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"DESIGN ISSUES SEEKING RESEARCH ANSWERS"

by

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INTRODUCTION

BACKGROUND

The 1992 United Nations Framework Convention on Climate Change (UNFCCC) recognized the principle of global cost-effectiveness of emission reduction in Art. 3 (3) and thus opened the way for flexibility. As it did not fix a binding emission target for any country, the need to invest in emission reduction either at home or abroad was not pressing. In December 1997, though, industrial countries and countries with economies in transition agreed to legally binding emission targets at the Kyoto Conference and negotiated a legal framework as a protocol to the UNFCCC - the Kyoto Protocol (UNFCCC 1997). This Protocol will become effective once it is ratified by at least 55 parties representing at least 55% of the total carbon dioxide (CO_2) emissions of Annex I countries[1] in the year 1990.

Art. 3 of the Kyoto Protocol defines the five-year commitment period (2008-2012) in which the emission targets that are set out in Annex B for individual countries have to be reached. Together, Annex I countries must reduce their emissions of six greenhouse gases by at least 5% below 1990 levels over the commitment period 2008-2012. They cover a basket of six greenhouse gases listed in Annex A: carbon dioxide, methane, nitrous oxide, HFCs, PFCs and sulfur hexafluoride. 100-year Global Warming Potentials are used to convert gases in a common unit. Emission targets relate to the base year 1990 whereas countries in transition can use a different base year if established in their first national communication.

Besides emissions reduction, "verifiable" sequestration through afforestation and reforestation taking into account deforestation can be used to meet the targets. The Meeting of the Parties (MOP) is authorized to include further sequestration activities, e.g. soils, for the next target period after 2012. Countries are allowed to use such sequestration for the current targets if the decision of MOP is taken prior to 2008.

If emissions during the commitment period are lower than the target, the difference may be banked for the next commitment period.

Article 3.3 of the UNFCCC states "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost". To implement this provision the Kyoto Protocol has incorporated four provisions for cooperative implementation mechanisms.

- The Kyoto Protocol incorporates the "bubble" concept into the final text of Article 4. Although originally conceived as a way of allowing the European Community as a regional economic integration organization to accommodate its internal burden sharing of the Kyoto commitments among its member states, the final wording of the Article is framed in general terms. It allows a group of Annex I countries to jointly fulfil their commitments under Article 3, provided that their total combined aggregate GHG emissions do not exceed their assigned amounts.

- The Kyoto Protocol also accepts the concept of emissions trading under Article 17. Annex B countries will be allowed to purchase the rights to emit greenhouse gases (GHG) from other Annex B countries that are able to cut GHG emissions below their "assigned amounts" (AAs). Although Annex B to the Kyoto Protocol and Annex I to the UNFCCC are now identical in nature, this change from Annex I into Annex B potentially allows a

[1] Annex I countries refer to the OECD countries and countries with economies in transition. These countries have committed themselves to legally binding greenhouse gas emissions targets.

developing country to engage in emissions trading if it voluntarily adopts an emissions target and is inscribed in Annex B. Emissions trading transfers "assigned amount units".

- The third option involves project-oriented emission reduction credited to the investing country. This possibility was named “Joint Implementation” (JI) in the negotiations leading to the Rio Conference. The Kyoto Protocol allows JI between Annex-I countries.
- The Kyoto Protocol also includes a "Clean Development Mechanism". Countries that fund projects through the CDM can get credit for "certified emission reductions" (CERs). from these projects. In contrast to the other flexibility mechanisms, CERs accrue for the whole period 2000-2012, not just for the commitment period.

AN OVERVIEW OF THIS PAPER

When the Kyoto meetings left the details of implementing the emissions trading article up to subsequent meetings, the UNFCC Secretariat asked UNCTAD (United Nations Conference on Trade and Development) to produce a background report which could be used to facilitate the discussion of implementation procedures by the delegates. (UNCTAD, 1998)

That report discusses the establishment of a trading system. It was based upon two specific sources of evidence—the historical experience with existing trading programs and existing international agreements. The objective was to derive lessons that should prove useful in designing a workable system.

As team leader of that project I became acutely aware of how limited our information was and how difficult it was to craft an optimal system in the face of this information void. For my remarks today, therefore, I use my experience in writing that report to extract a few key areas where I believe additional research information would be helpful. Thus my suggestions are derived from the very practical considerations of how we might design a trading system to implement the Kyoto protocol.

