

Heller, Thomas Charles

**Working Paper**

## Additionality, transactional barriers and the political economy of climate change

Nota di Lavoro, No. 10.1998

**Provided in Cooperation with:**

Fondazione Eni Enrico Mattei (FEEM)

*Suggested Citation:* Heller, Thomas Charles (1998) : Additionality, transactional barriers and the political economy of climate change, Nota di Lavoro, No. 10.1998, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/154868>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# **Additionality, Transactional Barriers and the Political Economy of Climate Change**

Thomas Charles Heller\*

NOTA DI LAVORO 10.98

**JANUARY 1998**

ENV – Environmental Economics

\*Stanford Law School, Stanford University, USA

This paper was presented at the Conference on “International Environmental Agreements on Climate Change”, Venice, May 6-7, 1997, organised by Fondazione Eni Enrico Mattei and the Stanford Energy Modeling Forum with the sponsorship of IPCC and under the auspices of EFIEA.

*Address for correspondence:*

Thomas Charles Heller  
Stanford University  
Stanford Law School  
Stanford, CA 94305-6072  
Phone: 415+7237650  
Fax: 415+7250253  
E-mail: [theller@leland.stanford.edu](mailto:theller@leland.stanford.edu)

Le opinioni espresse nel presente lavoro non rappresentano necessariamente  
la posizione della Fondazione Eni Enrico Mattei

## **SUMMARY**

Stabilization of greenhouse gases at sustainable levels is the objective of the FCCC. Strategies to achieve this aim have been the object of intense debate. This paper focuses on one emissions trading system under scrutiny, Joint Implementation (JI). The basic premise of JI is that one nation party can satisfy its obligations to control emissions by financing emission mitigation in another nation party. Such an approach can optimize access to least cost mitigation options, and predicts collective participation even in the absence of centralized determination of universal quotas. A key issue for JI is the concept of additionality. "Business as usual" trajectories provide a baseline against which additionality is measured. Accurate estimation of baselines needs to take into proper account institutional and organizational transaction costs. Hence, the implementation of a climate change system incorporating JI as a core element requires a greater understanding of the incentives and barriers that underlie the patterns of infrastructure development in rapidly growing economies.

*Readers should note that all of this paper's analyses and conclusions related to JI apply equally to the new clean development mechanism established by article 12 of the Kyoto protocol.*

## **NON TECHNICAL SUMMARY**

The aim of the Framework Convention for Climate Change (FCCC) is the stabilization of atmospheric greenhouse gases at sustainable levels. At the Rio Earth Summit in 1992, the industrialized countries known as Annex I parties agreed on returning their greenhouse gas emissions at 1990 levels by the year 2000. No obligations had been specified beyond 2000. A subsequent conference, held in Berlin in 1995, initiated the negotiation process intended to culminate in Kyoto in December 1997, on the strategies to be implemented in the post-2000 period. This paper focuses on one emissions trading system under debate, Joint Implementation (JI). The basic premise of JI is that one nation party can satisfy its obligations to control emissions by financing emission mitigation in another nation party. In this way, the cost of compliance is lowered by allowing the choice of the least costly set of global reduction options.

The author argues that emphasizing JI among all parties to the FCCC may provide an effective regime for climate change mitigation. JI is consistent with the US proposal for the Kyoto Protocol. JI also shifts part of the cost of climate change regimes onto capital transfers to the third world, which overcomes the concern by non-Annex 1 parties that reduction activities in developing countries will impede their export-led growth. Finally, JI predicts collective participation by encouraging a shift away from the centralized determination of universal quotas by the FCCC.

Implementation of a regime with JI as a core mechanism must, however, first make clear its definition of additionality. Additionality implies that a policy intervention, like the institutionalization of JI, is conditional on improving the environmental situation with respect to the situation without the intervention. Emission-reduction investments in non-Annex 1 countries can be used to offset abatement obligations that would have otherwise required compliance in the investors' home country, only if these improvements would not have occurred in the normal course of events in the host country. Hence, a judgment about what would have been the baseline situation without the intervention is required. "Business as usual" patterns of development provide such a baseline. Accurate estimation of the baseline is critical in evaluating the appropriateness of a JI mechanism.

Opposition to JI is primarily based on the concern that JI baselines could be set at excessively permissive levels. Such concern, however, relies on analyses that often do not take into proper account transaction costs or barriers. Transaction costs, such as institutional costs arising because of existing policies and organizational costs arising because of restructuring, are typically hard to quantify. But failure to incorporate them in models used to define JI baselines will lead to incorrect emission abatement predictions. The inclusion of transaction, as well as production, costs in modeling is thus critical to the optimal definition of additionality. It is also important to consider policy baselines that encourage sound environmental and economic policy and that prevent backsliding on institutional reforms that might otherwise have been forthcoming.

In conclusion, in order to implement cost effective climate change systems incorporating JI as a core element, it will first be necessary to understand better the patterns of infrastructure development in rapidly growing economies, and particularly the incentives and barriers that underlie these patterns. Because of the central importance of China in any climate change strategy, the author suggests exploring these issues using case studies of Chinese sectors with emission mitigation potential.

*Readers should note that all of this paper's analyses and conclusions related to JI apply equally to the new clean development mechanism established by article 12 of the Kyoto protocol.*

PLEASE DO NOT QUOTE WITHOUT PERMISSION

ADDITIONALITY, TRANSACTIONAL BARRIERS AND THE POLITICAL ECONOMY OF  
CLIMATE CHANGE

Thomas Charles Heller  
Stanford University  
September 23, 1997

1. The Framework Convention for Climate Change (FCCC), announced at the Rio Earth Summit in 1992, has been signed by more than 150 nations. In Article 2 the FCCC states its objective to be the stabilization of “atmospheric concentrations of greenhouse gases at a level that would prevent dangerous anthropogenic interference with the climate system”. In Article 4, the FCCC obligates the industrialized (OECD) nations, known as “Annex I” parties, to aim to return their greenhouse gas emissions to 1990 levels by the year 2000. It suggests policies and measures taken to meet this aim may be implemented individually or jointly with other parties. Although the FCCC does not specify any particular obligations for Annex I or other signatories beyond the year 2000, at the First Conference of the Parties (COP-1), held in Berlin in April 1995, a decision (Berlin Mandate) was taken to initiate a negotiating process to determine the set of multilateral actions to be taken in the post-2000 period. This process, intended to culminate in Kyoto in December 1997 at the Third Conference of the Parties to the FCCC (COP-3), now constitutes the site of intensive bargaining over reductions targets, policies and mechanisms for reaching them, and the financial instruments that might make up a prospective international regime.

2. Joint implementation (JI) is a type of emissions trading system that remains a subject of debate in the Berlin Mandate process (Heller, 1996). Under conditions for qualification that remain to be defined, JI would permit nations or firms with legal obligations to control emissions in one nation party to the FCCC to satisfy all or part of those obligations by financing, directly or indirectly, emissions reductions in another nation party. As with all emissions trading systems, JI could lower the costs of compliance with the climate change regime by allowing actors to pursue the least cost set of global mitigation options.

