International tradable carbon permits as a strong form of joint implementation

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1 INTRODUCTION

The concept of international tradable carbon permits has been discussed in scientific circles for over ten years. Since mid 1996, however, it has become a subject of more than just academic interest. The main reason for this change is to be found in the US Draft Protocol to the Framework Convention on Climate Change (FCCC), submitted by the US government on January 17, 1997. The US contribution to preparations for the third Conference of the Parties (COP3) to the FCCC, held in Kyoto in December 1997, represents the first concrete official proposal for an international emissions trading scheme. The European Union (EU) proposal for internal community burden sharing is also in line with the broad definition of emissions trading, although the individual country quotas are currently not transferable. These proposals clearly indicate that international trade in carbon dioxide (CO_2) emissions has turned into a politically relevant subject.[2]

In this article we use the term 'strong form' deliberately to distinguish a tradable carbon permit (TCP) scheme from a weak form of project level joint implementation. We focus on discussing the following three aspects: (1) basic requirements for a TCP scheme; (2) a blueprint for designing national TCP schemes; and (3) constituting elements of an international TCP scheme. By discussing these aspects, the chapter indicates what a TCP scheme could look like and how it relates to joint implementation.

2 BASIC REQUIREMENTS FOR A TCP SCHEME

Greenhouse gases are uniformly mixed pollutants, i.e. one tonne of a greenhouse gas emitted anywhere on earth has the same effect as one tonne emitted somewhere else. This means that it does not matter where reductions in greenhouse gas emissions take place; what is important is whether we are able to reduce the emissions effectively on a global scale. This provides the environmental rationale for TCP. Moreover, a TCP scheme is both economically efficient and environmentally effective, whereas other instruments are either not as effective (e.g. a carbon tax) or not as efficient (e.g. emission standards). Thus, an international TCP scheme is considered by many to be the most promising way to control CO_2 emissions (IPCC, 1996; UNCTAD, 1995). Then, what are the basic requirements for setting up a successful international TCP scheme?

First, there should be an international agreement or a protocol to the FCCC in which legally binding emission targets and timetables have been set. Countries that would wish to participate in an international TCP scheme should be committed to the binding

obligations. This means that prospective participating countries are at least signatories to the FCCC. At the time of writing, a negotiating process towards such a protocol, in accordance with the Berlin Mandate adopted at the first Conference of the Parties to the FCCC in Berlin in April 1995, is well under way. It is likely that a protocol will be adopted at COP3 and that the new protocol will set emission targets and timetables (Dudek and Goffman, 1997; Matsuo, 1997; Mullins and Baron, 1997). The negotiated emission targets would then serve as a basis for determining the emission limits for individual countries in an international TCP scheme. Even though non-Annex I Parties to the FCCC (i.e. the developing countries) already have general commitments under the FCCC it is unlikely that the new protocol will commit these Parties to any specific emission targets. Given that binding emission limits are a necessary prerequisite for setting up a TCP scheme (Dudek and Goffman, 1997; Mullins and Baron, 1997), an international TCP scheme would be unlikely, at least initially, to include the developing countries.

Second, in this scheme emissions are transferred between sources in the countries involved. This condition should ensure that the scheme operates between entities that have the information and the incentives to secure the opportunities for lowering their costs of reducing carbon emissions by buying and selling carbon permits. In this respect the scheme should operate in a way that does not differ from international trades in any other commodity. This view of international carbon trade differs from some competing proposals which view the transfer of carbon quotas as the domain of governments negotiating with each other, where governments have to distribute their additional emissions or emission reductions among their national sources (legal entities). We think that allowing trading among individual emission sources could significantly improve cost-effectiveness because it would provide sources with strong incentives to exploit cost-effective abatement opportunities. 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 governmental trading if one country or bloc holds a significant proportion of the total number of permits. Another major consideration is that national governments possess only global and imprecise information about CO_2 emission reduction options and their marginal cost. They can therefore make errors in their decisions of how many permits to buy or sell. Individual sources which have information on their technical options and costs can choose their efficient emission level by comparing marginal costs and the international permit price. Moreover, inter-source trading may lead to lower transaction costs than inter-governmental trading (Mullins and Baron, 1997). Finally, there is some suspicion that governments could loose their stance on domestic actions when facing political pressure to expand or contract purchases of permits abroad, just as there is pressure on central banks to set higher or lower interest rates (Palmisano, 1997).

