 1996).

Table 1 summarizes the status, as of early 1997, of JI and AIJ projects that have been approved by both governments. Of the 40 projects listed, 24 are US and 16 are non-US. Sectorally, sixteen projects are in forestry and land use; thirteen are in electrical generation (renewable, geothermal, or biomass); three are in retrofit fuel switching; six in energy end-use efficiency and two in methane capture from gas pipelines or landfills. All have some cost-sharing with a host-country sponsor, either the government, a firm, or an NGO. All involve either north-south or east-west partnerships (between OECD countries and either non-Annex 1 countries or Eastern Europe or Russia). [18]

[18]More detailed discussions-of AIJ projects can be found in. Schmidt [1996], Figueres et al [19961, the Joint Implementation Quarterly (JIQ [19961), and the Web-site JI Online (www.ji.org). One German project under development with Portugal will be the first JI project within the OECD.

At the project level, the JI landscape is a jumble of projects at various stages of development and official status. The FCCC Secretariat only records a project as official AIJ once a) all participating governments have designated a responsible JI authority, and b) all authorities have reported, separately or jointly, that they approve the project as AIJ. As of December 1996, 13 projects had met this requirement. [19] This status reflects only administrative and reporting/approval requirements, implying nothing concerning a project's state of implementation or funding.[20]

Many more projects are under development (some with approval of one government), which are considering seeking official recognition as JI. In addition, a great many other bilateral development initiatives and private investments in energy or land-use could plausibly be characterized as JI. This is evident from some national programs' adding monitoring and analysis components to pre-existing projects to turn them into AIJ and from the large number of profitable (or potentially profitable) private initiatives being developed under the IUEP and WBCSD programs.

Being fully funded is not required for approval as a JI project; many projects are not. Rather, it was hoped that JI listing would help worthy projects secure financing. While the projects of the Dutch and Norwegian programs are fully funded, mostly by their sponsoring governments, most projects approved by USIJI, and by the other national programs that pursue private financing, are not. Assessing funding status is full of ambiguities; funding details are not publicly available, and projects may proceed in phases or with less than complete funding. Still, it

[19] These include eight USIII projects in Costa Rica, two USIII projects in Russia, two Netherlands projects in Hungary, and one Norway-World Bank project in Mexico.

[20](F000/SBSTA/1996/17; personal communication, Mr. Kai-Uwe Schmidt, FCCC Secretariat)

appears that by early 1997, fewer than ten USIA projects had attained funding levels sufficient to proceed with development, and only two were completed and operational. [21]

In sum, current JI projects are few in number, small in scale, and hard to fund. Many projects are at early stages, so it is too soon to evaluate project effectiveness. Most claim substantial incidental benefits to the host country; some claim profitability. Several projects have multiple participants with funding from more than country, suggesting the importance of careful accounting to avoid double-counting.

4.3. Key JI Participants and their Interests

A JI project requires the participation of several actors, with different concerns and interests. Registration as AU, or as JI under most existing national programs, requires the approval of both host and investor-country governments. On the investor-country side, the investor may be the government, but it is more often a private firm or firms; NGOs may also invest, and also (more often) act as project facilitators. On the host-country side, firms or NGOs may be involved as project investors, promoters, or implementers, and various local actors may have stakes in project design or effects. In this section we outline likely typical interests and incentives of each class of participants. Members of each class are diverse, of course, and will weigh different interests differently; the argument here seeks only to identify broad patterns of potential interaction in JI projects, not to specify the details of any particular project or actor.

Investor-country governments: Several interests may draw investor-country governments into JI, at least at present small levels of activity. Even without concern about climate change, JI

[21] Interview with E. Holt, USIJI, June 1996, said three; Elizabeth Cook interview, Greenwire, October, said "at most four"; interview with E. Holt, April 1997, stressed that some can proceed in phases or with partial funding; "fewer than ten" is conservative estimate.

programs can promote export and foreign investment opportunities.[22] More relevant to climate, if JI can in fact promote cost-effective global abatement, then early development of a national program can bring several benefits: increase standing in international negotiations of future policy design, improved goodwill in particular host countries and demonstration of commitment which could persuade reluctant parties to join the climate regime. In a future JI system with international credits, investor-country governments would share the interest of investors: reduced costs of meeting a regulatory burden by abating where it is cheaper.

Host-country governments: In host countries, governments and other actors may also act from several interests. For the host-country economy, II projects can represent desirable increases in foreign investment (Sugandhy 1996; Government of Brazil, 1996; Kureya, 1996), and will have various local environmental or economic impacts. Descriptions of current AIJ projects suggest that these local impacts are dominated by benefits: employment, local air-quality improvements, provision of electricity to unserved areas, habitat or watershed protection, increased organizational capacity, etc.

However, JI projects could also impose local costs, bid scarce resources away from other productive uses, or foreclose potential future development opportunities (Shukla, 1996; Gupta, 1996). Among the central concerns of host-country representatives have been that JI projects would effectively be forced on them, making them unable to control such potentially harmful local impacts or to negotiate satisfactory sharing of financial returns and credits. The Berlin decisions specifying that non-Annex 1 participation in AIJ was voluntary and required prior government approval were attempts to meet these concerns.

Potential hosts also express two reservations about the international political economy of JI. First JI may permit foreign investors to skim the cream -- to claim a limited set of low-cost abatement options in a host country, leaving only more costly or otherwise less desirable options

[22]The JI program documents of Australia, Canada, Japan, and the US all mention these benefits.

when the host comes under a future abatement obligation. Second, JI may inappropriately reduce the pressure on IC governments to make required changes in their own policies and emissions.[23] The largest potential host countries have been skeptical or hostile toward JI, reflecting some combination of these reservations. While some reports suggest slight recent diminution of this skepticism (Dower, 1996; Greenwire, Nov 1, 1996), the most enthusiastic JI hosts remain small developing countries whose potential impact on the global greenhouse problem can only be modest.[24]

The Investor: Present investors include governments and NGOs who seek to promote and demonstrate the benefits of JI, but a substantially expanded JI system will derive most of its finance from private, profit-motivated investors. [25] Their interests will likely be of four types, all related to the ultimate profitability of projects: financial return, credits and associated regulatory relief, public relations and a cluster of strategic interests principally concerned with developing operations in the host country.

Financial Return: Many JI projects yield a stream of financial returns. Negotiated details of project design and financial structure determine the size of financial flows and the division of risk and return among participants. Some JI projects are expected to earn profitable rates of return, though

[23]Here, most DC governments and most environmental NGOs are aligned, arguing that equity and the need to demonstrate leadership require ICs to abate domestically first, over-riding concerns of cost-effectiveness.

[24]See list of projects to date in Table 1.

[25]Even the Dutch and Norwegian R programs, which have most stressed government funding in the pilot phase, state that after the pilot phase JI will mostly be concerned with stimulating private investment (Government of the Netherlands 1995; "Netherlands' Policy Statement", 1995; "AIJ Pilot Project", 1996).

these are based on projections and detailed financial information is proprietary.[26] As discussed below, treatment of profitable projects under a JI credit system is contentious, for it is argued that profitable investments are not additional.

Regulatory Relief The most widely proposed incentive for JI investors is the opportunity to avoid a regulatory obligation at home by investing in cheaper abatement abroad. Creating this incentive requires some form of credits, which is not yet available. Even without international credits, any government could offer its nationals domestic credit for successful JI projects -- as relief from a domestically imposed emissions limit or a rebate on a tax. If and when any major country enacts national emission controls with firm national credits for abatement through JI, the credits will likely represent a substantial incentive for investors.

Until then, investors' regulatory incentives are vague and contingent, perhaps even of uncertain sign. Some current investor firms have asserted that they expect future regulatory benefits, and some national programs imply the possibility of such benefits.[27] Consequently, a current investor might attach some (small) probability to being spared a future burden for their far-sighted environmental conduct. Firms might also invest in JI for a collective benefit, undermining political support for regulation by demonstrating industry leadership.

The contribution of such potential future regulatory advantages to investors' current incentives in JI is probably very small, though. Governments cannot readily bind themselves to offer future relief to individual firms (Rodrik, Zeckhauser 1988), and forestalling future regulation through industry leadership will be hampered by collective-action problems among firms. Indeed, it is ambiguous whether anticipatory industry action would more likely reduce or increase the

[26] Though detailed financial projections are not publicly available for any official JI project, USUI literature asserts that some projects will earn commercial returns, while the private IUEP and WBCSD JI programs require both demonstrated abatement and profitable rates of return to register a project.

probability of subsequent regulation, as plausible theoretical arguments are available on both sides. Consequently, the regulation-avoiding value of investing in JI before regulation is imminent is likely very small.

Public relations: Participating in JI projects, consequently building international harmony and protecting the environment, can gain investors public goodwill of some potential commercial value. Maximizing such gains requires visible partnership with governments and NGO's and depends very little on the size of investment. Hence, firms seeking such benefits would likely invest modestly in high-profile, environmentally attractive projects. Moreover, such benefits, unlike financial returns or credits, need not be divided among multiple participants; consequently, we would expect -- and often see -- multiple firms in partnership with a single NGO on a JI project, dividing the cost while fully sharing the credit. Certain strategic and learning interests could also account for this pattern of participation, though.

Strategic Advantages: JI investors may gain several kinds of potential long-term strategic benefits. In the international arena, early JI participation may grant standing in negotiations or provide information about JI opportunities, pitfalls and problems. In the host country, investors may gain market access, favorable regulatory treatment, services of knowledgeable JI program officers or relationships with senior decision-makers. Any of these can represent an important competitive advantage for future expansion in host-country markets, whether for further JI projects or for other business. The value of these benefits is greatest in large host countries with strong growth prospects. That most early JI activity is in small countries does not necessarily mean, though, that these interests are not salient, since the largest potential hosts are not yet participating.

[27] "Without strong incentives we will see merely the continuation of the modest efforts of the recent past - small pilot projects, mostly government-funded, with limited business involvement. This is a recipe for no JI market growth, and no real learning and innovation." (Leslie, 1995); see also Government of the Netherlands, 1995.

