

International Rules for
Greenhouse Gas
Emissions Trading

*Defining the principles, modalities,
rules and guidelines for verification,
reporting and accountability*





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OVERVIEW

The Kyoto Protocol to the United Nations Framework Convention on Climate Change authorizes four cooperative implementation mechanisms - bubbles, emissions trading, joint implementation and the clean development mechanism (CDM). The provision on emissions trading, the focus of this report, allows trading of «assigned amounts» among the so-called Annex B Parties, while leaving the drafting of implementation details to subsequent conferences of the Parties. Three distinct trading possibilities emerge from this authorization: trading among countries with domestic emissions trading systems, trading among countries without domestic trading systems, and trading among countries with and without domestic emission trading systems.

The case for a tradeable entitlements system is based on the advantages that it would offer over other politically feasible alternatives. In the short term, it offers the possibility of reaching environmental goals at a lower cost than would be possible if each country were limited to reduction options within its own borders. Making it easier to reach these goals may encourage more countries to sign the Protocol, and should increase compliance with those goals. Because it separates the issue of who pays for control from who implements control, it facilitates transboundary cost-sharing, an item of particular importance to both the developing countries and the transition economies of Eastern Europe. Tradeable permits also facilitate the mobilization of private capital for controlling global warming; private capital is likely to be a critically important component of any effective global warming strategy for as long as there is insufficient public money to finance it.

Finally, and perhaps most importantly, tradeable entitlements facilitate the development and implementation of novel approaches to climate change control. By offering greater flexibility in how the emission reductions are achieved (as well as by providing economic incentives for the adoption and use of unconventional approaches), tradeable entitlements can significantly lower the long-term costs. Lower long-term costs may be an important element in gaining greater international acceptance for the idea of emission limits and in reducing the difficulties associated with ensuring compliance. Furthermore, if it becomes desirable to ensure that participants cover the administrative costs of running the system, levying a low annual fee on each entitlement could raise revenue. This revenue could be used for financing technology transfers or for other worthy purposes without jeopardizing the cost-effectiveness of the system.

Historical precedents: other emissions trading programmes

Previous emission trading programmes have taken one of two forms: credit trading or allowance trading. Credit trading allows emission reductions above and beyond pre-specified legal requirements to be certified as tradeable credits. Credit programmes tend to focus on specific sources or projects. Allowance trading, on the other hand, starts by defining an aggregate emissions cap. The emissions authorized by this cap are then allocated to eligible Parties.

In general, programmes that imposed emission caps coupled with allowance trading have performed well, whereas credit trading systems have generally not met expectations. Credit

trading systems have proved to be less secure environmentally and have created higher transaction costs and greater uncertainty and risk than allowance trading, leading to reduced trading.

- The **Acid Rain Programme** in the United States is the largest and most successful emissions cap and allowance trading programme in the world. The Programme has achieved a strict environmental goal of reducing of sulphur dioxide emissions, and results since 1995 show that compliance costs have been less than half those predicted by the Environmental Protection Agency (EPA), and many times lower than those predicted by industry.
- The **Regional Clean Air Incentives Market (RECLAIM)** establishes an emissions cap covering most stationary sources of nitrogen oxides and sulphur oxides in the Los Angeles area. RECLAIM has achieved significant success in reducing the price of compliance, with annual savings relative to command and control regulation projected at \$58 million annually, or 42 per cent.
- **New Zealand Fisheries License Trading** uses a cap and trade system to manage the majority of its commercial fisheries. Since 1986 the government has set total allowable commercial catch limits and individual transferable quotas (ITQs) for each fish species in defined management areas, based on sustainable harvests. The ITQ system has led to heavy trading, and it is estimated that 77 per cent of all ITQs initially allocated have changed ownership. The costs of monitoring, administration and enforcement are similar to those of other fisheries management programmes. There are high penalties for non-compliance, including fines and forfeiture of vessels.
- **Emissions credit trading** programmes in the United States have been established for major pollutants since 1977. These programmes allow firms to demonstrate emissions reductions that are either below the firm's permitted levels or below previous levels, whichever is lower. The credit trading systems in the United States have generally performed poorly, principally because of their high transaction costs and the uncertainty and risk involved in obtaining government approval for credit trades. Although there have been thousands of trades over the decades, the extent of trading has been less than expected, and sometimes much less. More importantly, the programmes have uncertain environmental impacts, and they have not achieved significant economic benefits or introduced flexibility into a fairly rigid regulatory system. Finally, since credit trades are project-specific, continued oversight is needed to ensure that the Parties perform as promised. The history of credit trading in the United States demonstrates the tension between the need for high levels of government oversight to ensure credit trades are legitimate, and the high transaction costs such oversight entails.
- **The lead phasedown programme** established by EPA in the United States in 1982 was expanded in 1985 to greatly reduce lead levels in gasoline. The lead phasedown programme performed successfully as the first free and open trading market. Lead credits

were briskly traded, and trading is believed to have so significantly reduced the cost to producers that it facilitated major additional lead reductions in 1985.

- **A pilot programme for activities implemented jointly** that reduce or sequester greenhouse gases was established under article 4.2(a) of the Framework Convention on Climate Change at the first Conference of the Parties in 1995. While not strictly comparable to other credit trading programmes as investors gained no formal crediting for the tons purchased, experience with this programme is useful in indicating procedures for determining the "additionality" of emissions reductions, which is also required for trades under articles 6 and 12 of the Convention. Results from this programme indicate that a greenhouse gas credit trading programme which requires a showing of additionality can involve even higher transaction costs and uncertainty than has been the case with other credit trading programmes.

Lessons from previous trading programmes

Lessons drawn from emissions trading history are both relevant to the design of an international trading system and useful to countries that are structuring national compliance and trading systems. The design of trading programmes is critically important to their success, as it will determine the transaction costs as well as the uncertainty and risk inherent in the trading system.

In the United States, the cap and trade approach under the acid rain programme and RECLAIM has resulted in significant programme-wide cost reductions, while emissions credit trading has not been as successful. The reasons for this have to do with the fact that credit trades are not of a commodity nature, with their higher transaction costs, and with the regulatory barriers to their creation.

Since only credible systems succeed, deviations from simplicity should be introduced only when demonstrably necessary to promote the achievement of the climate change goals. Systems are not credible if they become a vehicle for evading, rather than complying with, international agreements. Hence, the administrative procedures must be adequate to ensure compliance with the climate change goals.

All existing emissions trading programmes involve trading between private entities. Allowing private entities to trade appears to be important if the efficiencies of trading are to be realized. The essential benefit of trading programmes is that they allow private firms the flexibility to determine technology choices and options themselves, and compare these to emissions permit prices to determine an overall least-cost path of compliance. Allowing private entities to trade amongst themselves creates maximum flexibility. Since it is the actual sources of emissions that are in a position to implement energy-saving technologies and processes, allowing them to trade gives them the greatest opportunity to achieve these efficiencies.

The banking of allowances allows sources of emissions and Parties to the Convention significant additional flexibility in compliance-related investment and decision-making. There has been heavy use of banking in both the acid rain programme and the lead credit trading market in the United States, and it has led to early reductions and substantially lower overall costs of compliance. Banking is especially significant for industries in which major capital expenditures must be made, as it allows individual sources flexibility in the timing of such major investments. The protocol to the Convention does allow banking in relation to expected future compliance periods, which may encourage further early reductions (article 3(13)).

The allocation of allowances to sources is a contentious issue, since the allowances can be very valuable. The above programmes have allocated allowances to existing sources at no charge. This may be the most politically practical method since it provides the greatest number of rights to existing sources. However, it makes it more difficult for new sources to enter the market, as they must buy allowances from existing sources. Alternative methods of allowance allocation would be to auction allowances or to allocate them on the basis of a rolling average of past emissions. Both methods would reduce the barriers to new entrants, and would deal better with sources that have shut down.

A provision that allows otherwise uncovered sources to opt to be covered under the regulatory system can increase the scope of a programme. While it is desirable to include as many sources as possible in a regulatory system, it may not be practical to include all emitters of a pollutant in an emissions cap and allowance trading system owing to uncertainties in measurement for some classes of sources. An opt-in process allows these sources to be included once the uncertainties are resolved to an acceptable degree.

Transaction costs play a key role in the success or failure of an emissions trading system. In the past, only emissions trading programmes with low transaction costs have succeeded in substantially lowering the cost of compliance. Credit trading programmes create high transaction costs by requiring each credit generation or use to be separately approved by a regulatory authority. Cap and trade programmes, on the other hand, have generally low transaction costs and low risk.

The experience with existing programmes has been that the private market has supplied an adequate to high number of allowances or credits, so that market power issues have not been of concern. Several mechanisms can be and have been implemented in past programmes to address concerns about market power and the potential hoarding of allowances, such as regular auctions of allowances.

Providing price information is important to reduce the uncertainty of trading and create public confidence in the trading programme. The disclosure of price information could be required under the reporting requirements for emissions trades, or through systems such as regular public auctions.

Some credit trading programmes impose a 10 per cent or greater deduction on trades for air quality enhancement, or for other purposes such as to make grants available to new entrants.

This may help create public support for a trading programme by creating public benefits if firms take advantage of trading to reduce their costs. On the other hand, imposing a percentage deduction on trades creates another barrier to the economic efficiency gained through trading. Arguably, the environmental benefits of clean air are better established by adjusting the overall cap, not by penalizing trades.

Past emissions trading programmes have shown that high-quality monitoring is essential to ensure the effectiveness of both compliance and trading systems. Several programmes require continuous emissions monitoring by sources, but other verifiable methods are also possible. Some programmes require ongoing testing of these monitoring systems on a frequent basis to ensure their reliability, and also require the results of monitoring to be made publicly available.

Reporting is a key compliance mechanism, and covers both emissions monitoring results and emissions trading activity. On a national level, many countries require monthly reporting of pollution emissions data, and continuous emissions monitoring technology allows reporting as often as every 15 minutes. United States domestic trading programmes require reporting of emissions trading activity to a government registry, which is open to the public, and may be available on the worldwide web. This helps to assure openness of the system, and is also used by the Government for compliance purposes. Additional procedures for compliance reporting can be extremely simple for allowance trading, and quite complex for credit trades which are individual and project-based.

Allowance trading does not require the certification of trades, as the structure of the programme defines a limited cap and the authenticity of each allowance. However, almost all forms of credit trading require some kind of certification system. Under credit trading programmes in the United States, the principal certification criteria are that emission reductions be quantifiable, surplus, either permanent or discrete, and enforceable. The certification process is most complex and demanding for discrete project-based credit trading, especially if a showing of additionality is required.

The level of penalties in trading programmes appears to be positively correlated with compliance levels. The United States Acid Rain Programme has achieved 100 per cent compliance in all years, due to reliable monitoring and reporting, high transparency and high penalties. Penalties typically include the restoration of tons of excess emissions, which are taken from the source's next budget period, and may include fines and other sanctions.

A relevant aspect of both the Acid Rain Programme and RECLAIM is the provision of a two-month reconciliation period following the end of a year for sources to purchase any allowances needed to equal their emissions. This promotes compliance and reduces risk in the market.

Monitoring and verification

The national reporting system of each Party to the Convention would have the dual responsibility of tracking both emissions and allowances. Each Party would be responsible for

tracking emissions of all greenhouse gases in the format prescribed by the oversight agency established by the Conference of the Parties. In the case of a Party that has delegated trading authority to private sources, emission levels for those sources or sectors must be included as separate entries in these inventories. Each Party would also be responsible for reporting all allowance transfers and would have responsibility for verifying ownership of any traded allowances. Both reports would 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. Generally these reports would be submitted on an annual basis, although more frequent reporting would be possible if the Conference of the Parties deemed it necessary.

An international authority would be expected to perform the following key monitoring and compliance functions: (1) initial approval of a country's monitoring system, which would allow it to participate in emissions trading; (2) receipt and review of the reports by countries, which would have to provide credible data on monitoring results and methods on an ongoing basis (once a country was accepted into the international trading system, the international agency would need the capacity to receive and review the national reports, including those submitted under article 3 (13); and (3) periodic inspections to ensure compliance and proper functioning.

The monitoring systems for both allowances and emissions must rely heavily on self-reporting. Polluters have the most information about their activities and thus can provide it as part of a monitoring system at a cost much lower than the cost of using independent monitoring systems. Virtually every domestic and international enforcement system is based on self-reporting, since other modes are not economically or politically viable.

The first level of reporting and coordinating allowance transfers with emissions is at the level of the Parties to the Convention. National monitoring is not only a physical necessity; it is probably the most effective system.

All reports must be harmonized both in terms of reporting format and in terms of collection protocols to ensure comparability and reliability. The ultimate authority for aggregating, standardizing and interpreting reports from the Parties must remain with an authorized subsidiary body of the Conference of Parties.

Creating layers of veracity checks should strengthen the integrity of the allowance and emissions monitoring systems. Systems of self-reporting do offer many opportunities for deception, although some analysts may overstate the extent to which deliberately deceptive self-reporting occurs. Nonetheless, there are risks of deception, and assuring the integrity of the permit system will require assuring the integrity of self-reporting. National Governments could provide many (or most) of the domestic checks, provided that those checks are themselves reviewed occasionally at the international level.

Environmental non-governmental organizations can exercise general oversight over the compliance process and may even play a role in the monitoring of individual sources. The capacity of such organizations and their access to publicly available information are important determinants of how effective this component will prove to be.

Transparency should be promoted by making collected data widely available. The integrity of the system can be more readily assured 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 a rich database. Some reluctance to reveal information for reasons of privacy and industrial secrecy is to be expected, but the free flow of information should be the norm. One model for the transparent reporting of trading activity is provided by the allowance tracking system used in the acid rain programme in the United States. This system is open to the public and helps to create a transparent and self-enforcing compliance system, and has contributed to high compliance in the programmes. Transparency could also be promoted by forcing some or all transferred allowances to be sold at auction. In addition to promoting good international information on allowance prices, this technique would diminish opportunities for strategic manipulation of the market.

Certification and verification

Since emission reductions used to generate credits under article 12 require considerably more scrutiny, a certification function is necessary to ensure that only certified emission reduction become part of the allowance system. Certified allowances would be treated in the same way as all other allowances. The certification process is one practical way to help ensure that the trading system runs smoothly, and that it furthers the goals of the Convention.

While the ultimate authority for certification would be the Conference of the Parties, the operational authority for certification can, and should, be delegated to subordinate bodies specifically designed to fulfil that function. While the Conference of the Parties would be well-suited for defining the parameters of the certification process and exercising general oversight over that process, it would be ill-suited for dealing with the day-to-day operations of certification.

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 that certain preconditions were met. These preconditions would include: (1) an identified organizational unit willing and able to assume the responsibility for certification; (2) the existence of sufficient enabling legislation to ensure the unit had 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.

Certification and monitoring processes should be initiated promptly. Although the commitment period is still a few years away, it will be important to test and refine the system before it is put to the test. Furthermore, non-Annex B nations that contemplate establishing private tradeable entitlements systems will need guidelines on the appropriate processes of certification and monitoring. If these are provided early, the chances of achieving harmonized procedures in the future will be higher. Viable and legitimate systems created today, even if they are small, will become the de facto standard, and the early creation of such systems will highlight the changes needed in domestic institutions and procedures, allowing more time to make the necessary reforms.

Monitoring procedures and institutions should be designed with future expansion in mind; they will inevitably need to expand to accommodate different gases, different Parties and different commitment periods.

While certification is sufficient for transfer of a credit, use of a credit to fulfil part of an assigned amount obligation would 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 entail making sure that the planned forest was in existence and was absorbing carbon at the expected rate, while an energy efficiency project would verify that emissions actually mirrored the emissions expected on the basis of the design criteria.

Compliance and enforcement

Multiple commitment periods offer significant opportunities for enforcing compliance. The principal tools for enforcing compliance include declaring non-compliant Parties ineligible for trading and reducing assigned amounts in subsequent commitment periods; such tools work best, of course, if subsequent commitment periods are in place and assigned amounts defined. Currently the Protocol establishes that there will be negotiations to fix assigned amounts in subsequent commitment periods, but it has perhaps not been generally recognized how important that task is in promoting compliance within the first commitment period. We believe that process should be given a much higher priority than has so far been the case.

A wide range of enforcement and compliance instruments is 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 that can be imposed. In some countries there may be an evolving norm in favour of stiffer penalties, including imprisonment and personal liability for the actions of organizations and firms, and administrators can now resort to a wider array of sanctions.

The key issue in enforcement - whether at domestic or international level - is deterrence, not just the reversal of non-compliance. There is empirical support for the proposition that the frequency of monitoring and inspection, as well as the level of penalties makes a difference, but comparisons between enforcement instruments are difficult.

Transparency is another tool for ensuring compliance, since much of domestic law presumes that enforcement will be based upon public opinion and normative pressures to comply. Transparency is an important complement to enforcement because it makes violations apparent, and the fear of detection promotes compliance. Transparency systems require the disclosure of basic information regarding obligations, actual emissions and trading activity, in order to allow judgements about compliance status. To date, transparency systems have relied heavily on self-reported data, and have worked best when data have been made available to the public. Such data need to be collected and verified at the international level, which will require the use of

international public databases of self-reported and verified information, under the responsibility of the authorized body.

Transparency mechanisms have also been effective at the domestic level to promote compliance. In the United States, a law requiring industries to report their pollution discharges to the public has resulted in dramatic voluntary decreases in discharges. Thanks to their access to this information, environmental non-governmental organizations have been able to act as agents for protecting the environment and to initiate law suits, thus complementing the role of public agencies.

Designing enforcement systems at the international level is difficult because international institutions are sometimes weak, and international treaties rest on the assent of their Parties. These shortcomings are tempered by strong norms in the international system in favour of complying with international law. Most environmental treaties have relatively weak enforcement mechanisms, and most episodes of non-compliance and potential enforcement actions take the form of disputes, which are dealt with diplomatically through negotiation.

Although domestic agencies could provide most public enforcement functions, international institutions are needed at least to supervise domestic enforcement and to provide assurance that the domestic system is operating properly. The international system does not need to force harmonization through a single international system; rather, it needs to ensure that, despite national differences, internationally traded offsets and entitlement are secure. As with monitoring, this could be based primarily on self-reported assessments of effectiveness together with veracity checks, following agreed procedures to assure the integrity of the system. Without such international supervision, operating on a regular basis with established guidelines for how Parties must address identified failures, the market may destabilize because of fears of incomplete domestic enforcement.

In addition to official international enforcement systems, some countries have been able to take unilateral enforcement measures, such as import bans or threats of retaliation, in areas where domestic interest is high. However, this is possible only for powerful States with large domestic markets and would be hard to apply in a fair and even-handed manner in a regime with large and small States alike.

Strict eligibility requirements governing the right to engage in trading are an important element of a complete compliance system. Parties that do not comply with reporting or other requirements could be suspended from trading within the initial compliance period. Once subsequent commitment periods are 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.

Parties that are unlikely to have the infrastructure, or that lack the will, to enforce the domestic policies and abatement measures would not be able to participate in trading. Under this system, the more stringent the criteria, the greater the assurance that traded tons would represent real reductions. From the environmental perspective, more stringent criteria are preferred. From an economic perspective excessively stringent requirements would reduce the number of

participants and, hence, the cost savings that otherwise could have been realized. Clearly a balance is needed.

An important element of an enforcement system is establishing a credible system for restoring any ton of excess emission by a non-complying Party. This protects the environmental objectives of the Protocol by ensuring that the total cap on greenhouse gases is not exceeded. The most common way this has been done in past trading programmes 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. However, the nature and length of the current five-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.

It is possible to consider ways of restoring tons during the commitment period. One method used in domestic programmes would be to establish a "true-up" period of several months at the end of a commitment period to allow Parties finding themselves in non-compliance to obtain or purchase additional tons. This method could be enhanced if the secretariat were authorized to reserve a percentage of, or purchase, allowances for this purpose. Another option which Parties could consider in future protocols is the desirability of dividing a commitment period into discrete budget periods, such as one- or two-year periods, in order to facilitate transparency, trading and, particularly, compliance mechanisms.

At the domestic level, Parties could impose financial penalties for excess tons of emissions on sources or sectors. Most domestic trading programmes impose fines per ton of excess emissions, typically at a level several times the expected economic value of the emissions. However, imposing penalties on Parties has proven difficult under other international conventions.

Another enforcement tool, which is available to both domestic and international enforcers, is to require non-complying entities to retire an added amount of tons. This amount would be higher, by a stated percentage, than their non-compliance overage. Assigned amounts covered by the penalty could be retired and therefore not used to legitimize excess emissions.

It is important to establish and ensure the proper operation of dispute resolution procedures for enforcement issues. Agreed procedures could help to keep disputes productively focused on the issues at hand. We recommend the early adoption of institutions and procedures.

Reporting

Article 5 (1) of the Protocol states that each Party shall install a national system for estimating emissions and removals. These systems shall use the methodologies and Global Warming Potentials (GWP) of the Intergovernmental Panel on Climate Change. Revisions of methodologies will only apply to future commitment periods. Inventories have to be submitted annually after 2008 via national communications, and the Meeting of the Parties shall develop additional guidelines for reporting and accounting. Thus general reporting requirements have become more strict.

In the design of the international trading system, certain common methods and reporting formats should be considered as requirements for participants to be eligible to join the trading system, such as the use of comparable methods for setting emission baselines for individual emission sources that create certified emission reductions, and the use of common reporting formats for making information on emissions and greenhouse gas unit holdings accessible to other countries and to the public.

Standard reporting formats would facilitate the review exercise. The frequency of reporting would need to be carefully considered, weighing the cost of information against market participants' need for certainty that emissions commitments are being met. Reporting requirements are not unique to trading, however. The frequency of reporting could increase, if necessary, as domestic reporting systems improve.

Countries who want to trade would need to take on the monitoring, reporting and compliance requirements of the trading system. The benefits of participating in an international emission trading system would be a strong incentive for prospective participants to comply with agreed trading rules such as these.

The national reporting system of each Party would have the dual responsibility of tracking both emissions and allowances. Each Party would be responsible for tracking emissions of all greenhouse gases in the format prescribed by the oversight agency established by the Conference of the Parties. In the case of a Party that has delegated trading authority to private sources, emission levels for those sources or sectors must be included as separate entries in these inventories. Each Party would also be responsible for reporting all allowance transfers and would have responsibility for verifying ownership of any traded allowances. Both reports would be submitted in standardized formats. Standardized formats would facilitate comparison of authorized emissions with actual emissions and would facilitate comparisons among Parties. Generally these reports would be submitted on an annual basis, although more frequent reporting would be possible if the Conference deemed it necessary.

All private traders, whether companies or individuals, should be required to register with a central governmental body responsible for recording all transactions (such as EPA in the United States or the Department of Environment in the United Kingdom), which will establish an account in the trader's name. In the case of a domestic trading system, companies would have to notify sales to foreign companies or Governments to a domestic government agency, which would record the transaction and adjust the account of the seller. In the buying country, a government agency should also be notified of the transaction by the buyer, so that it can record the transaction, adjust the trader's account, send confirmation of the acquisition back to the buyer, and notify the United Nations Framework Convention on Climate Change (UNFCCC) secretariat. If trading takes place between countries without domestic trading systems, the Governments concerned should have to report the transaction in the official gazette.

All international trades would have to be reported by the Parties to the UNFCCC secretariat or to a designated subsidiary body, who would keep accounts of international permit trade and calculate changes in the allowances of participating countries by adding up all notified

trades by the end of each year. Finally, the secretariat or subsidiary body would inform the enforcement agency about each country's position at the end of the commitment period. It could use the experience of the EPA allowance tracking system, which controls the trading through serial numbers attached to allowances.

All government agencies and the UNFCCC clearinghouse should have to publish data on transactions and permit accounts of countries on websites as well as annual reports. This is crucial to enhance compliance following earlier exposure of fraudulent trades, such as by non-governmental organizations.