However, we have to bear in mind that to make inter-source trading operational is not a simple matter. It can only be effective when complemented by stringent monitoring and vigorous enforcement by countries participating in the scheme. This brings up the issue of consistency in an international TCP scheme. It demands that the countries participating in the scheme have to first establish their national TCP schemes. Moreover, these national schemes should be compatible with each other.

The question arising from the requirement that an international TCP scheme should bring together countries with national TCP schemes is which preconditions should be fulfilled before a country could even consider to begin such a national scheme. We

think that a basic requirement is that national environmental policy should have evolved to a stage of institutional maturity which ensures that the following conditions are satisfied.

First, governments should preferably have experiences with formulating national emission targets and timetables; not only as a paper exercise but as a binding emission obligation that has to be taken seriously and has to be translated into policies and measures to implement it.

Second, there should exist a reliable national registry of individual emission sources that could participate in a TCP scheme. Without such an inventory of sources and their present emission levels it would be impossible to design a scheme for permit allocation by means of grandfathering. Moreover, since countries (not sources) sign international agreements and it is the responsibility of governments to ensure that their countries are in compliance with the national emission limits, inter-source trading would have to be accounted for at the national level. This also underlines the need for such an inventory.

Third, there should be in place some system of monitoring emissions, either directly or indirectly. This is to ensure, among other purposes, that the emission permits sold by any source would represent real emission reductions from the allowed emissions levels. This, combined with the above requirement for accurate emission inventories, would provide certainty about the validity of permits traded, thus increasing confidence in the scheme and incentives for inter-source trading.

Fourth, there should be a tradition of effective enforcement; that is detection of non-compliance and application of sanctions. Although enforcement is necessary for effective application of other instruments as well (e.g. charges and regulations), this requirement is of particular importance to TCP because under a TCP scheme firms which operate in a country without adequate enforcement can emit without handing over their permits. Consequently, they can sell their permits to firms in other countries, thus leading to increased emissions in those countries. By contrast, when charges or regulations are used, firms which defraud cannot sell permits to sources in other countries. Clearly, if enforcement was inadequate, it would be easy for a firm to sell permits or refrain from buying permits without taking adequate measures to reduce emissions. Consequently, a TCP scheme would lead to higher overall pollution levels compared with instruments like charges or regulations. Besides, enforcement at the international level often proves to be more difficult and less likely to be effective than at the national level because of the absence of an institution with the international jurisdiction to enforce policy. This further underlines the importance of national legal mechanisms for enforcement.

From the preceding discussion, it follows that a domestic TCP is bound to be a failure if the infrastructure defined by the four conditions does not exist. So where do countries now stand in this regard? For example, we notice that in the Netherlands, a country with a highly regarded environmental policy, the last four preconditions were not fulfilled 20 years ago; perhaps even not 10 years ago. A number of countries in the EU where environmental policy is less advanced do not meet the conditions at this very moment. The same holds for those countries with economies in transition, which are also listed in Annex I to the FCCC. They are still not ready yet for establishing national TCP schemes. This raises the question of whether the EU can participate as a whole in an international TCP scheme requiring high standards of compliance, a proposal put forward by the EU Council of Environment Ministers at their meeting in March 1997. Nevertheless this indicates that not all Annex I countries, and possibly not even all

Annex II (OECD) countries, would qualify for engaging in emissions trading according to the above-specified conditions. This suggests that a TCP scheme might initially begin with only a handful of OECD countries, although this does not preclude its subsequent expansion to include other qualified countries. The narrow scope of participation would imply a smaller scope for efficiency gains than could be expected from wide participation beyond the OECD, but these are nevertheless larger than without emissions trading (IPCC, 1996; Richels *et al*., 1996). A major advantage of starting small and under optimal conditions is that such a 'demonstration project' would reduce uncertainties and accordingly increase confidence in the permit market. Moreover, since initial participating countries are all parties to the GATT/WTO, it might even be possible that enforcing an international TCP scheme can go beyond persuasion and adverse publicity by means of using trade measures, provided these do not violate the GATT/WTO rules. Besides, so far there has been limited international experience with tradable permits. While tradable permits have enjoyed some considerable success in various domestic contexts, this by no means guarantees their success in an international context (Tietenberg and Victor, 1994). Thus, such a scheme should initially be validated through more experience on a small rather than a large scale. In this regard, the initial experiment of implementing an international TCP scheme within a limited number of countries would serve the very important purpose of ensuring a smooth evolution of an international TCP scheme and providing opportunities for the various supporting administrative institutions to 'learn by doing' and for all potential participants to learn more about how such a scheme works (Tietenberg and Victor, 1994; Zhang, 1997). Thus, the phasing process is deemed necessary and can be an advantage rather than a disadvantage (Tietenberg, 1995; UNCTAD, 1995).