BASIC DESIGN RESEARCH ISSUES

INTERPOLLUTANT TRADING ISSUES

Under Article 17 the tradable commodity would be a carbon dioxide equivalent allowance. Each allowance would authorize the emission of one metric ton of carbon dioxide equivalent gas. The total number of allowances a Party would hold at any time would consist of: (1) the assigned amounts (AAs) (appropriately adjusted to reflect the “net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change an forestry activities, as authorized by Article 3.3), plus (2) allowances acquired from other Annex B parties, plus (3) certified emission reductions (CERs) acquired from non-Annex B countries under Article 12 minus (4) any allowances transferred to other Annex B parties.

The greatest cost advantages from Article 17 would accrue if all gases identified under Annex A would be eligible to be included in trades on a carbon equivalent basis. On the other hand none of the existing emissions trading systems allow inter-gas trading, so we have little experience with it's benefits and costs in practice. And some have suggested that the varying degrees of uncertainty associated with the various gases opens the possibility that trading could result in real increases in gases with reliable monitoring in return for "apparent" reductions in gases where the monitoring uncertainty is high. (Lanchbery 1998).

The ultimate question therefore is what gases should be traded? Should the trading system include all six gases or some subset of those gases? A number of suggestion have been floated, but very little hard research is available on the benefits and costs of following these suggestions.

One option would be to limit trading to GHG sources that may be readily and accurately monitored. Some have suggested, for example, that only energy-related CO_2 and CH_4 emissions should be eligible for trading (Lanchbery 1998).

Limiting trading to a subset of gases is not likely to be effective unless the Protocol is further amended to partition the assigned amounts into two categories—tradable and nontradable gases— with separate assigned amount goals assigned for each. In accordance with Article 5.3, Global Warming Potentials (GWPs) are to be used to convert non-CO_2 gases into carbon equivalent terms both for verifying compliance and for defining the trading baseline and adjustments to it as a result of trades. [2] With the current lack of separation of categories it would be easy for countries to use the flexibility inherent in the equivalence process to substitute freely among the gases regardless of the trading rules.

Another possible strategy for coping with emissions uncertainty involves adjusting the emissions inventories or adjusting the trading ratios in the emissions trading program to reflect the uncertainty in monitoring[3](Sussman, F.,1998). The presence of uncertainty implies that a distribution of possible estimates exists. The range of that distribution will reflect the degree of uncertainty. This variation is an additional source of information that could be used in the monitoring process if the Conference of Parties deemed it necessary.

An alternative approach would involve imputing conservative presumptive values for emissions factors. Presumptive values could considerably reduce the cost of developing more sophisticated (and more accurate) measures, or as a stop gap measure until more accurate data can be obtained. The values chosen for these imputed factors could be intentionally conservative, thereby assuring environmental quality and providing an incentive for development of more accurate monitoring techniques.[4] How conservative these should be, however, would presumably depend on the cost. Without further research the cost implications of various strategies are unknown.

All of these possibilities provide a menu of possible research areas. How much interpollutant trading is likely to take place? How large is the environmental risk posed by trading pollutants with various levels of monitoring uncertainty? How effective are the various remedies? What price (in terms of increased costs) is paid to achieve these results?

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[2] Section 5.3 the Protocol requires that the GWP factors used in the conversion should be fixed for the first commitment period.

[3] Since the net change in uncertainty depends both on the uncertainty associated with the reductions achieved by the seller and the increases in emissions authorized for the buyer, both aspects should figure into the process for adjusting the trading ratio. Yet as a practical matter it may not be possible to identify the specific emissions associated with the trade for either the buyer or the seller.

[4] Notice that conservatism means different things depending on whether these methods are used to define the emissions inventory or to define the reductions that qualify for CERs or ERCs. In the case of inventories a value in the higher range would be conservative while in quantifying emission reductions a value in the lower range would be conservative.

FUTURE COMMITMENT PERIODS

One of the conclusions of the UNCTAD (1998) report was that multiple commitment periods offer significant opportunities to improve compliance in a weak enforcement environment. Principal tools that capitalize on the availability of multiple commitment periods include declaring noncompliant Parties (those with resolved overages in the current commitment period) ineligible for trading and reducing assigned amounts of noncompliant Parties in subsequent commitment periods.

One important element of an international enforcement system for allowance trading is establishing a credible system for restoring any ton of excess emission by a non- complying party. The most common way this has been done in past trading programs has been to require the non-complying Party or source to purchase or restore the ton of excess emission in the next budget period, usually the next year. This protects the environmental objectives of the Protocol by ensuring that the total cap on GHG is not exceeded. However, some problems arise in applying this system to GHG trading under the Kyoto Protocol.