Non-compliance with reporting and monitoring requirements is covered only under article 6.4 of the Protocol, which states that if an Annex I country is found in non-compliance with the reporting provisions of article 8, any emission reduction units acquired by the buyer country cannot be used to meet its commitments under article 3 until the question of compliance by the seller country is resolved. Arguably the same rule should be made to govern non-compliance with all the essential monitoring and reporting requirements needed for a trading system to operate, and should apply to emissions trading under article 17, as well as joint implementation under article 6.

Accountability

An accountability system must be established between sellers and buyers of allowances. 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 general the principle of strict seller liability is preferable in a strong enforcement environment. It provides incentives for those creating the credits to ensure their validity, and it reduces risk and uncertainty in trading, significantly enhancing the tradeability of permits.

However, a seller liability policy may not always work because there is only one very long commitment period in the Protocol and, as of now, no additional commitment periods have been defined. Unless these and other elements of a strong compliance system are defined, there may be a need for some form of a buyer liability programme to ensure that tainted acquired allowances could not be used to satisfy the buyer's "assigned amount" requirements. This may discourage purchasers from buying tons from countries that appear to be headed towards non-compliance.

Because buyer liability erodes the commodity nature of allowances by allowing them to be retroactively devalued, thereby creating uncertainty and discouraging trading, refinements of this approach may be desirable. One refinement would be to impose buyer liability only on Parties found to be in non-compliance in the previous commitment period. This approach could be extended to Parties whose annual emissions exceed by a certain margin their annualized assigned amounts during the commitment period.

If the Parties decide that buyer liability is needed to complement traditional compliance procedures, a «vintage model» is probably better than the "proportionate reduction" model. A

vintage model imposes liability on the latest reductions sold by the non-compliant country (up to the level of non-compliance), whereas a proportionate reduction approach imposes proportional liability on all allowances from the seller.

Special considerations are needed for article 12 credits. 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 emission reduction units created under the CDM, so an additional level of accountability, such as insurance or certification, is needed for such credits. Only verified actual reductions from CDM projects with developing countries could be incorporated into an international emissions trading scheme.

Under the Protocol, Parties may bank allowances by emitting fewer greenhouse gases than their assigned amounts, thereby facilitating early emissions reductions. To assure the functioning of this banking mechanism, governments should never confiscate banked allowances even to reduce emission levels, (this should be accomplished by lowering emissions caps in subsequent periods). Borrowing is much more controversial, and, if allowed, a number of safeguards (such as limiting borrowing to those periods with assigned amounts and restricting borrowed allowances to own use rather than sale) could be added to limit possible abuses of the system.

Article 17 specifies that emissions trading shall be «supplemental to domestic actions». The issue of supplementarity is influenced by perceptions of the likely cost of domestic emissions reductions, since with low-cost domestic reductions this provision will have little affect on international trading. One approach advocated has been to implement a quota for the overall amount of assigned amounts fulfilled through any of the cooperative mechanisms or separate quotas for each cooperative mechanism.

If a quota system is adopted, one issue is how to ration available credits when their availability exceeds the demand as constrained by a quota. A first-come, first-served approach would encourage early reductions, and may advantage CDM projects. This approach could be implemented by setting a "soft" quota that slowly discounts the carbon credits achieved beyond the initial quota. Another possibility would be to allow banking of credits for the next commitment period after the quota is filled. These credits would get preference in filling the next quota, so projects of a long duration would be penalized less.

It is not necessary to impose quotas on trading in order to respond to the concerns that motivated the placement of the supplemental norm in the Protocol in the first place. Rather, the supplemental norm requirement in the Protocol could be handled by requiring Parties to demonstrate adequate domestic efforts to control emissions. This approach would not jeopardize the benefits to be achieved from implementing a vigorous trading system.

The allocation of allowances has the potential to bring Parties into conflict with the World Trade Organization (WTO) provisions, raising concerns about international competitiveness. Such concerns are not limited to trading, where allowance allocation can make

unequal treatment explicit, but can be even more easily hidden from the general public if conventional command-and-control regulations are used.

One way to deal with competitiveness issues, would be to ensure that the rules, modalities and guidelines for international emission trading ensure that domestic reallocation rules are compatible with basic WTO principles and do not result in implicit subsidies or barriers to new entrants.

Chapter I

INTRODUCTION

A. Emissions trading: the concept

The case for a tradeable entitlements system is based on the advantages that it would offer over other politically feasible alternatives.¹ In the short term, it offers the possibility of reaching the environmental goals at a lower cost than would be possible if each country were limited to reduction options within its own borders. Making it easier to reach the goals may encourage more countries to sign the Protocol and would probably increase compliance with those goals. Because it separates the issue of who pays for control from who implements control, it facilitates transboundary cost-sharing, an item of particular importance to both the developing countries and the transition economies of Eastern Europe (Tietenberg, 1990). Tradeable permits also facilitate the mobilization of private capital for controlling global warming; private capital is likely to be a critically important component of any effective global warming strategy for as long as there is insufficient public money to finance it.

Finally, and perhaps most importantly, tradeable entitlements facilitate the development and implementation of innovative approaches to climate change control. By offering greater flexibility in how the emission reductions are achieved (as well as by providing economic incentives for the adoption and use of unconventional approaches), tradeable entitlements can significantly lower the long-term costs. Lower long-term costs may be an important element in gaining greater international acceptance for the idea of emission limits and in reducing the difficulties associated with ensuring compliance. Furthermore, if it becomes desirable to ensure that participants cover the administrative costs of running the system, levying a low annual fee on each entitlement could raise revenue. This revenue could be used for financing technology transfers or for other worthy purposes without jeopardizing the cost-effectiveness of the system.

B. Review of the relevant provisions on emissions trading in the Kyoto Protocol

1. General rules on emission targets

¹ We only summarize here a few major points. For a complete discussion of the advantages of this approach see United Nations Conference on Trade and Development (1992).

The 1992 United Nations Framework Convention on Climate Change recognizes the principle of global cost-effectiveness of emission reduction in article 3 (3) and has 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, however, 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 Convention - the Kyoto Protocol (United Nations Framework Convention on Climate Change, 1997). The Protocol will become effective once it has been ratified by at least 55 Parties representing at least 55 per cent of the total carbon dioxide emissions of Annex I countries in 1990.²

Article 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 per cent below 1990 levels over the commitment period. They cover a basket of six greenhouse gases listed in Annex A: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). 100-year global warming potentials are used to convert gases into a common unit (article 5 (3)). Emission targets relate to the base year 1990, although countries with economies in transition can use a different base year if established in their first national communication (article 3 (5)). This applies to Hungary (average of 1985-1987), Poland and Slovakia (1988) and Romania (1989). Croatia, Lithuania, Slovenia and Ukraine can still choose their base year, as they have not yet issued their first national communication. The base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride can be shifted to 1995 (article 3 (8)).

Besides emissions reduction, «verifiable» sequestration through afforestation and reforestation taking into account deforestation shall be used to meet the targets (article 3 (3)). Article 3 (4) allows the Meeting of the Parties 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 Meeting of the Parties takes the decision before 2008. Countries may include net emissions from land-use change and forestry in the 1990 inventory (article 3 (7)) – currently this only applies to Australia, Estonia and the United Kingdom.

Small countries for whom single projects have a significant impact on emissions in the target period shall benefit from special rules to be decided upon at the fourth Conference of the Parties (decision 1/CP.3, para 5. (d)).

If emissions during the commitment period are lower than the target, the difference may be banked for the next commitment period (article 3 (13)).

² «Annex I countries» are the countries of the Organization for Economic Co-operation and Development (OECD) and countries with economies in transition. These countries have committed themselves to legally binding greenhouse gas emissions targets.

2. Reporting and accounting rules

Article 5 (1) states that each Party to the Protocol shall install a national system for estimating emissions and removals. Inventories have to be submitted annually after 2008 via national communications (article 7 (1-3)). Additional guidelines for reporting and accounting shall be developed at the Meeting of the Parties (article 7 (4)).

3. Monitoring and verification

National communications are to be reviewed by expert teams (article 8 (1)). The members are to be appointed by Parties and intergovernmental organizations (article 8 (2)). If the team identifies contentious issues, they are referred to the Meeting of the Parties (article 8 (3)).

4. Cooperative implementation

Article 3.3 of the Convention states that «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 a variety of provisions for cooperative implementation mechanisms (see box 1).

Box 1: Mechanisms of cooperative implementation in the Kyoto Protocol

Article 4.1

«Any Parties included in Annex I that have reached an agreement to fulfil their commitments under Article 3 jointly, shall be deemed to have met those commitments provided that their total combined aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of Article 3. The respective emission level allocated to each of the Parties to the agreement shall be set out in that agreement.»

Article 6.1

«For the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy...»

Article 12.2

«The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.»

Article 17

«The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in Annex B may participate in emissions trading for the purpose of fulfilling their commitments under Article 3. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article.»

Source: The Kyoto Protocol, 1997.

□ **Bubbles**

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 greenhouse gas emissions do not exceed their assigned amounts. A bubble must be declared when the ratification is deposited. Once the terms of agreement have been registered with the UNFCCC secretariat, the commitments agreed on cannot be revisited during the commitment period in question. The bubble approach is often termed «trading without rules» because it sets few restrictions on trading between Parties. If it turns out to be too difficult to agree on the common rules and guidelines for verification, reporting and accountability for emissions trading pursuant to the Kyoto Protocol, the bubble approach at least opens the possibility of trading emissions permits within the voluntarily formed group. In addition to the current European Union bubble, the United States has reached a conceptual agreement with Australia, Canada, Japan, New Zealand, Russia and Ukraine to pursue an umbrella group to trade emissions permits (United States Department of State, 1998). Whether this develops into a fully-fledged bubble under article 4 remains to be seen.

□ **Emissions trading**

The Kyoto Protocol also accepts the concept of emissions trading under article 17, under which one Annex B country will be allowed to purchase the rights to emit greenhouse gases from other Annex B countries that are able to cut greenhouse gas emissions below their assigned amounts. Although Annex B to the Kyoto Protocol and Annex I to the Convention are now identical in nature, this change from Annex I into Annex B potentially allows a developing country to engage in emissions trading if it voluntarily adopts an emissions target and is inscribed in Annex B. Because the emissions trading proposal was adopted at the very end of the Kyoto negotiations, designing the relevant principles, modalities, rules and guidelines governing emissions trading has been deferred to a subsequent conference. The design of a workable emissions trading scheme is essential to the success of emissions trading. The market-based emissions trading approach can only achieve significant cost reductions in cutting greenhouse gas emissions while also allowing flexibility for reaching compliance if it is structured effectively. This study aims to facilitate the design of an international emissions trading scheme that is both workable for the Parties eligible for emissions trading and acceptable to all the Parties to the Protocol.

Emissions trading transfers "assigned amount units". Ensuring that the post-transfer commitments are appropriately adjusted requires that the amount transferred should be added to the buyer's assigned amounts and deducted from the seller's assigned amounts (article 3 (10,11)).

□ **Joint implementation**

The third option currently is most relevant concerning worldwide cost minimization - project-oriented emission reduction credited to the investing country. This possibility was named «joint implementation» in the negotiations leading to the Rio Conference. In 1995, the Berlin Conference of the Parties decided on a pilot phase for joint implementation without crediting called «activities implemented jointly». By 2000, it should be decided whether activities implemented jointly would be followed by joint implementation with crediting. The Kyoto Protocol allows joint implementation between Annex I countries (article 6). It does not state, though, whether projects considered as activities implemented jointly will automatically become joint implementation projects after 2000.

Joint implementation projects shall be approved by all involved Parties and shall be «supplemental» to domestic actions (article 6 (1d)). The Meeting of the Parties shall define guidelines, verification and reporting rules (article 6 (1c)). Emission reduction units (ERUs) created through joint implementation under article 6 are treated in the same way as those from emissions trading under article 17 (article 3 (10,11)). Emission reduction units from joint implementation do not accrue if inventories are not submitted annually or do not use the agreed guidelines (articles 5 and 7). Emission reduction units questioned through expert review teams may be transferred but are «frozen» until the question is resolved (article 6 (4)).

□ **Clean development mechanism**

The Kyoto Protocol includes a new way of linking emission reduction with economic development. A "clean development mechanism" (CDM) shall be set up, which has been defined only rather vaguely (article 12). It leads to the creation of «certified emission reductions» (CERs) (article 3 (12)). Article 12 (3) states that countries that fund projects through the CDM get credit for certified emission reductions from these projects provided benefits accrue to the host country (article 12 (3a)). Crediting shall be only allowed until a certain percentage of the emission target, which remains to be defined, is reached (article 12 (3b)). It is unclear whether crediting up to this quota is in full or only partial. Besides countries, companies are allowed to invest and execute projects (article 12 (9)). In contrast to the other flexibility mechanisms, CERs accrue for the whole period 2000-2012, not just for the commitment period (article 12 (10)). On the other hand, it is unclear whether sequestration is covered.

The CDM shall cover its administrative budget through project revenues. Moreover, a part of these revenues shall be used "to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation" (article 12 (8)). It remains open as to who carries out certification of emission reductions but verification shall be carried out by independent bodies (article 12 (7)). The project criteria remain the same as for activities implemented jointly implemented (article 12 (5)).

C. Aims of this report

This report discusses the establishment of a trading system. We note that many of the issues discussed have great importance and relevance beyond any trading system. Monitoring and reporting requirements are fundamental not only to a trading system, but also to achieving the emissions reduction obligations under article 3 of the Protocol. Likewise, the difficult issue of liability is a key issue not only in establishing an adequate compliance system for trading, but also in respect of Parties' basic obligations under article 3. While we discuss these issues in the context of trading, we urge readers to keep in mind their importance and relevance to achieving the overall goals of the Convention.

Our purpose is not to sell a particular form of emissions trading, but rather to facilitate the process of selection by examining two specific sources of evidence - the historical experience with existing trading programmes and existing international agreements - in order to derive lessons that should prove useful in designing a system of emissions trading. Although we do not hesitate to point out where the evidence points in a particular direction, our main objective is to provide options and to trace the implications of various choices.

Chapter II

REVIEW OF LESSONS FROM OTHER EMISSIONS TRADING SYSTEMS

A. Overview

Lessons drawn from emissions trading history are relevant both to the design of an international trading system and to countries that are structuring national compliance and trading systems. The design of trading programmes is critically important to their success, as it will determine the transaction costs as well as the uncertainty and risk inherent in the trading system.

In general, programmes imposing emission caps coupled with allowance trading have performed well, whereas credit trading systems have generally not performed up to expectations. Well-designed allowance trading systems have led to both economic gains in reducing the costs of compliance and environmental gains, as the reduced costs allow the acceptance of more stringent environmental standards. In contrast, virtually no system of credit trading has been associated with major economic or environmental gains. This has been due to the higher transaction costs and greater uncertainty and risk inherent in credit trading as compared to allowance trading.

The lessons learned from past programmes also indicate the importance of national compliance laws and trading systems if an international system is to work well. If a nation creates an allowance trading system, and especially if it allocates the allowances to private entities, transaction costs are expected to be low and trading is expected to contribute to significant cost reductions. On the other hand, if a country relies exclusively on policies and measures to achieve its targets, only credit trading or joint implementation at the source level is feasible, and trading would be expected to be less effective.

A review of past trading systems also indicates the kinds of rules needed for the monitoring, reporting and verification of trades. While high-quality monitoring is needed for all trading systems, the rules for reporting, verification and liability will depend on the kind of trading systems adopted under national laws. Allowance trading requires only very simple rules and provides very high credibility. The rules for credit trading systems are much more complex, and depend in part on whether a nation implements a permitting system or other policies and measures for greenhouse gas abatement. All credit trading systems, however, require extensive procedures for reporting, verification and liability enforcement, although the resulting quality assurance is not as high as with allowance trading.

B. Emissions cap and allowance trading systems

1. The Acid Rain Programme

The Acid Rain Programme in the United States is the largest and most successful emissions cap and allowance trading programme in the world³. It was established in 1990 to reduce industrial emissions of sulphur dioxide (SO₂), which cause acid rain and directly affect human health. The programme sets a national emissions cap equal to 50 percent of base year (1980) emissions of SO₂, and allocates allowances in two phases to 2,200 utility units. It also allows operators of affected facilities - primarily electricity utilities - to trade emissions allowances between their own facilities or with other utilities in order to save costs in achieving the emissions cap.

The Programme creates a "gold standard" for compliance that can be adapted to article 17 trading. It includes high-quality continuous monitoring of all emissions, high penalties for non-compliance (including fines and forfeiture of allowances), and self-reporting of both actual emissions and trading activities to a public database. The combination of these elements has led to full compliance without the need for further enforcement action.

Another notable feature of the programme is an annual public auction of approximately 3 per cent of the allowances, conducted by EPA. The auction does not raise revenue for the Government, but serves a useful purpose in providing a highly visible price signal and addressing potential concerns about market power and the hoarding of allowances.

The Programme's emissions cap and allowance trading approach has achieved a strict environmental goal at dramatically lower costs than traditional forms of regulation. Results from the first few years of operations (since 1995) show that plants overachieved pollution reduction goals, at compliance costs of less than half those predicted by EPA, and many times lower than those predicted by industry (Ellerman et al., 1997; United States General Accounting Office, 1994). Allowance prices have fallen from a predicted range of \$400 - 1,000 per ton to around \$150. In addition, the programme has fostered innovation, reduced litigation and required only a very small regulatory staff to manage (Burtraw and Swift, 1996; McLean, 1995).

³ The Acid Rain Programme was promulgated in Title IV of the Clean Air Act as part of the 1990 Clean Air Act Amendments (Clean Air Act, 401 et seq.; 42 United States Congress 7651 et seq).

2. RECLAIM

The Regional Clean Air Incentives Market (RECLAIM) was created in 1993 to cap the emission of nitrogen oxides (NO_x) and sulphur oxides (SO_x) from most stationary sources in the Los Angeles area, which suffers from the worst air pollution in the United States. Under RECLAIM, all participating stationary sources with emissions over 4 tons/year receive an annual emission cap (an allocation) and an annual rate of reduction. Facilities are assigned starting (1994), mid-point (2000) and ending 2003 allocations, measured in annual tons of NO_x and SO_x. The allocation for any compliance year may be freely traded subject to reporting requirements and some spatial restrictions (Schwarze and Zapfel, 1998).

The District authorities do not regulate the market or control prices, but do maintain an official registry and keep a public bulletin board where facilities and interested Parties can identify availability. About two-thirds of all facilities must measure emissions with continuous emissions monitors that report actual emissions every 15 minutes to the authorities on a publicly available database.⁴ Facilities are on a 12-month staggered compliance cycle. At the end of its compliance period, each facility submits a final report and is given a two-month reconciliation period in which to sell or secure any emissions units necessary to balance its emissions for the final quarter. Facilities that fail to meet their reduction requirements are required to achieve the reduction by the following year and may be subject to monetary penalties.

RECLAIM has achieved significant success in reducing the price of compliance. Before RECLAIM, the marginal costs of NO_x control in the Los Angeles area had reached \$25,000 per ton for some sources (such as electric power plants), whereas the cost per ton under RECLAIM has been around \$2,000.⁵ The city authorities project that annual savings in compliance costs relative to command and control regulation average \$58 million annually, or 42 per cent (Anderson, 1997).

Although RECLAIM has worked successfully for NO_x and SO_x, the programme failed to establish an emission cap and trading element for volatile organic compounds as initially contemplated. This was due to strong differences of opinion among differing stakeholder groups, notably environmental and industry groups, as to what the initial baseline allocations should be, and how quickly reductions were to be achieved. This demonstrates the political difficulties that may be experienced in setting and allocating initial allowances under a cap and trade system, as the value of the rights distributed is so great.

3. *New Zealand Fisheries License Trading*

⁴ Cheaper and less exact monitoring methods are allowed for the remaining sources.

⁵ These results have to be taken with a grain of salt, however, since the initial permit allocations tended to be generous. The real test will come when the programme requires substantial new reductions.

New Zealand has used total allowable commercial catch limits (TACCs) and individual transferable quotas (ITQs) since 1986 for the management of the majority of its commercial fisheries. Strictly enforced limits under this cap and trade system have enabled New Zealand to move commercial harvesting towards sustainable levels (OECD, 1997).

The Government sets total allowable annual catch limits for each fish species in defined management areas, based on sustainable harvest considerations. The TACC is the commercial share of that limit, and can be 100 per cent.⁶ The Government initiated the programme in 1986 by assigning ITQs, which are permanent rights to harvest fish from a particular area, to each of approximately 2,500 commercial fishing permit-holders based on their historic catch levels. If the sum of the individual quotas exceeded the TACC for a fish stock, the Government made a one-time purchase of the difference in 1986, and retired that portion of the quota.

From 1986 to 1990, the ITQs were expressed as a fixed tonnage of fish per year, requiring the Government to buy and sell quotas to ensure the sum of ITQs equalled the TACCs. Because of the expense of this, since 1990 the ITQs have been expressed as a proportion of the annual TACC for each fish stock. At present, fishers may "borrow" up to 10 per cent of the following year's ITQs but must then limit their catch in the next year. Similarly, 10 per cent of unused ITQs can be "banked" or used in the following year. These provisions may be repealed, however, as borrowing has proven administratively complex and has caused enforcement problems.

ITQs are fully transferable, subject to a minimum quota provision for administrative reasons and certain quota aggregation restrictions to restrict potential abuses of market power. The programme also has political elements, such as a requirement that holders must be New Zealand residents or be less than 25 per cent foreign-owned.

The ITQ system has led to heavy trading, and it is estimated that 77 per cent of all ITQs initially allocated have changed ownership. The costs of monitoring and administering the ITQ system are similar to those of other fisheries management programmes, although costs were high during the initial establishment of the system. The main control point is the first receiver of fish, who must attest the fish products they receive are covered by ITQs. The Government investigates the paper records to detect inconsistencies, and has successfully prosecuted violators. There are high penalties for non-compliance, including fines and forfeiture of vessels.

C. Credit trading programmes

1. Emissions credit trading in the United States

Emissions credit trading programmes in the United States have been established for «criteria pollutants» (carbon monoxide, lead, nitrogen oxides, sulphur oxides, particulates and

⁶ The Government relies on other policies and measures to manage the non-commercial catch of a fish stock.

volatile organic compounds) since 1977, when emission offset rules were first developed for new sources entering degraded airsheds. These form part of a suite of EPA credit trading incentive policies, including bubbles, netting, offsets and, more recently, discrete emission reduction credits.

Each of these programmes allows firms to trade emissions reductions that are shown to be below the firm's permitted levels or actual emission history, whichever is lower. Each programme contains rigid procedural requirements for reporting and approval by governmental authorities (in some programmes multiple approvals are required), essentially making trades into rule-making events. Consequently, these programmes have suffered from high uncertainty, high transaction costs and high regulatory risk.

The United States credit trading systems have generally performed poorly. Although there have been thousands of trades over the decades, the extent of trading has been less than expected, and sometimes much less. More importantly, the programmes have not achieved significant economic or environmental benefits, nor introduced flexibility into the fairly rigid regulatory system governing criteria pollutants. The disappointing results achieved by these programmes have been generally attributed to their high transaction costs and the uncertainty and risk involved in obtaining the needed government approvals for credit trades (Dudek and Palmisano, 1988; Hahn and Hester, 1989).

Not only have these programmes had a relatively weak economic impact, but they have also caused environmental concerns. Since each credit trade is unique, they have uncertain environmental impacts, especially for the shutdown credits allowed for offsets, as they may increase total net emissions. The uncertain environmental impact of these credit trading policies has led to criticism by the environmental community, and ultimately led to increasingly stringent rules for review and approval of credit trades, adding to transaction costs.

Finally, since credit trades are project-specific, continued oversight is needed to ensure the Parties perform as promised. This has led to complex liability rules to ensure that buyers or sellers are responsible for the potential failure of a trade. This reduces the tradeable commodity nature of the credit trade.