3 BLUEPRINT FOR DESIGNING A NATIONAL TCP SCHEME

Since a national TCP programme is the basis and precondition for a successful international TCP scheme we start by discussing the constituting elements of a national scheme. Attention is paid to: (1) the definition of the permits; (2) the issue of permits; (3) the initial distribution of the permits; (4) the permit market; (5) compliance with the scheme; and (6) its administrative cost.

3.1 Definition of the permits

For the time being, fuel saving and inter-fuel substitution are the major economically feasible options for reducing CO_2 emissions. For that reason and also for reasons of administrative efficiency and enforcement it makes sense to implement a policy of restricting CO_2 emissions by means of tradable permits for the carbon contained in fuels. The allowed national levels of carbon emissions can be based on the internationally agreed CO_2 emission targets and timetables. On this basis, a given number of tradable carbon permits are issued. A carbon permit is equivalent to a tonne of carbon; one carbon permit allowing the use of a quantity of fossil fuels which contains a tonne of carbon.

Within the jurisdiction where the carbon permit scheme applies, the permits are not limited in any way with regard to the period or place where they can be used. Restriction of place makes no sense because CO_2 is a uniformly mixed pollutant: its impact on climate is independent of the place where it is released. Restriction of time

would be unnecessary since the greenhouse effect is caused by the accumulation of CO_2 and other greenhouse gases. Therefore, permit holders could be allowed to bank their unused permits to offset future emissions or to sell them to others. If property rights to permits are well defined, banking would encourage permit holders to go further with reducing emissions than their required emission limit in early years if it were more cost-effective for them to do so. Governments should not confiscate banked permits 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 permits proportionally from the year for which the stricter emissions cap applies. This suggests that a TCP scheme would have to be designed from the outset to be flexible enough to facilitate any changes that might be required in the overall emission limit.

3.2 Issue of the permits

The number of permits that can be issued annually is determined by the national emission targets. Each year a new vintage of permits can be made available. The carbon permits can be used from the year in which they are issued onwards. Put another way, the carbon permits are issued as an emissions budget that would allow permit holders to meet their target on average over a period of, for example, 3 to 10 years.

Since fossil fuels are an essential resource for the economy, a steady supply at a reasonable stable or steadily changing price is a necessary condition for economic stability. To avoid bottlenecks caused by a temporary lack of permits in the initial stage, the emission limit for the first stage should not be too strict, allowing permit holders to save or bank permits for later use. The US Acid Rain Program gives a good example of such an approach.

If a country starts with a strict limit on CO_2 emissions, bottlenecks could be prevented by allowing the borrowing of a limited amount of future permits 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 minimised while keeping to an overall emissions budget. Therefore, as with banking, borrowing is another way to increase flexibility and lower the cost of abating CO_2 emissions (Richels *et al*., 1996).

However, borrowing should be used with considerable caution because there are many problematic issues associated with it (Matsuo, 1997; Mullins and Baron, 1997). Borrowing would make 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 may tend to discourage trading among individual emission sources, thus reducing market liquidity. Borrowing may also undermine the incentive to search for cleaner technologies. To some extent, the delayed response will mean additional committed warming. All this suggests that safeguards should be developed to allow borrowing in such a way that it does not undermine the environmental objectives. Such safeguards may include:

- limiting the contribution of borrowing to meeting an emission target;
- restricting borrowed permits to own use, rather than sale to others;
- making the allowance of borrowing contingent on the stringency of overall emission limits (perhaps postponing its adoption until more stringent limits are agreed); and

- restricting how far into the future permits can be borrowed.

The last option depends on how often the Conference of the Parties to the FCCC is supposed to review the adequacy of commitments by the parties to the FCCC and on stability considerations. The former may favour shorter rather than longer budget periods; while the latter requires that emission targets and planned permit allocations should be formulated for long periods in order to reduce uncertainty for permit holders in planning their investment and fuel consumption. Clearly, a compromise needs to be reached between the desirability of allowing borrowing and its environmental effectiveness.