- The first is the nature and length of the commitment period, a single, 5-year period. The long length means compliance is not determined until the end of the commitment period. Unlike existing trading programs the Kyoto commitment period is not divided into several (annual) budget periods.

- In addition, the Protocol mandates no subsequent budget periods or assigned amounts after 2012.

Both of these aspects of the Protocol create uncertainty for a methodology that would require excess tons of emissions to be taken from a subsequent commitment period. Currently the Protocol anticipates negotiations to set assigned amounts in subsequent commitment periods, but currently those negotiations have not resulted in assigned amount goals beyond the initial commitment period.

Future commitment periods cannot be defined until the assigned amount goals for signatories are determined. And research should play a significant role in providing the information necessary to set future assign amount targets. What are the benefits and costs of possible the assigned amount trajectories be in the short run and long run? How might these be affected by the amount of leakage from nonsignatory nations being experienced? Should allowance entitlements over time converge to a common metric?[5] If so, what should that metric be?

ROLE OF TECHNICAL PROGRESS

One of the determinants of the costs of various trajectories will be the amount of technical progress promoted by the Protocol. To quote the conclusions from one recent study (Dowlatabadi, H., 1998) that considers sufficient control of CO2 emissions to limit its concentration to no more than 550 ppm, starting in the year 2000, and delayed to 2025:

- If endogenous technical change is assumed, expected business as usual emissions are higher than otherwise estimated --- nevertheless, while 25% greater CO2 control is required for meeting the CO2 concentration target, the cost of mitigation is 40% lower.

[5] Some have suggested, for example, that over the long run all assigned amount obligations should converge to a common per capita entitlement. (Centre for Science and the Environment, 1998).

This study. like most, treats technical change as exogenous. Yet the theoretical literature makes clear that the form of the policy instruments should make a difference in the rate of technical change. (Jaffe, A. B. and R. N. Stavins ,1995; Jung, C. H., K. Krutilla, et al. ,1996; Laffont, J.-J. and J. Tirole ,1996; Maleug, D. A. ,1989; Milliman, S. R. and R. Prince,1989).

At this point, those theoretical predictions remain largely unsupported by evidence. We need to develop a series of studies that can provide empirical evidence of the relationship between instrument choice and technical progress. Is it possible to show empirically not only that instrument choice matters in determining the rate of technical progress, but that it matters in the same direction suggested by theory? And last, but not least, are the effects of instrument choice on technical progress of sufficient magnitude that this should actually be a conscious element in the choice of instruments?

A related issue is the degree to which outside influences would inhibit the market penetration of energy saving technological progress in both signatory and nonsignatory nations. One major such influence is the expected decline in oil prices for non-Annex B nations in response to the lower demand for oil induced by implementation of the Kyoto Protocol. Presumably the market penetration of energy substitutes or of energy-saving production processes will depend on the cost of fossil fuels. Low cost fossil fuels would presumably retard entry of these technologies. How serious a barrier is this?

EARLY TRANSITION ISSUES

EARLY ACTION INCENTIVES

Reducing emissions frequently involves capital investments. And the magnitude of the reductions anticipated by the Kyoto Protocol certainly suggests that greenhouse gas saving investments will probably play a prominent role.

Greenhouse gas saving investments can be classified in two categories. The first, known popularly as "no regrets" investments, offer a sufficient rate of return regardless of the ultimate fate of the Protocol. The second category of investments only make economic sense if the Protocol is implemented.

The first research question is how much of the total reductions can be achieved by "no regrets" investments. Significant differences of opinion currently exist within the economics community. (American Council for an Energy Efficient Economy et al., 1991; Energy Information Administration, 1998). To the extent that "no regrets" investments are sufficient, then early action initiatives are less important.

If it turns out that "no regrets" strategies are not sufficient, then the current political climate creates several obstacles to additional investments. First of all it is by no means clear that the United States will ratify the agreement. The U. S. Senate has stipulated that the participation of the developing countries would be a necessary condition for ratification.[6] Developing countries have stated that won't happen. Second, if the United States, the major emitter, does not ratify, it is not clear the agreement will take effect.[7]

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[6] Senate Resolution 98 (June 12, 1997)

[7] This Protocol will become effective only when it has been ratified by at least 55 parties representing at least 55% of the total carbon dioxide (CO_2) emissions of Annex I countries[7] in the year 1990.