The history of credit trading in the United States demonstrates the tension between the need for high levels of government oversight to ensure credit trades are legitimate, and the high to very high transaction costs such oversight entails. As a consequence, credit systems have been associated with far lower levels of trading and overall impact than allowance trading.

2. Lead phasedown

As part of an effort to greatly reduce lead in gasoline, EPA established a lead credit market in 1982 and expanded it in 1985. The programme, which ended in 1987, was designed to facilitate the transition to lead-free gasoline. The lead credit market paired efficiency gains for industry with lead reductions for the environment, the latter largely paid for by the cost savings of trading.

The programme was a typical credit market: a refinery that used less lead in gasoline than the standard required earned credits; these credits could be traded to any other refinery. However, unlike other credit trading programmes, trading did not require prior approval by the Government. Instead, trading activity was reported to EPA at the end of each quarter.

The trading market in lead credits was established primarily because imposing an equal lead reduction standard on all Parties was inequitable because the marginal costs of control were vastly different from one refiner to another, especially in the case of small producers. Trading allowed EPA to set a uniform standard while allowing small refiners the option of buying lead credits instead of making major capital investments in short time periods. Moreover, trading provided efficiency savings to refineries generally, so that total compliance costs declined nationally. Trading allowed those with excess capacity to sell to those who had not yet made the necessary capital investments.

Under initial rules in effect between 1982 and 1984, refiners could only trade and use credits within the same calendar quarter, but banking was introduced in 1985, and allowed credits to be sold or banked for later use or sale. The 1985 amendments to the rules significantly reduced overall lead levels and allowed the banking of credits for future compliance, which significantly reduced the total cost, even with the greater reductions.

The lead phasedown programme performed successfully as the first free and open trading market. Lead credits were briskly traded, and trading is believed to have significantly reduced the cost to producers, as well as to have facilitated the additional lead reductions in 1985.

The enforcement history of the programme is also instructive. Initially, EPA detected a significant number of violations under the programme, especially after banking was introduced. Almost all violators were refiners who did not sell to consumers under their own brand name, indicating that concerns about public image complemented the regulatory incentives to comply for the larger brand-name refiners. In response, EPA significantly increased oversight and enforcement efforts in 1986 in order to stop the cheating (Loeb, 1996).

This history indicates the tension in credit trading programmes between the need for low transaction costs and the need for high levels of oversight. One of the important reasons why lead credit trading worked more effectively than other pollutant credit trading programmes is that it did not require government approval for credit trades. As a consequence, transaction costs were low and vigorous trading took place, associated with significant economic and environmental gains. However, cheating was a problem until EPA increased enforcement oversight.

Subsequent EPA credit trading programmes have included more stringent procedural requirements, including advance government approvals, in order to ensure that each credit trade is legitimate. However, these reduce the commodity nature of the credit, increase transaction cost and uncertainty, and inhibit trading.

3. Pilot programme for activities implemented jointly (AIJ)

Under the Convention (article 4.2 (a)), a pilot programme for activities implemented jointly was initiated at the first Conference of the Parties in 1995. This programme was intended to explore the design of emission reduction and sequestration projects situated in developing countries and countries in transition and was financed through funds from Annex I Governments or private entities. It is not strictly comparable to other credit trading programmes as investors gained no formal crediting for the tons purchased. The pilot phase explicitly excluded crediting and did not try to develop rules to implement crediting. However, experience under this programme is useful to indicate procedures for determining the "additionality" of emissions reductions, which is also required for trades under articles 6 and 12.

The AIJ pilot programme focused on developing methodologies to show how much of the reductions would be additional to what would otherwise have occurred. In order to show this, it has been necessary to scrutinize the actual economic and contextual situation of each trade closely, and to forecast what would have happened in the absence of the project. This raises transaction costs and lengthens approval processes to between one and two years. As a consequence of the lack of formal crediting, the lack of incentives for investing and high transactions costs, only a few projects have been approved (Michaelowa, 1997).

The pilot programme for activities implemented jointly focused on developing methodologies to show how much of the reductions would be additional to what would otherwise have occurred. In order to show this, it has been necessary to scrutinize the actual economic and contextual situation of each trade closely, and to forecast what would have happened if no activities had been implemented. This raises transaction costs and lengthens approval processes to between one and two years. As a consequence of the lack of formal crediting, the lack of incentives for investing and high transaction costs, only a few projects have been approved (Michaelowa, 1997).

Although the pilot nature of this programme means the results may not be applicable to a full programme, the results do indicate that a greenhouse gas credit trading programme which requires a showing of additionality can involve even higher transaction costs and uncertainty than other credit trading programmes. This indicates that it may prove difficult to foster significant trading under articles 6 or 12, as both require a showing of additionality.

D. Historical perspectives on design features

1. Basic structure of programmes

Fixed emissions cap with allowances

In order to implement an allowance trading system, a country must at a minimum establish a fixed emissions cap and create a specific number of allowances equal to that cap. It then decides whether to keep the allowances itself or allocate all or part of them to private entities so they can trade with other entities (see «Allowance allocation to private entities» below).

□ **Allowance trading versus credit trading**

Allowance trading programmes have proven superior to credit trading systems in terms of both economic and environmental results. In particular, the United States history of emissions trading shows the cap and trade approach under the Acid Rain Programme and RECLAIM has resulted in significant programme-wide cost reductions, while emissions credit trading has not been as successful. The reasons for this are summarized below, but essentially have to do with the fact that credit trades are not of a commodity nature, with their higher transaction costs and with the regulatory barriers to their creation (Dudek, Wade and Goffman, 1995; Hahn, 1989; Naughton, 1994).

A cap and trade programme using allowances offers a systems-based solution in which issues such as baselines, allowable levels and allocation are dealt with in the initial phase of establishing the overall programme. Allowance trading can then proceed without the need to revisit these issues for individual trades, greatly reducing the need for government oversight. However, if allowances are allocated to private entities, this initial phase can be contentious, as valuable economic rights are being allocated.

Credit trading is project-based, and requires all these issues to be analysed and certified for each trade. Each source must establish its emissions baseline, permitted level, reduction plan and enforcement mechanisms. This system requires a process of verification and government approval, as well as continued monitoring. As a result, transaction costs and uncertainty are high. While an allowance might be comparable to a currency unit, a credit might be better compared to a specific good whose value must be determined each time through a regulatory process.

One of the most important differences in the two types of trading programmes is the level of government involvement in trading. Although allowance trading has very high quality assurance, once the programme has been designed it requires no government involvement in approval of trades and consequently has very low transaction costs.⁷ Credit trading in contrast is project-based, and requires one or more approvals for every trade, leading to higher transaction costs, uncertainty levels and risk, together with lower environmental quality assurance.

□ **Allowance allocation to private entities**

All existing emissions trading programmes involve trading between private entities. Allowing private entities to trade appears to be important if the efficiencies of trading are to be realized. The essential benefit of trading programmes is that they allow private firms the flexibility to determine technology choices and options themselves, and compare these to emissions permit prices to determine an overall least-cost path of compliance. Allowing private

⁷ Government involvement in the design phase of the programme remains as high or higher than in credit programmes.

entities to trade among themselves creates maximum flexibility. Since emissions sources are in a position to implement energy-saving technologies and processes, allowing them to trade gives them the greatest opportunity to achieve these efficiencies.

Banking/saving

The banking or saving of allowances allows firms significant additional flexibility in compliance-related technology and investment decisions. There has been heavy use of banking in both the acid rain programme and the lead credit trading market in the United States, and it has led to early reductions and substantially lower overall costs of compliance. Banking is especially significant for industries in which major capital expenditures must be made, as it allows individual sources flexibility in the timing of such major investments.

Banking or saving are expected to be important primarily as an element of national trading systems, since the Kyoto Protocol creates only one compliance period, from 2008-2012. However, the Protocol does allow banking in relation to expected future compliance periods, which may encourage further early reductions (article 3 (13)).

Method of allowance allocation

The allocation of allowances to sources is a contentious issue, as economic rights of considerable value are allocated to sources based on their past emissions history or permit levels.⁸ The above programmes have allocated allowances to existing sources at no charge. This may be the most politically practical method since it provides the greatest number of rights to existing sources. However, it makes it more difficult for new sources to enter the market, as they must buy allowances from existing sources.

Alternative methods of allowance allocation would be to auction allowances or allocate them on the basis of a rolling average of past emissions. Both methods would reduce the barriers to new entrants, and would deal better with sources that have shut down. An auction would also raise considerable revenue, which could become a source of revenue for the Government, or else could be recycled to sources or used to reduce other taxes on employment or investment. Due to the presence of distortionary taxes that raise the cost of pollution abatement relative to an efficient level, the regulator's decision on whether to auction or grandfather allowances can have significant cost impacts (Goulder et al., 1998).

Opt-in provisions

⁸ In the Acid Rain Programme this issue led to numerous special rules for individual sources, and in the RECLAIM programme contributed to the failure of the trading element related to volatile organic compounds, as agreement could not be reached on the allocation and scope of reductions.

It is desirable to include as many sources as possible in a regulatory system. However, including all emitters of a pollutant may not be practical in an emissions cap and allowance trading system because of uncertainties in measurement for some classes of sources, because of political constraints, or because it is impractical to cover the smallest sources. In this case, a provision that allows otherwise uncovered sources to opt to be covered under the regulatory system can increase the scope of a programme.

The Acid Rain Programme, for example, covers only emissions by utility boilers, but allows other industrial boilers with SO₂ emissions to voluntarily subject themselves to regulation under the programme once they demonstrate their baseline emissions and accept an emissions cap calculated in the same manner as the utility sources. So far several industrial boilers have chosen to opt in.

Another way to broaden the scope of a programme is to offer firms subject to the emissions cap a credit if they contract with uncapped sources to reduce their emissions. As long as the emissions can be verified and monitored, this approach also can expand the number of entities covered in a regulatory system, although experience has shown its high administrative costs may reduce its usefulness.

Inter-gas trading

None of the existing emissions trading systems allows inter-gas trading. In most cases, it is simply not possible, as the environmental effects of different gases are different. However, inter-gas trading is feasible for greenhouse gases, as it can be based on their relative global warming potentials. Allowing inter-gas trading could expand the number of sources trading, and promote efficiency by including all sources of greenhouse gases in a unified trading system.

Phasing

The phased inclusion of gases or industries may be feasible if there is little interconnectivity between sources or industries in the different programme phases. If there is economic interconnectivity, the programme could experience leakage, as covered sources would shift activity to uncovered sources. The phased inclusion of sources within an industry sector has created significant administrative problems in the Acid Rain Programme because of this problem of interconnectivity and leakage, and so should be avoided.

2. Implementation

Transaction costs

Transaction costs play a key role in the success of an emissions trading system. In the past, only emissions trading programmes with low transaction costs have succeeded in substantially lowering the cost of compliance. These include all the allowance programmes such as the Acid Rain Programme, RECLAIM, fisheries permit trading in New Zealand and the United States lead credit programme, the only credit trading programme that does not require

government approvals for trades. All other credit trading programmes, have high transaction costs and have failed to significantly reduce the costs of compliance.

Transaction costs have several components, including monetary costs borne by the generators and purchasers for documentation, verification and procedural requirements, the cost of delay, and costs created by the uncertainty of regulatory approval. Credit trading programmes require each credit generation or use to be separately approved by a regulatory authority. They therefore create high transaction costs as well as risk and uncertainty to participating businesses, because transactions are typically only approved after reductions have been generated. Finally, they involve ongoing monitoring and liability concerns to assure continued compliance of the original credit generator.

Cap and trade programmes, on the other hand, have generally low transaction costs and low risk. Instead of conducting a case-by-case review of credit transactions, firms can simply transfer issued allowances, without subjecting the transfers to regulatory intervention, and without having to bear any costs related to ensuring the environmental performance of the selling firm or for indemnification related to environmental non-performance. At the same time, the credibility of the underlying emissions reduction is very high.

In addition to transaction costs borne by the sources involved in trading, transaction costs are also borne by the regulatory authority to validate and administer the trading system. Here again, the costs of allowance trading appear to be an order of magnitude lower than those of credit trading. EPA has estimated that total cost to the Government for administering the Acid Rain Programme is \$1.50 per ton abated, compared to \$25 or more for the case-by-case review process under a more typical permit process under Title V of the Clean Air Act (Kruger and Dean, 1997; McLean, 1995).

Auctions and concerns about market power

Several mechanisms have been implemented in programmes to address concerns about market power and the potential hoarding of allowances, and are described below. However, the experience of existing programmes has been that the private market has supplied an adequate to high number of allowances or credits, so that market power issues have not been of concern.

An auction of a certain portion of permits is one important tool to address concerns about potential market power. An annual auction of approximately 3 per cent of allowances under the Acid Rain Programme was created in part to address this concern, although a plentiful supply of allowances has become available under the programme. However, the auction has proved to be useful in signalling the low prices of allowances at the outset of the programme. RECLAIM also included an auction at the beginning, in order to initiate the market, although it is quite different from the acid rain auction in nature and implementation (Schwarze and Zapfel, 1998).

Another provision in the Acid Rain Programme to address concerns about market power is a provision for the direct sale of a small percentage of allowances at a fixed price of \$1,500. If these allowances are not bought, they are added to the amount being auctioned.

Price information

Providing price information is important to reduce the uncertainty of trading and create public confidence in the trading programme. However, existing emissions trading programmes do not require that the price of privately conducted trades be revealed. Instead, they tend to leave the provision of price information to the private sector, although the Acid Rain Programme supplements this with an annual auction.

It is possible to argue that price information should be included in emissions trades, and that the public benefits of revealing prices outweigh the interest of private entities in non-disclosure. The disclosure of price information could be one of the reporting requirements for emissions trades, or could be introduced in alternative systems such as regular public auctions.

Deduction or depreciation

Some credit trading programmes impose a 10 per cent or other deduction on trades for air quality enhancement, or for other purposes such as to make grants available to new entrants. This may help create public support for a trading programme by creating public benefits if a firm takes advantage of trading to reduce its costs. On the other hand, imposing a percentage deduction on trades creates another barrier to the economic efficiency gained through trading. Arguably, the environmental benefits of clean air could be better established by adjusting the overall cap, rather than by penalizing trades.

3. Compliance system

A final key feature of a successful emissions permit trading system is an effective compliance mechanism that ensures the integrity and fairness of the system and at the same time ensures that transaction costs are relatively low. The compliance system will normally include monitoring and reporting requirements and enforcement mechanisms.

Monitoring

Past emissions trading programmes have shown that high-quality monitoring is essential to ensure the effectiveness of both compliance systems and trading systems. Methods for monitoring emissions, however, have varied from one programme to another. The Acid Rain Programme requires continuous monitoring of emissions by sources. This provides great certainty, but is expensive, as such monitors cost between \$100,000 and \$150,000 each. Emissions credit trading programmes in the United States rely on standard pollutant monitoring approved by EPA, whereas programmes like the lead credit trading incorporate monitoring in regular paperwork reporting requirements.

Fortunately, carbon emissions from energy use can be accurately measured using predictive methods, which significantly lower monitoring costs. Monitoring of a fuel-provider or emissions-source model could be done reactively simply through the filing of records about

fuel transactions. However, the monitoring of methane emissions or biotic carbon sources is much more difficult, and may limit the ability of some of these sources to participate in a cap and trade model (Environmental Law Institute, 1996).

Several elements of the Acid Rain Programme are aimed at ensuring the highest quality of monitoring data. First, it required that monitoring devices and systems be installed and verified in the year before actual trading started, and ongoing testing of these monitoring systems is required. Second, emissions data are sent on an hourly basis to the EPA's Emissions Tracking System, and are summarized in a quarterly report to EPA together with the quality assurance data from the monitoring tests. These procedures could also be followed in a greenhouse gas trading system to ensure the quality of monitoring data.

Reporting

Reporting requirements are of two kinds: the reporting of emissions monitoring results and the reporting of emissions trading activity to the international authority for compliance purposes.

Emissions reporting is part of any nation's greenhouse gas compliance structure, regardless of trading, and is described in article 3. On a national level, many countries require monthly reporting of pollution emissions data, and continuous emissions monitoring technology allows reporting as often as every 15 minutes. Emissions reporting to an international authority would be needed so that the authority could assure the integrity of the basic monitoring system.

Trading programmes, however, do require reporting systems for emissions trading activity for quality assurance and enforcement. One element of this is the reporting of trades. All recent emissions trading programmes in the United States require immediate reporting of trading activity to a government-controlled registry, which is open to the public. This helps to ensure openness of the system, and is also used by the Government for compliance purposes. Earlier United States programmes, such as the lead credit trading, as well as the New Zealand fisheries permit trading programme, require less frequent reporting of trades.

The additional procedures needed for compliance reporting can be extremely simple for allowance trading, but quite complex for credit trades, which are individual and project-based. In allowance trading, the reporting of emissions trading activity for compliance purposes is generally part of the reporting process at the end of each quarter and at year end. This is a paper or electronic report which states the source's total emissions limit, the units of pollution actually emitted during the compliance period, and any trading activity in allowances, such as sales or purchases. Units emitted during the year, plus or minus any allowance transfers, must equal the source's total limit. Past reporting requirements for credit trading have varied depending on the kind of credit trading programme. If sources are permitted, trading can be made enforceable under the permit system, and reporting requirements become integrated with regular permit reporting. Trading only changes the level of permitted emissions. This system is evident in the lead credit trading programme and offset-type credit trading systems in the United States.

The most complex reporting requirements are needed for project-based credit trading systems, such as joint implementation, CDM or trading of discrete emissions reductions. A precedent for such reporting is found in the United States rules for such trading, which require between three and five separate reports to ensure quality control (EPA, 1995). The late filing of reports can lead to penalties or deductions of credits.

EPA's model rule would include the following reports: (1) notice of generation of discrete emissions reductions to be filed soon after generation of the credits; (2) notice of intent to use such reductions for compliance purposes must be filed at least 30 days prior to a source's first use of them and renewed at least annually in cases of continued use; and (3) notice and certification of the use of discrete emissions reductions soon after the end of the period of use. Some states require the following additional reports: (1) notice of transfer whenever the reductions are transferred; and (2) notice of verification of the discrete emissions reduction, which represents an independent third-party assessment of the validity of the reduction.⁹ Massachusetts is the only state that relies on its existing permit system, as opposed to a series of notices.¹⁰

Public information

Credit and allowance trading programmes in the United States all provide for a State-maintained public registry containing documentation of all trades and trade notices. Possibly the most developed of these methods is the allowance tracking system used in the Acid Rain Programme. These allowance registry systems are open to the public and help to create a transparent and self-enforcing compliance system, and have contributed to high compliance rates in the programmes.

Any additional relevant information submitted to the registry or to the department concerned must be maintained as a public record open to inspection and duplication. In many cases, information contained in the registry is available on the worldwide web. In addition, EPA's model rule and most state rules require a credit generator or user to make all documents and supporting information available to any person who requests it.

Certification

The method of certification of trades is one of the key differences between allowance trading and credit trading systems. Allowance trading does not require certification of trades, as the authenticity of each allowance is built into the structure of the programme. All the cap and

⁹ See New Jersey Department of Environmental Protection, Emission Offset Trading Programme: New Jersey Administrative Code 7: 27-18 (effective June 30, 1979); New Jersey Department of Environmental Protection, Emission Reduction Credit Trading Programme, 28 New Jersey Register 3414 (a) 7 (effective July 1, 1996) (proposed rules at 28 New Jersey Register 1148, February 20, 1996); New York Code of Regulations, Title 6, Part 231.

¹⁰ Massachusetts Department of Environmental Quality, Emissions Offset and Discrete Emission Reduction programmes, 310 Code of Massachusetts Regulations 7.00, Appendix B (1997).

trade programmes discussed above allow free trading of allowances without verification or other forms of government approval.

However, all forms of credit trading require some kind of certification system. The history of certification under past programmes is relevant to ensuring the validity of trades under the CDM (article 12) or if a country chooses to create a private system for international credit trading under article 6 (joint implementation).

In order to be acceptable, credit trades must be judged to be valid on a number of criteria. Under United States credit trading programmes, the principal criteria are that the emission reductions should be quantifiable, surplus, either permanent or discrete, and enforceable. Again, the form of certification depends on the kind of credit trading. If the credit trade is lasting and takes place in the context of an overall permitting system, certification can focus primarily on quantification; the surplus, permanent and enforceable nature of the trade is dealt with through the permitting system.

However, in discrete project-based credit trading, the certification process must address all of these issues. One of the most difficult things to certify is additionality, which in the absence of a permitting system requires a forecast of future economic events and probabilities. Under the pilot programme for activities implemented jointly, this verification process has led to the rejection of many proposed trades, and can take one to two years, creating high transaction costs and uncertainty.

Penalties

The level of penalties in past programmes appears to be positively correlated with compliance levels. A remarkable achievement of the Acid Rain Programme has been its record of total compliance in all years. Highly reliable monitoring and reporting requirements, a public accountability system and very high penalties have all helped to create this record.

Under the Acid Rain Programme, a source that emits more than the number of allowances in its account must automatically pay a financial penalty of \$2,000 (adjusted upwards for inflation) for every excess ton and offset the excess emission with equivalent allowances. This price is much higher than the current \$100 price of an allowance, and is based on original perceptions of the likely cost of an allowance. These high penalties have helped to achieve the perfect compliance rate with low transaction costs.

Penalties are also high in the New Zealand fishing licence trading programme, and include fines and possible forfeiture of vessels. These have led to high reported rates of compliance. Fines are also significant under RECLAIM and United States emissions credit trading. Penalties under the lead trading programme were initially low, principally involving the need to make up the lost credits, and enforcement was a problem for a time under this programme.

A relevant aspect of both the Acid Rain Programme and RECLAIM is the provision of a two-month reconciliation period following the end of a year for sources to purchase any allowances needed to equal their emissions. This promotes compliance and reduces risk in the market.

□ **Liability and enforcement**

Liability rules are fundamentally different for the different kinds of trading programmes. Allowance trading requires few special liability requirements, reinforcing the low transaction cost of this system. Credit trading based on a permit system, where liability can be integrated into existing permit rules, is more complex. The most complex system is a liability system which must be created for credit trades based on joint implementation or discrete emission reductions.

Liability is straightforward for allowance trading because all covered sources need simply show that they have sufficient allowances to cover their emissions at the end of each compliance period. Sources are liable if they do not have enough allowances. An international greenhouse gas trading system could adopt this system if the integrity of the underlying monitoring and compliance systems of allowance trading countries was high, and if a compliance system at least ensured that any country or source emitting an excess ton made the environment whole by replacing that ton with emission reductions purchased or achieved elsewhere.

All credit trading involves greater transaction costs and an effort to develop an adequate liability system. The most straightforward rules are found where credit trades take place in a context where existing sources are already subject to a permit for their greenhouse gas emissions. Here, the existing liability and enforcement mechanism of the permit system can be used to enforce credit trades, as the permit of the selling firm would reflect its new lower emissions limit after the trade, and that of the receiving firm its new higher amount. An international trading system would need to guarantee that the nations trading have adequate capabilities to enforce the permit levels.

In the absence of a permitting system, credit trading programmes must create a separate liability system, as any discrete emission reduction is a one-time event and is not reflected in a permit. Developing an adequate liability system in this context is problematic, and involves a trade-off between higher transaction costs and lower credibility. These problems are magnified in an inter-jurisdictional trading regime.

The options are to impose liability on the buyers or users of traded credits, or on the sellers or generators of the credits. The relative advantages of the two systems have been addressed in the United States by rules for discrete credit trades in its urban ozone abatement programme. After considerable stakeholder discussion and review, EPA adopted the buyer-beware liability system in its model rule for this programme (EPA, 1995). EPA believed a seller or pre-certification system would significantly inhibit trading by requiring advance government approval of all trades, and was concerned about enforcement under that approach when generators from other jurisdictions were concerned.