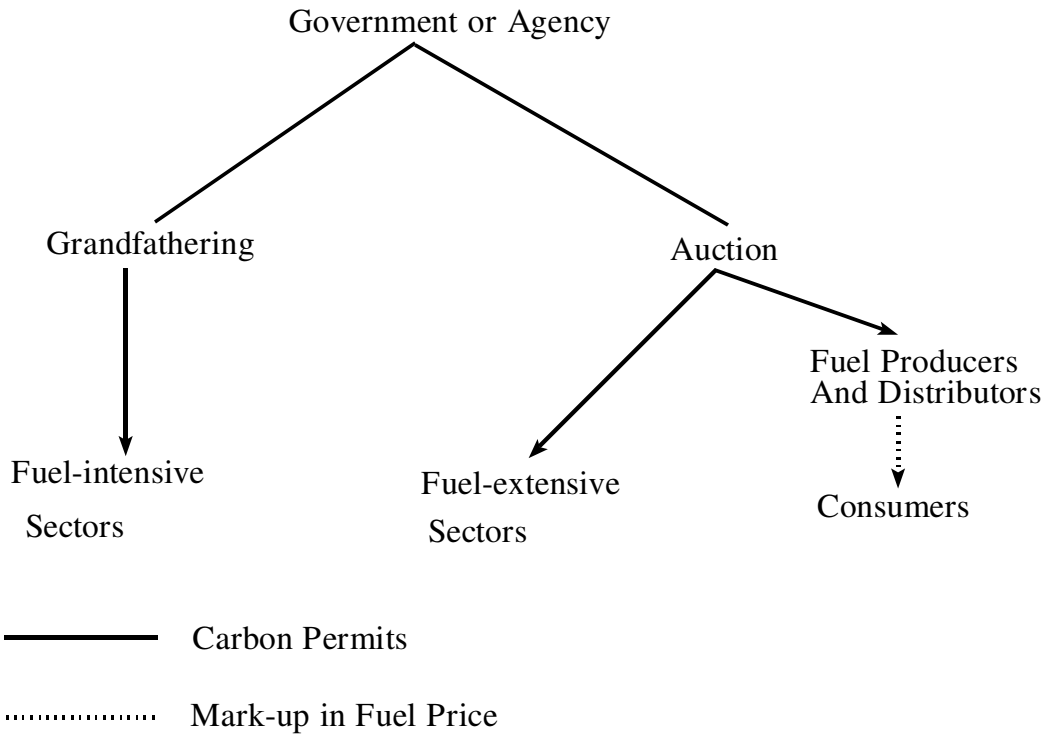
3.3 Distribution of permits

The initial distribution of permits among users can be organised as an auction (which implies that permits are sold to the buyers who make the highest bids), or permits could be distributed among fuel users for free, according to certain criteria. Auctioning of permits brings in revenue for the government, whereas grandfathering means distributing permits for free. As a basis the environmental authority can take the 'historical rights' of established polluters: existing sources receive an amount of permits which is a given fraction of their carbon consumption in a reference year.

With grandfathering, polluters can save considerable expenditures, since the individual source has to pay only for additional permits, if needed. Taken as a group, permit holders who receive permits for free will only have to make additional expenditure for reducing fuel use. Consequently, the political resistance of industry against the use of economic instruments to control CO_2 emissions can be overcome more easily with a system of tradable permits with grandfathering than with auctioned permits (Nentjes and Dijkstra, 1994). Moreover, a TCP scheme creates an asset of value to firms. So, even if a firm has to buy permits to now to cover all of its emissions, it still can acquire the value of those additional permits by selling them in the future if its actual emissions are lower than what it is allowed to emit. This in turn creates an incentive for firms to comply with their caps. This scheme is also more attractive to firms than carbon taxes, because the latter scheme extracts revenues from firms without offering any compensation, let alone the political difficulties of introducing such taxes in countries such as the US.

Figure 1 shows a system for distributing carbon permits, which is a compromise between enhancing the political feasibility of tradable permits and keeping the administrative cost of grandfathering in check. It can be seen that a portion of the permits are grandfathered to fuel-intensive industries, while the other permits are auctioned by the government or its agency. Some of the auctioned permits are sold directly to end users, in particular to industry, and the rest are auctioned to fuel distributors who act as a purchaser for the smallest end users, in including households and individual car owners.