If the agreement does not take effect, the mandates for greenhouse gas reductions that are contained within the agreement will not be binding. Investments that were made specifically to meet those mandates will have been proven in retrospect to have been unnecessary. Recognizing this possibility in advance undermines the incentive to invest.

A class of early reduction schemes have been proposed to encourage investments in the face of this political uncertainty. The earliest US legislative initiative was S. 2617, a bill introduced by Senator Chafee. After significant opposition to that bill based upon the fact that it would amend the Clean Air Act, a replacement, S.547, was introduced. Generally, this legislation, if enacted, would provide the President with the authority to establish "binding" agreements with businesses. Those companies would be encouraged to reduce their greenhouse gas emissions in return for early recognition in the event of any kind of domestic policy mandating mitigation of those emissions prior to 2008.

The credits would be based on reductions below a predetermined baseline of current emissions—an annual average of 1996-1998 emissions, or earlier, going back to 1990. The companies would be awarded one-for-one credits, which could be sold or traded, for voluntary cuts below that baseline, multiplied by the number of years in the program.

Participants would be responsible for annually measuring, tracking and reporting their levels of greenhouse gas emissions. Credits would also be available for actions taken overseas—subject to certain conditions—for carbon sequestration via forests and farmlands and for reductions made through the use of nuclear power.

Implementing this effort would be facilitated by research into these various schemes. Significant questions remain. Credits are to be created when emissions fall below prespecified baselines. What should the baselines be? Research can help to define appropriate baselines by tracing out the implications of various choices.

Before early credits are issued, however, the type of system must be defined. Two major possibilities exist. An "*upstream*" trading system would target fossil fuel producers and importers as regulated entities, so would reduce number of allowance holders to oil refineries and importers, gas pipelines, LNG plants, coal mines and processing plants.[8] In contrast, a "*downstream*" trading system would be applied at the point of emissions. As such, a large number of diverse energy users would be included.

In the event that the US has ratified the agreement and has chosen to implement an early reduction system the credits would, in principle, be designed to insure favorable treatment of early investors in the initial allocation of allowances. Accepting the principle of "favorable treatment", however, does not provide much guidance for how to implement the principle. And in the case that the Protocol is not ratified, what becomes of the credits?

Working out an acceptable early reduction system it not a trivial exercise. However it would certainly facilitate the implementation of the Kyoto Protocol.

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[8] This is the approach suggested in "Proposal for Credible Early Action in U.S. Climate Policy" by Raymond Kopp, Richard Morgenstern, William Pizer, and Michael Toman available at http://www.weathervane.rff.org/features /feature060.html (May 8, 1999).

SUBSEQUENT TRANSITION ISSUES

EXPANDING TO THE DEVELOPING COUNTRIES

Under the Clean Development Mechanism a host country could finance projects on its own and sell credits earned. Art. 12 would not prevent this. As host countries have no targets, however, they have an incentive to maximize credit sales. Here the baseline issue becomes crucial; it should not reward high emission policies. When assigned amounts are to be based upon historical emissions, an incentive is created to boost emissions to qualify for a higher assigned amount. (Michaelowa 1997).

This baseline problem could only be fully solved by providing an incentive for developing countries to adopt limitation targets voluntarily and participate in emissions trading and JI under Art. 17 and 6. In the medium and long term, emissions trading could be instrumental in establishing an international climate change policy that fully accommodates developing country economic growth, but requires that this growth be achieved in a carbon-efficient manner.

The key questions in this area are: (1) How can the developing countries be made full partners in Article 17 of the Kyoto Protocol? (2) How can the transition from the Clean Development Mechanism to Article 17 be accommodated? Research can facilitate this process by expanding the menu of possibilities and by clarifying the consequences of various choices.

Plenty of options are already on the table. According to one model developing countries should be able to "opt in" in the allowance trading system by adopting "growth baselines" (Center for Clean Air Policy 1998). Countries opting in would have to not only assure that their greenhouse gas emissions grew at a slower rate than their economic output in the near term, but also to accept the inevitability of an eventual cap on emissions. Developing country economic growth would thus not be constrained initially, but countries would commit to improving the "carbon efficiency" of this growth in the short run and accepting an ultimate limit on emissions in the long run. The key benefit to developing countries of adopting growth baselines would be the substantial capital inflows promoted by emissions trading.