EPA developed four additional elements to reduce the uncertainties and transaction costs associated with a buyer-beware liability structure: (1) keeping certain liability with the generator through generator certification; (2) creating guidance through emissions quantification protocols; (3) encouraging third-party relationships; and (4) enacting a separate policy for "good faith" purchasers. EPA believes these four features of the proposal will provide generators, users and government authorities with sufficient guidance and certainty to develop an active market in high-quality trades.

Nevertheless, the states of New York and New Jersey have adopted the seller certification system, and require credit generators to gain either government or third-party verification of the credits generated. These states stress the difficulty of requiring buyers to review all documentation relating to the generation of the credits, especially from different jurisdictions, and to the lack of government resources to inspect a reasonable number of credit trades under the buyer-beware approach.¹¹

Independent authors have also criticized the buyer-beware system, because it creates uncertainty and risk by failing to provide generators and users with a guarantee that they will benefit from reductions until they have been approved. While this may be the case, the alternatives available under seller liability also constrain trading; for example, a pre-certification approach creates high transaction costs, and the alternative random audit approach has lower credibility.

These problems in creating a good liability appear inherent in a discrete credit trading system, which would include all joint implementation (article 6) and CDM (article 12) trades. For these, as well as discrete credit trades under other articles, a choice must be made between higher transaction costs and uncertainty, on the one hand, and greater credibility, on the other.

¹¹ See New Jersey Department of Environmental Protection, Emission Reduction Credit Trading Programme, 28 New Jersey Register 3414 (a) 7 (effective July 1, 1996) (proposed rules at 28 New Jersey Register 1148, February 20, 1996); New York Code of Regulations, Title 6, Part 231.

Chapter III

RUDIMENTS OF AN ARTICLE 17 TRADING SYSTEM

A. Emissions trading models

With regard to domestic emissions trading systems, three distinct international emissions trading models are likely to emerge (Joshua, 1998):

- (1) Trading among countries with domestic emissions trading systems;
- (2) Trading among countries without domestic emissions trading systems; and
- (3) Trading among countries with and without domestic emissions trading systems.

In terms of whether sub-national entities are eligible for trading, two types of emissions trading models can be distinguished:

- (1) Intergovernmental emissions trading; and
- (2) Inter-source trading.

In the first model, Governments elect not to allocate the assigned amounts to sub-national entities, and retain the sole right to trade.¹² As such, intergovernmental emissions trading takes place on a Government-to-Government basis. The legal basis for such trading has been provided by article 17 of the Kyoto Protocol, which unambiguously states that Parties included in Annex B to the Protocol are eligible for emissions trading. It should be pointed out that intergovernmental emissions trading differs from joint implementation, as specified in article 6, for at least two reasons. First, intergovernmental emissions trading separates the issue of the financing from the source of generating allowances, whereas joint implementation creates ERUs which may be transferred and acquired, but are always tied with specific joint implementation projects. Second, under normal conditions, no specific approval is needed to make the

¹² Besides being based on domestic trading systems, inter-company international emissions trading could rely on other policy instruments such as emission taxes or regulation. If a domestic emission tax exists, companies could get a tax reduction proportional to the number of acquired international emission permits. In return for the tax break they would have to cede the permits to the State. The creation of permits for sale would be analogous to a credit programme: if a company achieves CERs through a project which does not lead to a corresponding emission tax reduction, it could sell them on the international market. Companies not subject to the tax for competition purposes could not create permits in this way.

In a system of regulation such as emission standards, permit purchases by a company might provide the basis for a temporary relaxation or waiver of the domestic standard. Here permits could be created if the standard is surpassed. Verification would need to be extensive in such a system.

transactions in intergovernmental emissions trading, whereas any joint implementation projects need the approval of both the host and investor Annex I countries. Moreover, intergovernmental emissions trading differs from the bubble approach specified in article 4 in that the latter predetermines the transfers and acquisitions of assigned amounts within the voluntarily formed group prior to the beginning of the commitment period.

In the second model, Governments elect to allocate the assigned amounts to individual sub-national entities, and authorize them to trade on the international emissions allowances market. The great advantage of this model is that it limits the Governments to setting the rules rather than undertaking emissions trading themselves, and leaves individual companies the freedom to choose how to comply with their limits. By incorporating sub-national entities into an international emissions trading scheme, the companies that actually have control over emissions would be able to profit directly from emissions reduction activities, thus providing them with strong incentives to exploit cost-effective abatement opportunities. This would potentially increase the total amount of transactions in the international scheme, meaning greater capital flows to selling participants and greater cost reductions for buying participants. By increasing the number of trades, it would also improve market liquidity and reduce the potential for abuse of market power. The latter might occur in intergovernmental trading if one country or bloc held a significant proportion of the total number of permits. Moreover, individual companies which have information on their technical options and costs can choose their efficient emissions level by comparing marginal costs and the international permit price, whereas, in the intergovernmental trading model, national Governments could make errors in their decisions on how many permits to buy or sell because they possess only global and imprecise information about greenhouse gas emission reduction options and their marginal cost.

National trading systems can be modelled as either «upstream», «downstream» or «hybrid» systems (Zhang, 1998). An upstream trading system would target fossil-fuel producers and importers as regulated entities, and so would limit allowance holders to oil refineries and importers, gas pipelines, liquefied natural gas plants, coal mines and processing plants (Center for Clean Air Policy, 1998a; Zhang and Nentjes, 1998). Implemented effectively, an upstream system would capture virtually all fossil fuel use and carbon emissions in a national economy. Firms would raise fuel prices to offset the additional cost. In an upstream system, the number of firms that has to be monitored for compliance is relatively small, and thus it is easier to administer. Moreover, existing institutions for levying excises on fossil fuels, which exist in most industrialized countries, could be used to enforce the scheme (Zhang and Nentjes, 1998). Even with such a relatively small number of regulated sources, market power would not be an issue. In an upstream system of this kind in the United States, the largest firm has only a 5.6 per cent market allowance share and the lion's share of allowances is held by smaller firms, with each having a share of less than 1 per cent (Cramton and Kerr, 1998).

In contrast, a downstream trading system would be applied at the point of emission. As such, a large number of diverse energy users would be included. This would offer greater competition and stimulate more robust trading, thus leading to increased innovation. However, such a system would be more difficult to administer, especially in the case of emissions from the transportation sector and other small sources.

To keep a downstream trading system at a manageable level, regulated sources could be limited to utilities and large industrial sources. Governments could then address uncapped sources through other regulatory means such as carbon taxes. In doing so, however, Governments would need to establish additional programmes. This would be administratively burdensome, not to mention the political difficulties of introducing carbon taxes in some countries. Moreover, the actual reductions in carbon dioxide emissions that might be achieved by a proposed carbon tax remain uncertain because of imperfect knowledge of the price elasticities of demand and supply for fossil fuels, especially in the case of large price increases resulting from the use of carbon taxes to achieve major cutbacks in emissions (Cline, 1992), which would expose Governments to the risk of non-compliance with their emissions commitments.

Alternatively, national trading systems could be modelled as hybrid systems (Zhang and Nentjes, 1998). A hybrid system is similar to a downstream trading system in the sense that regulated sources at the level of energy users are also limited to utilities and large industrial sources. On the other hand, like an upstream trading system, a hybrid system would require fuel distributors to hold allowances for small fuel users and to pass on their permit costs in a mark-up on the fuel price. Small fuel users would therefore be exempted from the necessity (and transaction costs) of holding allowances. Yet the rise in fuel price would motivate them to reduce fuel consumption or to switch from fuels with a high carbon content, such as coal, to fuels with a low carbon content, such as natural gas.

No matter what national trading system is adopted, importers and domestic producers of fossil fuels should be treated equally in obtaining emissions allowances under the WTO «like product» provisions (Zhang, 1998). Moreover, regardless of whether individual countries choose to empower private trading, the ultimate responsibility for fulfilling the Kyoto Protocol commitments would remain with the national Government concerned.

B. The trading baseline

For the first commitment period, the starting point for defining authorized emissions for Annex I nations is provided by Annex B, which defines the required reduction of anthropogenic carbon equivalent greenhouse gases (listed in Appendix A) from the base year or period. The base year is 1990, except for certain countries in Annex I which are undergoing a transition to market economies. The number of tons of anthropogenic carbon equivalent greenhouse gases produced by this multiplication is then multiplied by 5 to obtain assigned amounts during the five-year commitment period. For Annex I nations, the assigned amounts are the basis both for determining compliance and for initiating a trading system.

Assigned amounts for subsequent commitment periods will have to be decided upon at subsequent meetings. Changes in the baseline that are accepted during any commitment period should go into effect at the beginning of the next commitment period.

C. The tradeable commodity

Under article 17 of the Protocol the tradeable 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 designated in Annex B (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 and forestry activities, as authorized by article 3.3), plus (2) allowances acquired from other Annex B Parties, plus (3) 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 were eligible to be included in trades on a carbon equivalent basis. On the other hand, if in the estimation of the Conference of the Parties monitoring and enforcement circumstances precluded including all gases in the initial trading system, trades could be limited to «eligible gases». Eligible gases in this case would be defined as the subset of gases listed in Annex A which have been approved for trading. Some have suggested, for example, that only energy-related carbon dioxide and methane emissions would 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 - tradeable and non-tradeable gases - with separate goals assigned for each. In accordance with article 5.3, global warming potentials would be used to convert gases other than carbon dioxide into carbon equivalent terms both for verifying compliance and for defining the trading baseline and adjustments to it as a result of trades.¹³ Without a separation of categories it would be easy for countries to use the flexibility inherent in the equivalence process to substitute freely among the gases.

D. Determining compliance

To comply with its obligations under the Kyoto Protocol, a Party's actual emissions of carbon dioxide equivalent tons during the commitment period must be no greater than the number of allowances it holds.

¹³ Article 5.3 of the Protocol requires that the factors in global warming potentials used in the conversion should be fixed for the first commitment period.

Unused allowances could be carried forward to be used in satisfying obligations in subsequent years. Overages (actual emissions higher than the assigned emissions) would incur a stipulated financial penalty and would result in at least a ton for ton reduction in the following commitment period.

Though not required by the Protocol, Governments would be free to impose additional limits on emissions during the commitment period. For example, if a Party is allowed to emit 10,000 tons during the five-year commitment period, that Party might choose to add the restriction that no more than, say, 65 per cent of those allowances should be used by the end of the third year. This could either be a guideline or a standard applied domestically.

E. Eligibility for trading

Participation in article 17 trading would be voluntary. Any Party that has an assigned amount, as set out in Annex B of the Kyoto Protocol, could elect to trade under article 17. Countries that currently are not listed in Annex B can become eligible for article 17 trading by negotiating an acceptable assigned amount.

Governments could either elect to allocate assigned amounts to sub-national entities (thereby facilitating private participation) or not. If they choose to allocate assigned amounts to private entities, a variety of possible allocation mechanisms could be used. The decision to allocate the assigned amounts to private parties would be the first step in allowing trades between private sources in addition to trades between Parties.

The freedom to allocate or not allocate assigned amounts to sub-national units would ensure that any individual Government maintained its right to determine the domestic policies and measures that would be taken to meet its Kyoto obligations. For example, a Government that wanted to use taxes or regulations for domestic emissions control could retain the sole right to trade. Alternatively, a Government could allocate its assigned amounts to private entities to trade. In fact, any combination of domestic policies would be broadly consistent with article 17 trading.

A final dimension that must be resolved involves whether the right to acquire allowances is reserved to eligible buyers. If so, the term «eligible buyers» must be defined. Possible choices include Annex B Parties and only Annex B Parties, all signatories, all Parties and private sources which have been allocated assigned amounts. An alternative, and we believe the preferred alternative, is to allow anyone to purchase the allowances, including private citizens and environmental groups, the approach taken in the United States sulphur allowance programme.

F. Banking and borrowing

The banking of allowances offers a greater degree of intertemporal flexibility, a flexibility that tends to reduce costs considerably (Kruse and Cronshaw, forthcoming; Manne and Rutherford, 1994; Rubin, 1996). The banking of allowances involves allowing Parties to carry allowances that are unused in one commitment period forward for use in the next commitment

period. Borrowing involves using allowances assigned for one commitment period in an earlier commitment period.

Banking decisions arise in two different contexts: «internal» banking within commitment periods, and «external» banking between commitment periods. The Protocol seems to place no restrictions on internal banking. In the absence of additional restrictions, Parties seem free to allocate emissions within the commitment period in any way they see fit.

The first type of external banking was built into article 12.10 of the Kyoto Protocol. It specifies that CERs obtained under the CDM during the period 2000-2008 can be banked for later use in meeting Annex I country's commitments during the first commitment period (2008-2012). This banking clause provides the incentive for private firms in Annex I countries to invest in emissions reductions in developing countries prior to the beginning of the first commitment period.

The second type of external banking is similar to the banking element built in the United States Acid Rain Programme. Once an emissions trading scheme, either domestic or international, is established among Annex B countries, allowance holders are allowed to bank their unused allowances to offset future emissions or to sell them to others.

The third type of banking extends the second mechanism by including emissions reductions achieved within the jurisdiction of Annex I countries prior to the beginning of the first commitment period as well. In comparison with the first type of banking under the CDM, it also provides a similar incentive for private firms within Annex I countries to take early actions at home rather than shop around abroad. Currently, this type of banking has not been an option under the Kyoto provisions, but it does warrant special attention.

Potential use of the option could be contingent on ratification of the Kyoto Protocol (Kopp et al., 1998). The banking option might only be authorized from the year in which the Protocol is ratified onwards. This would provide a strong incentive for Annex I countries to ratify the Protocol earlier than would otherwise be the case.¹⁴

One option would be to allow the banking of each Annex I country's own early reductions: that is, any credits an Annex I country awards its sub-national legal entities for pre-2008 reductions would be drawn from the assigned amounts of the country in question. On the one hand, this option would give these early movers a competitive advantage over those not undertaking early actions (Environmental Defense Fund, 1998). On the other hand, since the credits awarded to early movers would be otherwise allocated to those entities not undertaking

¹⁴ If «hot air» becomes a dominant issue, it would also be possible to deny the banking option to those countries that have accumulated excess emissions. This option would alleviate to some extent the concern about hot air trading, because it would provide more incentive for legal entities in the advanced OECD countries to take abatement actions at home.

early actions, with a limited supply of early credits, the option amounts to government encouragement of uneconomic rent-seeking (Fischer et al., 1998).

If an Annex I country starts with a very strict limit on greenhouse gas emissions, bottlenecks could be prevented by allowing the borrowing of a limited amount of future allowances provided that a premium is paid. By taking into account the turnover of capital stock, the prospect for low-carbon or carbon-free backstop technologies, and time discounting, borrowing would allow total abatement costs to be minimized while keeping to an overall emissions budget. Therefore, as with banking, borrowing is another way to increase flexibility and lower the cost of abating greenhouse gas emissions (Richels et al., 1996).

External borrowing is more controversial and is not addressed in the Protocol. In the section on accountability we offer some possible options for integrating borrowing into an emissions trading scheme while alleviating some of the concerns that have been expressed.

G. Expanding the set of Annex B Parties and Annex A gases

Under the CDM, a host country could already finance projects on its own and sell credits earned. Article 12 would not prevent this. The Government of Costa Rica has already pioneered this kind of trade by financing umbrella forestry and energy projects through a fuel tax and trying to sell certified tradeable offsets.

As host countries have no targets, they have an incentive to maximize credit sales. Here the baseline issue becomes crucial: there must be no reward for developing countries if their policy promotes high emissions. Such a situation may arise as a perverse effect of the additionality rule; since emission reduction measures are cheapest where there is no national sustainability policy (Michaelowa and Dutschke 1997). The CDM would have to be extremely cautious concerning baseline verification.

This problem could only be fully solved by setting an incentive for developing countries to adopt limitation targets voluntarily and to participate in emissions trading and joint implementation under articles 17 and 6. In the medium and long term, emissions trading could be instrumental in establishing an international climate change policy that fully accommodates the economic growth of developing countries, but requires that this growth be achieved in a carbon-efficient manner. Such an incentive could be to prohibit the trading of host-country credits now but to allow them to bank credits against future targets. One could also envisage a quota for credit trades for each country and banking for additional credits created. However, both approaches have drawbacks; for example, they do not consider different degrees of development or the differing likelihood of accepting a commitment.

Developing countries should be able to opt in to the allowance trading system by applying the concept of «growth baselines» (Center for Clean Air Policy, 1998c). Countries opting in would have to make sure that their greenhouse gas emissions grew at a slower rate than their economic output in the near term, and would have to accept the inevitability of an eventual cap on emissions. The economic growth of developing countries would thus not be constrained initially, but countries would commit to improving the carbon efficiency of this growth. The key

benefit to developing countries of adopting growth baselines would be substantial capital inflows through 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):

- Negotiations could also consider bubbles involving regional groupings such as the Association of South-East Asian Nations (ASEAN) and the Southern Common Market (MERCOSUR);
- Developing countries could be allowed to introduce partial caps, which could, for example, could be based on industrial sector limits, and could be coupled with joint implementation in the uncapped sectors, as a form of progressive restriction leading to the imposition of a national cap involving all sectors. Countries operating growth limits in the industrial sector could continue to have access to the CDM for investment and trading in CERs 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.

Allowance trading would result in greater total capital flows 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 which has now been labelled the «tropical air» problem. Our review of the evidence 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. This two-step procedure - negotiate fair and appropriate general criteria first, and then 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.

The process for admitting new Annex B countries may also be quite important. Two avenues are available to establish such rules of procedure. One is based on voting to admit new entrants. So far the decisions made by the Conference of the Parties to the United Nations Framework Convention on Climate Change have been generally adopted by consensus. If admitting new entrants required unanimous assent by all current Annex B countries eligible for emissions trading, this would effectively confer on any Party a *de facto* veto power that they could use to try to prevent the decline in allowance prices which might accompany any expansion of the sources of supply. A three-fourths majority vote of the current Annex B countries present and voting at the meeting could be adopted to prevent exploitation of market power. The second avenue rests on automatic inclusion once a prospective country meets predetermined criteria. In

our view, the second avenue is superior to the first. Such criteria should include the conditions under which any new entrant could be incorporated into the emissions trading scheme. Once such criteria are set, they should remain stable in the short-term, although in the long-term they may need to be adjusted as more information and experience is gained.

Chapter IV

DESIGNING THE ADMINISTRATIVE SYSTEM

A. General principles

The design and implementation of a trading system should be guided by the following general principles (OECD, 1998a):

- **Environmental effectiveness:** satisfying this criterion requires successful evaluation, monitoring and verification;
- **Economic efficiency:** this criterion demands minimization of transaction costs;
- **Equity:** no interest groups should gain an unfair advantage;
- **Political acceptability:** however desirable the rules may be in principle, if they cannot be implemented through the Conference of the Parties process, they are of little practical use.

Guidelines should aim for consistency, technical soundness, verifiability, objectiveness, simplicity, relevance, transparency and cost-effectiveness. They need to state qualification criteria for people to report, monitor, evaluate and verify greenhouse gas reductions.

It is important to provide as thorough an understanding as possible of the uncertainties involved when monitoring, evaluating, reporting and verifying. Inherent uncertainty in the scientific understanding of the basic processes leading to emissions and removals cannot be manipulated but will vary according to the different gases and types of emission and sequestration processes. The division of responsibilities in an international trading system is shown in table 1.

Table 1: Primary responsibilities in an international emissions trading system

	Monitoring	Evaluation	Reporting	Verification
Companies creating emission reduction units	√	√	√	
CDM project developers	√	√	√	
Traders			√	
Consultants	√	√		
Private accreditors				√
Non-governmental organizations	√	√	√	√
Governmental agencies	√		√	√
UNFCCC secretariat/clearing house	√	√	√	√

B. The role of administrative structures and procedures

An effective tradeable permit system presumes the existence of a supporting administrative structure. With such a supporting administrative structure in place, a tradeable permit programme could facilitate the cost-effective achievement of global warming goals, encourage the development of new greenhouse gas technologies, and provide a basis for equitable sharing of the cost burden between the developed and less developed countries. Without the appropriate administrative structures and procedures, a tradeable allowances system could not only fail to achieve the objectives of the global warming Convention, but could make the problem worse. If entitlements were transferred without ensuring that the appropriate compensating reductions were achieved, total emissions could rise, thereby violating one of the fundamental premises of the programme.

Since the administrative procedures and structures to accomplish these functions did not exist before the Kyoto Protocol was negotiated and were only partially addressed in the Protocol itself, this task presents some considerable challenges. Put starkly, resolving global environmental problems will require some subordination of national power to the interests of the global community. For nation states which have become comfortable with exercising their sovereignty with relatively few international restrictions, blending national interests with global interests is not going to be easy. It will be necessary to design a set of structures and procedures which not only harmonize immediate and long-term interests but which also stand a reasonable chance of being accepted by the nations of the world.

C. Components of a facilitating institutional structure

An effective trading system relies upon two rather different sets of institutions and procedures: (1) a set of market institutions to promote cost-effectiveness and to provide incentives for the development of new ways of meeting climate change objectives; and (2) a set of administrative institutions to ensure that the pollution-control objectives are met.

The market institutions would exist for the purpose of facilitating exchange and reducing the associated transactions costs. Trades could be handled through a clearing house or an organized exchange. Contractual procedures would be used to apportion the risks, such as the risk of breach of contract. It is not unreasonable to expect that private institutions could arise to fulfil many if not all of the market functions.

Since the market institutions are covered in a separate report (Sandor et al., 1994), the administrative functions form the focus of this report. The functions of concern, as laid out in article 17 of the Kyoto Protocol, include procedures for verification, reporting and accountability for emissions.

1. The monitoring function

Monitoring serves two primary functions. First, it provides a basis for assessing compliance with the agreement. Assessing compliance is an important initial step in the process of assuring compliance. This monitoring function focuses on matching emissions with allowances. A second monitoring function focuses on the concentrations of greenhouse gases in the atmosphere and the consequences of those gases for climate change. Monitoring provides a basis for deciding whether stronger international actions would be necessary and adjusting the assigned amounts in future commitment periods accordingly.¹⁵

Since not all nations have Annex B commitments under the Protocol, at least initially, even if the Convention were completely successful in achieving the country-specific Annex B emission reductions, further increases would be possible in the nations not covered by Annex B requirements. In order to track progress toward the global objectives specified by the Convention, it is important to keep track of emissions not only in the Annex B nations, but, to the extent possible, in the other nations as well. Establishing a monitoring process requires identifying a monitoring authority and specifying both its responsibilities and the responsibilities of those being monitored.

¹⁵ As experience with the Montreal Protocol on Substances that Deplete the Ozone Layer indicates, initial international actions may not be strong enough.

2. The reporting function

The ability to monitor the process presumes a flow of reliable, useful information to the monitoring authority. The information flows can be based on a self-reporting system, a system of direct or indirect inspections or some combination of these. Direct inspections, the approach taken in some of the disarmament agreements, would involve visits to the emission sources. Indirect inspections can involve the collection of related data (such as energy consumption by fuel type) which can provide indirect evidence on emissions. Self-reporting involves the submission of reports which provide details on specific data requested by the monitoring authority.

3. The verification function

The reporting function generates a wealth of raw information. The verification function attempts to verify compliance with the Protocol and to recognize uncertainties associated with measuring emission reductions as well as to design institutional ways of handling those uncertainties in such a way as to ensure that the objectives of the Protocol are fulfilled.

Verification is necessary to assure the global community at large that the entitlement transfers are facilitating, not impeding, the attainment of global warming goals. As described below, verification procedures should differ considerably depending upon the type of allowance being transferred.

4. The certification function

When nations have assigned amount baselines (as all Annex B nations now do), the sale of an allowance automatically reduces the number of allowances remaining to cover emissions during the commitment period. This would be true both for assigned allowances and for created emissions reduction credits under article 6 which are used to fulfil the obligation under article 3. For this category of trade, as long as every trade results in equal and offsetting changes in the two Parties' allowances, certification is not required because the need to balance emissions with allowances during the commitment period provides a check to ensure that the trade will not increase emissions. No such assurance is automatically provided for nations that have no Annex B baseline, but that assurance can be obtained from the certification process. Specifically, one of the purposes of certification is to ensure that trading does not increase emissions and that purchasers of these credits have some assurance as to their validity.