3. Experience under the FCCC since Rio has not been auspicious. Although the Second Assessment Report (1996) of the Intergovernmental Panel for Climate Change (IPCC) expressed the substantial agreement of the scientific community that anthropogenic actions are influencing the climate system in ways that risk damage to human and natural ecosystems (IPCC WGI, 1996), there has not been any clear policy development in the Annex I nations that has led toward fulfillment of the aim of stabilizing emissions at 1990 levels by the year 2000. Almost all Annex I parties will overshoot this level. Those few which have reduced emissions (United Kingdom; Germany) owe their compliance to measures (privatization; re-unification) unrelated to climate change policy. In the United States, reliance on voluntary (no regrets) measures-- principally

measures said to introduce emissions saving energy sources or uses that yield net economic, over and beyond environmental, benefits by reducing the cost of energy services--has not shifted the post-Rio emissions trajectory far from the otherwise expected emissions baseline. In the European Union, proposals for a carbon tax and mandatory efficiency standards (SAVE), put forward as no regrets measures, were defeated on both economic and political grounds (Heller, 1997).

4. In addition to the Berlin mandate, COP-1 instituted a pilot program called Activities Implemented Jointly (AIJ) intended to permit the later evaluation of the costs and benefits of international emissions trading. However, there has been very limited investment in AIJ projects to evaluate because of evident flaws in the pilot program design. Most importantly, there are no real incentives for private actors to invest in offshore mitigation since they have no legal obligations in their home nations against which to credit activities abroad. Moreover, such crediting was explicitly forbidden by the pilot program as a political compromise between opponents and supporters of JI. Finally, there is great uncertainty about the rules which define whether an AIJ project is "additional" to mitigation activities that would otherwise have occurred and, thereby, potentially recognizable as a positive contribution to the improvement of the global environment.

5. Multilateral negotiations about the post-2000 climate change regime are deeply contested and their success in reaching a consensual solution remains problematic. An important part of this difficulty is due to the fact that the value of an international regime depends on collective action. Nations will resist spending resources for mitigation unless they are confident that a critical mass of other states is also committed to reducing emissions to acceptable levels. In the absence of a credible belief in effective collective action, nations will prefer a strategy of adapting locally to damages they will have to bear in any case, in as much as they will at least have control over the efficacy of these expenditures. For mitigation to become a dominant bargaining strategy for a nation party to the FCCC, the expected national cost of implementing an effective collective regime must lie below the expected domestic cost of adaptation to the damages that nation might suffer.

For example, imagine that we were to accept the conclusions of various models that suggest, on the average, the United States could expect to bear in the neighborhood of \$60 billion in annual damages over the next century from predictable degrees of climate change. (IPCC WG III, 1996 : 203) If stabilization of greenhouse gas concentrations at negotiated levels were to require a reduction in emissions of 500 million tons of carbon each year, we might estimate the cost per ton of adapting to or living with climate change damage of \$120 per ton of carbon. Unless mitigation that is effective in forestalling damage can be secured for less than \$120 per ton-- an amount that is less than various estimates of the carbon tax needed to achieve stabilization-- it is very possible that the United States will opt for an adaptation strategy by defaulting in the FCCC negotiations.

The cost of mitigation is the sum of the actual costs of emissions savings at home or

abroad through international trading or JI, and any further administrative contributions or financial transfers that must be paid to secure the effective collaboration of other (developing) nations in the regime. However, it may be the case that the actual costs of mitigation are not independent of the time and place where they are made. Least cost options that affect the choice of climate change strategy may only be available in particular time windows in particular nations. A plausible scenario for the existence of limited time windows would be if mitigation costs varied substantially with the installation of energy or transportation infrastructure. To miss out on emissions saving opportunities during periods of heavy infrastructure investment might raise the average cost of mitigation to a level where it no longer dominated adaptation. In this sense, the willingness of a nation to pursue a mitigation based bargaining strategy could turn on the link between reduction commitments and mechanisms for trading or banking emissions credits necessary to ensure that the costs of carbon mitigation lie below an adaptation cost threshold.

The point that I wish to make here is strictly ordinal. I do not want to argue that there is some widely accepted set of mitigation and damage/adaptation cost curves such that we can hope to specify where lies the crossover for one or more nations from a mitigation to an adaptation based strategy. What is clear is that, wherever this threshold is believed to be, there are political incentives for actors to be biased in favor of adaptation because its costs may be largely deferred into future political administrations and do not require collective action to be effective. In these circumstances, and given the enormous uncertainty that will continue to plague the consensual definition of climate change science and economics, to neglect an important set of low cost mitigation options due to a regime design that does not allow their legitimate exploitation is to risk worsening what is already a problematic situation.

#### 6. Modeling exercises on the costs and benefits of climate change fall broadly into three schools of thought.

A minority view is that the expected damages from, or the costs of adapting to, climate change at the levels predicted by the IPCC are inconsequential or even non-existent. This is relatively more likely to be the case for specified temperate and economically developed regions, including the United States (Mendelsohn et. al., 1996). The estimate of damages, or the cost of adaptation, may also be low if they will be concentrated in the latter part of the 21st century and a positive cost of capital (discount rate) is assigned to their valuation.

A more common viewpoint, often associated with technology or engineering driven cost estimates, is that the expected costs of mitigation are small or even negative. In this case, regulations that mandate emissions saving policies and measures can result in both environmental and economic gains.<sup>1</sup> Arguments that mitigation can have net economic

---

<sup>1</sup> Although the policy preference of those who posit a large pool of no regrets possibilities for regulation is common, it is not logically necessary. As long as parties to a mitigation regime



benefit all turn in some way on asserted inefficiencies in private markets to maximize social well being. Usually, it is suggested either: 1) that there are existing technologies that save cost and emissions that are not employed because of lack of information or installation capital; 2) that demanding policy standards will signal or elicit an efficient increase in the private rate of development of new no regrets technologies; 3) that the revenues from carbon taxes or the auction of emissions permits can replace those of more inefficient existing taxes and yield a net social gain; 4) that the abolition of inefficient subsidies to fossil fuels or deforestation will improve both net emissions and national wealth; and 5) that carbon taxes will produce little damage to GNP because there is a high elasticity of substitution for carbon intensive goods and services. While there is some argument for each of these contentions, neither the recent experience of the United States with voluntary programs nor of the European Union with a proposed carbon tax lends credibility to the belief that a stock of technically identifiable no regrets options, by itself, can assure nations that mitigation will be preferred politically to adaptation.