Other options could also serve to provide flexibility in the negotiations over including developing countries in the Annex B list of nations (Joshua 1998)

- Regional groupings such as ASEAN and MERCOSUR could apply to be covered by a regional bubble.

- Developing countries could be allowed to introduce "partial caps" which, for example, could be based on industrial sector limits, and coupled with joint implementation in the uncapped sectors, as a form of progressive restriction towards the imposition of a national cap involving all sectors. Countries operating industrial sector growth limits could continue to have access to the Clean Development Mechanism for investment and trading in credits for uncovered sectors.

- Developing countries could be allowed to choose different base years for each greenhouse gas they propose to bring under a sectoral or national cap.

Presumably allowance trading would result in greater total capital flows under Article 17 than the CDM, because transaction costs would be lower. To participate in trading, a country

would simply need to develop an accurate emissions inventory and then compare actual emissions to the emissions budget. To the extent that actual emissions come in under the budget, the country could sell allowances. Issues such as additionality and the development of appropriate project emissions baselines, which may reduce the incentive to invest in CDM projects, would not be present in an allowance trading system.

Fears have been expressed that developing countries will seize the opportunity to negotiate unreasonably large assigned amounts, a phenomenon that has now been labeled the "tropical air" problem. The United Nations Conference on Trade and Development (1998) study suggests that this problem can be diminished by using uniformly applied specific criteria for defining assigned amounts for those seeking to join Annex B in the future rather than negotiating each situation from scratch on a case-by-case basis.[9] This two-step procedure—(1) negotiate fair and appropriate general criteria and (2) apply them to individual Parties—would seem to offer the opportunity to expand the set of Annex B nations without placing the goals of the convention in jeopardy. But what are "fair and appropriate criteria"? That seems a fair target for further research.

Once the questions about the shape of ultimate integration have been settled, it is still necessary to design the transition process. The major transition question is how certified credits created under the Clean Development Mechanism should be incorporated into the definition of an assigned amount when a non-Annex B nation agrees to join Annex B? Suppose a country has leased or sold 30 tons of CO_2 offsets for five years to another country prior to signing the agreement and receives 1000 tons per year of allocated entitlements following acceptance of the agreement. How should the accounting of these two types of entitlements be handled? Can previously transferred credits simply be subtracted from assigned amount allowances as initial analysis suggests?

ACCOUNTABILITY RESEARCH ISSUES

THE DEMAND FOR ACCOUNTABILITY

Emissions trading is neither new nor unproven as an instrument of national environmental and resource policy. Issues such as measurement, monitoring, verification, and the institutional requirements governing trading amongst different trading partners have been addressed. (Environmental Law Institute 1996). They have been addressed, however, in the domestic, not the international, context.

It is in the areas of accountability, risk, transparency, reporting and enforcement that international greenhouse gas emissions trading probably differs most fundamentally from any previous experience. Concerning these issues, to a large extent the Kyoto Protocol takes us into *terra incognito.* This is for two main reasons, both of which derive from the fact that the legal basis for international greenhouse gas emissions trading - the Kyoto Protocol - is an agreement between sovereign states. Ultimately, therefore, legal accountability derives from the legal authority of the governmental institutions that sign and subsequently ratify the Protocol.

Resolving issues of accountability is an especially fertile area for the possible contributions of future research. Key questions include: (1) How can an adequate monitoring and compliance system be implemented, given the inherent difficulties posed by operating in a international

[9] The criteria would specify the relevant variables and their weights, while the application would involve inserting the relevant data for each country into the predefined formula.

arena with sovereign states as the Parties? (2) Can liability for short-term noncompliance be assessed in such a way as to preserve the incentives of all Parties to comply over the long - term? (3) How can Parties be assured that credits created under the Clean Development Mechanism represent real reductions and how can liability for noncompliance be assessed in those cases? and (4) How can the "supplemental means" requirement (defined below) be met?

MONITORING AND COMPLIANCE ISSUES

The first line of accountability is, of course, provided by compliance and enforcement procedures. Compliance and enforcement procedures, when they work well, provide complete accountability. It follows that the first step in providing accountability in the case of inadequate compliance and enforcement procedures is to strengthen those procedures to the extent possible. How that can be done is to date not a resolved issue.

The national reporting system of each Party would have the dual responsibility for tracking both emissions and allowances. Both reports would necessarily be submitted in a standardized format to facilitate comparison of “authorized” emissions with “actual” emissions and to facilitate comparisons with the reports of other Parties. The form and frequency of these reports must be decided.