For profit-motivated investors, public-relations and strategic benefits will more readily motivate small initial participation than large investment, for they yield most of their benefit with very modest financial commitments. Attracting larger investments will require some combination of financial return and regulatory benefits. These two can substitute for each other; higher regulatory benefits (i.e., more valuable emission credits) would be required to motivate investment in projects with lower financial returns.[28]

These sketches of the interests of major participants suggest the broad outline of JI project negotiations. Successfully implementing a project will require designing it to yield an attractive bundle of benefits (financial return, local benefits, and credits if available), and successfully negotiating the division of these benefits among the parties. If investor-country governments persist in not granting credits, there is one less dimension on which division must be negotiated, but projects will offer less total value to be divided.

Present JI projects appear to yield attractive economic and environmental benefits to the host country. The skepticism of major potential hosts, however, puts the onus on JI proponents to continue to demonstrate that such benefits will outweigh local costs. Whether such benefits can be sustained with substantial expansion of the scale of JI is an important empirical question. Since the projects pursued first are likely the most attractive on several dimensions, it is plausible that opportunities with such attractive combinations of benefits will grow harder to find if and when the scale of JI expands. If local benefits shift from being natural consequences of JI investments toward being costly add-cons in project design, then they will increasingly become another distributive aspect of project negotiations between host countries and investors.

[28]Published project examples in the WBCSD program illustrate potential flows of abatement and financial returns available for specified investments. It is straightforward to demonstrate that as the project's financial structure is varied to give smaller monetary returns to the investor, abatement credits must increase in value for the investor to receive their required aggregate return.

4.4. An Expanded JI System: Requirements and Implications

This section considers JI's potential contribution to efficient global emissions abatement. While other indirect goals are sometimes claimed for JI, such as supporting learning or providing a transition to a tradable-permit system, we defer these to a brief discussion in the concluding section. Here, we consider only JI's direct potential to contribute to efficient abatement.

In the present pilot phase, JI's dominant problem is low participation. Few large host countries are engaged, few projects are being developed and, most seriously, projects are having great difficulty attracting financing. One consequence is that current projects are likely quite unrepresentative of those that would occur under much larger mobilization of private finance in their technical characteristics, the type of investor they attract and the character of investors' motivations and involvement in implementation. Pilot phase experience alone may thus be a misleading guide to the functioning of a larger-scale JI system.

For JI to make a significant contribution to the global greenhouse problem, it must attract much greater participation from both major host countries and investors. Our argument concentrates on investors, for we contend that increased investor interest is a necessary condition for increased host-country interest.[29] Present investor interest in JI might be low for two reasons: potentially attractive projects might be obstructed by high transaction costs, or current opportunities might not be attractive enough in meeting investors' primary interests.

Transaction costs of JI can clearly be substantial and are worth reducing. Several current JI programs are principally concerned with seeking to lower transaction costs on the hypothesis that these are obstructing some substantial supply of intrinsically attractive (i.e., negative or low

[29]Major hosts may have several sources of skepticism, as discussed above. Among them may be doubt that enough investment will be available to merit their attention. Currently engaged host countries could, though, absorb much more investment than is presently coming forward (Zollinger and Dower, 1996).

abatement cost) projects.[30] Whether or not this hypothesis is presently true, reducing transaction costs will also be important if future emissions regulation creates a larger potential market for JI.

Two classes of JI transaction costs appear to be particularly salient: those associated with market development, such as identifying and bundling project opportunities, matching projects and investors, making markets, and allocating risk, and those associated with monitoring and oversight, such as registering projects, defining baselines, and monitoring and auditing performance. Approaches to performing these functions and lowering the associated costs have been extensively discussed elsewhere (e.g., Anderson 1995; Wexler, Mintzer, Miller 1994; Mintzer 1994; Watt, Sathaye, et al 1994). We do not discuss these here, except to note that the stringency of monitoring and oversight is a basic design decision for a JI system, reflecting a tradeoff between reducing transaction costs and defending the integrity of JI's claimed abatement contributions. Strict defense of JI system integrity raises transaction costs and will deter some worthy projects as it excludes some fraudulent ones. This tradeoff may become less strict if increasing experience permits standardized oversight methods or increases in project size reduce the fractional contribution of transaction costs.

It is widely argued, however, that JI is failing to attract investors because it is not adequately meeting their central interests. That is, the available strategic and public-relations benefits, plus highly uncertain future regulatory benefits, are insufficient to offset financial returns perceived to be low relative to project risk. If the pool of available project opportunities is presumed fixed, there are two ways to improve this balance: subsidies or emission credits. Since overt public subsidy of corporate investment abroad ranks low on most nations' political priorities and is tangential to the goal of mobilizing private capital, most JI proponents focus on credits. Many have argued that a firm commitment to credit is essential for a large increase in private JI investment (Dower, Zollinger 1996; Leslie, 1995). Moreover, if JI is expanded by creating market

[30] Early analyses support the intuition that transaction costs for current JI projects are very high. One evaluation of two early projects suggests that transaction costs may exceed environmental benefits (Roland and 1-laugland, 1994).

instruments to bundle projects and pool risk, this expansion will obscure, or sever the direct relationships between investors and projects that are responsible for present public-relations and strategic benefits. Hence, any attempt to expand JI by facilitating market development will create a self-reinforcing tendency for the system to depend on investors' interests in financial return and regulatory relief through credits.

If credits were offered for JI projects, their supply would be determined by available project opportunities. Some credits derived from projects that are nearly viable in financial terms alone would be available at low cost. If disequilibriums, reducible transaction costs or lack of information are obstructing otherwise viable projects, some credits could even be available at negative cost. Additional abatement opportunities would be available at higher costs, yielding a conventional upward-sloping supply curve for credits.

In contrast, the demand for credits would contain two separate components. Some investors, including those now supporting sub-profitable JI projects, would be willing to buy abatement even if formal credits remained unavailable or had no value. These could include some NGOs or governments who value abatement for its own sake; and some private investors who buy abatement out of strategic or public-relations interests. This component of demand is present now without credit and could well persist, but it would not grow much larger unless major governments decided to spend heavily on abatement abroad which present positions suggest is unlikely. By far the larger component of demand would be driven by the value of credits to private investors. This second component would only appear with the enactment, or the imminent threat, of a costly regulatory burden on emitters that they are permitted to avoid (or to meet at lower cost) by JI investments. Of these investors, those whose regulatory burden is most certain and whose marginal abatement cost in their own operations is highest would be willing to pay the most for JI credits. Others with lower abatement costs, or facing a less certain regulatory burden, would offer less, yielding a conventional downward-sloping demand curve.

This second component of demand is entirely a creation of regulation. Until a major emitter nation announces regulation avoidable through JI credits, only the much weaker demand

for pure abatement would exist. Such regulation, once created, would generate the stronger demand for some specific quantity of abatement; beyond this quantity, only the weaker demand for pure abatement would exist.

Credits could be granted either internationally or nationally. Credits granted under an international climate regime would reduce, or substitute for, national emission obligations; credits granted by a national authority would reduce, or substitute for, regulatory obligations of domestic emission sources. While the Berlin decision has suspended consideration of international credits through the pilot phase, any national government could choose to enact national credits as part of its domestic policy, even without international credits. Whether national or international, the value of credits will depend upon their representing real emission reductions.

Ensuring that credits for JI projects do represent real emission reductions poses serious conceptual and practical difficulties, which are subsumed into current policy debates on "additionality". Even in the pilot phase with no credits and small stakes, determining additionality has been difficult and contentious. In a substantially expanded JI system with real credits, failing to ensure that JI projects make incremental contributions will both be a greater risk and have higher consequences. The risk will be higher because in an expanded JI system there will be substantial incentives and opportunities to over-state project contributions; many profit-seeking actors in the system will not share the environmental motivations of pilot-phase pioneers. Consequences will be higher because both the value of credits to investors and the effectiveness of the entire endeavor in limiting emissions will be at stake.

Under the AIJ pilot phase, and presumably under any subsequent JI regime, projects are required to be additional in two dimensions, finance and emissions. Each dimension embodies the concerns of one party to a JI transaction. Buyers of credits (including investors) who want credits to have secure value will worry that projects really represent additional abatement; issuers of credits (including host-country governments) who want to obtain secure value in return for the credits they relinquish will worry about additionality of finance. Pursuing additionality on two dimensions yields four possible outcomes: in the best, real new money finances real new

abatement; in the worst, re-labeled investment flows are coupled with fictitious abatement but nobody changes their behavior.

Whether in finance or emissions, additionality can only have meaning relative to some alternative reference point. Since JI is intended to include activity in countries without emissions targets, and since there are no specific obligations to finance abatement abroad, no binding target will be available to provide this reference point for either emissions or finance. Rather, "additional" is taken to mean that the abatement and finance exceed what -would have happened without the project. Determining this requires constructing a hypothetical, or "counter-factual" baseline (Vellinga, Heintz 1994; Jones 1994):

Two serious conceptual problems obstruct the attempt to construct such baselines and determine additionality. The first concerns indirect effects of projects, which arise because both the project, and the money spent on it, move resources from other uses to which they would otherwise have been put. Indirect effects can be small or large, near or far, obvious or subtle, and can occur through various markets (e.g., energy, land, labor, forest or agricultural products) or non-market pathways. The second problem concerns opportunism and the possibility of deception. Because JI is organized around projects, many aspects of additionality will be determined in the negotiation, design and analysis of each particular project. All participants in a project are likely to benefit if the project is deemed to represent a large additional contribution. Consequently, while all JI investors have a collective interest in defending the credit system against excessive claims, all parties to a particular project -- including the investor -- have an interest in inflating the benefits that project achieves. Since benefits are measured relative to what would have happened without the project, all parties have an interest in exaggerating the difference between what they are doing and what they would have done. Investors can claim that they would not have invested without JI credits, while project developers can claim that without

JI credits they would have built a technologically obsolete, highly polluting, coal-fired alternative. Such claims cannot easily or decisively be refuted, particularly in their more nuanced forms.[31]

Even in the pilot phase there has been some controversy over additionality of finance, perhaps anticipating struggles that will become serious if credits are adopted. The Berlin decision, and national pilot-phase programs, has adopted a very simple definition of financial additionality based on the source of funds, excluding projects entirely financed from the GEF or other ODA sources.[32] Consequently, any present private JI funding is deemed additional. Disagreement has arisen, however, over the profitability of projects. Some have argued that if a project returns a commercial profit, it should be deemed non-additional, as a rational investor would have made the investment in any case.