Figure 1 Distribution of carbon permits



Generally speaking, oil refineries, the chemical industry, basic metals, electricity producers, and freight transport are considered as fuel-intensive sectors. These would fall under the grandfathering regime. The remaining industrial sectors, together with agriculture, households, services and (personal) transport can be taken as falling under the auctioning regime, either directly or indirectly (see below). The major argument for grandfathering permits is to exempt the fuel-intensive sectors from a considerable financial expenditure which would mobilise strong political opposition against a system of tradable permits. This is of particular importance in open economies where the fuel-intensive sectors have to compete on international product markets with those in countries that have made no hard commitments to reducing CO_2 emissions.

Grandfathering of tradable permits to small fuel users would entail high transaction cost, since it would be necessary to determine the carbon quota for each single user. Furthermore, experience in the Netherlands shows that it is easier to impose carbon taxes on small users like households and firms in fuel-extensive sectors than that in fuel-intensive, export-oriented sectors. For this reason we envision a scheme in which permits are auctioned, either directly to users with medium fuel use or to fuel distributors. If permits were awarded free to fuel distributors they would reap the rent of the higher fuel prices that would be necessary to reduce fuel use. This would not be accepted by other groups in society and therefore, in our view, it is not a politically feasible option. Under the auctioning regime, the distributors act on behalf of the groups with lowest fuel use, in particular households. For the Netherlands the most relevant examples are natural gas consumption of households and petrol and gasoline consumption of cars. Distributors sell fossil fuels to customers from these sectors, putting a mark-up on the fuel price which is equal to the price of the permits. With such a system small fuel users are exempted from the necessity (and transaction costs) of

buying permits. Yet the rise in fuel price will 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.

3.4 The permit market

In the system outlined above two markets can be discerned. First, there is the auction of a portion of the permits by the government or its agency to fuel users, mainly the firms and fuel distributors that do not receive their permits for free. This market can be called the primary market. Next to that a secondary market will develop where firms with a surplus of permits trade with fuel users who have a shortage of permits. Arbitrage will equalise permit prices between the two markets.

The auction of carbon permits could be designed largely to conform to the example of auctioning in the US Acid Rain Program.[3] The auction can be held once or twice a year. A fixed number of permits is offered, equivalent to carbon use for half a year or a full year. Potential buyers have to send in sealed orders, stating the number of permits they are willing to buy at a stated maximum price. The auctioneer then supplies permits beginning with the highest bidder until the excess supply is zero. All bidders pay the price of the marginal buyer. The revenue from the auction is available for government expenditure or for a general or specific cut in taxes.

The number of potential actors on the secondary market is large. In the Netherlands, for example, there are more than 45,000 sources in industry alone. In addition to these, energy suppliers, such as gas distribution companies and power generators, can be expected to trade. Transaction costs may be relatively large for small fuel users. As we have seen, they can arrange for their fuel supplier to provide the carbon permits, complementary to the fuel. The supplier will pass on the permit cost as a mark-up on the fuel price.

3.5 Monitoring and enforcement

Monitoring of carbon use can be grafted onto the existing monitoring systems for levying taxes on fossil oil. For every tonne of fossil fuel that energy users purchase from distributors, they have to transfer an equivalent number of carbon permits. Distributors in turn can only obtain fuels from their suppliers in exchange for carbon permits. This way all permits will end up in the hands of producers and importers of fuel, including the permits purchased by distributors to cover their fuel supply to consumers and other small users that do not buy permits.