Chapter V

MONITORING

It is widely acknowledged that emissions trading should only take place in an environment of highly credible monitoring of both emissions and trading activity. Annex B countries are required to have a reasonable estimate of aggregate national emissions of the six greenhouse gases mentioned in Annex B. However, the quality of monitoring needed may be higher for emissions trading than it is generally for the purposes of the Protocol, raising important questions regarding the countries and sources which are to be included in the trading system. In this way, the need for accurate monitoring to underpin a trading system could lead to improvements in the overall quality of monitoring and reporting requirements.

This section first reviews the basic issues involved in monitoring greenhouse gases, as the accuracy of monitoring is an important consideration in determining whether and how each source should or could be included in an emissions trading system. Fortunately, the sources of carbon emissions and most sources of other greenhouse gases can be effectively monitored, but there are exceptions such as nitrous oxide (N₂O) and agricultural and land-based sources of methane. Fundamental choices need to be made. One option could be to establish a trading system only for gases and sources that can be accurately monitored. Alternatively, rules of the sort discussed below, which would allow other sources to be included, could be followed.

Secondly, we review the international system for monitoring both emissions and allowance trading that is required to give effect to article 17 trading. The emissions monitoring system would be based upon the reports required by article 3 (4), and would attempt to cover insofar as possible all signatories, not merely those with Annex B obligations. The allowance tracking system would include the assigned amounts designated in Annex B (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 and forestry activities, as authorized by article 3 (3)), and any transactions in ERUs and CERs.

A. Emissions monitoring

This part will review the adequacy of emissions monitoring techniques for various gases and sources, and the implications of this in designing a trading system.

1. Accuracy of monitoring

There is an extensive literature reviewing what is known about the different sources and sinks of greenhouse gases, and studies have explored the extent to which the «monitorability» of these is compatible with the administrative needs of a system of tradeable entitlements (Environmental Law Institute, 1997; Sussman, 1998; Victor, 1990).

Emissions can be monitored either directly using monitoring devices or indirectly using predictive methods. For carbon emissions and possibly some other gases, we can expect that

indirect emission - monitoring methods would be used. This involves monitoring-related activities (such as the amount of fuel consumed) and using estimated relationships between the activity and emissions to estimate emissions. Sometimes this is as simple as multiplying an emission factor by the level of the activity, while in other cases this may involve applying a function which depends on factors other than the level of the emission-generating activity (the age of the plant for example).

If predictive methods are inaccurate, direct emission monitoring must be used. This involves actual measurement of emissions as they are injected into the air. This can be done continuously, as it is in the sulphur allowance programme in the United States, or by means of a periodic sampling technique. Continuous emissions monitoring is the most accurate, but it is also the most costly, and is not likely to become the core of any greenhouse gas monitoring programme. Sampling approaches can be reasonably accurate, in part because repeated samples can reveal patterns of emission over time as well as differences among sources that may be due to, say, the degree of maintenance. The accuracy of the samples will depend on their frequency and on the representativeness of the samples. Infrequent samples drawn during announced visits are less likely to be representative than more frequent samples drawn during unannounced visits.

Finally, direct measurement of production may be an accurate monitoring method for manufactured gases such as hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride if producers of these man-made gases are made responsible for future emissions.

In the case of carbon dioxide emissions due to combustion of fossil fuels, monitoring costs should be low because the proxy - quantities of fossil fuel disaggregated by type - is already monitored, and the emission factors are well understood. Because the vast majority of fossil fuels are traded commercially and energy is such an important political and economic issue, most countries have in place elaborate systems for monitoring flows of energy through the economy. Data systems are especially well developed - with detail to the level of individual refineries or even vendors to final consumers - in settings where the sale of fuels is taxed, and thus existing institutions that administer fuel taxes could be used to administer an entitlements system. At the international level, the International Energy Agency (IEA, a quasi-independent arm of OECD) has a regularized system of assessing and harmonizing those national data.¹⁶ These data systems

¹⁶ This capacity can be and has been used also to assess the national statistical systems for energy in non-OECD countries.

are disaggregated by fuel type, and the carbon emission factors for each of the fuels are well known.¹⁷

Including other greenhouse gases is more difficult. Some analysts believe that sources and gases other than carbon dioxide from the burning of fossil-fuel are not sufficiently monitorable for inclusion in an entitlements system at present (Victor, 1992). However, point sources of methane such as coal mines and flared gas can be readily monitored, as can the actual production of gases such as hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Emissions from other sources of methane such as landfills can be monitored, but require estimations based on assumptions of overall humidity and temperature, which can vary throughout the landfill. Agricultural sources of methane, such as ruminant animals and animal wastes, sources of nitrous oxide and carbon sinks, are also difficult to monitor accurately.

Further, as recognized by article 5.3 of the Kyoto Protocol, determining compliance and allowing trading in a multi-gas system that allows trading between gases would require an index that converts different sources (and sinks) into common greenhouse units. Although such an index exists - the Global Warming Potential - the key parameters are poorly understood (Harvey, 1993; Swart, 1992). Moreover, any point index must integrate future effects into a single number, but a common index would require common assumptions about inter-temporal comparisons that would be misleading (Eckaus, 1990).

2. Mechanisms for coping with imperfect emissions monitoring

One option for coping with unreliable emissions monitoring would be to limit trading to greenhouse gas sources that can be readily and accurately monitored. This could include carbon emissions, certain methane sources and all the manufactured gases if producers were made

¹⁷ These factors may be adjusted for local fuel types to provide more accurate estimates. We have not addressed whether those factors should be adjusted for other emissions, notably sulphur dioxide, which offset some of the forcing due to carbon dioxide. The exact amount of the offset is debated and depends on many factors, including issues of time horizons (discussed later in this section).

responsible for the emissions. It could be argued that emissions trading should be limited to these gases and sources under either private or Government-run trading systems, as to allow trading in poorly monitorable sources or sinks would create too severe environmental risks.

For systems which allow private sources to trade, it is both feasible and desirable to limit international trading to certain gases and sources. Moreover, private sources with highly accurate monitoring systems should trade, which may exclude certain sources of methane and nitrous oxides.

The situation is more complex for trading between Annex B countries, as their assigned amounts include an undifferentiated set of sources and sinks of all six gases. However, under article 17 more stringent rules could be developed for intercountry trading than for the country's emissions reduction obligation under article 3. Intercountry trading might be allowed only for the level of assigned amounts which equals a country's emission of readily monitored gases, and compliance obligations for trading could also be based on the measured emissions of those gases. Doing so would greatly reduce the environmental risks of trading in poorly monitorable gases.

Another possible strategy for coping with emissions uncertainty involves adjusting the emissions inventories or adjusting the trading ratios in the emissions trading programme to reflect the uncertainty in monitoring.¹⁸ 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.

One way to cope with uncertainty would be to impute presumptive values for emissions factors, which would considerably reduce the cost of developing more sophisticated and more accurate measures, or as a stopgap measure until more accurate data could be obtained. Conservative values could be chosen for these imputed factors, thereby assuring environmental quality if the imputed values are chosen, and providing an incentive for the development of more accurate monitoring techniques.¹⁹

B. Allowance monitoring

¹⁸ 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 in 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. Therefore the adjustment would have to reflect «average» uncertainty for the two government Parties concerned.

¹⁹ Note that being conservative means different things depending on whether these methods are used to define the emissions inventory or the reductions that qualify for CERs or ERUs. 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.

Countries with Annex B obligations face two monitoring burdens: one is the need to keep track of actual emissions and the other is the need to keep track of emission trading transactions to ensure that the level of authorized emissions is accurate. Emissions must be monitored to ensure that total emissions do not exceed the sum of the assigned responsibility plus net acquired article 17 or article 12 allowances minus net article 17 allowances transferred to other Annex I countries. Also, emissions of sources creating article 12 credits (CERs) must be monitored to ensure that the reductions used to create the CERs are real. Taken together, these monitoring tasks make it possible to balance the books.

For Annex B nations, monitored emissions must be matched to allowances to verify compliance. The allowance monitoring system should be sufficiently harmonized with the emissions monitoring system to allow matches between the two to be easily obtained. In practice this means using a computerized database with specialized software designed to perform such functions as aggregating the different gases using the Global Warming Potentials, aggregating across sectors and even aggregating across Parties. In addition, to ensure adequate transparency, these data should be routinely made available to the public, presumably on a read-only basis on the internet.

C. An international monitoring authority

Although much of the burden of monitoring will be born by the Parties using a self-reporting system, an international authority is necessary to assure the use of standardized monitoring procedures and to collect, aggregate, harmonize and interpret the reports from the Parties.²⁰ The Protocol assigns a portion of this responsibility to the Subsidiary Body for Scientific and Technological Advice, but the responsibilities of a true monitoring authority would be larger than those assigned by the current Protocol.

In addition to providing a quality control check on procedures, this authority would have to oversee the development of both the allowance and emissions tracking systems. It would also supervise the monitoring effort and report to the Conference of Parties periodically. These reports would serve not only to inform the international community of progress on reaching the goals of the Convention, but also to provide information which would be useful in guiding the evolution of the system over time.

Several options for funding this authority exist. One option, which is appealing for both its fairness and its efficiency, would be to fund it from per-ton fees levied on assigned amounts. Other possibilities include levying fees on international allowance trades or lump-sum fees on Annex B Parties or signatories.

The international authority would be expected to perform the following key functions:

Give initial approval of a country's monitoring system, which would allow that country to participate in emissions trading. Arguably, only countries with an excellent system of monitoring domestic emissions should be allowed to participate in an international trading system. The international agency would need to initially determine whether a country has, at the domestic level, an adequate system of self-reporting from emissions sources, and the means and the programme to adequately monitor or verify the self-reported data.

Receive and review reports from countries that provide credible data on monitoring results and methods on an ongoing basis. Once a country is accepted into the international trading system, the international agency would need the

²⁰ For an elaboration of the possible models that could be used for organizing and governing this organization, see Stewart et al., (1996).

capacity to receive and review the national reports, including those submitted under article 3 (13).

Carry out inspections to assure compliance and proper functioning. Existing institutions, especially at the domestic level, along with familiar processes of extensive self-reporting, could form the basis for a viable monitoring system, but periodic veracity checks would be needed to ensure the integrity of such a decentralized monitoring system. Such checks would be needed both within nations, to ensure that self-reporting by individual sources is accurate, and at the international level, to ensure the accuracy of national reports. In theory, multiple levels of self-reporting along with veracity checks should also allow cross-checking, but in practice this is frequently difficult unless all data are complete, accurate and collected in a harmonized format.

D. Precedents

Any monitoring system must necessarily fit within the context of existing international and domestic institutions. Thus, precedents are important because they form expectations on the types of systems that are economically and politically feasible.

1. International precedents

Monitoring has not been a salient aspect of international environmental agreements and the extent to which previous international environmental agreements are sufficiently monitored varies widely.²¹ Despite a long history of international monitoring systems based on self-reporting of data, the various secretariats that receive the data typically do not do much with the data except make them available to the Parties and others. Secretariats are often overworked and typically do not have the political mandate to do anything too controversial, such as explicitly assess levels of compliance on the basis of self-reported data or even assess the quality of reports.

²¹ For a review of the functions, concepts and evidence related to each of these types of monitoring, see Ausubel and Victor (1992).

Although self-reporting systems are regularly established under international environmental agreements, the extent to which the Parties take them seriously by providing timely and accurate reports is mixed and generally negative (General Accounting Office, 1992). However, some evidence suggests that where the reporting systems are demonstrably useful, the Parties are much more cooperative in providing the needed information.²²

Experience with arms control suggests a long-term trend towards the increased acceptability of intrusive monitoring techniques that require a physical presence in the territory or airspace of a country. The reduction in tension between the former superpowers has increased the sharing of data, and recent agreements, such as those covering intermediate-range nuclear forces and conventional forces in Europe, make much greater use of self-reporting along with periodic veracity checks, including intrusive inspections. However, most intrusive inspections have occurred at government facilities and thus the issue of whether the international inspection schemes can examine private facilities has not received much attention so far.

²² See, in particular, Mitchell, (1992). Using the example of the self-reporting under the International Convention for the Prevention of Pollution from Ships and the 1978 Protocol thereto (MARPOL 73/78), Mitchell shows that self-reporting was incomplete - even Parties that had the information (e.g. industrialized countries) simply did not bother to report it. However, when the European Parties organized into a subgroup to track rogue tankers, they were able to set up a highly effective computerized data exchange system, at very low cost. The system worked because the Parties each saw the benefit from their participation in terms of higher prosecution of illegal tankers, and failure to participate in the system resulted in exclusion from those benefits.

There is a long history of intrusive inspections under the Nuclear Non-Proliferation Treaty managed by the International Atomic Energy Agency (IAEA). This treaty is essentially based on self-reporting and trust, with periodic veracity checks by IAEA inspectors. The example of the IAEA safeguards reveals a trade-off between the cost of and political opposition to fully intrusive inspections and their ability to completely check the veracity of self-reports. In theory, an optimal inspection strategy for IAEA would condition veracity checks on past behaviour, with fewer checks on countries that consistently reported accurate data.²³

In the area of international economic agreements, self-reporting is also the norm. Governments maintain domestic systems of national accounts and other economic indicators in order to manage the economy, and self-reporting at the international level is based on data from these systems. Because it would be expensive and difficult to keep separate accounting systems, strategic mis-reporting of data by Governments is probably rare, but the quality of data is dependent upon the quality of the underlying statistical systems. In the cases where good statistical data are needed, which will be true especially at the culmination stage of an entitlements system, inclusion of countries with poor statistical systems may require agreements on improving data and perhaps also financial assistance for that task.²⁴

In sum, self-reporting is by far the most common mode of gathering information, and this experience is echoed in other areas. There is limited experience with intrusive inspections, and

²³ This strategy of targeting a higher level of scrutiny on previous offenders can also produce significant deterrent effects even when the imposition of appropriate penalties is difficult. For an analysis of this approach to enforcement, see Harrington (1988) and Russell et. al. (1986).

²⁴ An alternative to improving data (and enforcement) is to discount current data by an amount that reflects the uncertainty. If the errors are randomly distributed the discount rate might be zero. Some have argued that the discount rate should be set so that any errors do not harm the environment - that is, set the discount rate so that bias favours over-control of emissions. However, this would be economically inefficient and would probably inhibit trading, although it might provide an incentive to improve the statistical system (and enforcement).

it is clear that regular systems of intrusive inspections, especially if they include private sites, would require prior and explicit international agreements.

2. Domestic precedents

Much has been made of the differences between international and domestic settings, with the presumption that the international system is anarchic while the domestic is dominated by an all-powerful State. However, the authority under the Protocol to craft specific rules for countries if they wish to gain the benefits of trading allows considerably greater opportunity to impose adequate conditions. Also, the reality is that the extremes are not so pronounced. The international system is marked by substantial cooperation, sharing of information and some systems of inspection and enforcement - that is, nascent features of governance. At the domestic level, the State is not a Leviathan, and its ability to monitor, inspect and enforce is not unlimited. Limits on State action depend on what is politically acceptable, the State's ability to raise and leverage resources, and norms against intervention in private affairs.

Regarding inspection to check the veracity of self-reports, there is rich experience in many diverse areas, from income taxation to labour standards. In the environment, experience in the United States suggests a wide range of effectiveness. At one extreme is inspection of compliance with workplace health and safety regulations, which is very infrequent (on average one inspection per century per firm); at the other extreme is inspection of behaviour related to water pollution regulations, which is frequent (on average once per year per firm). Compliance with, and the effectiveness of these different laws varies with the frequency of inspection, suggesting support for the basic hypothesis that inspection frequency matters (Magat and Viscusi, 1990; Viscusi, 1986). The main conclusion from research on monitoring in the United States is that inspections of polluters are too infrequent and cursory (Russell et al., 1986b; General Accounting Office, 1989,1990).

E. Roles of different actors

1. The private sector

The fundamental source of monitored information is private sources. They are the major economic actors responsible for most of the emissions, and they intrinsically have the most information about their behaviour. Thus systems that rely on self-reporting will be much less costly - both in terms of social cost and in terms of on-budget governmental cost (for which tax revenue must be raised) - than those that establish independent full-blown monitoring systems. In the case of carbon emissions, carbon users such as utilities, refiners or airlines would self-report emissions. Even in the early stages of market development - when trading is limited - the system is likely to depend fundamentally on self-reporting by emitters because government self-reported data will be based on private self-reporting at the source level.

The potential exists for non-governmental organizations to play a monitoring role as well. Industry associations might facilitate the exchange of data and help improve data quality, as is true in the international agreement to regulate whaling and in many fisheries agreements. New

or existing associations may be willing to fulfil this function, since establishing one harmonized reporting system would avoid the duplication of effort involved when many firms develop independent reporting systems. It may prove helpful for Governments to encourage the formation of such associations and to encourage the full utilization of existing associations.

Environmental non-governmental organizations can promote more effective agreements by monitoring the suitability of international agreements to address the problems at hand and by setting political agendas. They may also play a role in the monitoring of individual sources, but here issues of their capacity and access to publicly available information are important. Perhaps those non-governmental organizations that are able and prepared to gather information would do so as part of an enforcement action, and thus as a way to pressure emitters into compliance (or over-compliance) through public shaming or legal action.

2. Science and technology research organizations

Research on emission factors and inventories is already under way. This must continue, with greater attention being paid to the economic aspects, notably the marginal economic costs of alternative monitoring instruments and systems. Science and technology research programmes can discover accounting and surveillance methods that help check the integrity and effectiveness of international agreements and monitoring systems.²⁵ This can assist trading programmes, especially for gases such as methane and nitrous oxide, where more accurate emissions monitoring techniques are needed. Conversely, as shown in the Acid Rain Programme, the opportunity to trade can also create an incentive to provide more accurate emissions estimates within the private sector.

3. International and domestic public agencies

The conventional assumption is that monitoring is a public good and thus will be under-supplied, and the conventional prescription is that public agencies should perform this function. Indeed, while firms may have the basic information needed for a monitoring system, public law and administrative actions must ensure that the information is reported. At a minimum, public

²⁵ An example is the «inverse method», where regional emissions can be inferred from meteorological data, atmospheric concentrations and known emissions from other regions. This could be helpful for monitoring and verification, but it currently rests on incomplete knowledge of the relevant parameters as well as incomplete models. For an initial demonstration case using trichlorofluoromethane (CFC 11) see Hartley and Prinn (1993). Chlorofluorocarbons (CFCs) are the easiest case amongst the major greenhouse gases because the sources of CFCs are reasonably well known (i.e. the inverse method is relatively well constrained, at least in comparison with other greenhouse gases) and they are not chemically reactive in the lower atmosphere (i.e. their observed concentration depends primarily on air currents, not chemistry, and thus the model used for comparing observed and calculated concentrations and emissions is much simpler than would be the case if both chemistry and air flow had to be simultaneously modelled).

agencies must provide the veracity checks needed to ensure that self-reported information is accurate. Furthermore national Governments frequently have sufficient investigative power (such as the power to conduct on-site audits) and sufficient sanctioning power (such as the power to use criminal sanctions against those who falsify reports) to provide a degree of quality control. Therefore not all the monitoring capacity needs to be located at the international level, where it has proved difficult to create and fund effective institutions.

Rather, international institutions need only approve the form of domestic monitoring and verify that it is functioning properly.²⁶ As with the self-reporting system itself, veracity checks will telescope from the local to the international. One element of this quality control involves the need to standardize, insofar as possible, the procedures for producing the emission inventories. Allowing complete discretion in how the estimates are generated provides an invitation for parties to interpret the data in the most favourable way possible. Not only can this produce estimates which may not really reflect the total picture accurately, but it also raises basic issues of fairness which, if not dealt with, could undermine commitment to fulfilling the obligations imposed. Standardization simultaneously produces more consistent data and it can produce a greater sense of fairness by ensuring that every Party is treated in the same way.

F. Monitoring article 12 emissions

Emission reductions used to generate article 12 credits require considerably more scrutiny because they could be used to reduce emission obligations in Annex B nations. This monitoring is typically on a project or sector basis and should be specified and institutionalized as part of the process of certifying article 12 reductions. Adequate monitoring of these emissions should be a condition for certification. For countries that have created CERs, it will be necessary to monitor emissions from the creating sources on an ongoing basis to ensure that the reductions on which the credits are based represent real, not mere paper, reductions.

The task is not trivial because self-reported information under the Convention is likely to be provided at the national level, whereas certification takes place at the level of the individual source (or related class of sources, such as the electricity grid). In recognition of the greater difficulties posed by this particular form of monitoring a certification function is proposed below. This function would assure that only certified emission reductions would become part of the allowance system, but once certified, these allowances would be treated in the same way as all

²⁶ Appropriate action in this context is in part a political decision about the tolerance for non-compliance, uncertainty and other deviations from a perfect market. Presumably choices here will be based on experience as the market unfolds as well as analysis. Continued monitoring of such tolerances will be essential if the value of the entitlements, and thus the integrity of the market is to be preserved.

other allowances. The certification process is a practical way to help ensure that the trading system runs smoothly, and that it furthers the goals of the Convention.

Chapter VI

CERTIFICATION, VERIFICATION AND NOTIFICATION

A. The role of certification and verification

The allowances to emit greenhouse gases in the systems discussed in this report are of two different types: (1) assigned allowances, and (2) created emission reduction credits (ERUs and CERs). Created entitlements are more troublesome when they are not associated with a specific trading baseline. It is this difference that gives rise to the need for a certification process. Certification provides an *ex ante* judgement on the acceptability of the underlying emissions reduction.

When nations have baselines (as all Annex B countries now do), the sale of an allowance automatically reduces the number of allowances remaining to cover emissions during the commitment period. This would be true both for assigned allowances and for created emissions reduction units which are used to fulfil the article 3 obligation. For this category of trade, as long as every trade results in equal and offsetting changes in the two Parties' allowances, certification is not required because the need to balance emissions with allowances during the commitment period provides a check to ensure that the trade will not increase emissions.

No such assurance is automatically provided for nations that have no Annex B baseline, but that assurance can be obtained from the certification and verification process. Specifically, one of the purposes of this process is to ensure that trading does not increase emissions.

Certification would be the first step towards creating a tradeable credit. The certification process would occur whenever a Party not subject to an assigned amount wished to create a tradeable credit. Its purpose would be to assure that a specific quantified reduction from a baseline could be expected from the credit-creating action. Verification, the second step, would provide assurance that the reductions actually occurred. This step would occur after the activity commenced operation to verify that the reduction expected from certification had, in fact, materialized. Trading would normally be allowed to occur following certification, but use of the credit would be delayed until the reductions were verified.

Once they have been certified and verified, these credits could be used by Annex B Parties for use in meeting their obligations under article 3. Since non-Annex B Parties have no internationally specified targets, trading among these Parties would presumably be designed to satisfy only domestic goals and would therefore not be subject to the certification process.

Any Party that joined the Annex B list of countries by negotiating an acceptable assigned amount would thereby eliminate the need for certification in that country.

B. The certification/verification authority

The ultimate authority for certification and verification would be the Conference of the Parties. While the Conference of the Parties would be well-suited for defining the parameters of the certification process and exercising general oversight in that process, it would be ill-suited for dealing with the day-to-day operations of certification. The operational authority for certification and verification can, and should, be delegated to subordinate organizations specifically designed to fulfil that function.

Although responsibility for the certification and verification of CERs would be vested in the subsidiary body, under stipulated circumstances that body would have the power to further delegate some authority to specific governmental units or private organizations, providing certain preconditions were met. These preconditions would include, (1) an identified organization willing and able to assume the responsibility for certification and/or verification, (2) the existence of sufficient enabling legislation to ensure that it had adequate powers to carry out its mission, as well as adequate staff and resources, and (3) acceptance of, and willingness to apply, the standard certification and verification criteria.