The third school of thought, more often articulated by economists, tends to the view that mitigation strategies can dominate the risks posed by adaptation only if a collective regime provides flexibility in where and when emissions savings may be achieved, in order to discover the least cost portfolio of mitigation opportunities. Recent estimates, the magnitude of whose results is debated more than their direction, indicate that the present value of the cost of stabilizing emissions at 1990 levels can be reduced from more than 8 trillion to less than 4 trillion dollars if trading is possible and, again, to less than 1 trillion if both trading and time, or “where and when”, flexibility are allowed (Richels, Edmonds, Gruenspecht & Wigley, 1996).

7. In preparation for the negotiations leading up to COP-3 at Kyoto, the United States has floated an informal framework for a post-2000 climate change regime. The key elements of this position include an overall global long-term concentration stabilization target, binding medium-term emissions national emissions budgets, and banking and trading mechanisms that allow nations party to maximize flexibility in time and place of implementation. Moreover, although the obligations of non-Annex I parties lie outside the explicit charge of the Ad Hoc negotiating Group on the Berlin Mandate (AGBM), the United States suggests that it will be critical to move now toward defining a longer-term, evolving commitment from fast developing nations whose participation will be necessary to an effective mitigation system. Given the projected disparity in rates of growth of greenhouse gas emissions between the Annex I and many developing nation parties, even if the Annex I parties unilaterally achieved a 20% reduction in their stable emissions, it would delay hazardous incremental climate effects by only a few years. Nor is it easy to imagine a least cost or affordable solution to climate change without more universal engagement than the FCCC has engendered in its first period. In this regard, the United States has reiterated

---

have hard targets they must meet, and the potential to bank current emissions reductions against later obligations, it will be rational for them to implement all such cost less opportunities as soon as possible.

its insistence that any new multilateral regime incorporate emissions trading between those parties who do accept a binding emissions target and creditable JI between nations with binding targets and other parties to the regime.<sup>2</sup> Although the United States has often been considered among the most resistant Annex I parties to hard climate change commitments, its framework may be read as a willingness to negotiate binding obligations if the regime ensures effective where and when flexibility in compliance.

8. The American proposal is both distrusted and contested within the Berlin Mandate negotiations. There are several dimensions to this debate which threaten to prolong the bargaining impasse that has plagued the FCCC process since Rio. First, there remains disagreement within the Annex I nations about whether particular policies and measures ought to be mandated or whether parties should be left alone to fashion their own portfolio of mitigation strategies under an assigned emissions cap or budget. In part, this disagreement reflects different legal traditions that place more or less stress on regulations or market instruments. In part, it reflects a supposition that the absence of clear technically defined obligations will pose too great a temptation to postpone compliance indefinitely. More importantly, there is a principled refusal, reflected in the AGBM's refusal even to table the American requests for the phased-in evolution of non-Annex I party obligations, to consider universalized commitments at this juncture. The demand for such commitments has been seen as morally unjust, inconsistent with norms of international law, and, thereby, not discussable until the OECD nations have demonstrated their good faith by first scaling back their historically high levels of emissions at home (the early action principle). While the lack of agreement within Annex I over specific instruments, like JI, might seem in itself resolvable, it is the interdependence of the availability of mechanisms to ensure that the benefits of where and when flexibility may reduce the costs of hard and substantial commitments that brings the issue of allowable instruments to the center of the negotiating table. In turn, untying the tangled knot of targets, timetables, and instruments has become more complex due to recent analyses of the economics of climate change that question the thus-far established logic of the multilateral negotiations.

Although the specification of emissions budgets and their distribution among Annex I parties in the American framework for a Kyoto Protocol is highly schematic, the clear emphasis in its regime design is on flexibility in timing and location of emissions mitigation actions. This

---

<sup>2</sup> Since the submission of the US proposal, there has been growing concern about the effects of a trading system between Annex I parties with FCCC targets. This concern stems from the fact that Russia and other former socialist bloc states have experienced large decreases from earlier (1990) emissions levels due to economic declines and the closure of highly inefficient and carbon intensive plant. If these existing reductions are allowed to be marketed to other Annex I parties as offsets against their domestic emissions, there will be no environmental benefits in the permit selling nation to counterbalance the emissions excess in the buying nation. This "hot air" problem can be remedied either by reducing the emissions commitment in the former Soviet Union states to a level that reflects post-1990 conditions or by incorporating this trading to a comprehensive JI system that requires a showing of additionality to qualify offset crediting.

flexibility has been interpreted as a backing away from the principle of early action in the advanced industrial world which is the historical source of greenhouse gas emissions. While the bloc of developing nations (G-77 and China) has insisted throughout the FCCC negotiations on the centrality of the early action principle, and has been generally supported in this assertion by both the European Union and most Green NGO's, this corner stone of the FCCC process has been recently weakened by two assaults from opposing directions. Analyses underlying the United States proposal point out that the economics of investment cycles in energy and transportation infrastructures suggest that an efficient climate change regime would combine deferral of ambitious targets for current mitigation in capital-mature Annex I parties with refocused early action attention to low cost mitigation options in non-Annex I countries now in the beginning stages of an expansionary period.<sup>3</sup> Although there is at all times some turnover in any capital base that opens opportunities to use proven technologies such as co-generation and integrated gas combined cycle to reduce near-term emissions in Annex I states, affordable mitigation in these nations at the scale needed to stabilize by 2100 global greenhouse gas concentrations at levels like 550 ppm is likely to demand an emphasis on "when flexibility" attuned to the development and installation of new technologies in hydrogen fuels, carbon sequestration, and distributed energy systems. (Edmonds & Wyse, 1997) In addition, G-77 bloc nations worry increasingly that deep early cuts in emissions in the OECD nations will lead to reductions in GNP growth rates that will yield still steeper declines in imports from the third world, with consequential development losses (Babiker, Maskus & Rutherford, 1997). In either case, uncertainties whether the Annex I early action commitment embedded in the AGBM negotiations is economically feasible has made its political stature problematic as the legal and moral foundation of the multilateral process.