The attraction of this argument is precisely the attraction of seeking to define additionality relative to a consistent alternative: if an investment would have been made for its financial returns in any case, one would wish to avoid also granting a rent in the form of a valuable emission credit. The argument's weakness, though, lies in its assumption that any project that turns out profitable would have been made in any case. This neglects project risk, confuses ex ante with ex post profitability, and conflicts with empirical evidence that many profitable conservation investments are not made (Wilson, Swisher 1993). Moreover, attempting to reclaim all super-normal profits from investors is equivalent to seeking to reduce their permit value to zero -- the current value of permits, at which investors are not coming forward.

[31] Other approaches for counting emission credits have been proposed, using other bases than "what would have, happened without the project". Possibilities include setting an agreed project-level or national-level baseline from which all departures are measured and using benefit-cost analysis to determine what level of project effort would have been justified by national benefits alone, granting credits for abatement beyond that point. These approaches are as difficult, and as open to misrepresentation, as the approach discussed here, except for the agreed national baseline but that approach assumes away the problem (no national target) that it is intended to solve. See Tietenberg and Victor (1994).

[32] The criteria are summarized in FCCC/CP/1996/14/Add 1, Table 4.

While additionality of abatement has been less controversial in the pilot phase, early project experience demonstrates how difficult it is to establish additionality coherently. Both indirect effect, and the difficulty of establishing reliable, opportunism-proof baselines, are serious. Current JI programs use simple rules to determine additionality and accept claims that would be hard to police against exaggeration at face value. For example, while emissions leakage may be particularly serious for forestry projects, only USIJI requires project developers to identify potential sources of leakage and measures taken to avoid it, and. even they have established no reliable way of identifying all major sources and reliably preventing them. (Watt et al, 1996; Dower 1996). USUI has also approved one project to protect forest land that was about to be sold for cutting,[33] an approach that in an expanded JI system would clearly be at risk of fabricated claims that particular tracts were about to be cut.

For new energy supply, the additionality problem involves identifying what generation, if any, is displaced. Some JI projects provide renewable electricity to regions not presently served by the electrical grid. For such projects, the Japanese program endorses the convenient assumption that electricity would otherwise have been provided by diesel generation while acknowledging that often the real alternative would be no electric supply for some time. Several USIJI projects use the same assumption and are subject to the same limitations. The Netherlands Bhutan project has sought to define a more accurate alternative by claiming credit for displacement of the fuelwood, kerosene, and dry batteries that villagers are presently using, but the required laborious and highly inexact village-scale estimation could not easily be replicated at an expanded scale. Determining the alternative is also ambiguous for projects providing new electricity on the grid. Generation that is supposedly displaced may not be retired, or may be only temporarily retired, particularly where existing supply is highly limited or demand rapidly

[33] The Rio Bravo project in Belize, in USIJI Round 1.

growing[34] or may already be operating at very low capacity, due to reliability problems or fuel shortages.[35] Determining alternatives in all these cases both poses real conceptual difficulties, and presents ample opportunities for exaggeration.

Specifics of the design of a credit system can affect these incentives to exaggerate. In any project the investor, project developer, and host government all share an incentive to exaggerate the abatement achieved, generating more valuable credits for them to share. Under an international credit system the investor-country government- also has the same incentive since credits also reduce their national obligation. Only the largest investor-country governments, big enough to capture a substantial share of the collective benefits of a sound credit currency, would be likely to have this incentive significantly reduced (Parson and Zeckhauser, 1995a). The international currency of credits would consequently be at risk of debasement through widespread opportunism unless carefully defended by close third-party oversight and cheat-proof accounting rules on every project. In contrast, under a national crediting system the investor-country government would not share this incentive to exaggerate project credits. Rather, as the banker to a national credit system, its interest would be in defending the integrity of the system. It is possible that some appropriately designed system combining national and international credits could retain and exploit this investor-country interest in sound credits, but detailed consideration of such a design is beyond the scope of the present paper.

It is also possible that standardized methodologies for project design, monitoring, and credit accounting could limit the harm that exaggeration poses to the integrity of credits and the effectiveness of a JI system. In part, this would require defensible, standardized approximations

[34] Such non-displacement is a risk of any project that claims to displace existing fossil-generating capacity. USUI examples include the Don Julia hydro, and Aeroenergia and Tierras Morenas wind projects in Costa Rica. An extreme illustration is the claim of the Malaysian government that its huge and controversial Bakun dam project in Sarawak is being undertaken to reduce greenhouse gas emissions. (CC:Info National page, http://www.kjc.gov.my/ccm/actresp.htm)

[35] E.g., Watt et al (1996) summarize an example in which the capacity claimed to be displaced was already shut down due to fuel shortages.

for counting the emissions benefits of projects. Though such approximations would have to be sufficiently correlated with real abatement achieved, they would not need to be highly accurate; rather, their essential requirement would be to restrain the magnitude of exaggeration, so the meaning of credits could not be debased without limit.

In practical terms, such inflation-resistant approximations are likely to be available for some types of projects. The clearest example might be certain kinds of energy retrofit projects. When a project replaces old energy production or conversion equipment with more efficient equipment serving the same demand, and the old equipment is dismantled, a simple comparison of recent pre-conversion operations with emissions from the new equipment would provide a defensible, difficult to manipulate, approximation to the true emissions effect. Simple, uniformly applied accounting rules could accommodate cases in which the capacity of the new plant was larger than that of the old plant it replaced. Retrofits of existing energy-consuming equipment in which the old equipment is verifiably retired could use similarly simple accounting rules, as could projects to capture methane leaks from existing systems (e.g., gas pipelines, landfills, or coal mines). Among forestry and land-use projects, it is plausible that projects planting currently unforested land would more readily admit such approximations than projects to protect, or to change management practice on, currently forested land.

These proposals for approximate additionality-counting rules are obviously preliminary, and only illustrative. The purpose of such rules is not precise identification of true baselines and project effects, though they must represent defensible and acceptably accurate approximations to these. Rather, their purpose is to impose limits on exaggeration, limiting the extent to which exaggeration can degrade the integrity and benefits of a JI system. Such approximations and rules would serve a purpose similar to that of the rules of financial accounting. If they performed this central function adequately, then over-statement of project abatement and hence over-awarding of credits would not represent a central threat to the integrity or effectiveness of a JI system. Whether such approximations can be constructed for various project types, how well they can approximate true abatement and how effectively they can limit the extent of exaggerated

abatement claims are crucial empirical questions that analysis of pilot-phase projects should seek to resolve. Such simple rules could pose several problems including the risk of adverse selection among heterogeneous project opportunities. They would in no way avoid the requirement for careful oversight of project implementation.

The most serious risk of such approximate counting rules would be a bias in the types of project pursued through JI. Such rules will likely be much easier to construct for some project types, sectors, or countries than for others. Consequently, JI projects will tend to concentrate in those areas where such rules are most readily available and most strongly defensible. This bias would be present even without official imposition of particular accounting rules as long as claims of project abatement are much more likely to be denounced or threatened with revocation for some project types than for others.

This bias will likely be particularly severe in considering the potential contribution of JI to global abatement over several decades. Over this period, the largest piece of the global abatement task will be deflecting future emissions growth trends, particularly in the rapidly growing developing countries. This is fundamentally a task of shifting the character of new capital investment toward less emitting forms. Because new investment will usually represent an emissions increase over the status quo, without national emission targets the problems of defining and defending acceptable baselines for such investments will be severe. For JI, the problem of coherently defining additionality in rapidly growing economies will likely shift JI investment toward sectors and project types whose effects are easiest to count and defend, most likely retrofits of existing capital, emissions recapture and perhaps reforestation. Investments in these areas may be important and valuable, but they are not where the largest contribution is required. If JI investment flows predominantly to these types of projects, then JI's potential contribution to limiting global emissions growth will be seriously constrained.

Moreover, it is also in these project types where host countries' concerns about cream-skimming may be most well founded. The pool of easy-to-count retrofit opportunities in the present capital stock is fixed, while the pool of abatement opportunities in a growing economy is

not. If future abatement opportunities should turn out to be less attractive than presently available ones, this concern will have been justified. Whether this is so, though, will depend on the trend in abatement costs over time, which cannot be predicted even as to its sign. If the marginal cost of abatement in India after 30 years of new investment and technological change is higher than it is now, then allowing industrialized countries to claim credit for current JI projects will deprive India of its best opportunities for future abatement;[36] if lower, whoever received emissions credit for retrofitting a 1955 boiler in 1998 will be of no interest a few decades hence.

4.5. The Potential Contributions of JI

Joint Implementation can facilitate some level of efficiency-enhancing exchanges of abatement effort with financial transfers even between nations who have not all agreed to global emissions ceilings. However, current experience suggests that investors will not undertake JI, and hence these gains will not be available, without some form of regulatory credit. If more than symbolic investments are sought, regulatory benefits stronger than the vague hope offered by the present system will be required. Without some form of credit, even the learning benefits of the present JI system are limited because current activity is so minimal and so likely unrepresentative of what would be undertaken under an expanded system.

The enactment of international credits is likely to be tightly linked to the negotiation of Annex I (industrialized country) emission limits. A JI system with international credits should offer Annex 1 nations more and cheaper ways to meet a near-term abatement obligation than if they were required to abate at home. Consequently, an international credit system should make nations more willing to accept emissions targets, for it would reduce both the cost of meeting them and the risk of failing to meet them by making investment in abatement abroad a substitute for abatement at home. This advantage is the obverse of the critique often made against JI that it

[36] This also assumes that the activity undertaken now as JI for credit would not have been done for other reasons between now and when India comes under an abatement obligation.

allows industrialized countries to avoid their obligation to abate domestically; it does so by letting them instead bear the financial burden of abating elsewhere, so abatement is cheaper and they are more likely to agree to it. This advantage would be lost, as some NGOs advocate, if JI were only allowed as additional voluntary abatement after each country has fully met its abatement obligation domestically (Hornung 1996; Climate Action Network 1994).