Certification or verification workshops may be needed to ensure that the activities are being conducted in a responsible and credible manner. Training should be sector-specific: for example, a certified evaluator in forestry may be trained. The entities responsible for certification should be identified in the guidelines (Vine and Sathaye, 1997).

C. Certifying created entitlements

Because they are not already part of national compliance plans, CERs must, at least initially, be certified on a case-by-case basis. The basic requirement is «additionality». In other words, the traded reductions must be surplus to what would have been done otherwise. Deciding whether created entitlements are surplus requires the existence of a baseline against which the reductions can be measured. When emissions are reduced below this baseline, the amount of the reduction that is «excess» can be certified as surplus. In this case the baseline has to be on the project level rather than at the national level as it is for the Annex B Parties.

The threshold condition for certifying credits should be proof that the underlying surplus reductions are monitorable and enforceable. Reductions involving highly uncertain or unmonitorable emissions would not be candidates for certification.

One aspect of the initial certification processes that should be pursued actively is the development of general criteria, insofar as possible, that can be used to define additionality in place of a completely subjective case-by-case determination.

D. Burden of proof

Two issues regarding the burden of proof arise during the certification process: (1) who bears the burden of proving that the certification criteria have been satisfied? and (2) how heavy a burden should they have to bear?

The most complete information on the fulfilment of these criteria will naturally come from those creating the credits. However, should some non-fulfilment of these criteria become evident as the process continues, the Conference of the Parties would not have sufficient authority with non-signatories to correct the situation. For this reason, non-signatories would bear the responsibility for assuring the continued fulfilment of the certification criteria for those CERs. Subsequent violations of the certification criteria would void the certification of affected CERs; they could no longer be used by the acquiring nation to justify carbon emissions during the commitment period. The risk of losing that credit would underpin the certification responsibility of those acquiring CERs from non-participating nations.²⁷ Upon the loss of certification, the recipient would have to make up for the lost entitlements by undertaking compensating reductions within its own borders or securing additional offsets from other nations.

E. Additionality: the baseline issue

The different actors in a CDM project must have an incentive to publish credible estimations of emission reductions before a project starts and should receive credits only to the extent the project really reduces emissions.

Investors in and hosts of CDM projects - companies as well as countries - have the same interests. They want to get a maximum number of CERs through the project. The gain for the investor depends on the ratio of total project costs to CERs. The host will only find an investor if the project leads to a gain for the investor, and therefore is likely to overstate the possible emission reduction. As the gain depends on the credited emission reduction, there also exists an incentive to over-report emission reductions during the project. This also enhances the possibility of attracting investors for future projects. It is obvious that cheating will be very widespread if there is no close monitoring and verification of the projects.

Even if projects are very well monitored, it is still possible that the real emission reduction will be below the reduction credited. The amount of emission reduction depends on

²⁷ Private credit-rating systems could also play a role here. When entitlements from a particular source become known as having a dubious underpinning of emission reductions or carbon absorptions, these entitlements would receive a lower rating, resulting in lower prices. This partly internalizes the costs of lax certification and reduces the incentives to engage in it.

the emission that would have occurred without the project. The construction of such a hypothetical state is known as the «baseline» of the project.

Overstating the emission reduction would become rather difficult if an internationally agreed methodology existed to calculate what the emission levels of a country would be without a joint implementation project. A single standardized methodology for designing forecasting models and amassing data would be required, which would be drawn up by the scientific and technological advisory subcommittee of the Framework Convention on Climate Change. The question facing us now is how this seemingly simple problem can be solved. The discussion below shows that there are no easy answers, and standard methodology is a long way off.

It seems very appealing to calculate a baseline for a whole country and then aggregate the effects of the different CDM projects. Reliable quantified measurements of actual emissions are an important prerequisite for establishing such a baseline. A number of very different approaches are currently used to this end, producing highly divergent results (Michaelowa, 1995, p. 63 ff).

Several philosophical approaches towards defining the created entitlements, baseline based on either rules or discretion, are available. Three possible rules are: (1) the "what would have happened otherwise" rule; (2) the marginal external cost rule; and (3) the international benchmark rule.

The "what would have happened otherwise" rule allows deviations from expected outcomes to be counted as additional. For example, the carbon-sequestering capability of a forest that is saved from being cut down or the reductions in carbon emissions from building a new energy-efficient factory to replace a less energy-efficient one might both qualify as credits under this rule.

The pitfall in using this rule is that potential credit creators can manipulate the resulting baseline for their own advantage. For example, since preventing forest destruction could create surplus credits, threatening the destruction of a forest becomes a means of creating an advantageous baseline. Under this rule, actions which create more carbon dioxide could become individually rational in the short-term as a means of creating a favourable baseline. Naturally this type of strategic behaviour undermines the achievement of the objectives of the United Nations Framework Convention on Climate Change.

Not all situations, of course, raise this concern. When what would have happened otherwise can be clearly deduced from historical experience and no evidence of strategic manipulation is apparent, this particular rule could well be applicable. However, even this circumstance is suspect if, for economic or other historical reasons behaviour is no longer rational. Suppose, for example, that global energy prices increase. Historically energy-intensive production methods may no longer be economically rational. Investments in production changes, which are undertaken by investors for purely economic reasons, may have the side effect of reducing greenhouse gases. It is not clear that these reductions should be declared «surplus», even if they do represent a departure from historical patterns of use.

A major obstacle to defining a country-related baseline is that the emission levels have to be forecast for the entire lifetime of the project. In the case of sequestration projects, the lifetime can be up to a century. Forecasting emission levels for such a long period will amount to pure guesswork. The differences between the different scenarios of the Inter-governmental Panel on Climate Change, for example, reach an order of magnitude. But even for short-term projects that last for five to ten years, calculating an accurate baseline seems impossible. The difficulty of forecasting business cycles is well known, as shown, for example, by the forecasts for development in Eastern Europe made in 1988.

1. Treatment of «no-regrets» projects

Many opportunities for emission reduction are profitable either for a company or for a country as a whole. Opportunities that benefit the latter include externalities such as the reduction of other pollutants. The question arises as to whether these so-called micro- or macroeconomic no-regret projects should be included in the baseline. This question has led to heated debates among economists. While some say that there cannot be no-regret projects as such opportunities would have been grasped immediately (see Sutherland, 1996), others estimate that 10-30 per cent of today's emissions could be reduced via such projects (see Intergovernmental Panel on Climate Change, 1996).

These differences of opinion arise from the fact that despite the theoretical profitability of many options, there are still regulatory and juridical obstacles, lack of information and skilled personnel, and organizational rigidities, particularly in the case of countries in transition and developing countries. Often an investor cannot appropriate a gain as it is an externality accruing to others. Therefore, it seems that pure microeconomic no-regret opportunities are rather scarce, whereas macroeconomic no-regret opportunities abound.

So far, emission reduction projects have not been funded by countries even if they are a clear macroeconomic no-regret project. A good example is the ILUMEX project in Mexico, which would lead to a macroeconomic gain of \$0.05 per ton of carbon dioxide by distributing subsidized compact fluorescent lamps; the gains accrue to the participating households. Furthermore, the project would accelerate the market development of the lamps. However, from the microeconomic perspective of the Mexican utility, the project has net costs of \$30 per ton of carbon dioxide (Anderson, 1995). Similar examples would also apply in the case of industrialized countries. For example, the abolition of coal subsidies in Germany would surely be a macroeconomic no-regret project of considerable size (Michaelowa, 1995, p. 33). So far, the no-regret issue has been markedly neglected in the debate on CDM and joint implementation, and it is mainly referred to in very general terms. While some authors say that all no-regret projects have to be included in the baseline and therefore excluded from joint implementation, others would accept all of them. (For the former view, see van der Burg (1994) and for the latter see Bedi (1994)). A possible criterion could be whether a project is a microeconomic no-regret project. If those projects were excluded from joint implementation, an investor would have an incentive to artificially raise costs to demonstrate that his project has positive net costs. Therefore, even that distinction is fraught with peril.

2. Political distortions of baselines

The problems in establishing country-related baseline scenarios have also been evident in the business-as-usual projections in the national reports of the signatories to the United Nations Framework Convention on Climate Change. These are necessary for determining reduction targets within the framework of international negotiations. Substantial evidence can be found that countries tend to overstate business-as-usual emissions, which can be used to support a negotiating position that offers high reduction from a spurious baseline (Jochem et al., 1994). If realistic baseline scenarios cannot be established, then not only CDM crediting, but any form of controlled greenhouse gas reduction policy becomes impossible. The calculation of country-related baseline scenarios and aggregate reductions resulting from CDM projects is therefore very uncertain.

3. Project-related baselines

Taking into account the uncertainties of country-related baselines, project-specific baseline scenarios have been proposed as an alternative. In the case of a sequestration project, relevant sources and sinks of greenhouse gases must be identified prior to estimating their quantitative impact. Moreover, a quantification of past emissions is necessary. The calculation of the business-as-usual scenario has to take into account likely changes in relevant regulation and laws, the trend in autonomous efficiency improvements and changes of other basic variables such as the development of markets for products of the project.

It is now possible to define either a «median» baseline or a set of baselines with different assumptions which are weighted according to their probability. For example, if a power-station project does not replace existing plant but creates additional capacity, the baseline scenario depends on the fuel that might be used in an alternative solution. The alternative to a hydroelectric power station can be a coal-fired power station, for instance, burning either hard coal or lignite and producing very different emissions. For practical reasons, the host country's average fuel mix should be chosen when calculating the baseline scenario in such cases. This problem does not arise if a plant that already exists is to be replaced.

However, project-specific baseline scenarios do not take into account indirect effects which can arise, for example, when a project uses goods whose production causes greenhouse gas emissions. Emissions can also be influenced by price effects. For example, if carbon-rich fuels are largely replaced by low-carbon fuels, the price of the latter increases while the price of carbon-rich fuels falls. This price effect would provide an incentive for greater use of carbon-rich fuels and lead to an increase in emissions. Demand-side energy savings would also cause prices to fall.

Another negative indirect effect would arise from the alleviation of energy supply shortages. If one assumes rising incomes in the countries concerned, these shortages would be alleviated in any case without any special incentives for emission reduction. It cannot be ruled out, though, that industrialized countries could try to push strongly for the expansion of electricity supply in developing countries to enhance export markets for power supply

technology. In this case, even the supply of state-of-the-art efficient technology would lead to additional emissions compared to a business-as-usual path. Nevertheless, the emissions from additional electricity use would be at least partially offset by a reduction in emissions from unsustainable biomass harvesting. Therefore, the indirect effect of CDM projects would be to raise emissions in the short term, but to lower them in the long term, and it is likely that the latter effect would be greater. However, these indirect effects can only partially cancel out the emission reduction achieved by a CDM project.

The effects described above arise in any sort of climate protection projects and not just in the case of CDM. Moreover, improved access to modern technologies via joint implementation can contribute to emission reductions. The same applies if products of the project sequester greenhouse gases and substitute energy-intensive goods. It is impossible to specify whether indirect effects lead to more or less emission reductions than the project-specific baseline scenario suggests. Thus, in the case of undistorted markets, project-specific baselines show no systematic tendency towards excessive claims of emission reductions.

Besides indirect effects, a problem with project-related baselines arises if the host country distorts the fuel and electricity markets by granting production or consumption subsidies. A project-related baseline cannot take into account changes in these subsidies that would change a country-related baseline. As tight public budgets and the liberalization of energy markets lead to subsidy cuts, project-related baselines could show an excessive emission reduction. Higher energy prices would produce an incentive to save energy.

A solution to this problem could be to prescribe a combination of a country-wide baseline and project-specific ones that allows for adjustment of the latter if the subsidies are phased out. This combination should only be used in cases of high subsidies or market distortion. It should be taken into account, however, that such a solution would provide a disincentive to phase out subsidies as the creditable emission reduction will be positively linked to the amount of subsidies.

The problems that are created by fixing baselines for projects with long lifetimes could be alleviated through «dynamic» baselines, which use emissions and operating data of the project to adjust the baseline. Dynamic baselines would lead to uncertainty on the investor's part, as the credited emission reduction would depend on the adjustments of the baseline.

4. Alternative rules

Strategic manipulation of the certification process can also be countered by using other rules for baseline definition. Two of the rules mentioned above are not as susceptible to manipulation as the «what would have happened otherwise»rule. The "marginal external cost» rule is a familiar one since it is the rule used by the Global Environment Facility to dispense funds for projects of global environmental significance. According to this rule, emission reductions would be surplus if they exceeded levels that would be rational for individual countries to undertake purely in pursuit of their own self-interest. The test is based upon a benefit/cost analysis in which all the benefits and costs of reducing emissions are defined purely

in terms of the individual country's interests. No transboundary benefits or costs would be included in this particular calculation. The level of control up to and including a level of control which maximizes that nation's net benefits (total benefits minus total costs) from a purely self-interest point of view would be included in the baseline. Any control beyond that would be considered surplus.

While it does reduce the potential for strategic manipulation, the marginal external cost rule introduces a few problems of its own. First, it takes no account of the ability of individual countries to finance the level of control which maximizes domestic net benefits. Second, relying on a benefit/cost test would not only make the certification process rather expensive and time-consuming, but it is not clear that current benefit estimation procedures could be relied upon to the extent necessary to satisfy the rather stringent requirements a certification procedure would impose. For example, in many countries where this rule might be applied, the data necessary to implement these procedures are difficult, if not impossible, to come by at any reasonable cost. Finally, the marginal external cost rule prevents any rent from being transferred to developing countries. All funds they receive are designed to provide external benefits. Using the "what would have happened otherwise" rule, by way of contrast, could benefit developing countries as well as the global community.

A final approach to defining the baseline for created credits, following the «international benchmark» rule, envisions the application of a predetermined threshold-of-control responsibility. Once this threshold was reached, additional reductions would be considered as surplus. A source-specific threshold would stipulate how much control would be necessary from an individual source before additional reductions from that source could be certified as tradeable entitlements.

Source-specific or sector-specific baselines could either result from the application of universal standards ("off the shelf") or from a case-by-case discretionary process. Whereas under an approach based on universal standards the bureaucracy would attempt to define baselines for likely projects in advance, applying those standards to all parties seeking certification as necessary, under a discretionary approach the baseline would be defined on a case-by-case basis as the need arose. Early case-by-case determinations could and should establish precedents for subsequent decisions. A case-by-case process would prioritize certification determinations by focusing on specific issues as they arose.

F. Trades among Annex B Parties: the notification requirement

Although no certification would be required for trades among Annex B Parties, all international trades would have to be recorded in the dual tracking system, and notification of all Parties of the intention to trade would be required. This would afford an opportunity for a Party to challenge the trade before large investments were made.

For international trades involving private sources, an additional layer of notification would be required. Prior to trading, private sources would also be required to notify all affected Parties (normally meaning those who have either a buying or a selling source within their borders) of their intention to trade.

G. Certification and programme evolution

Would the certification process described above facilitate, or at least not impede, the evolution of the system? How smoothly the transition can be handled depends on the relationship between credits granted by the certification procedure and subsequent assigned obligations when Parties join Annex B.

The major possible impediment to a smooth transition could arise from the treatment of certified credits which a non-Annex B Party has either sold or leased to others, once that nation decides to join Annex B. For example, if the rule for allocating allowances to new signatories were based on historical emissions (and all potential signatories were aware of that relationship), an incentive to increase emissions for the purpose of receiving a larger entitlement allocation, once the agreement was signed, would be created.

Basing future entitlement allocations on variables other than historical emissions is one practical solution to the problem, and it is a solution that seems quite compatible with a basic sense of fairness. Most discussions of allowance allocation envision allocating more allowances to developing countries than would be justified by historical emission patterns as a means of accommodating future development.²⁸

The remaining question is how certified credits should be incorporated into the definition of an assigned amount when a non-Annex B Party agrees to join Annex B. Once the assigned amount allocation for the new participant has been negotiated (presumably based on some criterion other than historical emissions), entitlements which have already been transferred should be counted against the allocated entitlements. In other words, suppose a country has leased or sold 30 tons of carbon dioxide offsets for five years to another country prior to signing the agreement and receives 1,000 tons per year of allocated entitlements following acceptance of the agreement. How should the accounting of these two types of entitlements be handled?

Once the agreement is ratified and a specific entitlement allocation received, any outstanding offsets should be counted against that allocation for the years remaining. Consider the effect of adopting this rule in the context of our previous example. For the remainder of the sale or lease agreement the nation in question would have 970 unencumbered entitlements; once the five years were completed it would have the full 1,000.

²⁸ This can even be justified on efficiency grounds (see Chichilnisky et. al., 1993).

Chapter VII

REPORTING

A. Transparency: the cornerstone

As non-compliance can be much reduced through the deterrent of public loss of face, strong provisions for the disclosure of information are necessary. That means that strict reporting requirements help in achieving compliance.

Comprehensive reporting is a key feature of a successful trading system. For trading in stock exchanges, companies must agree to undergo financial audits and must disclose information. Reporting is even more important if formal enforcement is difficult, as it enhances public pressure. Requirements differ according to the kind of participants.

B. Reporting and monitoring costs

Concerning the creation of ERUs in a domestic trading system, effective monitoring and enforcement can be achieved at relatively low costs to the Government. In contrast, it will require high levels of private investment in monitoring systems and changes to legislative enforcement provisions, as the following example shows. The monitoring requirements on emitters in the RECLAIM programme cost an average of \$30,000 more per emitter than earlier monitoring requirements. Increased monitoring costs can lead, however, to much more effective programmes. The United States Acid Rain Programme, for example, combines tamper-proof continuous emissions monitoring and reporting systems with automatic administrative penalties of \$2,000 per ton. This programme achieves 40 per cent of the emission reductions under the Clean Air Act while employing only 1 per cent of EPA personnel. These kinds of efficiencies are only achievable in a cap and trade programme with automatic monitoring and penalties.

CER trading, on the other hand, may require significantly more resources for enforcement while the reporting costs are similar. The validity of CERs will only be ascertainable through audits, and the threat of audits will need to be sufficient to deter the creation of bogus CERs. Enforcement staff will have to analyse technologies and methodologies with which they are unfamiliar and to enforce projects at locations outside their normal purview (Rolfe, 1997).

C. Kyoto Protocol requirements

Article 5 (1) states that each Party to the Kyoto Protocol shall install a national system for estimating emissions and removals. These systems shall use methodologies and Global Warming Potentials accepted by the Intergovernmental Panel on Climate Change (article 5 (2) and (3)). Revisions of methodologies will only apply to future commitment periods. Inventories have to be submitted annually after 2008 via national communications (article 7 (1-3)). The Meeting of the Parties shall develop additional guidelines for reporting and accounting (article 7 (4)). Thus general reporting requirements have become stronger.

The Kyoto Protocol adopts a commitment period of five years. The multi-year compliance format is designed to avert the danger that a single-year target may pose due to fluctuations in economic performance or certain extreme weather conditions, and to provide countries with additional flexibility in meeting their targets. Despite these advantages, the establishment of a multi-year commitment period might undermine the actual scope of a country's achievement in meeting its obligations under the Protocol if monitoring, reporting and enforcement do not prove to be adequate. This underlines the importance of strong and frequent reporting obligations to help in achieving compliance. Such obligations will provide the basis for reviewing expected performance, facilitating early identification of plausible compliance problems, and then initiating early corrective actions to encourage compliance with national commitments.

D. Strengthening requirements

In the design of the international trading system, certain common methods and reporting formats should be considered as requirements for participants to be eligible to join the trading system. In particular, the following should be considered:

- Comparable methods for setting emission baselines for individual emission sources that create CERs;
- Common reporting formats for making information on emissions and greenhouse gas unit holdings accessible to other countries and the public.

Standard forms or reporting formats would facilitate oversight. The frequency of reporting would need to be carefully considered, weighing the cost of information against market participants' need for certainty that emissions commitments were being met. Reporting requirements are not unique to trading, however. The frequency of reporting could increase, if necessary, as domestic reporting systems improved.

Countries that wished to trade would need to fulfill the monitoring, reporting and compliance requirements of the trading system. The benefits of participating in an international emissions trading system would be a strong incentive for prospective participants to comply with agreed trading rules of this sort (OECD, 1997).

E. Reporting on a national level

The national reporting system of each Party would have the dual responsibility of tracking both emissions and allowances. Each Party would be responsible for tracking emissions of all greenhouse gases in the format prescribed by the oversight agency established by the Conference of the Parties. In the case of a Party that has delegated trading authority to private sources, emission levels for those sources or sectors must be included as separate entries in these inventories. Each Party would also be responsible for reporting all allowance transfers and would be responsible for verifying ownership of any traded allowances. Both reports would 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. Generally these reports would be submitted on an annual basis, although more frequent reporting would be possible if the Conference of the Parties deemed it necessary.

All traders, whether companies or individuals, should be required to register with a central governmental body responsible for recording all transactions (such as EPA in the United States or the Department of Environment in the United Kingdom), which will establish an account in the trader's name (Joshua, 1998). In the case of a domestic trading system, companies would have to notify sales to foreign companies or Governments to a domestic government agency, which would record the transaction and adjust the account of the seller. In the buying country, the transaction should also be reported to a government agency by the buyer. It would record the transaction, adjust the trader's account, send confirmation of the acquisition back to the buyer, and notify the UNFCCC secretariat. If trading takes place between countries without domestic trading systems, the Governments should have to report the transaction in the official gazette.

F. Reporting at the international level

All international trades would have to be reported by the Parties to the UNFCCC secretariat or a designated subsidiary body, which would keep accounts of international permit trade and calculate changes in the allowances of participating countries by adding up all notified trades at the end of each year. It would also inform the enforcement agency about each country's position at the end of the commitment period. It could use the experience of the EPA's Allowance Tracking System that controls the trading through serial numbers attached to allowances (Atkeson, 1997).

G. Adequacy of publicly available data

All government agencies and the UNFCCC clearing house should have to publish data on transactions and permit accounts of countries on websites as well as annual reports. This is crucial to enhance compliance following the earlier exposure of fraudulent trades, especially through non-governmental organizations.

Chapter VIII

COMPLIANCE AND ENFORCEMENT

A. Background

1. Introduction

Effective procedures for promoting compliance and for dealing with non-compliance are an essential part of the process for achieving the goals of the United Nations Framework Convention on Climate Change whether trading is involved or not. Trading, however, does put more pressure on the compliance system for it offers additional opportunities for non-compliance. In this chapter we review compliance objectives together with lessons from domestic and international law, and suggest options for promoting compliance and, if necessary, applying enforcement actions under a trading system.

The compliance regime suggested in this report relies upon multiple commitment periods. The principal tools include declaring non-compliant Parties ineligible for trading and reducing assigned amounts in subsequent commitment periods. Currently the Convention has a process for setting 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 with the first commitment period. We believe that this process should have more priority than it appears to have currently.

The essential foundation for effective compliance is a compliance system that Parties perceive as both fair and justified. Here, the Parties' power under article 17 to define the relevant principles, modalities, rules and guidelines for emissions trading may allow the definition of clearer, more precise or stricter rules to govern compliance in the case of trading than may be generally applicable under the Kyoto Protocol. This may lead to better rules, for example, for the monitoring and reporting of emissions, or even to the development of increased compliance mechanisms for countries that wish to trade. In addition, the withdrawal of the right to trade adds a possible sanction for non-compliance to other enforcement tools.

A certain amount of pressure for compliance is implicit even without investigation or formal penalties, and to date most international enforcement has relied heavily on this fact. However, it appears unlikely that moral suasion and informal pressures will be sufficient to induce specific emitters and nations to comply rigorously with the entitlement systems envisioned under the Protocol. The incentives could be strongly aligned against compliance, especially if the overall targets imposed by subsequent commitment periods are stringent and permit prices are high.

Despite these obstacles, enforcement is essential to assure the integrity of an emissions trading market. Any loss in market confidence would seriously erode the benefits of the emissions trading system. Trading systems work best in a strong enforcement and compliance context.