9. If these multiple difficulties presage a continuing likelihood that the problem of constructing an effective regime for climate change mitigation, an accord which emphasizes JI as a means to ensure "where flexibility" among all parties to the FCCC may provide some avenues of escape from deadlock. First, JI is consistent with the proposals of the United States for comprehensive emissions trading that would maximize immediate access to the full stock of least cost mitigation options. Assured access for OECD actors to the set of potentially wasting low cost mitigation opportunities in developing countries would both reduce the overall costs of mitigation commitments and inhibit defection by Annex I nations based on the perception that adaptation

---

<sup>3</sup> "Transitions from reliance on one fuel source to another have typically involved a highly time-consuming pattern of search, experimentation, pilot plant operation, and the design and eventual construction of extensive infrastructure as well as the specific new facilities. As a result, even when new technologies are available, it may take many years before the new fuels make a significant contribution to energy needs. This slow adjustment response is reinforced by an affluent society's stock of existing capital. Such societies are always, to a considerable degree, the prisoners of their own past investments in long-lived capital assets. Fuel-saving improvements are often highly expensive to insert into existing capital structures through retrofitting and, as a result, are not installed until capital is actually replaced. Consequently, technology is adopted and exercises its impact slowly..." (Rosenberg, 1994: 184-85)

strategies are less expensive than available mitigation investments.<sup>4</sup>

Second, to the extent that non-Annex I parties are concerned that extensive mitigation activities in the first world will slice into their export led growth, JI relocates an important part of the burden of mitigation onto capital transfers to the third world. Ironically, much of the current G-77 opposition to JI has stemmed from its supposed anti-developmental character. This belief arose because most of the first publicized proto-JI projects have involved carbon sequestration. Whatever the merits of reforestation and better forest management, there was an initial fear that JI was a surreptitious campaign to preserve the third world as global park space. Moreover, sequestration projects contributed to the view that JI would deplete a fixed, conservable stock of low cost mitigation assets (low hanging fruit) that would have been sold off at the time that non-Annex I parties were forced to assume their own mitigation commitments. In these regards, forestry is unlike JI projects in the energy or transportation sectors where economic development is facilitated and cheap mitigation possibilities often waste as soon as long-lived capital of a particular type and quality is installed. If JI investment is credited in key development infrastructure, lowers the effective cost of capital to fast growing economies, and markets assets that cannot be preserved for home use, its attraction to non-OECD parties concerned about the economic losses that mitigation might entail should become evident.

Finally, JI addresses indirectly the problem of the scope of participation in the collective mitigation regime. There is no present indication that the politics of the non-Annex I bloc in the multilateral forum will allow agreement to, or even discussion of, binding commitments to limit the rates of their emissions growth. Therefore, prior to agreement on a multilateral process to establish the criteria according to which developing nations will graduate to formal FCCC obligations, a functional equivalent for national caps must be devised outside that forum if the system is to become comprehensive and effective. Since JI qualification will be conditioned on a reduction in emissions trajectories relative to some baseline, the determination of the appropriate baseline by the governments of Annex I parties, approached by their investors proposing projects to be credited against national legal obligations, is the assignment of an implicit target. Annex I nations can steer capital toward polities willing to assume such surrogate commitments by variably discounting the credits they offer for JI projects in those jurisdictions that bid in more environmentally ambitious baselines. In effect, a competitive, multi-sited process that sets JI baselines can serve as a near-term substitute for an immediate political and centralized determination of universal quotas in a stalled FCCC.

---

<sup>4</sup> It is possible to conceive of a scenario in which the incremental emissions from the installation of inefficient, carbon-intensive infrastructure in fast growing economies will be sufficiently large that, thereafter, Annex I parties will have to expend resources on adaptation to that change. If their marginal costs of further adaptation beyond that initial expenditure are low, it could become rational for them to switch to adaptation as a dominant overall strategy and to abandon mitigation expenditures as wasteful. In such a case, a failure to take advantage of JI opportunities early may alter the entire structure of the climate change regime (Heller, 1996: 333).

10. JI cannot be the centerpiece of a climate change regime that will lead to stable greenhouse gas concentrations at ecologically tolerable levels over the next century. The core assumption of when flexibility is that substantial reductions in historical emissions levels in the Annex I parties will become more affordable as the installed capital base depreciates and new technologies are brought on line at the time of its replacement. Technology policies and checkpoints to ensure this result may well be essential to regime design and accord (Edmonds & Wyse, 1997). In addition, a comprehensive solution will demand a mechanism to ensure that successfully modernizing states, in accord with an equitable standard that equates their future position to current Annex I income levels, assume binding obligations in the coming decades. Nevertheless, JI may be an essential element of a comprehensive climate change strategy that compromises the early action principle in order to implement where flexibility and pick up what may be an economically critical stock of wasting, low cost mitigation opportunities. This stock of projects would improve environmental quality for the life cycle of new capital infrastructure by providing subsidies for installations that take advantage of off-the-shelf, proven technologies that would not otherwise now be employed in fast growing economies for financial or institutional reasons.

As illustrated in the attached figure, in a system that approximates a cost-effective mitigation path, JI may compose an important part of early mitigation action in the overall design. In effect, we may imagine a politically viable comprehensive stabilization regime to require: (1) an increasing percentage and increasing absolute quantity of global emissions reductions, located in and financed by Annex I parties, timed to reflect technological innovation and the depreciation of the existing energy and transport capital stock; (2) a decreasing percentage and decreasing or stable absolute quantity of reductions attributable to JI projects located in non-Annex I states and financed in part by capital transfers from Annex I parties; and (3) an increasing percentage and increasing absolute quantity of mitigation projects in graduating non-Annex I parties located and financed domestically. Mitigation commitments for Annex I states in this conception would combine the first and second elements above, and their hard targets would therefore grow across the century. Non-Annex I states would assume legal responsibility for the third element, plus any implicit costs of emissions savings obligations they undertake in conjunction with defining national baselines for qualifying JI projects.<sup>5</sup> Although the pragmatic emphasis in this alternative regime blueprint on the reorientation of early action toward JI and mitigation opportunities in non-Annex I parties is inconsistent with the more normative early action in Annex I states principle now enshrined in the AGBM negotiations, it may offer a basis to unblock the current Kyoto impasse.<sup>6</sup>

---

<sup>5</sup> See discussion of policy baselines and shared cost assignments in sections 12 and 13 below.

<sup>6</sup> In addition, an active early JI market in the post-Kyoto period may also facilitate an extended process of establishing regime commitments by developing nations since its operations may elicit the real prices of supply and demand for emissions reductions which tend to be disguised strategically in the cartelized politics of the multilateral negotiations. In this sense, the behavior of individual non-Annex I parties in bidding for JI capital transfers outside the FCCC forum may be the best indicator of their actual supply price for regime participation and help to

11. However, if a comprehensive and complex regime that relies, in part, on JI is to evolve toward an optimal mitigation level, Annex I parties must institutionalize JI crediting rules and procedures that give the proper incentives for increasing environmental quality in states without a formal mitigation commitment. JI can in theory result in a declining spiral as non-Annex I nations reduce or postpone the deployment of domestic environmental laws to increase their stock of marketable potential emissions reductions and Annex I nations credit projects against ever more permissive baselines to minimize their costs of compliance. While such a strategy makes little sense in theory collectively for Annex I nations since it would be both ineffective in mitigating the damages of climate change and more expensive than the costs of adaptation which they will ultimately have to bear in any case, there is a risk that lack of coordination among Annex I parties on the definition of additionality could make a political charade of a system built in important part around a JI component.