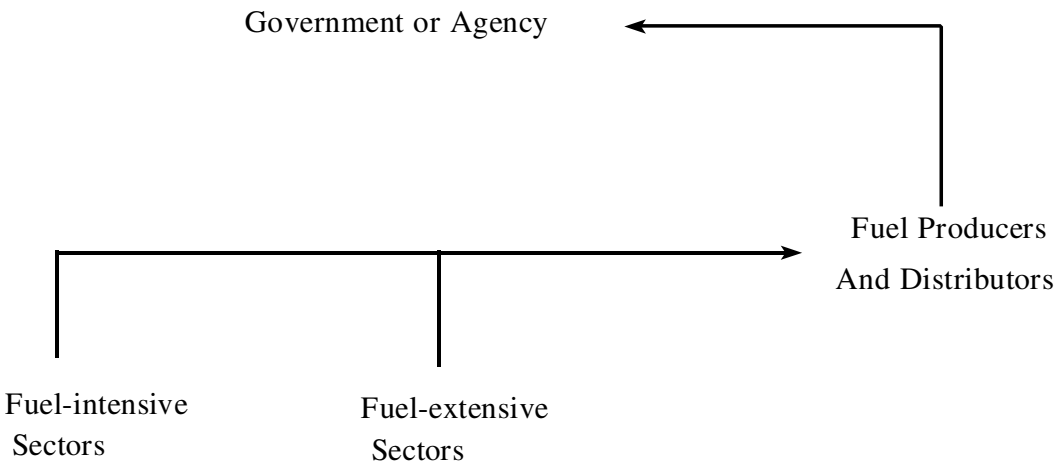
At the end of the year or the budget period, every fuel producer and importer has to report the type and quantity of fuels sold and the changes in fuel stocks. In addition, the fuel supplier has to show the enforcement agency that he has a sufficient number of permits on his account to cover the carbon equivalent of the fuel he has produced or imported. Following the example of the US Acid Rain Program, the firm can be granted a grace period (e.g. one month) to buy additional permits if necessary. If after this period for settling the account the firm does not comply with its cap, it has to pay a fine for each excess tonne of carbon. Such a fine for non compliance should be set high, say, five to ten times the average carbon permit price in the past year for the following reasons. The first is consideration of the international implications of a domestic TCP scheme. By selling their emissions on an international TCP market, non-complying

firms in one country would raise the overall supply of permits on the market and lower the value of the permits held by all the others, thus undermining the credibility of an international TCP scheme. Second, there are additional administrative costs in comparison with the US Acid Rain Program in which no reporting of domestic actions to any international organisation is required. As required by the FCCC, Annex I countries in meeting their commitments to limiting greenhouse gas emissions have to deliver their national communications to the FCCC for review, and their governments as the parties to the FCCC would be accountable if their national emission limits were above the allowed levels. This requires these governments to take enhanced monitoring and enforcement efforts to ensure national compliance regardless of whether a TCP scheme is adopted.

On the other hand, the fines should not be too severe, at least in the initial stage of a TCP scheme during which it is very important to reveal the marginal abatement costs among emission sources. Otherwise risk-averse firms would hold surplus permits rather than sell them in order to avoid the risk of non-compliance. This will reduce trades and thus limit market liquidity and efficiency. Thus, there is a clear trade-off between environmental effectiveness and cost-effectiveness in setting the level of fines. Whatever levels are set, fines from non-compliance can be added to a 'Green Fund' for strengthening the research, development and diffusion of climate friendly technologies, or further enhancing governments' monitoring and enforcement efforts, or for assisting developing countries in reducing their greenhouse gas emissions, or for compensating oil exporting countries if fossil fuel uses are reduced as a result of actions taken to protect the global climate.

By focusing on producers and importers the number of firms that have to be monitored for compliance is relatively small. They have either received the permits from their customers or bought them at the auction to cover fuel consumption of non-permit holders. Figure 2 illustrates the system of monitoring. The advantage of supervising compliance with the tradable permit system in this way is that the existing institutions for levying excise duty on fossil fuels, which exist in most industrialised countries, can be used to enforce the TCP scheme.

Figure 2 Monitoring compliance



3.6 Administrative cost

Expenditure is required for preparing and initiating the system. In particular there are costs associated with collecting data on historic fuel use and with making decisions on the quota which firms will receive when permits are grandfathered.[4]

Recurrent annual costs consist of monitoring and enforcement and the cost of carbon permit trades. The first cost factor, monitoring and enforcement, will be comparable to that of implementing a charge on carbon in fossil fuels. Its cost per permit will not differ very much from the cost of the existing system for levying excise duty on fossil fuels. Since monitoring and enforcement concentrate on fuel producers and importers, registration can be restricted to their transactions. Other transaction costs, mainly brokers' costs, are directly borne by purchasers and sellers. In the US Acid Rain Program these are less than five percent of transaction value (Klaassen and Nentjes, 1997). Since the number of sources in a TCP scheme is higher, we expect the transaction costs per permit to be lower.

4 CONSTITUTING ELEMENTS OF AN INTERNATIONAL TCP SCHEME

Once national permit markets are established, the next question is which elements should be added to extend them to an international market where a permit holder in county A can trade with a party in country B. For this, additional rules and agencies are required.

To ensure compatibility of linked national TCP schemes it is essential to have a rule that defines the type of permit that can be fully exchangeable internationally. Ideally the permit should be uniform. It can be defined as a tonne of carbon emissions when an emissions trading scheme only covers CO_2 emissions. If greenhouse gases other than CO_2 are involved, the permit can be defined in terms of ‘tonnes of carbon equivalent emissions’ as in the US Draft Protocol, or ‘carbon equivalent units’ as in Dudek and Goffman (1997), or something similar.