2. Rationale for compliance and enforcement

The need for effective compliance and enforcement under the Protocol has two rationales. The first is the need to respect the fairness and economic allocation embodied in the obligations set by the Protocol. This may be met by imposing economic penalties on non-complying Parties, removal of benefits or other sanctions, including the restoration of additional tons emitted. A second objective is environmental, and is met by ensuring that any additional tons of greenhouse gas emissions are recaptured and restored under the compliance system, so that the total cap imposed by the Protocol is inviolate. Arguably the most important element of the compliance systems is to ensure that tons are recaptured, which can fulfil both of the above objectives if recapture is the automatic consequence of non-compliance.

The goal of a robust enforcement system is to make ultimate sanctions credible so that threats - which are expensive to carry out - rarely need to be imposed. It is difficult to design optimal enforcement systems within domestic political systems and even more difficult at the international level, where enforcement mechanisms have been relatively weak and where the difficulty of raising budgets or delegating political authority for enforcement institutions is exacerbated.

3. Lessons from domestic law

The effectiveness of enforcement and compliance issues at the domestic level has received a great deal of attention (Russell et al., 1986). Work by economists has focused on the determinants of an optimal enforcement system and over time has focused on a variety of enforcement instruments such as fines, imprisonment and loss of reputation. Traditional approaches rely on investigation by public agencies, clarification and adjudication through the legal system, followed by penalties levied by public agencies and backed by the power of the State. Other complementary systems give a greater role to private action through the legal system, by creating civil liability for environmental harm for instance. These systems rely on private incentives: individuals and firms will monitor, investigate and initiate civil actions if they can gain by showing that they have been harmed.

In some countries, even those not directly harmed might initiate suits; notably, environmental non-governmental organizations seek to protect the environment and initiate suits on its behalf. These organizations have received much attention in this role, their incentive being altruism or increased membership and dues when they are perceived to be working effectively. The details of the rules - such as the rules governing recovery of legal fees, existence and recycling of penalty revenue, standards of liability and burdens of proof that allow such suits are important (Babich, 1995; Naysnerski and Tietenberg, 1992). Private actions will probably be relegated to an augmenting or complementary role when the number of stakeholders is very large, but even an augmenting role can free up resources of the public agencies that can be redirected towards more serious concerns.

As with monitoring, the frequency and effectiveness of domestic environmental enforcement varies considerably (Brickman, Jasanoff and Ilgen, 1985). Part of the variance is

explained by budgets but, beyond questions of finance, important political choices about the degree and type of penalties can be made. Studies in the United States in the 1970s and 1980s indicated that administrators and judges were unwilling to levy large penalties on violators because these led to expensive legal challenges and delays. However, there may be an evolving norm in favour of stiffer penalties, including imprisonment and personal liability for the actions of organizations (e.g. firms). Administrators now possess a wider array of sanctions to which they can resort.

In other settings, Ostrom's (1990) empirical study on the management of local commons shows that graduated enforcement, supported by monitoring of behaviour and compliance, contributes to the effective management of natural resources. Where monetary penalties are involved, economic studies have shown that the social costs are low. While imprisonment has not been favoured by economists, in settings where it is rarely used it may be highly effective as a deterrent, especially if appropriately high penalties are unavailable, perhaps as a result of legal restrictions or bankruptcy (Segerson and Tietenberg, 1992).

The key issue in enforcement - whether at domestic or international level - is deterrence, not just the reversal of non-compliance. Yet assessing the deterrent value of an enforcement instrument is an extremely difficult task. As suggested above, there is empirical support for the proposition that the frequency of monitoring and inspection, as well as the level of penalties does make a difference, but comparisons between enforcement instruments are difficult. Crucially, demonstrating effectiveness is difficult because, by definition, the threat is visible to the analyst only when it fails. Thus it is empirically difficult to separate observed levels of compliance (where data exist) from what otherwise would have occurred under alternative enforcement systems.

Transparency mechanisms have also been effective at the domestic level in promoting compliance. In Indonesia and the United States, laws requiring industries to report their pollution discharges to the public have resulted in dramatic voluntary decreases in discharges by these facilities. Public disclosure of enforcement actions also seems to enhance the effectiveness of those actions (Tietenberg, 1998).

When the difficulty of determining the optimal structure of penalties is coupled with the observation that different enforcement instruments are likely to work in different cultural settings, it is inevitable that a wide variety of enforcement systems will be involved.

4. Compliance at the international level

Designing enforcement systems at the international level is difficult because international institutions are sometimes weak and international treaties rest on the assent of their Parties. These shortcomings are tempered by strong norms in the international system in favour of complying with international law as well as strong pressures - in the form of reputation and reciprocity - to sign international treaties. Thus States remain Parties to treaties even when their

narrow obligations under the treaty are inconvenient.²⁹ Fear of being exposed as a violator of one's agreements - and as a violator of international law in general leads to a strong predisposition towards compliance within government bureaucracies, through State leaders' reputations and public opinion. Some persuasive evidence suggests that despite this weak formal enforcement, compliance with international agreements is actually quite high in general.³⁰ The use of sanctions is rare, in part because compliance is high and in part because nations are ultimately reluctant to use force.

Most environmental treaties have relatively weak enforcement mechanisms. By default, enforcement at the domestic level is left to the Parties themselves, and enforcement at the international level tends to be done on an ad hoc basis. Most episodes of non-compliance and potential enforcement actions take the form of disputes, and in environmental treaties the Parties can choose a variety of means to resolve disputes. Ultimate recourse is to the International Court of Justice, but this is a cumbersome process and rare. Consequently, disputes typically have no outlet and there is no regularized system of enforcement; disputes are addressed diplomatically through negotiation or left as unresolved differences in interpretation.

Although international enforcement systems are poorly defined in the environmental area, much can be learned from other areas. The best developed system is the dispute resolution process under the General Agreement on Tariffs and Trade (GATT), where disputants can initiate the formation of a panel of experts to investigate the claims and make a judgement based on GATT principles.

In addition to official enforcement systems, some countries have been able to take unilateral enforcement measures, including import bans or threats of retaliation, in areas where domestic interest is high. However, this is possible only for powerful States with large domestic markets. The quintessential cases are the Pelly and Packwood-Magnuson acts, under which the United States threatens retaliation in access to fisheries and trade in wildlife products against countries whose policies diminish the effectiveness of wildlife treaties, notable the Convention on International Trade in Endangered Species of Wild Fauna and Flora and the International Whaling Convention. In practice, sanctions are typically not imposed but the offending country is «certified» and retaliation is readied; the threat is usually sufficient and leads to political compromise and a change in the behaviour of the offending country.

²⁹ For example, Japan has remained a Party to the International Whaling Convention and portions of the Convention on International Trade in Endangered Species of Wild Fauna and Flora even when its obligations under those conventions strongly clashed with Japanese practice.

³⁰ See, for example, the often quoted statement "Almost all nations observe almost all principles of international law and almost all of their obligations almost all of the time" (Henkin, 1979).

A general review of unilateral actions shows their application has been patchy. Economic sanctions, especially restrictions on trade and the conditional provision of foreign assistance, have been used as an enforcement option in support of foreign policy goals (Hudec, 1993). Essentially, all detailed studies of economic sanctions have focused on their use where important matters of national interest are at stake, and their effectiveness is hotly disputed (Hufbauer et al., 1990). It is difficult to mobilize the necessary domestic and international support when one State seeks to impose sanctions on another. Consequently, while some States may enforce international law under some conditions, it seems unlikely that the unilateral use of sanctions would serve the purposes of the detailed and regular enforcement that is needed to sustain a trading system under the Protocol. Another tool is foreign assistance, but it is unlikely that foreign assistance could be used in a neutral manner to support international policy goals - rather than narrower national interests on such a regular basis that it would form a significant and legitimate international enforcement mechanism for a trading market. Also, as with any instrument of unilateral enforcement, relying on major powers for enforcement forecloses enforcement actions against those powers, resulting in effective coercion and enforcement of weak States but not the strong. It is risky to draw lessons from instances of effective unilateral enforcement that would be unlikely to apply to the even-handed maintenance of a regime for large and small States alike.

In sum, the international system is marked by a reluctance to enforce treaties and by inflexibility within treaties and international institutions to take swift and regularized enforcement actions. Few examples of regular enforcement procedures have been built into international agreements, and international institutions that perform enforcement functions are limited in their power.

Since much of international law presumes that enforcement will be based upon public opinion and normative pressure to comply, transparency is important because it makes violations apparent, and the fear of detection promotes compliance. Existing transparency systems rely heavily on self-reporting, although they do allow some room for the independent reporting of information. Non-governmental organizations, in cases where they are regularly and actively involved, have gained credibility and played a role in identifying violations (as the International Union for Conservation of Nature and Natural Resources did in relation to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, or as various industry associations did in relation to the International Whaling Convention), and secretariats can help, but the ultimate authority lies with the Parties to a particular agreement.

International enforcement actions are rare because the imposition of sanctions usually requires consensus within the decision-making bodies of the treaty, and access to those bodies is open, leading to many potential vetoes; deviation from consensus is possible but difficult and may require actions outside the mandate of the treaty. Unilateral enforcement may be used, but the Parties to any treaty would be reluctant to rely formally on enforcement that is subject to the interests of one of its members and not to its collective interests.

B. Compliance mechanisms and tools

1. The role of eligibility thresholds in compliance

Strict eligibility requirements are an important element of a compliance system. Our approach assumes that trading is a privilege, not a right. Initially, trading would only be authorized for those eligible Parties whose domestic monitoring and enforcement systems have met certain minimum quality criteria (Zhang and Nentjes, 1998). In this way, Parties that are unlikely to have the infrastructure (or the will) to enforce the domestic policies and measures taken to live within the assigned amounts would not be able to participate in trading until such time as they brought their domestic monitoring and enforcement systems up to the thresholds required for trading (Center for Clean Air Policy, 1998a).

Under this system, the more stringent the criteria, the greater the assurance that traded tons represent real reductions. From the environmental perspective, the more stringent criteria are preferred; however, they would lead to reduced participation in the trading market. As discussed further below, these measures should also be subject to continued refinement by the international authority as their effectiveness becomes clearer.

2. Transparency as a compliance tool

Much of internal law presumes that enforcement will be based upon public opinion and normative pressures to comply. To make these effective, transparency is important because it makes violations apparent, and the fear of detection promotes compliance.

Transparency systems require the disclosure of basic information regarding obligations, actual emissions and trading activity, in order to allow judgements to be made about compliance status. To date, existing transparency systems have relied heavily on self-reported data. Such data need to be collected and verified at the international level.

Access to this information could either be publicly provided or restricted to the use of the secretariat or the Parties to the Framework Convention. Experience in several countries with domestic enforcement shows that making such data generally available to the public is the best transparency mechanism, and creates the strongest force for compliance. Such public disclosure would require that international public databases of self-reported and verified information should be made available; making data available would be an important function of the secretariat.

3. Supervision of domestic enforcement

Although domestic agencies could fulfil most public enforcement functions, international institutions are needed at least to provide assurance that the domestic system is operating properly. The primary public enforcement functions must be conducted by domestic agencies, who have much more local information, better access and higher budgets than international agencies.

Domestic settings will vary enormously, as will cultures and characteristics of domestic enforcement. It would be politically and economically sensible not to force harmonized enforcement through a single international system, but rather to vest as much authority as possible in domestic institutions, especially those which already exist. All that is required at the international level is the assurance that, despite national differences, internationally traded offsets and entitlements are secure.

As with monitoring, this could be based primarily on self-reported assessments of effectiveness with veracity checks to assure the integrity of the system. Veracity checks and international adjustments should be performed through agreed procedures. Without these checks operating on a regular basis with established guidelines on how Parties must address failed checks, fears of incomplete domestic enforcement may destabilize the market.

4. Requiring insurance as an additional compliance tool

In addition to other compliance tools, the Parties could require that insurance be obtained for traded tons of emissions reductions. In this context insurance could take the form of extra allowances held for the premium payer to be claimed in the event that traded tons fail to be verified as complying with the agreement. A private mechanism would be used to provide insurance against possible excess emissions by the selling Party.

On the other hand, it may be expected that the buyers or sellers of allowances - especially private entities - would obtain insurance anyway, as a hedge against financial risk, thus obviating the need for any formal requirement. Overall, the best strategy to promote private compliance through insurance or other means may be to establish a credible international enforcement regime, thereby encouraging actions to ensure compliance.

C. International enforcement and sanctions

This section discusses actions that may be initiated when a Party is in non-compliance, specifically when it emits more tons of greenhouse gases than its authorized amount. Enforcement is the most noticeable gulf between theorists and international lawyers. The theorists argue that tough problems relating to collective action can be solved only if States submit to tough enforcement. Many international law scholars, on the other hand, argue that the need for such enforcement is overstated, and that compliance can be, and often is, high despite the absence of tough enforcement measures. Lawyers tend to stress compliance motivations that occur informally, such as shame and loss of reputation from negative publicity.

While monitoring provides the base of information upon which suspicions of non-compliance can be lodged, enforcement is the process of moving from suspicions to penalties. The life cycle of an enforcement episode consists of several stages: (1) suspicion and flag-raising; (2) investigation; (3) clarification and judgement; and (4) the penalty. As the process progresses, ultimate sanctions become clearer and the Parties frequently settle. In addition, transparency mechanisms in the early stages of the process may already have led to adverse publicity and consequences, which may lead to compliance without the need to use ultimate penalties.

1. Restoring the tons of excess emissions

To fulfil the environmental objectives of a compliance regime, a non-complying Party must establish a credible system for replacing any ton of excess emission. This ensures that the total cap on greenhouse gases imposed by the Protocol is not exceeded.

The most common way this has been done in past trading programmes 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 creates an «airtight» system in which any ton of excess emissions caused by failing to meet the standard or through trading is recaptured and the environment is made whole.

However, some problems arise in applying this system to greenhouse gas trading under the Kyoto Protocol. The first is the nature and length of the commitment period, which is a single five-year period. The long length of this period means that compliance is not determined until the end of the commitment period. Unlike existing trading programmes, the commitment period is not divided into several annual budget periods; such a division could serve to facilitate compliance and enforcement within the overarching commitment period. 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.

It is possible to consider ways of restoring tons during the commitment period. One method used in domestic programmes is to establish a "true-up" period at the end of a commitment period. This approach allows a Party some period of time, usually a matter of months, to come into compliance once it has tentatively been identified as being in non-compliance. Parties finding themselves in non-compliance can purchase available tons of allowances during this period. A Party that is able to come into compliance during the true-up period is deemed to have complied with the agreement and therefore not subject to the eligibility threshold or other sanctions which follow from non-compliance.

The need to develop a method to restore tons exists regardless of whether liability is imposed on sellers or buyers in the trading system, as discussed below. Regardless of which system is used, excess tons of emissions generated must be restored, either by the buyer or seller.

The Parties should consider for future protocols the desirability of dividing a commitment period into discrete budget periods, such as a one - or two-year period, in order to facilitate transparency, trading and, particularly, compliance.

2. Withdrawing the eligibility to trade as a sanction

Effective enforcement must balance the need to respect sovereignty with the need to promote compliance. This inevitably involves invoking a series of rewards for good behaviour

and sanctions for bad. One mechanism that appears to hold considerable promise in this regard involves using eligibility to trade as an enforcement mechanism.

The presumption that underlies this approach assumes that trading is a privilege, not a right, and should be reserved for those Parties that exhibit the requisite characteristics. Defining those characteristics then becomes the key to applying this approach.

Eligibility requirements can be useful in promoting both initial compliance and continuing compliance. Parties that did not comply with reporting or other requirements could be suspended from trading within the initial compliance period. Once subsequent commitment periods began to take effect it would also be possible to impose an additional requirement that only Parties that were in compliance in the previous commitment period would be eligible to trade. This particular approach, which could be used in addition to or instead of the approach described in the previous section, would be particularly easy to implement because it would be relatively straightforward to determine non-compliance.

3. Additional penalties

Financial penalties. Most domestic trading programmes impose fines per ton of excess emissions. The fine is typically several times the expected economic value of the emissions, creating a strong compliance incentive. Although it has proved difficult to impose financial penalties on State Parties under international conventions, the Parties could decide to impose fines on themselves.

Retirement of additional tons as a penalty. Another enforcement tool, implemented in United States credit trading programmes, is to subtract an amount from the subsequent commitment period that is some multiple of the non-compliance overage. For example, if a Party misses compliance by 100 assigned amount units, its assigned amount for the next commitment period would then be lowered by more than 100 units as a penalty. The size of the penalty could be subject to negotiation at the initiation of the process, but would be uniformly applied to all non-compliers once it was decided.³¹ Assigned amounts covered by the penalty could be retired and therefore not used to legitimize excess emissions; they represent initially authorized emissions that would be no longer authorized (EDF, 1998).

4. Facilitating early compliance

³¹ To enhance this system, Parties could authorize reserving a proportion of the allowances to fund a non-compliance bank. Parties in non-compliance could then secure allowances from this bank to cover overages. The prices for allowances from this bank would presumably reflect a considerable mark-up, of, say, 50 per cent.

Easing the transition into full compliance can also facilitate compliance. Several schemes are now emerging for how this may be done without compromising the emission reduction targets. One scheme uses early compliance as one of the factors in determining how many allowances domestic sources would obtain in those countries that are likely to authorize private trading. Sources taking aggressive actions to reduce emissions early would, all other things being equal, end up with a larger share of the domestic allocation (Center for Clean Air Policy, 1998e).

Chapter IX

ACCOUNTABILITY AND RISK IN INTERNATIONAL EMISSIONS TRADING

Emissions trading, as illustrated in this report, 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 among different domestic companies have been addressed in the context of domestic systems such as those described above. Previous sections have considered how some of these lessons from previous domestic experience might be adapted to the issues raised by the measuring, monitoring and verification of greenhouse gas emissions, whilst certification may also draw upon existing experience.

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 incognita*. 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.

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.

A. Accountability: general issues

What remains to be determined, after the issues in previous sections are resolved, is the question of liability, in the event that a Party sells tons of emission reductions and then fails to comply by emitting more than its remaining assigned amount. Should the seller or buyer of the traded ton be liable, or both? As we shall see below, strict seller liability is preferable if a strong compliance and enforcement context can be created. If that does not prove possible, consideration should be given to adding buyer liability.

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 tradeability 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 programmes, 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 a greenhouse gas 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.³² 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 programme to ensure 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 towards the end of the commitment period if they perceive that tons they have obtained through trading may not be fully valid.

³² Article 4 bubbles also raise an accountability issue. In the case of a regional economic integration organization (REIO) bubble, such as the European Union 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 relation to 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.

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 meetings on emissions trading in the United Nations Conference on Trade and Development (UNCTAD) have emphasized that this may interfere with the development of financial markets for allowances, and discourage trading.

Buyer liability may have the effect of putting well-intentioned buyers in a position of non-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 whole, either by the buyer or seller, through one of the above-mentioned methods, such as by deducting it from the next commitment period.³³

Another way could be to use the process of evaluating Parties' efforts to implement the Protocol during the commitment period. This would include 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 would 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, a «vintage» model is probably better than the "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 non-compliance of the seller, sufficient transferred allowances are voided to cover the overage, starting with the allowances transferred last. Because serialization provides the market with information that is helpful in assessing the magnitude of

³³ A buyer-beware system that applies to all transactions uses a fairly blunt instrument to solve a specific problem. In the long run a better solution would be 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 non-compliance 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 does not provide any help in facilitating compliance during the first commitment period.

this risk, it minimizes disruption of the trading system if a seller is found to be out of compliance. 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 applies 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 is necessary for them. Thus they would be accountable to their Governments, which in turn assume the accountability of the aggregation of private entities' trades in the ways described above.

Governments can 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 ensures that emitted tons are always restored. Another method would be to require obligatory insurance of private sellers and buyers of emission reduction units to minimize the risk that Parties would not comply because of invalid trades by private entities. Programmes such as the United States Acid Rain Programme show how a domestic cap and trade system can be structured to be extremely effective while minimizing costs.

B. Accountability for article 12 allowances

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 certified emission reductions 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 greenhouse gas 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 the CDM 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 from host country Governments.

As discussed above, accountability of ERUs units created through national trading systems would be made easier if the latter meet certain minimum quality criteria, in particular with respect to monitoring and enforcement.

As with trading under other articles, an accountability issue arises. 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? Establishing an insurance or reserve allowance system operated by the CDM could allow liability to be imposed on the CDM or sellers. Alternatively, the buyer could also be made liable to provide greater motivation for compliance. However, as discussed above, adding buyer liability could be expected to raise the uncertainty of and discourage trading in CDM credits, reducing the value of CDM trading to developing countries as well.

C. Special accountability considerations for banked or borrowed allowances

Under the Protocol, Parties may bank allowances by emitting fewer greenhouse gases than their assigned amounts, thereby facilitating early emission reductions (article 3.13). No matter what degree of flexibility is allowed in banking or borrowing, Governments should not confiscate banked allowances even if the latest scientific evidence suggests that further emission reductions are necessary. A more acceptable approach would be to reduce the issue of new allowances proportionally from the year for which the stricter emissions cap applies.

Although banking is relatively uncontroversial, borrowing is much more controversial (see Matsuo, 1998; Mullins and Baron, 1997; Zhang and Nentjes, 1998). Opponents fear that borrowing makes it more difficult to check whether emission sources are in compliance with their emission limits. If borrowing is allowed, firms facing bankruptcy have an incentive to borrow without being able to meet their future commitments. Borrowing could conceivably even discourage trading among individual emission sources, thus reducing market liquidity or undermining the incentive to search for cleaner technologies.

In case the Conference of the Parties deems it desirable to allow some external borrowing, some safeguards could be added to the system. Such safeguards could include:

- * Limiting the borrowing privilege to those countries with assigned responsibilities under Annex B and limiting borrowing to those periods with assigned amounts;
- * Restricting borrowed allowances to own use, rather than sale to others;
- * Restricting borrowing to special circumstances, such as insufficient availability of allowances on the international market;
- * Postponing its adoption of a borrowing provision until assigned amounts are defined for multiple commitment periods;
- * Limiting borrowing to those Parties with assigned amounts over multiple commitment periods;

- * Limiting borrowing to the one commitment period subsequent to the one in which the allowances would be used: borrowing two or three commitment periods ahead would be disallowed.

D. The provision for emissions trading as a supplemental means

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 effect 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 European Union Council of Environmental Ministers in March 1998, the United Kingdom delegation circulated a "non-paper" at the meeting of the Subsidiary Body for Scientific and Technological Advice in Bonn, on behalf of the European Union, Bulgaria, Croatia, the Czech Republic, Latvia, Poland, Slovakia, Slovenia and Switzerland. The non-paper 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 percentage of the assigned amount. Either any quota could apply to the overall amount of reduction reached through any of the cooperative mechanisms or specific quotas could be set for each mechanism. One issue raised by this interpretation of the concrete ceiling is how to ration available credits when their availability exceeds the demand as constrained by a quota.

A first-come, first-served approach would encourage early reductions. This may advantage CDM projects, as CDM credits can accrue from 2000. This approach could be implemented by setting a "soft" quota that slowly discounts the carbon credits achieved beyond the initial quota. For example, a quota for CDM credits could range between 20 per cent and 30 per cent of the national emission budget. Under the first-come, first-served approach, projects declared first would be fully credited, giving an incentive for early reductions. After reaching 20 per cent of the total budget, the credits would be gradually discounted to a minimum of the initial value when the 30 per cent mark of the national emission budget is reached. Any credit beyond this line would still be accounted for at the minimum rate. Thus domestic reduction would be promoted while the global reduction would be enhanced.

Another possibility would be to allow banking of credits for the next commitment period after the quota is filled. These credits would get preference in filling the next quota. Projects of long duration would thus be penalized less.