Additionality implies that justifiable policy interventions, like the institutionalization of JI, be conditioned on qualified actions producing an improvement of the environmental situation that would have existed or come into being in their absence. If mitigation investments in non-Annex I nations are to be credited as offsets to abatement obligations that would otherwise have required compliance in the home countries of the investors, an equivalent global balance will require that these improvements not have occurred in the normal course of events in the host jurisdictions. Business as usual trajectories then provide a baseline against which additionality must be measured such that the appropriate definition of the baseline is the key exercise in determining whether JI constitutes a legitimate climate change instrument. There has been considerable concern that JI baselines will be set at too permissive (high) a level to serve regime ends. In part, this fear reflects the pressure that investor home nations will systematically qualify low cost, non-additional JI projects in order to minimize the overall compliance cost for their local firms of climate change. As stated above, while positive expenditures on a globally ineffective race to the bottom are irrational, the emergent regime does have to concern itself with the coordination of national standards of baseline definition to reduce temptations to beggar-one's-neighbor. In addition, there is preoccupation that baselines may be set too permissively because they incorporate business as usual practices reflecting perverse incentives in JI host nations. If, for example, a host nation has for domestic political reasons long subsidized employment in the coal industry, there may be a diminished incentive to eliminate this subsidy if it has the effect of creating a larger stock of mitigation opportunities to be traded on the international JI market. A JI qualification rule that creates endogenous incentives to delay or preclude national policies that would have altered the emissions baseline presents a real moral hazard that must be confronted in regime design.

At the same time, it has been less noticed that the problems with baseline definition can also run in the opposite direction. In other words, there may be good reason to expect that baselines will be set at too restrictive (low) a level, such that JI projects that would have actually brought about incremental declines in emissions will not be certified as creditable. The value of any given

---

discover a solution point to the difficult bargaining problem of commitment evolution.

mitigation option is a function of the cost per tonne of carbon equivalent emissions reduced, the number of tonnes reduced, and the price at which carbon mitigation is traded. Assuming the costs of incremental capital are fixed and the prices of traded carbon are externally given, the relative attractiveness of a JI investment, like the installation of more efficient boilers in a coal fired power generation facility, depends on the difference between actual tonnes of carbon emitted and the legally recognized baseline. The failure to specify accurately the baseline means that the priority rank of potential investments will be altered and some cheap mitigation options will be neglected. The available pool of low cost mitigation opportunities would shrink with too restrictive baseline qualification rules, potentially to the point where the rising prospective cost of effective mitigation becomes prohibitive and strategies that favor defection to adaptation dominate. The determination of the JI baseline is then a delicate process, threatened in its utility on both sides. Too high an estimation will produce incentives that run against the proper direction of policy and undercut the possibility of an effective climate change system. Too low an estimate will eliminate the most valuable set of mitigation opportunities, and push the total costs of mitigation regimes toward levels that may be politically unsustainable.

It is relatively easy to see the forces that may induce an overestimation (too permissive) of the optimal baseline. Why there may be systematic features that lead to underestimating (too restrictive) the baseline may be less apparent. Setting too restrictive a baseline is like saying that something will happen in the normal course of events when, in fact, it will not. Baseline projections for a sector like energy or transport customarily would express expectations about sectoral growth, technical composition, and the relative demand and supply costs associated with alternative production technologies. Variables including price effects, capital depreciation cycles, and technological innovation dynamics would merit central attention in making credible estimates. These classes of calculation have been the normal practice of engineering based “bottom up” studies that often have indicated the potential for “no regrets” solutions wherein economic and environmental logics both favor a reallocation of resources away from their present configuration. The confluence of mitigation and profitability in no regrets cases would imply that, once exposed, the preferred solutions would be taken up by regular market forces. They should, in effect, be incorporated into the authorized baseline and, as such, afford a rationale on which to eliminate further policy measures that would only transfer economic surplus (rents) from the public to the private actors so subsidized. In this sense, there is a symmetry of views between those who believe that the pool of no regrets options is very large and those who disapprove of using market instruments, like JI, for climate change policy. The more extensive the pool, the more reliant should be regime design on command regulations that will cause private actors to do what is already in their interests. While there is no necessary reason for large-pool-no-regrets believers to preclude JI projects if they are qualified on a properly drawn baseline that would internalize all no regrets opportunities, opposition to JI is built on the assumption that JI in practice would define an excessively permissive baseline.

The potential difficulty in this analysis is frequently that production cost based studies do not focus on transaction costs that forestall or delay the expected uptake of alternative technologies. Consequently, such bottom up studies predict that the rate of emissions growth will

be lower than it will actually prove to be when transaction costs are considered. They tend to forecast baselines that will discredit projects that would not actually be realized because of the presence of the unaccounted costs. Transaction costs of importance are most likely to arise because of institutional (policy) and organizational (restructuring) factors. Organizational costs are frequently invisible or hard to quantify on a project basis because to any given private actor they have the characteristics of collective goods. Within a firm, the up-front investment that is needed to appraise and enter unfamiliar geographical markets or product areas may be one time or a diminishing stream of learning costs that cannot be associated with the return to a single project. Moreover, across firms, there may be good reasons to wait and watch first movers expend resources in innovative explorations whose benefits can then be appropriated by latecomers. Especially when the changes in question involve new goods like pollution credits, transiting markets like the Chinese energy sector, or unfamiliar production routines like such as those faced by monopoly utilities becoming energy service providers, the transaction costs of reorganizing can be formidable.

Similarly, institutional costs, which establish the context of relative returns and costs that influence private choice, will often resist quantification on a project-by-project basis. Yet policies in place such as subsidies, regulatory processes, taxes, capital market structure, legal enforcement of contracts and security interests, allowed forms of investment and corporate organization, foreign exchange access, sovereign guarantees, and political enmeshment of infrastructure provision can impede the utilization of production possibilities that make perfect sense in an engineering-only world. The costs of lobbying against, paying corruption around, living with, or distorting preferred business practice to manage extraordinary risks associated with institutionalized measures that are defended by entrenched domestic interests will not normally show up as attributable project specific costs. Yet, a failure to incorporate the effects of transaction costs into the expected market behavior or business as usual trajectories that define baselines will lead to the forecast of emissions abating activities that will not eventuate. Measured against such too restrictive baselines, JI credits that could have compensated for such institutional and organizational barriers will be ruled out as illegitimate.

12. The introduction of transactions costs as a substantial question in emissions modeling highlights the subtlety of the policy judgements that must underlie an optimal definition of additionality. Policy and organizational costs are more complex and strategically manipulable than the production costs that are more traditionally and easily calculated. They are often uneven over time and collective in nature so that tendencies to free ride and engage in other opportunistic behavior with moral hazards may be usual. Policy making takes on aspects of strategic game play that runs contrary to legal ideals that argue that the FCCC should enact at the outset protocols of general and unchanging rules. Moreover, other instruments that may be appropriate for reducing institutional market barriers, like Global Environmental Facility grants or Brazil's proposed Clean Development Fund, may be equally or more appropriate than JI for the reform of public goods, and the inter-relations among alternative mechanisms in a portfolio of climate change instruments must be worked out. Finally, institutional and organizational barriers may be so significant in instances of purported no regrets or low cost mitigation projects that marginal policy



adjustment by means of politically feasible levels of carbon taxes or other forms of carbon pricing like permits may be illusory. Though the formulation of an effective and efficient climate change regime cannot escape the problems caused by the impact of transaction costs on the determination of what constitutes business as usual, the principal point of this argument is that their systematic underestimation in current work yields an overestimate of available no regrets options and a tendency to imagine baselines that will mistakenly drain the pool of real low cost mitigation options.