The international authority is expected to perform the following key monitoring and compliance functions. These would include: (1) Initial approval of a country’s monitoring system that allows it to participate in emissions trading; (2) Receipt and review of the reports generated by countries that provide credible data on monitoring results and methods on an ongoing basis. Procedures for receiving, evaluating and acting on these reports need to be developed.

Creating layers of veracity checks should strengthen the integrity of the allowance and emissions monitoring systems. Systems of self-reporting are vulnerable to many risks of deception, although analysts may over-state the extent to which purposefully deceptive self-reporting occurs. What should these layers of veracity checks include? Who should oversee their design, construction and implementation? What role can private organizations play?

Transparency of behavior should be promoted through wide public availability of collected data. The assurance function is better fulfilled if data are widely available; veracity-checking is easier if multiple sources of information are available; and, the involvement of private monitors is frequently heavily dependent upon the existence of rich databases. How far can transparency be pushed before it runs into reluctance to reveal some information because of privacy and industrial secrets?

Since emission reductions used to generate Clean Development Mechanism credits require considerably more scrutiny, a certification function is necessary to assure that only certified credits would become part of the emissions trading system. Certified CDM credits would be treated as homogenous in quality to Article 17 allowances. The certification process provides one concrete means of attempting to assure a smoothly running trading system, while simultaneously assuring that the trading system furthers the goals of the agreement. How should this certification process work? How should oversee it?

Some certification authority could be delegated to specific governmental units within participating nations or communities of participating nations or even to private certification entities, providing certain preconditions had been met. These preconditions might include, *inter alia*: (1) an identified organizational unit willing and able to assume the responsibility for certification, (2) the existence of sufficient enabling legislation to assure adequate powers

to carry out its mission, as well as adequate staff and resources, and (3) acceptance of, and willingness to apply, standard certification criteria.

While certification is presumably sufficient for transfer of a credit, would use of a credit to fulfill part of an assigned amount obligation also require verification? Whereas certification would provide assurance that a specific emission reduction or carbon absorption would be forthcoming from the project, verification would provide the assurance that these expectations had in fact materialized. (For example, verification of a forestry project would assure that the planned forest was in existence and was absorbing carbon at the expected rate, while an energy efficiency project would verify that actually emissions mirrored the emissions expected on the basis of design criteria.)

Multiple commitment periods offer significant opportunities to enforce compliance**.**. Principal tools include declaring noncompliant Parties ineligible for trading and reducing assigned amounts in subsequent commitment periods, which work best if subsequent commitment periods are in place and assigned amounts defined. Currently the Protocol establishes a process for further negotiations to set assigned amounts in subsequent commitment periods, but it is not clear that it has generally been recognized how important that task is in promoting compliance within the first commitment period.

A wide range of enforcement and compliance instruments are available to domestic enforcers. The frequency and effectiveness of domestic environmental enforcement varies according to budgets, political will, and legal constraints on the types of penalties can be imposed. In some countries an evolving norm may favor of stiffer penalties, including incarceration and personal liability for actions of organizations and firms, and administrators in these countries now possess a wide array of sanctions they can apply. That is not uniformly true among all Parties however.

How about parties with fewer domestic enforcement capabilities? Should strict eligibility requirements be imposed on those Parties seeking the right to engage in trading? If eligibility requirements were imposed, Parties that fail to comply with reporting or other requirements could be prohibited from trading within the initial compliance period. Once subsequent commitment periods were established, it would also be possible to require that Parties be in compliance in the previous commitment period in order to be eligible to trade in a subsequent commitment period. The desirability of eligibility requirements is an appropriate question for further research.

Another possibly important element of an enforcement system would involve establishing a credible system for restoring any ton of excess emission by a non-complying party. (Environmental Defense Fund, 1998). This would protect the environmental objectives of the Protocol by ensuring that the total cap on GHG would not be exceeded. The most common way this has been done in past trading programs has been to require the non-complying party to purchase or restore the ton of excess emission in the next budget period, usually the next year. However, the nature and length of the current 5 year commitment period, and the lack of a defined commitment period subsequent to 2012, create uncertainty for such a methodology until future periods and targets are defined.

LIABILITY FOR NON-COMPLIANCE

Suppose that at the end of the commitment period, despite the best attempts at erecting a credible and effective enforcement system, some countries have exceeded their assigned amount obligations. For traded tons should the seller, the buyer or both be held liable for the shortfall?