We will learn little about JI's potential and problems until credits are available, but credits may take more forms than are normally considered. Even without agreement on international credits, any nation willing to act first could establish a national credit system. These would have to be enacted with domestic emissions regulation, permitting nationals to avoid a costly regulatory obligation if they successfully abate emissions through JI. Criteria and procedures could be negotiated bilaterally with host countries. Alternatively, a government could grant contingent national credits even without national emissions controls. These would represent promises of exemption from specified future abatement obligations, to be honored if and when domestic controls are enacted. Even allowing for the difficulty of making such contingent credits secure, they would represent a firmer commitment than any government is presently offering. National credits, whether certain or contingent, could be traded as financial instruments and could support a market in which emitters, project investors, environmentalists, and speculators all participated.

Either national or international credit would likely bring a large and sudden expansion of JI activity. In this case, the price of JI's flexibility, which permits projects between target and nontarget nations, is weak accounting of emission benefits. Because accounting problems can likely be managed adequately for certain projects, particularly retrofits of existing capital and reforestation, we would expect JI investments to be drawn preferentially to those project types. In these sectors, the conceptual problems of defining additionality are as severe as elsewhere, but defensible approximations and expedients are likely attainable. Consequently, while developing such expedient, exaggeration-limiting approximations is highly valuable, pursuit of refined or highly accurate measures of additionality are probably not warranted. On the other hand, granting of JI credits may have to be limited to project types admit the development of such defensible

approximations. Such restrictions, while necessary to defend a viable JI system with credits, will seriously limit the aggregate contribution to global abatement that JI can make. The potential contribution may be much larger than present activity, but it is still a small fraction of the abatement that may be required.

In addition to its direct contribution to global abatement, which we are arguing is likely to be real but modest, JI may offer indirect benefits. JI could be used to motivate countries to join the convention, or if paired with a system to control emissions under national targets, could motivate countries to adopt emission baselines. JI can help various actors learn about project and technology effects in various national contexts and increase experience with potential pitfalls and modes of project failure. Further early experimentation in JI will be necessary even to identify and refine the robust estimation methods discussed above for project baselines and effects. The public benefits of such learning may well be large enough to justify financial subsidy of early JI projects. To maximize these benefits, the subsidy should require full public disclosure of project information. Learning any of these things will require variance among project types, structures, locations, sectors, and technologies as well as a system that can accommodate project failure and learn from it.

To establish a JI system with credits is not to say where the projects will go. Much current controversy over JI reflects the presumption that most projects will involve OECD investment in a developing country, but it could be otherwise. Many current projects are in the former east bloc. More broadly, it has been argued that the presumption that JI's benefits will come from exploiting low abatement costs in developing countries reflects basic misunderstanding of their economies (Shukla, 1996). The benefit of JI's flexibility is that it does not matter whether this presumption is true or not, for the system will motivate pursuit of profitable abatement wherever it can be found. Indeed, the private WBCSD program already lists many offered abatement projects in the OECD countries.

In sum, JI's contribution to global abatement can grow much larger than the present pilot phase, but it is unlikely to represent more than a small fraction of proposed levels of global

abatement. More effective deflection of global emission growth trends will require a system that can motivate changes in the character of future capital expansion, particularly in the rapidly growing developing countries.

5. ADMINISTRATIVE FINANCIAL MECHANISMS

5.1. Background and Basic Characteristics

Of the three systems considered here, Administrative Financial Mechanisms (AFMs) have the most experience. Several moderate-scale examples are currently implemented, including the Global Environment Facility (GEF) and the Montreal Protocol Multilateral Fund. These and proposals for future AFM's are similar in their broad thrust. Their principal characteristic are as follows.

1. **Project Support from Public Funds:** The system disburses public funds internationally to support specific projects.

2. **Politically Negotiated Criteria:** International negotiations establish the environmental goals to be pursued and other criteria that define acceptable projects and levels of support.

3. **Assessed National Contributions:** National governments contribute funds to the system, following negotiated agreement of aggregate funding levels and national contribution shares.

4. **Decentralized Project Identification:** Many actors can develop and bring forward project proposals, including private actors, host-country governments, international agencies and various partnerships among these.

5. **Direct and Indirect Projects:** Projects may take the form of direct investments, but may also be activities to support the environmental goal indirectly, such as training, information dissemination, research and development or increased institutional capacity.

6. **Implementing Agencies:** International bodies, normally including both an executive body and an international secretariat or bureaucracy, oversee the implementation of programs and projects. In present AFMs, designated international agencies implement projects, sometimes

further sub-contracting to private bodies. In principle, AFMs could, include various governmental, intergovernmental, or non-governmental bodies as implementers.

5.2. Key AFM Participants and their Interests

As the largest current AFM, the GEF potentially holds the strongest lessons for potential future AFMs. In its initial three-year pilot phase from 1991-1994, the GEF disbursed a total of $712 million to 112 projects in 63 countries, addressing four designated global environmental issues.[37] During this phase three agencies -- UNEP, UNDP, and the World Bank (Chair) -- shared implementation responsibilities. A 1994 restructuring revised the GEF's governance structure, re-financed a second three-year period at roughly $2 Billion total and passed the chairmanship to a newly established, independent GEF Secretariat.

Many actors have the opportunity to influence the activities of an AFM at both political and bureaucratic levels. Relative to systems like JI and TPs that rely on market activity by decentralized actors, AFMs are likely to involve multiple stages of administrative and political review, retaining continuing political oversight of decisions once the system is established and including more actors in program and project decisions.[38]

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[37]The four designated issues are global warming, biodiversity conservation, pollution of international waters and ozone depletion. Of this funding, 43% went to biodiversity projects, 40% to global warming, 16% to water and 1% to ozone (UNDP, UNEP, the World Bank, 1994).

[38]1n addition to the three implementing agencies, bodies with influence over GEF operations, program and project decisions include the following: the GEF Council, which approves work programs, policies, final project proposals (political representatives of 32 countries: 16 developing, 14 developed, 2 economies in transition); the Scientific and Technical Advisory Panel (STAP) which reviews scientific and technical aspects of project proposals (a panel of experts chosen by the implementing agencies, the GEF, CEO, and the secretariat, who review proposals and prepare annual reports and guidelines; the GEF Operations Committee, which is involved in project and grant review (the STAP chair, reps of the implementing agencies, FCCC Secretariat, and GEF Secretariat, chaired by the GEF CEO); and the recipient countries, which work with implementing agencies at the operational level in project identification, proposal preparation, and implementation.

For example, the basic design of the GEF reflects broad multilateral negotiations in 1991 and 1994, which sought to balance the contending, and sometimes incompatible, interests of donor and recipient countries. Industrialized countries recognized that a financial mechanism like the GEF was necessary to bring developing countries into the Climate Convention, but sought to achieve this with limited financial commitment and donor control (one-dollar, one-vote). Developing countries sought to maximize donors' financial contributions while retaining broad (one-nation, one-vote) control over governance and operations. Both-sides possessed credible threats -- refusing to fund the GEF and refusing to join the Convention, respectively. The 1995 agreement on re-financing and a revised governance structure, with its carefully crafted double majority voting rules, reflected the agreed compromise between these two views (Fairman 1996).

The multiple contending interests of various political and bureaucratic actors have shaped GEF policy, operations, and project criteria in ways that have not always advanced the attainment of GEF's environmental goals. The three implementing agencies, predictably, fight over turf. An early agreement that assigned project domains to each agency in accord with their supposed "comparative advantage"[39] did not avoid these battles since the agencies did not agree on where their comparative advantages lay and because real projects do not divide neatly into such domains.

In addition, project criteria have reflected a confused collection of goals, which are not all compatible with cost-effective environmental protection or with each other. For example, GEF pays only the "incremental costs" of a project, the calculated cost increase required to advance a global environmental goal. This rule, reflecting donors' interest in not paying economic rents, has two important effects. Projects with negative calculated incremental costs are excluded on the presumption that private capital markets should fund them, even if they in fact do not.[40] Because incremental costs are hard to calculate and defend, support tends to go to projects for which the

[39]UNEP oversees "research projects", UNDP oversees "technical assistance projects", and the World Bank oversees "investment projects".

[40]This restriction principally affects certain energy efficiency and demand-side management projects.

calculation is easier. As we argued above for JI credits, this bias is likely to favor retrofits over new capital investments, even though new investments are more important for attaining substantial emission reductions. In addition, GEF seeks to distribute funds broadly across many developing countries, restricts eligibility to states with very low GNP per capita, and favors "innovative" projects that introduce a new technology or process to the host country, hence discouraging replication of successful projects within a country.

5.3. Principal Institutional Issues and Problems

In AFMs, many stakeholders are involved in negotiations and able to influence, delay, or obstruct projects or decisions. They may be able to do so even if they do not have a direct substantive connection to a project, and may choose to do so for a variety of substantive, bargaining, or ideological reasons which in aggregate may conflict with each other or with the overall goal of cost-effective greenhouse-gas reduction. As resources and stakes rise, the obstructive effect of this accumulation of multiple objectives becomes more severe. Fairman (1996) argues that GEF's early history illustrates this phenomenon. He contends that when GEF was first established, the prominence of environmental concerns raised actors' perceived stakes in its design and moved them to load it with many desired political objectives -- understandable behavior when a new institution is being endowed on a high-priority issue. Fairman argues that GEF's effectiveness has improved since 1994 precisely because the political salience of global environmental issues has declined, reducing parties' expectations of how rich and powerful an instrument GEF will be in advancing their broader political goals.

This early history has sobering implications for the prospect of vastly expanded AFMs. As the perceived job, stakes, and financial resources in an AFM increase, at least two factors would be likely to obstruct the system's effectiveness. First, donors would be more reluctant to pay the higher assessments and more likely to impose conditions on their payments. Even at GEF's present modest scale, securing payment has been difficult: the US, for example, contributed

nothing during the pilot phase, and has so far paid only roughly 60 per cent of the $107 million/year it pledged for the second phase.[41] Moreover, since donors' financial commitment to an AFM is an addition, not an alternative, to their domestic emissions abatement, increasing AFM levies may also limit donors' willingness to abate.

Second, big money means big fights. In a greatly expanded AFM, parties would increasingly seek to make the system serve numerous, disparate, and potentially conflicting policy priorities. At the political level, the system would risk becoming a forum for-negotiation over the broadest political, social, and environmental conflicts. At the administrative level, increasing numbers of multiple, conflicting criteria for project funding, coupled with pressure to spend available funds, would be expected to give more discretion to administrators and to bias projects toward the innocuous or those with powerful proponents.