The exercise of defining additionality and JI baselines for investments in host nations without emissions caps implies the study of transaction, as well as production, costs in several dimensions. The enactment of project baselines demands that the disincentives of the organizational costs associated with innovative behavior be internalized to the risk profile of the proposal under review. These organizational costs may be firm or industry specific and may decline over time as the diffusion of learning reduces the initial burden that merits public subsidy. The strategic relationship between institutional costs and baseline setting may also suggest a moving target and a case specific, non-generalizable decision process. Because it is impossible to disentangle the idea of business as usual from the policy background that shapes business choices and because of the probability that comprehensive trading in mitigation services in the absence of universal quotas will tempt nations to adjust policy to increase their stock of marketable assets, it will be important to consider policy baselines that prevent backsliding on institutional reforms that might otherwise have been forthcoming and that encourage the progressive legislation and enforcement of sound national environmental and economic policy. For example, although it might be expectable business as usual to see coal fired power plants developed where the price of domestic coal is heavily subsidized, a higher baseline drawn on a shadow rationalized price of alternative fuels could eliminate a JI based incentive to leave the subsidy in place and provide a market test of the real supply price of mitigation. As long as host nations were willing to revise and implement domestic policy to bring local events into conformity with the hypothetical baseline in order to attract JI accreditation, the system would tend to reveal the actual percentage of global climate change costs non-Annex I countries are willing to bear internally.

A homologous political interplay about policy baselines might focus on the degree of national enforcement of acid rain control programs. In many circumstances, developing countries enact formal pollution controls that seem to reflect externalities suffered locally, but do not force actors into compliance. Calculations about the costs and benefits of enforcement policy could be influenced by JI markets. If subsidized capital can be imported from abroad through carbon mitigation sales, it makes better sense to shift offshore the costs of fuel switching or new technologies than to raise the national baseline for carbon by curtailing the emissions of jointly produced sulphur. Again, defining a JI baseline requires a judgement about what policy would have been in the absence of the climate change intervention. To overestimate the likelihood of enforcement with an aggressive policy baseline would miss a potentially low cost opportunity to better a situation where formal laws are the normal case. To underestimate the policy baseline is to create incentives to prolong under enforcement. In such cases, the bilateral or mini-lateral negotiation of baselines that increase over time may be a practical and tolerable solution. A final

aspect of the politics of baseline setting concerns the potential for leakage of emissions from controlled to uncontrolled jurisdictions or the feedback of the price effects of policy on business as usual choices. While perverse effects of international relocation of polluting activities or world wide responses to price changes do not come from JI or emissions trading itself and must be expected with any regime which is not comprehensive in scope, the lack of national targets may exacerbate these problems within a non-Annex I nation. Forests saved in one area of a nation without an overall target may be replaced by cutting elsewhere in the same host nation benefitting from JI subsidized capital. Coal price declines stemming from increased supplies freed by efficient boilers may alter investment decisions by other generators. Sector specific national baselines or even the disqualification of projects in sectors where leakage effects are likely to predominate may be necessary responses to this threat.

The intricacy of designing satisfactory additionality criteria to support a cost effective and environmentally sound JI market should raise caution about the viability of using JI as a surrogate for multilaterally negotiated national emissions commitments. JI promises no avoiding of the exercise of either political judgement or power. The question is rather whether the definition of the terms of a comprehensive climate change regime are more likely to emerge from a decentralized and competitive process wherein politics is played out in small groups or whether the evolution of such a process is likely to spiral downward into wasteful expenditure and declining environmental quality. However, to the extent that the multilateral forum does not good offer prospects for a regime which moves quickly toward universal commitment, then it will be essential to study the multiple dimensions of the additionality problem in more detail and with different understanding than has generally been the case thus far. In particular, the scientific and economic communities that have played central roles in modeling climate change scenarios will need to expand their inquiry to assimilate knowledge that better lies within the experience and expertise of business and political organizations. Defining baselines that have a chance to induce the revelation of real climate change preferences will require the accumulation of case studies of locally and sectorally specific transactional barriers to the uptake of more sustainable production technologies.

13. The simplest way to approach additionality research is to ask why particular emissions savings projects don't happen, or why emissions intensive activities are structured differently in Annex I and non-Annex I states. The most evident explanation is that there is a cost differential between more and less clean technologies that might yield a similar output. If there is cost differential, and there are not national public policies that either require or pay for the cost increment, the international subsidization of this amount will be needed and justified as additional.

If there is no apparent difference in production costs, there is a prima facie case against subsidy that could still trigger an investigation of institutional and organizational risks that can impede technology uptake in the absence of compensating incentives. In turn, this investigation can lead in several directions. It may be the case that the barriers causing risks not normally quantified in project analysis ought to be torn down by domestic reform that is required by Annex I parties as the precondition of their qualification of JI projects in that host nation or sector. The conditional grant of external aid is a normal practice in other international cooperative regimes and assumes

that competition for funds is a legitimate mechanism of regime building. The conditional subsidization of authorized capital investments would be expressed as (restrictive) policy baselines that demand lower emissions trajectories than the unregulated market would otherwise yield. The use of restrictive policy baselines is the functional analogue of increasing the share of climate liabilities to be borne by nations without explicit national targets. Alternatively, counteracting the effects of existing policy and organizational barriers may be accepted as the responsibility of the Annex I community. To define a more permissive emissions baseline and credit a wider range of JI projects as additional is to treat transaction and production costs as legally indistinguishable. Like grants of public funds from multilateral agencies that compensate non-Annex I states for the incremental costs of institutional reforms, an expansive specification of additionality implicitly assigns greater relative liability for the costs of climate change to Annex I nations. Phased in increases in national baselines could divide these mitigation responsibilities between Annex I and non-Annex I parties in any acceptable proportions..

JI, in effect, may displace the politics of climate change from the multilateral forum to the mini-lateral negotiation of burden assignment through baseline definition. From the standpoint of strategic play in building an inclusive and effective regime, there is no necessary reason why these policy choices should be made on a uniform or once and for all basis. Baselines can be tailored to the political and environmental value of a nation's commitment to the system, the economic ripeness of an important sectoral pool of mitigation opportunities, an historical record of not gaming its domestic policies, or the strength of its competitive bid on national environmental action. While the successful evolution of the regime will ultimately turn on the skillful political management of baseline issues and the design of coordination mechanisms to prevent a self-defeating downward regulatory spiral between JI investor nations, the pressing immediate problem is to develop improved methods for identifying and classifying key transaction cost barriers that now increase the probability that uncertainty about additionality rules will cause the system to waste its least cost stock of time-limited mitigation opportunities.