However, defining supplementarity in terms of a constraint on emissions trading is not the only possible approach. It uses a blunt instrument to solve a problem that might be better handled with a more finely targeted instrument, and proposes a permanent solution for a transitional problem. Moreover, setting a ceiling on trading might make it even more difficult to set stringent emissions targets for the subsequent commitment periods beyond 2012. As discussed earlier, it is the lack of the post-2012 targets that makes some of the compliance mechanisms and tools hard to implement (or restricts the choice of compliance mechanisms and tools) and that creates some divergence of views on assigning liability.

Restricting trades would interfere with the operation of a private-sector trading market. If the Governments of Annex B countries elected to allocate the assigned amounts to individual sub-national legal entities and authorize them to trade on the international emissions allowances market, no country would know up-front what a percentage of its obligations would have been fulfilled via emissions trading. No legal entity would be guaranteed up-front whether its transactions fell below the national threshold.

This rule would raise transaction costs and inhibit trades, which would limit the effectiveness of emissions trading. Moreover, because the fundamental integrity of the Protocol relies on the accountability of a Party for ultimately matching its actual greenhouse gas emissions with its assigned amounts, this approach to compliance explicitly suggests that no one means of meeting the emissions commitments is superior to, or more valid than, any others, provided that actual reductions in greenhouse gas emissions occur (Environmental Defense Fund, 1998). In contrast, a quota would infer that an investment in domestic energy efficiency would be inherently superior to an identical investment in a different country.

Fortunately imposing quotas on trading is not necessary to respond to the moral concerns that motivated the placement of the supplemental norm in the Protocol in the first place. Rather the supplemental norm requirement in the Protocol could be handled by requiring Parties to demonstrate adequate domestic efforts to control emissions. Indicators could be developed to demonstrate compliance. Such indicators might include: changes in the average «price of carbon», levels of subsidies for carbon-intensive activities; road-pricing; norms and standards for energy efficiency; and funding for research and development promoting greenhouse gas emissions abatement. Unlike quantitative limits on international emissions trading, these indicators would refer to process rather than to outcomes. This approach would not jeopardize the benefits to be achieved from implementing a vigorous trading system.

Yet another approach to implementing the supplemental norm requirement would be to discourage (but not prohibit) the use of externally generated allowances by placing a fee on

allowance trades and using the revenue to promote the objectives of the climate change agreement.³⁴

Although imposing a transaction fee raises the cost of meeting emissions limits, it is much less trade-restrictive than imposing a percentage limitation on the use of emissions trading, because legal entities avoid the risk of being bumped over the national threshold. It alleviates to some extent the concern about hot-air trading, because legal entities in the advanced OECD countries face a higher transaction fee rate when engaging in trading with their counterparts in other Annex I countries. It also provides the incentive to search for cleaner technologies, particularly when the proceeds from such fees are used as buyer countries' research and development investments in climate-friendly technologies or to retire a portion of their allowed emissions allowances.

Finally, it should be pointed out that such a transaction fee differs from a carbon tax. A carbon tax is a mandatory tax for firms emitting carbon emissions. Therefore, it is expected that there will be great political difficulties in introducing such a tax in some countries. In contrast, a transaction fee leaves firms the freedom to determine how to meet their emissions limits. Firms that elect to meet their emissions limits only by taking domestic actions are under no obligation to pay such a fee.

E. Competitiveness and private trading

³⁴ The revenue from such a fee could be used in a variety of ways. It could be used to retire "hot air" allowances. It could also be nationally administrated and collected by buyer countries. Buyer countries could use the proceeds from such fees to strengthen their research, development and diffusion of low-cost climate-friendly technologies, to subsidize transfer of such technologies to non-Annex I countries, or to buy and retire a portion of their allowed emissions allowances from the market.

The allocation of allowances has the potential to bring Parties into conflict with WTO provisions, raising concerns about international competitiveness. Some fear, for example, that Governments could allocate their allowances in such a manner as to favour domestic firms against foreign rivals. Such action would violate the WTO principle of non-discrimination. The allocation of allowances could also be designed in such a manner as to advantage certain sectors over others and further enhance their existing imperfect market competition (Zhang, 1998). All this clearly indicates that the manner in which countries allocate their assigned amounts should be compatible with these basic WTO principles and should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade.³⁵

³⁵ See Zhang (1998) for a detailed discussion on greenhouse gas emissions trading and the world trading system.

Chapter X

CONCLUSIONS AND RECOMMENDATIONS

The Kyoto Protocol

The Kyoto Protocol authorizes four cooperative implementation mechanisms - bubbles, emissions trading, joint implementation and the CDM.

Emissions trading allows trading of assigned amounts among Annex B Parties. Authorized under article 17, this provision leaves the crafting of implementation details to subsequent conferences. Three distinct trading possibilities emerge from this authorization: trading among countries with domestic emissions trading systems, trading among countries without domestic trading systems, and trading among countries with and without domestic emission trading systems.

Some options could serve to provide flexibility in the negotiations over including developing countries in the Annex B list of countries. These include: allowing legally binding limits (for countries that wish to join the emissions trading system) to be based for early commitment periods on a growing, rather than a stable, baseline; bubbles involving regional groupings such as ASEAN and MERCOSUR could be allowed; developing countries could be allowed to introduce «partial caps» based, for example, on industrial sector limits, and coupled with joint implementation in the uncapped sectors, as a form of progressive restriction leading to imposition of a national cap involving all sectors; and developing countries could be allowed to choose different base years for each greenhouse gas they propose to bring under a sectoral or national cap.

Design principles

To comply with its obligations under the Kyoto Protocol, a Party's actual emissions of carbon dioxide equivalent tons during the commitment period must be no greater than the number of allowances it holds. The total number of allowances a Party would hold at any time would consist of: (1) the assigned amounts designated in Annex B (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 and forestry activities, as authorized by article 3.3), plus (2) allowances acquired from other Annex B Parties, plus (3) CERs acquired from non-Annex B countries under article 12, minus (4) any allowances transferred to other Annex B Parties.

Participation in article 17 trading would be voluntary. Any Party that has an assigned amount, as set out in Annex B of the Kyoto Protocol, could elect to trade under article 17. Countries that currently are not listed in Annex B can become eligible for article 17 trading by negotiating an acceptable assigned amount.

Governments could choose whether or not to allocate assigned amounts to sub-national entities, thereby facilitating private participation. If they chose to allocate assigned amounts to private entities, they could use a variety of possible allocation mechanisms. The decision to allocate the assigned amounts to private parties would be the first step in allowing trades between private sources as well as trades between Parties.

The emissions trading system should be designed to be as simple as possible. The historic evidence is very clear that simple emissions trading systems work much better than severely constrained ones. The transaction costs associated with implementing and administering an emissions trading system rise with the number of constraints imposed, and as transactions costs rise, the number of trades falls. As the number of trades falls, the cost savings achieved by the programme also decline.

Article 17 specifies that emissions trading shall be «supplemental to domestic actions». What is meant by that is a very important issue in the current international debate on emissions trading, and remains to be defined by the Conference of the Parties.

Following the decision of the European Union Council of Environmental Ministers in March 1998, the United Kingdom delegation circulated a "non-paper" at the meeting of the Subsidiary Body for Scientific and Technological Advice in Bonn on behalf of the European Union and some other countries, which called for, a concrete ceiling on the use of all the flexibility mechanisms. The form that such a concrete ceiling might take has yet to be elaborated. One interpretation of such a provision is that the amounts traded should be limited to a fixed percentage of the assigned amount. Any quota could apply to the overall amount of reduction reached through any of the cooperative mechanisms, or specific quotas could be set for each mechanism.

Defining "supplementarity" in terms of a constraint on emissions uses a blunt instrument to solve a problem that might be better handled with a more finely targeted instrument, and proposes a permanent solution for a transition problem. Restricting trades interferes with the operation of a private-sector trading market.

Because the fundamental integrity of the Kyoto Protocol relies on the accountability of a Party for ultimately matching its actual greenhouse gas emissions with its assigned amounts, this approach to compliance explicitly suggests that no one means of meeting the emissions commitments is superior to, or more valid than, any others, provided that actual reductions in greenhouse gas emissions occur. In contrast a quota would infer that an investment in domestic energy efficiency, for example, would be inherently superior to an identical investment in a different country.

The supplemental norm requirement in the Protocol could be handled by requiring Parties to demonstrate adequate domestic efforts to control emissions. Indicators could be developed to demonstrate compliance. Such indicators might include: changes in the average «price of carbon»; levels of subsidies for carbon-intensive activities; road-pricing; norms and standards for energy efficiency; and funding for research and development that promotes

greenhouse gas emissions abatement. Unlike quantitative limits on international emissions trading, these indicators would refer to process rather than to outcomes. This approach would not jeopardize the benefits to be achieved from implementing a vigorous trading system.

Lessons from previous trading programmes

Allowance trading programmes have proven superior to credit trading systems in terms of both economic and environmental results. In particular, the history of emissions trading in the United States shows the cap and trade approach under the Acid Rain Programme and RECLAIM has resulted in significant programme-wide cost reductions, while emissions credit trading has not been as successful. The reasons for this have to do with the fact that credit trades are not of a commodity nature, with their higher transaction costs, and with the regulatory barriers to their creation.

Since only credible systems succeed, deviations from simplicity should be introduced only when demonstrably necessary to promote the achievement of the climate change goals. Systems are not credible if they become a vehicle for evading, rather than complying with, international agreements. Hence, the administrative procedures must be adequate to ensure compliance with the climate change goals.

All existing emissions trading programmes involve trading between private entities. Allowing private entities to trade appears to be important if the efficiencies of trading are to be realized. The essential benefit of trading programmes is that they allow private firms the flexibility to determine technology choices and options themselves, and compare these to emissions permit prices to determine an overall least cost path of compliance. Allowing private entities to trade among themselves creates maximum flexibility. Since it is the actual sources of emissions that are in a position to implement energy-saving technologies and processes, allowing them to trade gives them the greatest opportunity to achieve these efficiencies.

The banking of allowances provides sources of emissions and Parties to the Convention significant additional flexibility in compliance-related investment and decision-making. There has been heavy use of banking in both the acid rain programme and the lead credit trading market in the United States, and it has led to early reductions and substantially lower overall costs of compliance. Banking is especially significant for industries in which major capital expenditures must be made, as it allows individual sources flexibility in the timing of such major investments. The Protocol to the Convention does allow banking in relation to expected future compliance periods, which may encourage further early reductions (article 3 (13)).

A provision that allows otherwise uncovered sources to opt to be covered under the regulatory system can increase the scope of a programme. While it is desirable to include as many sources as possible in a regulatory system, including all emitters of a pollutant may not be practical in an emissions cap and allowance trading system owing to uncertainties in measurement for some classes of sources. An opt-in process allows these sources to be included once the uncertainties are resolved to an acceptable degree.

Transaction costs play a key role in the success or failure of an emissions trading system.

In the past, only emissions trading programmes with low transaction costs have succeeded in substantially lowering the cost of compliance. Credit trading programmes create high transaction costs by requiring each credit generation or use to be separately approved by a regulatory authority. Cap and trade programmes, on the other hand, have generally low transaction costs and low risk.

The experience with existing programmes has been that the private market has supplied an adequate to high number of allowances or credits, so that market power issues have not been of concern. Several mechanisms can be and have been implemented in programmes to address concerns about market power and the potential hoarding of allowances.

Providing price information is important to reduce the uncertainty of trading and create public confidence in the trading programme. The disclosure of price information could be required under the reporting requirements for emissions trades, or through systems such as regular public auctions.

Some credit trading programmes impose a 10 per cent or other deduction on trades for air quality enhancement, or for other purposes such as to make grants available to new entrants. This may help create public support for a trading programme by creating public benefits if a firm takes advantage of trading to reduce its costs. On the other hand, imposing a percentage deduction on trades creates another barrier to the economic efficiency gained through trading. Arguably, the environmental benefits of clean air could be better established by fixing the overall cap, rather than by penalizing trades.

Monitoring and verification

The national reporting system of each Party to the Convention would have the dual responsibility of tracking both emissions and allowances. Each Party would be responsible for tracking emissions of all greenhouse gases in the format prescribed by the oversight agency established by the Conference of the Parties. In the case of a Party that has delegated trading authority to private sources, emission levels for those sources or sectors must be included as separate entries in these inventories. Each Party would also be responsible for reporting all allowance transfers and would have the responsibility for verifying ownership of any traded allowances. Both reports would 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. Generally these reports would be submitted on an annual basis, although more frequent reporting would be possible if the Conference of the Parties deemed it necessary.

An international authority would be expected to perform the following key monitoring and compliance functions: (1) initial approval of a country's monitoring system, which would allow it to participate in emissions trading; (2) receipt and review of the reports generated by countries, which would have to provide credible data on monitoring results and methods on an ongoing basis (once a country was accepted into the international trading system, the international agency would need the capacity to receive and review the national reports, including

those submitted under article 3 (13)); and (3) periodic inspections to ensure compliance and proper functioning.

Any discrepancies between authorized emissions and actual emissions can be corrected without penalty during a «true-up» period. During this period, participants with too many emissions in their account could sell or bank their surplus greenhouse gas units and those with too few could buy. A verified emissions account would then be issued for the period. Based on the emissions accounting and verification process, sanctions could be imposed for non-compliance.

The monitoring systems for both allowances and emissions would have to rely heavily on self-reporting. Polluters have the most information about their activities and thus can provide it as part of a monitoring system at a cost much lower than the cost of using independent monitoring systems. Virtually every domestic and international enforcement system is based on self-reporting, since other modes are not economically or politically viable.

The first line of monitoring authority will occur at the level of the Parties to the Convention. The first level of reporting and coordinating allowance transfers with emissions would be the national level. National monitoring is not only a physical necessity; it is probably also the most effective system.

The ultimate authority for aggregating, standardizing, and interpreting reports from the Parties must remain with an authorized subsidiary body of the Conference of Parties. All reports must be harmonized both in terms of reporting format and in terms of collection protocols to assure comparability and reliability.

Creating layers of veracity checks should strengthen the integrity of the allowance and emissions monitoring systems. Systems of self-reporting do offer many opportunities for deception, although some analysts may overstate the extent to which deliberately deceptive self-reporting occurs. Nonetheless, there are risks of deception, and assuring the integrity of the permit system will require assuring the integrity of self-reporting. At the initial stages of the permit system, veracity checks of government self-reporting would be needed, but as the system matured more extensive checks at the domestic level would be needed. National Governments could provide many (or most) of the domestic checks, provided that those checks were themselves reviewed occasionally at the international level. It remains to be seen how intrusive the international monitoring system for greenhouse gases will be.

Environmental non-governmental organizations can exercise general oversight over the compliance process and may even play a role in the monitoring of individual sources. The capacity of such organizations and their access to publicly available information are important determinants of how effective this component will prove to be.

Transparency should be promoted by making collected data widely available. The integrity of the system can be more readily assured 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 a rich database. Further, a monitoring system will produce a good deal of data that could be useful in other settings, such as scientific research. There will be reluctance to reveal some information for reasons of privacy and industrial secrecy, but the free flow of information should be the norm.

Transparency could also be promoted by forcing some or all transferred allowances to be sold at auction. In addition to promoting good international information on allowance prices, this technique would diminish opportunities for strategic manipulation of the market.

When countries have baselines (as all Annex B Parties now do), the sale of an allowance automatically reduces the number of allowances remaining to cover emissions during the commitment period. This would be true both for assigned allowances and for created emissions reduction credits used to fulfil the article 3 obligation. For this category of trade, as long as every trade results in equal and offsetting changes in the two Parties' allowances, certification is not required because the need to balance emissions with allowances during the commitment period provides a check to assure that the trade will not increase emissions.

One model for tracking trading activity is provided by the Allowance Tracking System used in the Acid Rain Programme in the United States. This allowance registry system is open to the public and helps to create a transparent and self-enforcing compliance system, and has contributed to high compliance records in the programmes.

One of the most difficult verification issues for credit trading is that of additionality. In the absence of a permitting system, an additionality demonstration requires a forecast of future economic events and probabilities. Under the pilot programme for activities implemented jointly, this verification process has led to the rejection of many proposed trades, and can take one to two years, creating high transaction costs and uncertainty. Another important issue in discrete credit trading systems has been enforceability, which requires the development of a detailed liability system, (see below).

Certification

Since emission reductions used to generate credits under article 12 require considerably more scrutiny, the certification function is necessary to assure that only certified emission reductions would become part of the allowance trading system. Certified allowances would be treated as in the same way as all other allowances. The certification process is one practical way to help ensure that the trading system runs smoothly and it furthers the goals of the Convention.

While the ultimate authority for certification would be the Conference of the Parties, the operational authority for certification could, and should, be delegated to subordinate bodies specifically designed to fulfil that function. While the Conference of the Parties would be well suited for defining the parameters of the certification process and exercising general oversight in that process, it would be ill-suited for dealing with the day-to-day operations of certification.

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 that certain preconditions were met. These preconditions would include: (1) an identified organizational unit willing and able to assume the responsibility for certification, (2) the existence of sufficient enabling legislation to ensure the unit had adequate powers to carry out its mission, as well as adequate staff and resources, and (3) acceptance of, and willingness to apply, the standard certification criteria.

Certification and monitoring processes should be initiated promptly. Although the commitment period is still a few years away, it will be important to work the bugs out of the system before it is put to the test. Furthermore, even non-Annex B countries that contemplate establishing private tradeable entitlements systems will need guidelines on the appropriate processes of certification and monitoring. If these are provided early then the chances of achieving harmonized procedures in the future will be higher. Viable and legitimate systems created today, even if they are small, will become the de facto standard, and the early creation of such systems will highlight the changes needed in domestic institutions and procedures, allowing more time to make the necessary reforms.

Monitoring procedures and institutions should be designed with future expansion in mind. Although the trading system may formally be at an early stage, monitoring systems for later stages need not wait. These systems will inevitably need to expand to accommodate different gases, different Parties and different commitment periods.

While certification is sufficient for transfer of a credit, use of a credit to fulfil part of an assigned amount obligation would require verification. Whereas certification would provide assurance that a defined 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 entail making sure that the planned forest was in existence and was absorbing carbon at the expected rate, while an energy efficiency project would verify that emissions actually mirrored the emissions expected on the basis of the design criteria.

Compliance and enforcement

The challenge for emissions trading is that as allowance prices increase, incentives to defect will be strong, but the problem is not catastrophic. Based on extending current examples from international and domestic settings, the following design principles can frame an economically and politically viable enforcement system; many are in the same spirit as the design principles for monitoring systems.

Rely heavily on domestic enforcement, especially by existing institutions. A wide variety of domestic enforcement systems should be expected because there are many histories and cultures, and enforcement instruments will vary with these. The international system must accommodate this, and in practice that must be done by allowing the major enforcement activities to occur at the domestic level through familiar institutions.

Politically, it may also be important to keep institutional costs off budget, especially at the international level, because political systems appear extremely sensitive to highly transparent budgeted costs. Economically, this is a dangerous strategy, and whatever choices are made about enforcement institutions should be supported by independent economic analysis that shows the costs are consistent with the benefits.

Set international standards for domestic enforcement. Although diversity must be expected, some international standards will be needed. At a minimum, agreed acceptable levels of non-compliance will be essential to ensuring that property rights are more or less stable across different markets. Failure to do so would result in loss of confidence in the value of internationally traded permits and substantial thinning of the market. These standards will have significant political and economic implications, and the broad features of the standards must be negotiated rather than set by technical experts.

Perform veracity checks and international adjustments through agreed procedures. As with monitoring, compliance with international standards for domestic enforcement will fundamentally be assessed by self-reporting, but those reports must be subject to layers of veracity checks. Without this capacity operating on a regular basis with established guidelines for how Parties must address failed checks, the market may destabilize on fears of incomplete domestic enforcement.

Ensure proper operation of dispute resolution procedures. Disputes could be prone to escalation because enforcement may affect allowance prices, in turn affecting the costs of production (notably energy costs) and international competitiveness. Thus disputes, even over seemingly technical issues, could destabilize into divisive debates over economic competition and welfare. Agreed procedures could help chart the way and keep disputes productively focused on the issues at hand. We recommend the early adoption of dispute resolution institutions and procedures.

Push early adoption of institutions and procedures. The system will evolve if leading countries take the initiative and show the way. The international system of organizations and diplomacy is not well suited to forging the path, but it can help by working with leaders to establish institutions and procedures before they are needed. (OECD does this frequently, and as a result OECD helps to set the agenda and pace for collective action on issues such as harmonization of chemical standards and trade in hazardous waste.) An endless supply of important details must be addressed, and early experience can help ensure that bad choices do not undermine later, broader markets once they are under way.

However, leadership may require the assumption of some (perhaps substantial) risk. This is not unprecedented in the international arena; for example, some countries decide to bear the risks of stable exchange rates by creating target systems supported by central banks, sometimes at enormous cost.

Transparency. The most important function of penalties is to act as a deterrent. Transparency is crucial to ensure that non-compliance will be detected and that detection will

lead to penalties. For reputable actors, a transparent system may be all that (or most of what) is needed, because the fear of losing reputation will be such a strong deterrent. Especially for private enforcement, which is probably very sensitive to incentives, a comprehensive and accessible base of information would be very helpful.

Assigned amount adjustments in subsequent commitment periods provide a reasonable means of protecting the goals of the Convention while encouraging compliance. Under this approach, an approach that has been applied in the United States sulphur allowance programme, non-compliance by a Party results in an amount being subtracted from that Party's previously determined assigned amount in the subsequent commitment period. The magnitude of the subtraction is greater than the amount of non-compliance. For example, if a Party missed compliance by 100 assigned amount units, its previously calculated assigned amount for the next commitment period would be lowered by 100 (1+ x) assigned units, where x is the non-compliance penalty.

The value of x could be subject to negotiation at the initiation of the process, but would be uniformly applied to all non-compliers once it was decided. It represents not only a penalty to the non-complying source, but also a source of additional emission reductions. Assigned amounts covered by the penalty are retired and therefore not used to legitimize emissions; they represent previously authorized emissions that are no longer authorized.

Allowing trading only among eligible Parties and defining «eligibility» to include only those countries that have approved domestic enforcement systems and are in compliance in the previous commitment period can promote compliance. The approach recognizes that it is easier to deal with circumstances that appear to promote non-compliance before they occur rather than after.

Currently the Kyoto Protocol has a process for setting 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 with the first commitment period. The compliance regime that has been suggested in this report assumes, and relies heavily upon, multiple commitment periods. Declaring non-compliant Parties ineligible for trading and reducing assigned amounts in subsequent commitment periods only works if subsequent commitment periods are in place. We believe the process of defining assigned amounts for subsequent commitment periods should have more priority than it appears to have currently.

Accountability

A regime that promotes universal compliance is the best means of promoting accountability. Therefore the first step in building accountability is to construct a widely accepted agreement with a reliable enforcement process.

Article 17 appears to impose a seller liability system because article 3 refers to transfers of allowable emissions from one Party to another without anything suggesting that transfers

would be invalidated if the seller is out of compliance. Therefore it seems clear that seller liability is already in place.

In general, the principle of «seller beware» makes sense in a strong enforcement environment because 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. In existing allowance programmes, the normal compliance procedure is to subtract the deficiency from the assigned amount in the next commitment period and to add a penalty.

In the Kyoto Protocol, a seller-beware policy may not always work for Annex B sellers because commitment periods are very long and, as of now, no additional commitment periods have been defined. This may create a need for some form of a buyer-beware programme where acquired allowances that are tainted could not be used to satisfy the assigned amount requirements.

If the decision is made that a buyer-beware programme is needed to complement traditional compliance procedures, a vintage model would probably be better than the proportionate reduction model. Under the vintage model, allowances are serialized from the time of transfer - earlier transfers involve lower numbers. In the case of non-compliance of the seller, sufficient transferred allowances are voided to cover the overage, starting with the allowances transferred last. This provides a means for the market to assess the degree of risk associated with acquired allowances and to discount prices accordingly.

Another way could be to use the process of evaluating Parties' efforts to implement the Protocol 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 do not exceed by a certain margin its annualized assigned amounts, the seller's tons will be valid. However, after a year when the seller is found to go beyond that tolerance margin, 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.

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