5.4. The Potential Contribution of AFMs

Because the details of AFM priorities and criteria can be politically negotiated, and because AFMs can remain under continuing political oversight, they can embed a broader collection of values than market-based systems can. For example, AFMs could be structured to reflect a comprehensive politically negotiated view of the relative importance of multiple environmental problems or a conception of sustainable development or explicitly include redistributive goals.[42] Alternatively, AFMs could support initiatives expected to bring broad, multiple benefits that are indirect or hard to measure, or compensate for local harms imposed by

[41]1n March 1994, as part of GEF replenishment, the US pledged $430M over four fiscal years (94-95 through 97-98), or $107 M per year. Their payments to April 1997 total $190 Million. Other donor countries, particularly France, are beginning to invoke a clause that suspends their obligation to pay if other countries do not, posing a risk of the funding unraveling. (personal communication, F. Van Bolhuis, GEF Secretariat).

[42]Both redistributive goals and broadly defined sustainable development goals have been carefully avoided, though, in the early operations of the GEF.

broad policy reform. Multilateral AFMs can be more legitimate instruments for such goals than conventional bilateral ODA because they can reflect wider negotiation of values to be represented and are less subject to shifting political priorities of individual donors. To pursue such goals effectively, AFMs must be managed according to guidelines broader than the cost-effective pursuit of a single environmental benefit. While market-based systems normally embed a single environmental goal in the design of their instrument (credits or permits for a single type of emission, or multiple emissions contributing to a single environmental harm) and so are less well suited for pursuing such diffuse multiple benefits, AFMs are likely to be less effective than market systems in the cost-effective pursuit of a single goal.

The advantages of AFMs, however, are likely only available at a modest aggregate scale of activity. At small scales, donors are willing to contribute, and both donors and recipients to participate in pursuit of a widely agreed set of environmental and related benefits. At much larger scales of activity, funds are likely to grow harder to obtain and operations are likely to be hampered by increasingly contentious application of multiple and conflicting objectives.

In sum, AFMs can be (and are) implemented now. At current or moderately expanded scales, they are likely able to serve certain objectives better than market-based systems. These may include supporting initiatives whose likely environmental benefits are substantial, but indirect or difficult to measure: integrating multiple environmental issues and transferring resources to the poorest nations or regions. But large expansion of their scale of activity on the order necessary to address a substantial fraction of the global greenhouse abatement-shifting problem would risk seriously hampering their ability to serve these goals and are unlikely to be feasible due to donor resistance.

6. INTERNATIONAL TRADABLE-PERMITS MARKETS

6.1. Background and Basic Characteristics

We have argued that both JI and AFMs, for different reasons, are likely to be severely limited in the size of contribution they can make to the global climate problem. JI is hampered because difficulties in measuring project-level abatement would debase a credit system at large scales, unless credits were restricted to those rather few project types for which defensible, inflation-proof accounting heuristics are available. AFMs are limited due to the large expansion, which would drive away donors and obstruct effective operations as parties sought to make projects and programs serve multiple, conflicting goals.

The third system we consider for shifting abatement effort among nations, with accompanying financial transfers, is an international market in tradable emissions permits. International experience with such systems to date has been very minor (only the exchange of CFC production permits during the phasedown period under the Montreal Protocol.)[43] There does exist growing domestic experience in the United States, most significantly the system of tradable sulfur-emission allowances established under the 1990 Clean Air Act.

The principal features that define an international tradable-permits system for greenhouse gas emissions are as follows:

1. **National Accountability**: The system focuses on national emission totals. While the system would seek to promote abatement activity at all levels from individual projects to national policies, monitoring and accountability lie with the nation.

2. **Aggregate Emissions Limit**: Participating nations would create a pool of emission permits equal in total to an aggregate emission limit they agree to meet.

[43] 1nternational exchange of production limits was permitted under the Protocol's "industrial rationalization" provision. Both the number of international trades, and the volume of material traded, were very small (Lee, 1996). These estimates exclude trade within the EU, which is not reported. At present, no international exchange of HCFC production quotas is permitted under the Protocol.

3. **Allocated Permits**: Some portion of this permit pool would be allocated to each participating nation. National allocations could be negotiated directly or granted on the basis of some negotiated principle, such as population or historical emissions.

4. **National Obligations:** Each participating nation would be obliged to emit no more than the quantity of permits it holds. Various terms and definitions would be possible for the permits and the form and period of the obligations: e.g., multiple greenhouse gases or only CO_2; emitted from all activities, or only certain classes; annually, or in total over some longer period.

5. **Exchange of Permits:** Nations may exchange permits to ensure that they hold enough to cover their emissions. It is assumed that a permit market will form similar to markets in other international financial instruments, possibly including forward, future, and option markets.

6.2. Key Tradable-Permit Participants and their Incentives

Beyond these essential features, variants are possible in many aspects of the design of a tradable emission-permit system. These can include the meaning of a permit (i.e., what activities and emissions are included; over what time and exchange is permitted among different emissions and times or only within each), the set of actors who can hold and trade permits; and the relationship between the international market in permits and national regulation of the subnational actors whose emissions the system is ultimately intended to change.

These details of system design can make large changes in the identity and interests of major system participants and the potential contribution, pitfalls, and limits of the system. Here we seek only to elaborate a few key implications of any tradable permit system, identify a few central design questions not yet adequately addressed and sketch a few salient design variants.

The major classes of actors involved in an international tradable emissions permit system would include: national governments, major emitters within each nation, some of whom are organized trans-nationally, other potential investors in permits and various inter-governmental or other actors who might be involved in system implementation and oversight, depending on the

particular design chosen. We discuss only the likely interests of national governments and emitters.

National governments would have several components of interest concerning the initial permit allocation and the operation and integrity of the system. Any government would prefer a larger allocation of permits, ceteris paribus, and allocation negotiations are likely to be difficult, but we do not consider approaches to the allocation negotiations here[44] If few enough permits were allocated that global emissions were constrained, some nations would initially be underendowed with permits while others might be over-endowed. Nations' interests in the operation of the system would likely depend on which of these groups they were in or expected to be in (i.e., sellers or buyers of permits). Those expecting to have excess permits relative to immediate needs would want the system design to maximize and protect permit value, making them more inclined to favor such measures as strong monitoring, enforcement and costly restrictive provisions for retrospective settling of emission exceedences. Those expecting to be short would prefer the reverse. All would likely prefer that monitoring of their own activities be deferential and non--intrusive.

Governments will prefer to reduce the cost of obligations bearing on their emitters. In part, this preference will incline them to seek or grant special exemptions for their largest and most concentrated emitters. It may also lead them to favor systems with high flexibility in the location, timing, and kind of abatement undertaken for the expected efficiency gains. Aggressive pursuit of such flexibility may lead nations to extend the domain of a permit system, in terms of the gases and activities included, beyond what can be reliably assessed or monitored (Victor 1991).

Like any system in which national obligations are defined only as national emission totals, international tradable emission permit systems grant substantial discretion in national

[44]For discussions of the problems of negotiating an allocation of emission permits, see Parson and Zeckhauser (1995a, 1995b).

implementation. If the permits, and the associated obligations to limit emissions, are held at the level of national governments, then governments can meet their obligation through whatever form of domestic regulation they prefer and with whatever level of stringency.[45] National governments could use broad policies like direct regulation, taxes, or domestic tradable permits. Alternatively, they could alter the form of a policy instrument or the allocation of permits to favor politically powerful sectors or regions or they could integrate various non-greenhouse criteria (e.g., other environmental, economic, or social goals) into their policy. While any government would likely prefer to have this flexibility, exercising it would introduce disparities between the costs faced by individual emitters and the price of permits in 'the international market. Hence, while such discretion is clearly within the authority of sovereign governments, its exercise weakens the efficiency claims of tradable permit systems.

Emitters' interests will depend on how national governments act under a tradable permit system. If emitters face a true, competitively determined permit price with effective enforcement, then the standard arguments for the efficiency of a permit system hold. Emitters will have incentives to make abatements that cost less at the margin than the price of a permit and to invest efficiently in technological development so as to abate more cheaply in the future.

If emitters do not face a competitive permit price with strict enforcement (or might be able to avoid it), then various rent-seeking incentives will arise. These are the converse of governments' flexibility in implementation. Emitters may seek exemption from obligations, maximal flexibility, sensitive monitoring and enforcement and subsidy for any costly efforts they undertake. If disequilibrium in permit markets or disparities in governments' domestic enforcement create disparities in effective permit cost between nations, major emitters may consider this factor in deciding where to make new investments. Governments that valued the domestic implementation flexibility of an international permit system may find their discretion

[45]This discretion even includes, as an extreme case, avoiding the political costs of domestic regulation entirely by buying excess permits in the international market and issuing government bonds to pay for them.

restricted by domestic political forces, competition among jurisdictions for major, investments and maneuvering by major emitters.

6.3. Principal Institutional Issues and Problems

Several major issues must be resolved to implement a feasible and effective international tradable emission permit system. Among these issues are allocating permits, measuring and projecting national emissions, identifying and responding to exceedances, and connecting domestic regulatory systems to the international permit system so actual emitters face the marginal abatement cost established by the international permit market. Of these, the problem of allocating permits has been extensively discussed elsewhere and we do not revisit it here except to note that negotiating an acceptable allocation is likely to be a less severe, though still difficult, problem among richer industrialized nations than among a larger and more dissimilar group. For discussions of allocating emissions, see Parson and Zeckhauser (1995a, 1995b); Rose (1992); Barrett (1992); and Grubb and Sebenius (1992).

Any international tradable emissions permit system will require projecting and measuring national emission totals for all participating nations. Only national totals matter, not emissions created or avoided by individual projects, because permits authorize emissions anywhere within national territory and the government bears the obligation not to exceed its permits. Both projection and measurement are required: projection, for governments to plan their domestic policies and their activity in international permit markets, and measurement to establish baselines and to determine how realized national emissions compare to permits held.