14. In pursuit of this goal, I would propose that one aspect of the next period of climate change modeling and policy design concentrate on the analysis of institutional and organizational barriers to the installation of new emissions mitigating capital infrastructure in nations and sectors where rapid economic growth affords the potential for economies of scale in abatement services. Rather than trying to resolve the many perplexing issues that attend the definition of additionality as a general legal term in all sectors where JI might be applicable, initial determinations of the rules of qualification might be limited to projects strategically central to the building out of an effective and efficient comprehensive climate change regime. The set of these key projects would be characterized by: 1) inexpensive mitigation opportunities at substantial scale; 2) the wasting nature of these opportunities because deferred mitigation would become expensive after capital infrastructure was installed and associated patterns of behavior were locked in; 3) a low potential for leakage; 4) transparent data on past practices in the sector that facilitate the specification of additionality; 5) the relative political importance of bringing the host nation into the climate change regime in its early stages. Such a selective exploration how to implement the "where flexibility" component of a low cost mitigation regime could be incorporated in an FCCC Codicil

that would charter in the post-Kyoto pilot period a sector specific evaluation of optimal additionality rules for prospective JI crediting.

In such an analysis, Chinese energy and transport infrastructure would seem to merit special consideration. China has played a central oppositional role to JI in the FCCC negotiations, but has recently moderated its views. China has also moved toward reform, especially in the removal of distortional pricing of energy sources, that are inconsistent with a record of overt opportunistic behavior in setting domestic policy. At the same time, the process of internal transition remains quite contested and transactional barriers are widely apparent. Moreover, since it is difficult to imagine an effective global mitigation regime that dominates adaptation for Annex I states without Chinese participation, it would be logical to explore the definition and political management of additionality against case studies of Chinese sectors with substantial mitigation potential. Such barriers oriented research might be structured around four elements:

1) Identify sectors and activities which have been suggested by prior study to have extensive potential for relatively low cost emissions mitigation because of the infrastructure growth, scale, possibilities for locking in around a newly installed, emissions-intensive capital base, and the proven existence of alternative, emissions sparing production technologies and organization. In the case of China, analysis by the World Bank, UNDP and other agencies that have been active in the Chinese economic transition indicate that priority consideration might be focussed upon:

- Electric power generation, with emphasis on fuel switching, consolidation of generation capacity, transmission efficiency and electrification of end uses;
- Increased energy efficiency in mid- and large scale industrial production, with particular emphasis on iron, steel, coke and concrete manufacturing and the installation of higher quality industrial boilers;
- Consolidation and production technology upgrading in small scale township and village enterprises, with emphasis on metal casting, and coke and brick making activities that constitute a large percentage of China's rural industrial growth;
- Transportation infrastructure, with emphasis on mass transit networks, land use patterns for urban development, and automobile design;
- Residential sector energy efficiency, with emphasis on fuel switching and higher efficiency systems in urban home heating and cooking.

In each instance, the inquiry should describe the current patterns of growth and the associated emissions budgets that are implied by those patterns. Although there are often good Chinese and international studies of these trajectories, particular care should be exercised to ensure that multiple, segmented patterns of development are sought out.

Segmented institutional and organizational practices can result in local analysts, and their external collaborators, concentrating their attention only on the developments that fall within their asserted jurisdiction. Too quick an extrapolation of business as usual patterns from these particular examples can lead to inappropriate and misleading generalizations. As an example, in the power sector, there are both large scale, state-of-the-art, clean coal fired generating plants and highly inefficient, low scale units under construction. There is further variation in fuel sources and uses of co-generation technologies. While these multiple paths can represent production cost differences, they can also result from institutional and organizational fragmentation relevant to baseline description and policy specification.

2) In each case study, production costs of proven and commercially available alternative technologies should be examined. Again, there is substantial investigation of these possibilities in many instances in the bottom up engineering studies that have constituted the normal science of energy efficiency analysis in recent years. Emissions savings associated with the alternatives selected for comparison can be detailed on the basis of existing practices in Chinese plant and demonstrated experience with the hypothetically substitutable plant in China or abroad. If positive incremental costs of improved technology emerge from these studies, a preliminary estimate of the shadow price of carbon that could alter technological choice at the margin can be specified. However, this shadow price exercise must be cautionary in two senses. First, the marginal impact of marketable carbon mitigation will depend on both the world price for carbon and the volume of carbon mitigation the substituted production technology yields. This latter figure is a function of the political definition of the JI baseline against which emissions savings are measured. Second, whether or not analysis reveals positive incremental production costs associated with alternatives examined, the distance that lies between the total costs and the margin of profitable substitutability may result primarily because of less quantifiable institutional risks and non-project specific organizational expenditures.

For example, it is an appropriate first step to compare economic and emissions budgets associated with proven and available clean coal technologies relative to much of the plant now being installed in urban China. This comparison can offer an initial estimate of the positive incremental costs, if any, of such substitution and a correlative putative carbon price that would be needed, under current political and organizational practice, to equate the profitability of these alternatives. However, there is a strong probability that, even with such an international subsidy through JI or other policy intervention, the alternative technology may not be brought on line. Understanding the particular transaction costs associated with the alternative projects project and the politics of how those costs should be jointly managed by host and home nations in the climate change system is the aspect of a more complete analysis which needs further development.

3) Transaction costs are likely to be specific to the idiosyncratic political and

organizational histories of nations and sectors within them. Because legal and political systems are self-organizing and relatively autonomous, their evolution cannot often be described in general terms. The jurisdiction of such agencies, especially in highly politicized and defended systems like Chinese socialist modernization, is frequently contested and the resulting patterns of rule between governmental organizations and levels of government are likely to be non-predictable and unstable. In transiting nations, the domain of political authority versus legally framed economic competition is equally problematic. Because non-governmental firms and other actors choose organizational strategies that are, in part, adapted to the context of institutional governance in which they operate, organizational forms, competencies and specializations will reflect attributes derived from the political environment in which they were formed. In these circumstances, it is likely that only case studies of sectors, and the organizations active in these sectors, where emissions mitigation is potentially available will be an appropriate method for exploring the trajectories of growth and the policy interventions that may be effective in modifying them. While I cannot pretend to illustrate such analysis in this paper, I can sketch the types of barriers and questions that merit attention with reference to the issue of consolidation in coal fired power generation in China.