In general the principle of strict seller liability makes sense in a strong enforcement environment for two reasons. In the first place it significantly enhances the tradability of permits, as it ensures all permits are a standard commodity, which reduces the risks and uncertainty in trading. Second, it provides incentives for those creating the credits or transferring the allowances to be sure that the supporting emission reductions are real. Internalizing this externality will reduce the incentive to cheat.

Seller liability systems are all that is needed if compliance mechanisms are strong and any tons of exceeded emissions are restored to the environment. In existing allowance programs, the normal compliance procedure is to subtract the deficiency from the assigned amount in the next commitment period and to add a penalty. This method could be used in GHG trading system as long as exceeded tons could be restored during or shortly after a compliance period.

However, in this Protocol a seller liability policy may not always work because there is only one very long commitment period and, as of now, no additional commitment periods have been defined.[10] In addition, it has been argued (Grubb,1998) that seller liability could lead to a regime of weak compliance because the lack of strong enforcement at the international level would provide few disincentives for buyers to acquire from sellers who take a lax attitude to compliance. This may create a need for some form of a buyer liability program to assure that tainted acquired allowances could not be used to satisfy the "assigned amount" requirements.

The rationale in adding buyer liability is that it may discourage purchasers from buying tons from countries that appear to be headed towards non-compliance. It may also prompt buyers to make additional emissions reductions toward the end of the commitment period if they perceived that tons they had obtained through trading may not be fully valid.

While adding buyer liability creates some added assurance of compliance, it creates its own set of problems. A major problem is that it erodes the commodity nature of allowances by allowing them to be retroactively devalued, thereby creating uncertainty as to their value until the end of the compliance period. Representatives of trading firms in UNCTAD trading meetings have emphasized that this may interfere with the development of financial markets for allowances, and discourage trading.

Buyer liability may act to throw well-intentioned buyers out of compliance. This is especially troubling since buyers may have difficulty ascertaining whether or not allowances are backed up by real reductions. The seller is in the best position to know.

While buyer liability adds a compliance incentive, it does not solve the compliance problem. Buyers who have relied on traded tons would find themselves out of compliance at the end of the commitment period. The excess tons must still be restored to make the environment

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[10] Article 4 bubbles also raise an accountability issue. In the case of a regional economic integration organization (REIO) bubble, such as the EU bubble, each REIO member and the regional organization itself are held accountable for the failure to achieve the required reductions for the REIO. Under the terms of the agreement notified to the UNFCCC Secretariat, the incentive for non-compliance is offset by the joint responsibility of both the individual members and the regional organization.

In contrast, in the case of a non-REIO bubble, the absence of a formal regional organization with enforcement powers means that the seller countries are solely responsible for their own non-compliance. As discussed in Article 17 trading, these countries may have an incentive to fall short of compliance. To ensure the environmental integrity of the Kyoto Protocol, it is thus desirable to assign some form of joint responsibility for non-REIO bubbles too. However, the countries concerned within a non-REIO bubble should be left free to work out an arrangement to bring the whole group into compliance.

whole, either by the buyer or seller, though one of the above-mentioned methods, such as by deducting it from the next commitment period.[11]

Another way could be to use the process of evaluating Parties' efforts towards implementation during the commitment period. This includes annual reporting of the progress of each Party in meeting its assigned amounts. If in a given year a Party's actual emissions did not exceed by a certain margin its annualized assigned amounts, the seller's tons would be valid. After the year when the seller is found to go beyond that tolerance margin, however, buyers become liable for potential non-compliance by the seller. As such, the allowances acquired prior to that year would not be discounted, thus avoiding the imposition of retroactive liability for the buyer. Under both of these methods the instrument would be targeted on the source of the problem.

If the Parties decide that buyer liability is needed to complement traditional compliance procedures, several models of buyer liability are available. Two of the most prominent are the "vintage model" and "proportionate reduction" model. Under the vintage model allowances are serialized from the time of **initial** transfer, with earlier transfers involving lower numbers. In the case of noncompliance of the seller, sufficient transferred allowances are voided to cover the overage, starting with the allowances transferred last.

Under the proportional model buyer liability is assessed on a proportionate basis. Thus if a country has a 100 ton overage and 1000 tons have been sold, 10% of all allowances secured from that Party would be invalid and could not be used to demonstrate compliance.

Serialization provides the market with information that apparently is helpful in assessing the magnitude of this risk. It also provides a better means for the market to assess the degree of risk associated with acquired allowances and to discount prices accordingly. The vintage approach distinguishes buyers who acquire allowances from sellers when no implementation problems are on the horizon, from those buyers who do so when serious implementation problems have arisen in the seller country (Goldberg *et al*. 1998).