Under the FCCC, nations are already required to report current and projected national emissions as well as any policies and measures they are enacting with their projected effects on

emissions.[46] The IPCC and OECD have collaborated to develop common, methodologies for conducting national emission inventories and have estimated the uncertainty associated with measuring particular kinds of emissions. These uncertainties span a wide range, from as low as 5 - 10 per cent for energy-related CO. emissions in countries with reliable energy statistics, to an order of magnitude or more for emissions from biomass burning, agricultural soils, rice cultivation and landfills (IPCC 1995; Leggett 1994). Serious conceptual and methodological problems with some emissions and sources, as well as capacity limitations in many countries, may preclude substantial early reduction of these uncertainties. Consequently, while broadly defined permit systems that allow trading among multiple emissions and activities may offer larger savings in principle, they risk including emissions that can be only poorly monitored or whose contribution to the climate problem is not well known (Stewart and Wiener, 1990; Victor 1991; Dudek and Tietenberg, 1992; Dudek and LeBlanc 1992). Recent discussions of permit systems presume that permits would initially be defined narrowly, perhaps broadening in the future as advances in knowledge, monitoring capability and institutional capacity allow (UNCTAD 1994).

An international tradable permit system will also require some means of verifying that national emissions have not exceeded the quantity of permits held, and of responding to and correcting exceedances. In part, this will depend upon sufficiently accurate and credible measurement of national emissions as discussed above. Because emissions (and the effects of national policies and measures) cannot be predicted with certainty, this process of verification and correction must take place retrospectively, implying certain conditions on the vintaging and fungibility of permits. When emissions inventories are completed for participating nations in a specified year, some may have emitted more and others less than the permits they held for that year and aggregate emissions may have been above, below, or equal to the total quantity of permits. Allowing over-emitting nations to buy old unused permits from under-emitting ones

[46]The first round of emission inventories, as well as reports of policies and measures with their projected effects, were only required of Annex 1 nations. Other nations are presently required to submit only emission inventories, the first of which is due in 1997.

would achieve part of the required reconciliation; but the possibility of monopoly power in a particular year's permits, and the possibility of aggregate global over-or under-emitting, both appear to require that it also be possible to move vintaged permits forward or backward in time. Years with emissions less than permits would generate surplus permits that could be used in the future, equivalent to emissions banking; years with excess emissions would have to correct the exceedance by transferring permits back from the future, equivalent to emissions borrowing. While allowing both such directions of transfer through time enhance cost-effectiveness, concerns about compliance could suggest imposing extra charges or limits on the magnitude of either kind of transfer. [47] There must be some provision for ensuring eventual compliance, though, that provides credible and sufficiently strong incentives.

Finally, any international tradable permit system must include some means of linking domestic regulation in participating countries with the international permit system. Attaining the cost-effectiveness advantages claimed for permit systems requires that the actual emitters face the correct incentives, as determined by the marginal permit price in the international market, to abate in their own operations, search for lower-cost abatement opportunities abroad, and invest in research and technology. But if national governments hold permits and bear the responsibility for national compliance, then it is the governments, not the ultimate emitters, who face the international permit price and they cannot reasonably be expected to experience the same effective incentives, or to respond in the same way, as a profit-maximizing firm.

Linking the domestic regulatory systems that determine incentives faced by emitters, and the international permit market, is a crucial aspect of any international permit system, one that is essentially ignored in current discussions of international tradable permit systems. Current discussions effectively ignore this two-level character of the problem through one of two assumptions, which we shall call the "all-state" and "no-state" assumptions.

[47] The US position calls for borrowing, but with a penalty.

To make the all-state assumption is to ignore domestic policy entirely and assume that states will respond to a permit system as if they were profit-maximizing firms, exchanging permits internationally until aggregate national marginal abatement costs are equalized. This assumption was prominent in early discussions of permit systems that stressed potential efficiency gains or that concentrated on the problem of allocating national emission totals. It ignores the problems of disaggregating the state: how an aggregate national marginal abatement cost would be perceived by state decision-makers and why the political and bureaucratic forces shaping state behavior would lead it to the cost-minimizing response.[48]

To make the no-state assumption is to err in the opposite direction, unpacking the state so completely that the incentives created by international permit prices pass directly to the emitters within each nation. Facing incentives undistorted by any governmental intervention, emitters would be expected to find efficient solutions, just as they (arguably) do under domestic tradable permit systems. The national government is reduced to the role of a functionary or accountant, reconciling the national and international systems to ensure that marginal incentives are passed through without distortion, perhaps signing off on trades by its nationals or maintaining a pool of permits to buy and sell so as to maintain liquidity and keep national and international marginal costs equal.[49]

The "all-state" assumption appears clearly false: states do not operate like profit-maximizing firms. The status of the "no-state" assumption is more complex, for it could be correct under extremely restrictive specifications of how national governments implement an international

[48] Discussions of tradable permit systems that appear to make this assumption include Swisher and Masters 1989; Grubb and Sebenius 1992; Rose, 1992; and Barrett, 1992. Hahn and Stavins (1995) recognize and avoid the problem, by focusing on two "prototype" systems, purely international trading, and purely domestic tradable permits.

[49]Discussions of tradable permit systems that appear to make this assumption include Dudek and Tietenberg 1992; Tietenberg and Victor, 1994; and Sandor, Cole, and Kelly 1994.

permit system. Two examples illustrate how this alignment of domestic emitters' incentives and the international permit price could be achieved. All participating nations might agree, for example, to implement the international system by issuing national tradable emission permits and establish a national clearinghouse that buys and sells national and international permits to keep their prices equal. Alternatively, participating nations might enact domestic emissions taxes whose level they continually revise to equal the price of permits in the international market.

However, these forms (and others that fully equate emitters' incentives with international permit prices) are unlikely, perhaps infeasible. Domestically, they neglect the heterogeneity of national emission sources, the need of regulated entities for a stable planning environment, and legal, political, and institutional differences among participating nations. Moreover, they exclude national governments from any active role in shaping domestic policy.

Sensible discussion of tradable permit systems must consider both the domestic and international levels of policy-making as well as complicating interactions between them introduced by, e.g., negotiations between major emitters and their national governments and multinationals seeking to optimize their operations internationally. Realistic permit systems are likely to involve complicated combinations of domestic and international measures that will obtrude on national sovereignty (Tietenberg and Victor, 1994, p. 5), but not obtrude so far as to reduce states to mere accountants or clearinghouses. Options worth exploring might include allowing major emitters to negotiate with governments to opt out of national greenhouse regulation in return for an enforceable (and revokable) pledge to comply directly with international permit requirements, or international trading in multiple national permits whose relative prices would reflect the risk of revocation based on international differences in the reliability of enforcement.

6.4. The Potential Contribution of Tradable Permit Systems

Tradable permit systems may have important advantages over either JI or AFM systems in supporting efficient distributions of international abatement effort. Like JI, permit systems can mobilize private capital and can decentralize decision-making about individual projects and

activities in pursuit of a single environmental goal, cost-effective global emissions abatement. Unlike JI, tradable permit systems avoid the problem of measuring counter-factual project baselines by placing accountability at the level of national emission totals. Consequently, permit systems are unlikely to show the bias we contended will hamper JI expansion in favor of project types for which project-level baselines and effects are easiest to count and defend.

Tradable permit systems do depend on measurement of national emissions totals, which presently appear to be adequate only for energy-related CO_2 emissions. Consequently, any permit system must initially be limited to these. The problem of negotiating allocations is also likely to limit near-term use of permits to high-income industrialized countries, and it may pose extreme difficulties even among them. Moreover, a permits system among these nations that significantly restricts emissions may shift emissions to non-participating countries through movement of the most emissions-intensive investment to non-participating countries or reductions in world fossil fuel prices, creating obstacles to the subsequent expansion of the system to wider participation. [50]

But any international tradable permit system depends on careful specification of the relationship between domestic regulation and the international permit system. No proposals have yet addressed this problem realistically; it must be solved for a tradable permit system that actually restricts emissions to be feasible. This is the priority area for policy development work and research. Of course, if a permit system were initially enacted at a level that is only very slightly constraining, the urgency of defining the domestic-international boundary would be reduced, just as would the concern about emissions leakage.

7. CONCLUSIONS

We have reviewed characteristics of three systems for international shifting of abatement effort and finance, particularly with a view to their potential for expansion. Some institutional

[50]This problem of leakage is not unique to a permit system, but can arise whenever some subset of nations impose stringent limits on their emissions while others do not.

mechanism such as the three investigated here will be essential to solving the problem of abating global emissions. They will be the primary vehicle both for controlling costs, and for distributing abatement burdens fairly among nations. Though some experience exists with all these at present, any or all of them would be transformed, and would face a host of unprecedented challenges, if expanded to the scale necessary to make a substantial contribution to the global problem. Any one of them can start off small and be expanded, but the problems that may arise when they are large should be considered during their creation.

Joint Implementation (JI) is a project-based system principally directed at transactions between target and non-target countries. JI is presently feasible and operating at a very small scale under the pilot phase. JI could be beneficially expanded to substantially greater scale, but doing so will require attracting private investment beyond present symbolic levels, which depends on the enactment of some form of regulatory credit for successful abatement or sequestration through JI. If credit at the international level is not politically feasible, then any major investor nation could promote JI by enacting national-level credit. This represents a substantial opportunity for national leadership, which could greatly expand the data available on how to do JI and what pitfalls to avoid. Because granting such national credit to sub-national investors would not reduce the nation's aggregate emissions obligation internationally, granting national credits would represent over-compliance with the nation's obligation. Consequently, a nation enacting national credits might only be willing to accept a less stringent national obligation than otherwise. While substantial expansion of JI from present levels is likely to be both feasible and beneficial, JI will not be able to address a substantial fraction of the overall global abatement problem due to problems in the credible measurement of emissions effects that are intrinsic to project-level accounting. These measurement problems are likely to shift JI investment into sectors and project types that are easiest to count, particularly retrofits, emissions recapture, and planting of unforested land. A bias toward such project types, and away from modifying the characteristics of new and expanded capital investment, will seriously limit JI's ultimate contribution, and will also

make it vulnerable to the host-country concern that JI allows foreigners to claim the cheapest and best abatement opportunities.

Administrative Financial Mechanisms (AFMs), like JI, are feasible and valuable to undertake at either their present modest scale or significantly larger scales. AFMs are the only system of the three we consider that does not depend on decentralized market choices for implementation. Consequently, they are best able to reflect politically expressed tradeoffs among multiple environmental issues, to support activities believed highly beneficial, but whose benefits are multiple, diffuse, or non-appropriable, or to incorporate redistributive objectives. With these as their strengths, though, AFM operations should not be strongly driven by cost-effectiveness criteria for narrowly defined environmental targets; to do so would neglect their areas of strength, instead pursuing narrow targets for which AFMs likely cannot equal the performance of market-based systems.