The use of proven clean coal technologies may often depend on the scale of generation facilities installed. At present, when plant size exceeds 300 megawatts, the installation of higher efficiency plant that burns less coal per unit of energy output becomes more technically and economically feasible. Yet, although Chinese development does evidence large scale construction of both coal and non-coal (gas, nuclear) energy infrastructure, there remains substantial building of new small scale, less efficient plants. Understanding this pattern of growth requires attention to existing effective Chinese institutional rules and practices, the absence, or under-enforcement, of domestic environmental controls, and the organizational capabilities of Chinese and foreign firms in the power sector. Especially to the degree that clean coal technologies and the scale and equipment needed to bring them on line are most available through foreign companies, their unfamiliarity with Chinese governance and markets will elevate transactional costs. The scale and organization of power development appears, even at preliminary examination, to be a product of a wide range of non-production barriers. These include:

\* The regulatory approval process of the central government is slow, expensive and unpredictable. Mitigating the costs of passage through this process often requires either corruption or strategic coalitions with rivalrous government agencies, local or provincial entities or overseas Chinese firms that have developed idiosyncratic business practices and/or political obligations and agendas of their own. Avoiding the regulatory process generally involves fragmenting the scale of investment to come in under the size at which extensive or central government regulation is triggered. In turn, this reduction in scale can lead to technical design and organizational alliances, usually with local or provincial entities, that will impact production options. These may include preferential access to differentiated capital markets and purchase commitments from local state owned

enterprises whose continuing viability may allow their governmental allies to avoid the burden of housing, health, education and other social costs which have been borne by production units. Finally, many Chinese energy managers continue to operate under separate capital and operating budgets that reduce incentives to engage in integrated assessments of least-cost planning that generally define the scale, technologies, and fuel mix of non-Chinese plants.

\* Security of return is problematic. Not only are legal security interests limited, but various forms of risk guarantees, sovereign and otherwise, are unavailable. Increased security risks cannot easily be compensated in pricing structures (see below) and affect the ability of projects to make use of orthodox international financial (debt) mechanisms. Because international financing of power projects is normally carried out on a “no recourse” basis-- in which debt financiers have legal recourse only against the income and assets of the power project, but have no claims against the assets of equity contributors--lack of secure and predictable income streams is a red flag to potential lenders. Build-operate-transfer systems or other innovative organizational forms that may mitigate some of these risks are not yet widely available in Chinese law. Domestic financial markets are principally accessible through local alliance partners and may sometimes be administered as constrained capital pools available at low costs through political allocations. Off loading of project risk to foreign governments or the availability of subsidized national or multilateral capital may even create the appearance that efficient development at scale is more practical than it is when these extraordinary and limited conditions are removed.

\* Pricing has been politically constrained with respect to allowable rate of return and predictability of tariff structures. There are often uncertainties with respect to the enforcement of power offtake agreements and with respect to assured access to transmission grids managed by multiple political authorities. Cost factors may also be difficult to estimate, in part because foreign investment enterprises may be subject to differential enforcement of labor and environmental regulation. Contracting issues with monopoly suppliers of labor, fuels, or transportation. Legal uncertainties also surround the valuation of local assets and services contributed to the joint foreign-Chinese firms that are needed to operate in the power sector. In general, even with increasing reliance on arbitration of contract risk for foreign entities in China and a new, if limited, formal legal power to contest the administrative decisions of regulatory bodies, a primary risk mitigation strategy must involve political alliances with local entities, which, in turn, generate associated risks of opportunistic behavior.

4) The case specific description of transactional barriers to efficient technology uptake should be used as a foundation for exploration of the policy space for sectoral intervention through a portfolio of international and national mechanisms. Where it is appropriate to include JI in this policy mix, the possible relevance to the definition of additionality of existing and projected institutional and organizational practices in a given sector can be mapped as a set of alternative policy choices. Scenarios can be developed which examine

the viability of each sector as a site for JI qualification with relation to variables such as the likelihood of moral hazard in domestic reform, leakage, the expected multiple patterns of business as usual under current institutional and organizational contexts, the prospective distribution of climate change burden between local policy reform and international transfers, and the consequent form, volume and timing of marketable emissions credits to be authorized.

In all of these cases, the principal value added of transaction cost or barriers analysis to most prior modeling exercises, and policy development therefrom, is its attention to the normality of suboptimal systems. Economic growth in China and other transiting countries is real. Firms make profits in these sectors. The problem is that the growth is distorted relative to some counter-factual market allocation of resources that remains very far from the current condition. Within this distorted pattern of growth, environmental quality is reduced by higher energy intensities, shorter lived assets that are likely be kept in operation by jury-rigging, and increased emissions from low efficiency production, and unenforced controls. At the same time, other patch-works of subsidies from domestic and international sources raise the level of environmental engineering in showcase facilities beyond what is generally sustainable. The formulation of international climate change policy, and particularly the definition of additionality in emissions trading systems, will err if it continues to treat suboptimality as no more than a passing phase. In the relevant period during which wasting stocks of low cost mitigation opportunities in fast developing nations will rapidly be depleted, suboptimal growth will be business as usual. While JI can play its prescribed useful role in harvesting these ripe abatement possibilities, the political economies of transiting nations like China will remain an unsystematic aggregation of regional and sectoral pockets characterized by local transactional residues of past political practice and co-evolved organizational behavior. While the relative domestic and external cost burden of reforming these residues is a matter for strategic interaction, imagining baselines of expected practice that ignore this condition could raise the global costs of mitigating climate change beyond its political tolerance.



## BIBLIOGRAPHY

BABIKER, Mustafa, Keith E. Markus and Thomas F. Rutherford (1997) "Carbon Taxes and the Global Trading System", paper presented at the International Energy Workshop and Energy Modeling Forum at IIASA, June 23-25, 1997.

EDMONDS, Jae and Marshall WYSE (1997) "Exploring a Technology Strategy for Stabilizing Atmospheric CO<sub>2</sub>", draft paper, Pacific Northwest National Laboratory, August 1, 1997.

HELLER, Thomas C. (1996) "Environmental Realpolitik: Joint Implementation and Climate Change", 3 *Indiana Journal of Global Legal Studies* 295.

HELLER, Thomas C. (forthcoming 1997) "EU Joint Implementation for CO<sub>2</sub> Reduction" in J. Golub (ed.) *Regulatory Reform and EU International Environmental Agreements*. London: Routledge.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP I (1996), *Climate Change 1995: The Science of Climate Change*. Cambridge: Cambridge University Press.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP III (1996), *Climate Change 1995: Economic and Social Dimensions of Climate Change*. Cambridge: Cambridge University Press.

MENDELSON, Robert et.al. (1996) "The Economic Impacts of Climate Change in the US", draft paper, Yale School of Forestry and Environmental Studies, July 26, 1996.

RICHEL, Richard, Jae EDMONDS, Howard GRUENSPECHT and Tom WIGLEY (1996) "The Berlin Mandate: The Design of Cost-Effective Strategies", draft paper February 3, 1996

ROSENBERG, Nathan (1994) *Exploring the Black Box: Technology, Economics and History*. Cambridge: Cambridge University Press

### Composition of GHG reductions (illustrative)