A final consideration is due to situations where Parties allow private entities to participate in trading activities. Since private entities are not accountable for the national targets under the Kyoto Protocol, another layer of accountability in necessary for them. Thus they are accountable to their governments which in turn assumes the accountability of the aggregation of private entities' trades.

Governments may wish to set rules that protect themselves against non-compliance by private entities. Parties may create a domestic enforcement system that imposes penalties for invalid trades and insures emitted tons are always restored. Another method would be to require obligatory insurance of private sellers/buyers of allowances to minimize the risk that Parties do not comply because of invalid trades by private entities. Programs such as the US Acid Rain Program show how a domestic cap and trade system could be structured to be extremely effective while minimizing costs. The bottom line is that a varied menu of options

[11] A buyer beware system that applies to all transactions uses a fairly blunt instrument to solve a specific problem. In the long run it might be more prudent to target the instrument only on those Parties that are causing the problem. One way to accomplish that would be to implement a "buyer beware" requirement only for any allowances purchased from any party found to be in noncompliance in the previous commitment period. Not only would this provide additional incentives to come into compliance, it would not saddle the trading system with this additional requirement except for those transactions where it was likely to be an issue. The disadvantage, of course, is the fact that it doesn't provide any help in facilitating compliance during the first commitment period.

exists and some initial insights have been derived. Further research is needed, however, to see whether deeper investigations reinforce or repudiate these tentative initial findings.

ACCOUNTABILITY UNDER THE CDM MECHANISM

Both emissions trading under Article 17 and Joint Implementation under Article 6 involve the transfer of assigned amounts, creating an enforceable standard that ensures the environmental integrity of the trading systems and the overall cap on emissions. No similar system exists for credits created under the CDM, so an additional level of accountability, such as insurance or certification, is needed for such credits.

Article 12 provides that Annex I countries can acquire the certified credits obtained from GHG reduction projects with non-Annex I countries under the CDM. Under the system proposed here, only certified credits from CDM projects with developing countries can be incorporated into an international emissions trading scheme.

The certification function could be performed either by an official CDM authority or a private certifier, making either the CDM or a private certifier responsible for CERs sold. The first option would be preferable, as there arises a default risk of the private certifier in the second. The CDM could demand insurance from project managers of projects that sell CERs or host country governments. If the CDM credits are ultimately deemed not valid in whole or in part, should the seller, buyer or both be liable for restoring the tons of excess emission and any other penalties? Should the certifier bear any of the liability?

THE "SUPPLEMENTAL MEANS" REQUIREMENT

Article 17 specifies that emissions trading "shall be supplemental to domestic actions". What is meant by this provision is an issue in the current international debate on emissions trading, and remains to be defined by the Conference of the Parties.

The issue of supplementarity is influenced by perceptions of the likely cost of domestic emissions reductions and the affect on international trading. If domestic costs are likely to be low in most countries, as some believe, compliance will take place largely domestically, and the supplementarity provision will never become a binding constraint. Only if domestic compliance costs are high would there be a need to consider mechanisms for promoting domestic compliance.

Following the decision of the EU Council of Environmental Ministers in March 1998, the UK circulated a "non paper" at the Subsidiary Body for Scientific and Technological Advice (SBSTA) meeting at Bonn on behalf of the EU plus the Czech Republic, Slovakia, Croatia, Latvia, Switzerland, Slovenia, Poland and Bulgaria. This states that:

> "We believe that domestic actions should provide the main means of meeting commitments under Article 3. This is consistent with the ultimate objective of the Convention. In this context, a 'concrete ceiling' on the use of all the flexibility mechanisms has to be defined ..... the rules governing the international emissions trading system should reflect this principle".

The form that such a “concrete ceiling” might take has yet to be elaborated. One interpretation of the "concrete ceiling” provision is that the amounts traded should be limited to a fixed percent of the assigned amount. Any quota could either apply to the overall amount of reduction reached through any of the cooperative mechanisms or specific quotas could also be set for each mechanism.

The necessity for, and the form of, any concrete ceiling is extremely controversial. Yet part of the controversy seems to stem from a lack of information. What would happen in the absence of a concrete ceiling? What alternative approaches to a concrete ceiling exist? What are the consequences of various choices on: cost, air quality, likelihood of ratification, compliance?

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