AFMs, however, are also likely (as is JI) to be severely limited in the magnitude of their contribution to global emissions abatement. With increasing resources and scale of operations, AFMs are likely to be increasingly obstructed by: a) donor reluctance b) multiple actors' opportunities to influence the character of projects and programs and, consequently c) the sclerotic effects of increasing conflict over multiple contending criteria and goals and over control of the system that are likely to become rapidly debilitating as large resource transfers are instituted or expected.

Unlike JI and AFMs, tradable permit systems do not appear to be intrinsically limited in the scale at which they could operate. Consequently, of the three systems considered here, they appear to be the only one that could contribute a substantial fraction of the required job of shifting global abatement effort and resources. They face serious unresolved difficulties of negotiation and implementation -- e.g., negotiating national allocations, developing acceptably reliable emissions inventories and monitoring -- but these may be rendered manageable by starting small and expanding. The most serious presently unaddressed problem in the design of an international permit system concerns the relationship between national obligations and domestic regulation.

Very simple and restrictive implementations might be feasible in the near term between similarly situated nations and with controls enacted at very gentle levels. Any attempt to extend tradable permit systems further -- in the diversity of nations or domestic implementation modes included, or in the stringency of aggregate controls -- will require substantial progress on elaborating the border between domestic regulation and international obligations.

Two of these systems presently co-exist (JI and AFMs) albeit at small scale. If the scale of abatement effort, and attempts to distribute it internationally, are. expanded, multiple systems will likely continue to co-exist. To consider the implications of expansion, it is important to think in advance, even if speculatively, about how multiple systems might interact.

Multiple systems might be administratively separated with particular systems restricted to certain nations or certain classes of projects. For example, one current proposal would establish a tradable permits program among Annex 1 countries only. Other countries would be allowed to opt into the permits system, subject to agreement on a national baseline, permit allocation and a monitoring and verification system. JI would be retained for projects in countries that do not opt into the permit system.

This proposal would renounce the immediate benefits of trading across a broader set of countries, emissions and activities in favor of enacting a small viable starting point with the possibility of future expansion. Indeed, the starting point could be limited to only a few enthusiastic nations, for any participant would surely have to accept the conditions specified for non-Annex I opt-in, and not all Annex I nations might be ready to do so. Allowing opt-ins from non-Annex I would mitigate the risk to long-term political sustainability of the system that might otherwise be posed by less than full participation.

But it is highly uncertain how many nations would wish to join. Gains from attracting emissions-intensive industry might motivate some nations to stay outside the system, unless it were accompanied by effective incentives to join. Retaining JI for countries outside the trading system might not mitigate this incentive since, as we have argued, credited JI will be most feasible in projects that do not alter the characteristics of new investment.

If multiple systems overlap in their domains, project proponents and investors could potentially choose whether to propose particular activities for permit or JI credits or seek funding from an AFM. The advantages of each system for a particular project or investor will likely depend on implementation details, but there may also be broad patterns that attract certain kinds of projects to particular systems.

From the investor's perspective, if their domestic regulatory system treats credits derived from JI projects and purchased tradable-permits equivalently, then the choice between the two will depend on the price and security of the instrument (which could vary depending on the degree of pooling underlying each)[51] and market conditions. From the project developer's side, the advantages of JI or tradable permits will also depend on implementation details, including the rigor and administrative burden of obtaining certification, whether at the national or international level. JI credits, even if pooled in a market, are ultimately generated by individual projects, while tradable permits are created and reconciled at the level of national aggregate emissions. Consequently, the host-country government would have to be more centrally involved in negotiations over a project to generate tradable permits than one being developed for JI credits. Which route the developer preferred may depend on domestic political and policy details, but it is likely that developing a project for tradable permits would shift a larger share of project risk onto the host-country government. Project developers who have a choice may consequently prefer to develop the riskiest projects for permits and the less risky ones for JI credits.

It has often been proposed that a central purpose of II is to serve as a transitional system to a full tradable permits system (e.g., Swisher, Masters 1992). This transitional role for JI has obvious advantages in that JI can mobilize private activity and gain experience with project activities, emissions accounting and monitoring, at an initially small scale.

[51]E.g., are II credits associated with individual projects? If they represent pooled credits from multiple projects, then how many projects, of how many types, in how many locations?

But JI experience in project-level accounting and monitoring may be of limited relevance to problems of national monitoring and accounting posed by a permit system, such as assessing the emissions effect of aggregate national policies.[52] Moreover, the transition from an initial system of JI with credits to a full permit system would not be smooth and could require negotiations with each joining nation essentially as difficult and complex as those required to establish a permit system from nothing. JI credits account for the abatement effect of individual projects, while tradable permits denominate accountability for all national emissions. The negotiation of a baseline and allocation for a nation joining a permit system will have to account for total national emissions, including the large residual unrelated to JI projects. Having JI projects in a country in no way eases this negotiation, for however large these projects' contribution to abatement may be, the remainder of national emissions may have been growing freely. There may well be a powerful and beneficial transitional role for JI, but it is much more likely to lie in disseminating knowledge about, and confidence in, abatement technologies that may increase national officials' willingness to undertake aggregate commitments than in providing a seamless administrative transition to a full permit system.

Whether they choose to operate through JI or tradable permit markets, private investors are likely to find the most cost-effective projects while AFMs are largely left with projects whose returns are lower, riskier, or harder to count. Since AFMs serve other purposes, including distributive ones, they should not be held to compete against market systems on narrow cost--effectiveness measures. Because they serve important functions that cannot well be provided by markets, they must be protected from the erroneous perception that their purpose is to abate emissions in the same way, and according to the same criteria, as market-like abatement systems.

Enacting and implementing any system (or combination of systems) to shift emissions and effort on the scale discussed will be a serious challenge. Large-scale international tradable permit

[52] Some components of national inventories may involve monitoring individual activities, projects, or factories, but most will likely be based on aggregated national statistics or emission proxies.

systems, or combined systems, will substantially affect economies, societies,, and multiple environmental values, and must be designed to accommodate concern on all these dimensions.

All these systems seek to establish environmental incentives for sub-national actors independent of the state in which they are located. Consequently, all obtrude on sovereignty to some extent, shifting some control over the incentives of emitting actors from national authority to an international system, albeit one agreed upon collectively by participating states. Tradable permit systems presently appear to offer the best prospect for expanding, as political will and technical feasibility allow, to a scale able to address the global environmental goal. But the preferred system, or more likely the preferred combination of systems, must be worked out incrementally and dynamically, with experimentation at scales moderately expanded relative to the present and careful consideration of the range of environmental, developmental and social values that such systems would affect.

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TABLE 1 - Current Joint Implementation Projects*

Project	Type	Description	Host	Sponsors	Cost	Offset
Bhutan Micro-hydro	Renewable Energy (Hydroelectricity)	The project will install a 100 KW hydroelectric plant in the Bumthang district, to provide electricity to about 100 households and displace wood, kerosene, and dry batteries.	Bhutan	Governments of the Netherlands and Bhutan	N/A	N/A
Uganda National Park	Afforestation	No details available	Uganda	FACE Foundation (Netherlands); Government of Uganda	N/A	N/A
Renel-SEP	Energy Efficiency	No details available	Romania		N/A	N/A
PROJECTS UNDER OTHER JI PROGRAMS						
ILUMEX	Energy Efficiency	The project will replace approx. 1.7M ordinary light bulbs with compact fluorescent light bulbs (Selrod and Skjelvik [1993])	Mexico	Norway, Mexico, GEF	$23M	120,000 tons/yr
Coal to Gas Conversion	Fuel Switching	The project converts district-heating boilers from coal to gas. (Selrod et al [1995])	Poland	Poland, Norway, GEF	$52M	N/A
Sustainable Energy Management in Burkina Faso	Renewable energy (solar), energy efficiency, and forest management	The project adds a JI component (community forest management, efficient charcoal processing, photovoltaic electricity and efficient cookstoves) to an existing rural devt. project financed by the governments of Denmark, the Netherlands, and Burkina Faso.	Burkina Faso	Norwegian Ministry of Foreign Affairs; Government of Burkina Faso	$2.4 M	1.45 M mt carbon over 6 years
Renewable Energy in Indonesia	Renewable Energy	No details available	Indonesia	E7 (international consortium of electrical utilities); included in national JI programs of both Germandy and Japan	N/A	N/A
Ainazi	Renewable energy (Wind)	No details availabl	Latvia	German program?	N/A	N/A
Virilla River Basin	Forest conservation	The project will pay farmers a fee of approximately $50/Ha-year to plant and protect forest land, through 20-year contracts.	Cosat Rica	Norwegian Ministry of Foreign Affairs; (Costa Rica): Ministry of Environment and Energy; Costa Rican National Power and Light Company; Consorcio Noruego; Costa Rican Forestry Financing Fund (FONAFIFO)	$3.4 million	250,000 mt Carbon over 25 years
Skoda-Mlada-Bolesiav	Energy efficiency	No details available.	Czech Republic	German JI program	N/A	N/A

* Sources: USIJI [1996]; JIOnline; JI Quarterly [1996]