However, uniformity is not strictly necessary. A sufficient condition is that participating countries come to agree on conversion factors or fixed rates of exchange that would enable the translation of one permit of country A into an equivalent number of permits in country B.

As regards the other elements of national TCP schemes, which are mentioned in the previous section, we do not think they should necessarily be uniform. However, they should meet certain ‘minimum quality’ criteria, in particular with respect to monitoring and enforcement.

Next to that, two new international agencies have to be established by the Conference of the Parties to the FCCC: 1) an international clearing house and; 2) an international enforcement agency (IEA). The tasks of an international clearing (or administration) house, which might be a private agency, are the following:

- It keeps accounts of international permit trade (participation is compulsory for traders).
- It administers transfers of permits between legal entities.
- It registers the changes in permit holdings of each participating country.
- It informs the IEA by the end of each year about each country's TCP position.

An international enforcement agency has the following major tasks:

- It combines information on the agreed national emissions, or fuel quota of countries and the information from the clearing house on TCP positions of countries (i.e. changes resulting from international permit transfers).
- It monitors compliance by countries; that is it settles the accounts between countries by comparing permit holdings and emissions.
- It reports compliance by countries and assesses other relevant aspects.

An important issue is whether there has to be a uniform rule for initial allocation of permits or not. Should nations agree before starting trade on questions like:

- auctions or/and grandfathering?
- if grandfathering, then to which sectors?
- if grandfathering, what is the basis for initial allocation?

In answering these questions, it is important to bear in mind that grandfathering itself implies an opportunity cost for firms receiving permits (Nentjes *et al*., 1995). What matters here is not how you obtain your permits, but what you can sell them for - that is what determines opportunity cost. Thus, relative prices of products will not be distorted and substitution effects (switching towards the products of firms whose permits are awarded free) will not be induced by grandfathering. This makes grandfathering different from the exemptions from carbon taxes which may lead to substitution effects. For example, the Commission of the European Communities (CEC) proposal for a mixed carbon and energy tax provides for exemptions for the six energy-intensive industries (i.e. iron and steel, non-ferrous metals, chemicals, cement, glass, and pulp and paper) from coverage of the tax on grounds of competitiveness. This not only reduces the effectiveness of the tax in achieving its objective of reducing CO_2 emissions, but also helps the industries which are exempt from the tax to improve their competitive position in relation to those industries which are not. There will therefore be some switching of demand towards the products of these energy-intensive industries, which is precisely the reaction that such a tax should avoid (Zhang, 1997).

On the other hand, grandfathering gives implicit subsidies to some sectors, the value of which is independent of the behaviour of those sectors. This means that there is a distributional effect comparable to a lump-sum effect. An important question is, do the GATT/WTO rules permit differential treatment in this respect? To answer this question, we have to look at the underling GATT/WTO trade principles. There are two basic principles governing the GATT/WTO: namely the 'most-favoured nation' clause (Article I) and the 'national treatment or non-discrimination principle' (Article III). The principle of relevance here is the one of national treatment. This principle requires imported products to be accorded no less favourable treatment than domestic products. Although grandfathering gives advantages to some sectors, GATT/WTO appears not to reject such a differential treatment if domestic and imported fuels are treated equally in obtaining emissions permits.

Theory suggests that either grandfathering or auctions will ultimately result in a cost-effective allocation of permits among various polluters as long as they are all price-takers, transaction costs are low, and permits are fully transferable (Tietenberg, 1995). Moreover, studies of the effectiveness of policy instruments in other areas suggests that,

whatever form international agreements take, domestic solutions should not be imposed on individual governments (UNCTAD, 1995).