TABLE 1 - Current Joint Implementation Projects*

Project	Type	Description	Host	Sponsors	Cost	Offset
Dona Julia	Renewable Energy (Hydroelectricity)	The project will construct a 16-megawatt hydroelectric plant displacing thermal fossil fuel-based facilities.	Costa Rica	(US): New World Power Corp. (Costa Rica): Compania Hidroelectica Dona Julia; Costa Rican Ministry of Natural Resources.	$28M	57,400 mtC over 5 years
KLINKIFIX: Klinki Forestry Project	Land Use and Forestry	The project will convert pastures to farm forests by planting klinki pine mixed with native species, to fix carbon and produce wood.	Costa Rica	(US): Reforest the Tropics, Inc. (NGO). (Costa Rica): Contonal Agricultural Center of Turrialba.	$3.8M	1.9 MtC over 40 years
Aeroenergia	Renewable Energy (Wind)	The project will develop a 6.4-megawatt private power wind facility. Electricity will be sold to the national utility company, and will displace fossil fuels.	Costa Rica	(US): Power Systems, Inc.; Bluefields Int'l; Energy Works. (Costa Rica): Aeroenergia. (Denmark): Micon A/S	$8.65M	9,800 mtC over 4 years
El Hoyo-Monte Galan Geothermal Project	Geothermal Energy	The project will develop a privately owned and operated 105 megawatt geothermal power plant using flashed steam technology.	Nicaragua	(Nicaragua): C & R, Inc. (US): Trans-Pacific Geothermal Corp.	N/A	5.4 MtC over 35 years
RUSAGAS	Energy (Fugitive Gas Recapture)	The project will reduce fugitive methane emissions from gas compressor stations through efficiency improvements and pipeline valve sealing.	Russian Federation	(US): Oregon State Univ; Sealweld Corp.; Sustainable Development Technology; USEPA. (Russian Federation): GAZPROM; Volgotransgas; Yugtransgas; Center for Energy Efficiency (CENEf--NGO)	$300K	8.2 MtC over 25 years
BIODIVERSIFIX: Forest Restoration	Land Use and Forestry	The project will regenerate tropical wet and dry forest for sustainable use.	Costa Rica	(Costa Rica): Guanacaste Conservation Area (quasi-govt); Costa Rican National Institute of Biodiversity. (US): the Nature Conservancy.	<=$64M	5.0 MtC over 50 years
Tierras Morenas Windfarm Project	Renewable Energy (Wind)	The project will construct a 20MW wind power facility to displace thermal fossil fuel-based facilities.	Costa Rica	(US): New World Power Corp. (Costa Rica): Energia del Nuevo Mundo S.A.; Molinos de Viento del Arenal S.A.; Costa Rican Ministry of Natural Resources.	$27M	0.5 MtC over 15 years
USIJI - ROUND 3 PROJECTS						
The BEL/Maya Biomass Power Generation Project	Biomass Energy	The project will install an 18 MW circulating fluidized-bed steam power plant, fueled by sugarcane bagasse, orange processing wastes, and wood waste. The plant will displace diesel oil-fired power generation.	Belize	(US): International Utility Efficiency Partnerships, Inc. (IUEP); e prime. (Belize): e prime (Belize)	N/A	954,545 mtC over 30 years
The Bio-Gen Biomass Power Generation Project Phase II, Sava Site	Biomass Energy	The project will construct a 15 MW steam power plant fueled by waste from forestry and palm-oil industries, displacing diesel-powered generation.	Honduras	(US): International Utility Efficiency Partnerships, Inc. (IUEP); Nations Energy Corporation. (Honduras): Biomasa-Generacion S de RL	N/A	627,273 mtC over 20 years
District Heating Improvements in Zelenograd	Energy Efficiency	The project will upgrade part of a district heating system by installing heat exchangers, pumps, control valves, and related instrumentation and control circuitry.	Russian Federation	(US): Johnson Controls, Inc.; Consortium for Integrated Resource Planning (Univ of Wisconsin); Leonardo Academy, Inc. (Russian Fed.): Russian Energy Efficiency Foundation	N/A	440,000 mtC over 30 years

* Sources: USIJI [1996]; JIOnline; JI Quarterly [1996]

TABLE 1 - Current Joint Implementation Projects*

Project	Type	Description	Host	Sponsors	Cost	Offset
Halophyte Cultivation	Multicomponent Land-Use	The project will cultivate a native halophyte (Salicornia, a salt-tolerant plant) for carbon sequestration, food and fibre, in Sonora.	Mexico	(US): Salt River Project (SRP); Halophyte Enterprises, Inc. (HEI): Econergy International Corp. (Mexico): Genetica y Systemas de Ingenieria Solar S.A. de C.V. (GENESIS)	N/A	660 tons of carbon
The Noel Kempff M. Climate Action Project	Multicomponent Land-Use	This land-use project combines elements of park expansion, protection, regeneration and development of sustainable forest product enterprises.	Bolivia	(US): American Electric Power Service Corporation; The Nature Conservancy. (Bolivia): Fundacion Amigos de la Naturaleza (FAN)	N/A	14.5 million mtC over 30 years
Reforestation of Chiriqui Province	Multicomponent Land-Use	The project will replant degraded pasture land with a teak plantation.	Panama	(US): Center for Clean Air Policy (Panama): CAOBO, Inc.	N/A	58,000 mtC over 25 years
Reforestation in Vologda	Reforestation	The project will convert active hayfield to forests in a location beside the Russky Sever National Park.	Russian Federation	(US): Environmental & Economic Consulting. (Russian Fed.): Department of Natural Resources, Center for Environmental Economics	N/A	240,000 mtC over 60 years
USIJI PROJECTS APPROVED FEBRUARY 27, 1997						
Bilsa Reserve	Forestry	The project will add 2,000 Ha of tropical forest to the existing 2,000 Ha Bilsa Reserve in Northwest Ecuador	Ecuador	(US): World Parks Endowment, Inc. (Ecuador) Fundacion Jatun Sacha	N/A	316,800 mtC over 40 years
Scolel Te	Sustainable Land Management	The project will improve forestry and agriforestry management on approximately 2,400 Ha of land in nine Mayan indigenous communities.	Mexico	Corp. (Mexico): El Colegio de la Frontera Sur, Union de Credito Pajal, Instituto Nacional de Ecologia; (Other) University of Edinburgh; IEA Greenhouse Gas R&D Programme; Federation International de Automobile	N/A	230,000 mt C over 30 years
NETHERLANDS JI PROJECTS						
Krkonose	Forestry	The project replants and improves management on 16,000 ha in Krkonose National Park	Czech Republic	Krkonose National Park; FACE Foundation.	N/A	N/A
Profafor	Forestry	The project will replant and manage 75,000 ha of forest.	Ecuador	FACE Foundation; INEFAN	N/A	N/A
Hungary Energy Saving	Energy Efficiency	The project adds a JI (monitoring and analysis) component to several ongoing energy efficiency projects (including cogeneration and demand-side management).	Hungary	VROM-The Netherlands (Gov't); Hungarian Ministry for the Environment;NOVEM; EGI	N/A	N/A
Compressed Natural Gas Fuel Engine	Fuel Switching	The project converts a small number of city buses to compressed natural-gas fuel.	Hungary	VROM-The Netherlands; Hungarian Ministry for the Environment;RABA; Ikarus;TNO	N/A	N/A
Landfill Project	Landfill Gas Recovery	The project recovers natural gas emissions from a landfill.	Russian Federation	VROM-The Netherlands (gov't); HYDROMET; Russian Federal Service for Hydromet; Grontmij; Geopolis.	N/A	N/A
Horticulture Project	Land use	The project improves energy efficiency in the horticulture industry.	Russian Federation	VROM-The Netherlands (gov't); HYDROMET; Russian Federal Service for Hydromet; RITZA.	N/A	N/A

TABLE 1 - Current Joint Implementation Projects*

Project	Type	Description	Host	Sponsors	Cost	Offset
USIJI - ROUND 1 PROJECTS						
Rio Bravo Carbon Sequestration Pilot Project	Land Use and Forestry (mixed components)	The project will purchase land to add to existing protected areas, and implement sustainable forest management practices on the larger conservation area.	Belize	(US): The Nature Conservancy; Wisconsin Electric; Detroit Edison; Pacificorp; and Cinergy. (Belize): Program for Belize	$2.6M	1.3 MtC over 40 years
CARFIX	Land Use and Sustainable Forest Management	The project will expand a pilot project instituting sustainable forest management in a major national park and a buffer zone in central Costa Rica.	Costa Rica	(US): Wachovia Timberland Investment. (Costa Rica): Foundation for the Development of the Central Volcanic Mountain Range (FUNDECOR (NGO)); Costa Rican Ministry of Natural Resources.	$21.4M	5.9 MtC over 25 years
Plantas Ecolicas, S.A.	Renewable Energy (Wind)	The project will construct a 20MW wind power facility to displace thermal fossil fuel-based capacity	Costa Rica	(Costa Rica): Plantas Ecolicas. (US): Charter Oak energy; Merrill Int'l; Kennetech.	$30M	71,800 mtC over 15 years
ECOLAND: Esquinas National Park	Land Use and Forestry	The project will preserve tropical forest in the Esquinas National Park in southwestern Costa Rica, by purchasing land from private landowners.	Costa Rica	(US): Tenaska Washington Partners; Trexler and Assoc; Nat'l Fish and Wildlife Foundation. (Costa Rica): COMBOS; Costa Rican Ministry of Natural Resources;Council of the OSA Conservation Area. (Austria): Rainforests of Austria	$5M	345,500 mtC over 15 years
Decin District Heating System	Fuel Switching, Cogeneration, and Energy Efficiency	The project replaces a lignite-fired urban district heating system with natural gas, and improves the efficiency of the hot water distribution network. In addition to GHG reductions, the project will dramatically improve local air quality.	Czech Republic	(US): Center for Clean Air Policy; Wisconsin Electric; Commonwealth Edison; Northern Indiana Public Service Development Co. (Czech Republic): City of Decin.	$8M	165,600 mtC over 25 years
Solar-based Rural Electrification in Honduras	Renewable Energy (photovoltaic)	Carbon dioxide will be displaced by replacing kerosene lamps with solar-based electric lights in rural homes.	Honduras	(US): ENERSOL (NGO). (Honduras): COMARCA (NGO); AHDEJUMAR (NGO); AHDE (NGO).	$0.3M-$0.6M in credit; $0.15M-$0.25M in tech assistance	4,700 mtC over 20 years
RUSAFOR: Saratov Afforestation Project	Land Use and Forestry	The project will reforest agricultural land.	Russian Federation	(US): Oregon State Univ; USEPA. (Russian Federation): Russian Federal Forest Service; Int'l Forestry Institute (NGO).	$250K	35,000 mtC over 60 years
USIJI - ROUND 2 PROJECTS						
Bio-Gen Biomass Power Generation Project	Biomass Energy	The project will develop a 10- to 15-megawatt generation plant burning sawmill and logging residues. Electricity will be supplied to the national grid.	Honduras	(Honduras): Biomass Generacion; (US): Nations Energy Corp; Int'l Utility Efficiency Partnerships; Add-on Energy 1	$24M	647,400 mtC over 20 years