Given rapid integration of the world economy, however, some express a concern that different allocation rules for permits among parties could distort international competitiveness, pointing out that a government that grandfathers permits to a firm could give it a competitive advantage over a similar firm in another country where permits are not awarded gratis. We think this is not necessarily the case, because even if a firm obtains emissions permits by auction, its government still can protect its international competitiveness by means of recycling the revenues raised through auctioned permits to lower other pre-existing distortionary taxes, such as taxes on labour and capital. Moreover, owing to national sovereignty considerations, it would not be feasible to set a uniform allocation rule. Given the fact that some governments are more touchy than others about national sovereignty, they may think that setting a uniform allocation rule will restrict their rights to select the option which is best suited to their own national circumstances. Take the above CEC proposal for a carbon/energy tax as an example. National sovereignty considerations to some extent explain why the CEC proposal for a carbon/energy tax failed to gain the unanimous support of its member states, partly because some member states opposed an increase in the fiscal competence of the Community and thus opposed the introduction at a European level of a new tax on grounds of fiscal sovereignty (Bill, 1997). This failure is also because some member states are loath to restrict themselves to the common CEC-specified framework of policies and measures to stabilise CO_2 emissions; they want the freedom to devise their own.

Given these theoretical and empirical findings, we conclude that individual governments should be left free to devise their own methods of allocating permits. The choice between grandfathering and auctions and the size of individual permit allocations will depend on a range of considerations. These may include: whether carbon taxes have been introduced; the importance of different sectors to the national economy; the bargaining power of each sector; the political and economic position of different fossil fuels; and the importance of minimising transaction costs. For example, some Nordic countries have already introduced carbon taxes as a means of achieving their unilateral carbon abatement goals. These governments, if replacing carbon taxes by a TCP scheme, would need to raise revenue to compensate for the loss of abolishing carbon taxes. Kågeson (1991) suggests that 80% of permits should be grandfathered and the remaining 20% auctioned. Even for those receiving permits by grandfathering, we could envisage charging an annual fee, as is used in New Zealand in addition to tradable quotas to control over-fishing of selected species. Such a fee should be much lower than the auction price so that it would place a smaller financial burden on polluters than auctioning. The revenue from levying a low annual fee would then be used to further enhance governments' monitoring and enforcement efforts (Tietenberg, 1995; UNCTAD, 1995). With second-best considerations, some governments would also decide to auction permits, and the revenues generated through auctioned permits could then be used to reduce pre-existing distortionary taxes, thus generating overall efficiency gains. Parry *et al*. (1996), for example, show that the costs of reducing US carbon emissions by 10% are four times larger under a grandfathered carbon permit scheme than under an auctioned scheme. This disadvantage reflects the inability to make use of the revenue-recycling effect in the former case. Besides, even without

considering the revenue issue, governments may also decide to hold a small number of permits for auction in order to provide the market signals on current permit prices and to ensure permits are available for new sources, just as the US Acid Rain Program has set aside 2.8% of the total allowance allocation for auctions and direct sales (Kete, 1992).

5 CONCLUSIONS

A TCP scheme can only be established if there are legally binding carbon emission limits. The EU has so far agreed to set a cap on overall emissions for the group as a whole and has worked out a specific cap for each member country. Although it has not proved easy for the EU to work out such an arrangement, it hopes that its 'bubble' approach to meeting commitments will gain recognition in terms of legal competence in the new protocol to the FCCC. As for the world's largest carbon emitter, the US is unlikely to agree to any targets unless it knows what degree of flexibility could be involved. Here flexibility includes to the following: 1) would the carbon permits be issued as an emissions budget over a period? 2) can early-achievement be banked for future use and can under-achievement in the current period be fulfilled by the borrowed permits from a subsequent period? 3) can emission reductions be achieved 'offshore' through emissions trading or joint implementation? Clearly, there is a 'chicken and egg' problem in setting the cap on carbon emissions. Given the ongoing tension over the responsibilities of different parties to the FCCC, if any concrete commitments and emission targets emerge from the upcoming COP3, they will only be the result of negotiation and agreement among the parties themselves.

Assuming that after lengthy negotiations CO_2 emission targets are internationally agreed and that emissions trading provisions are included in the new protocol as a long-term option, the details need to be worked out regarding the design of a feasible TCP scheme. From the discussion in this article, we think the following guidelines have to be considered in designing a feasible, effective, efficient and politically acceptable national TCP scheme.

- A permit should be defined as an allowance to use a tonne of carbon in fossil fuels.
- Carbon permits should be made available in quantities equal to the emission target for that year. These should be geared to clear and politically reliable timetables for reducing total CO_2 emissions. As a response to inevitable uncertainties and the latest scientific evidence, the number of permits may be subject to change but such changes should be scheduled in advance as far as possible to promote confidence in trading.
- Carbon permits should be issued as an emissions budget that would allow permit holders to meet the target on average over a period. The duration of a budget period needs to be carefully considered, weighting the economic efficiency of a longer budget period against the practical feasibility of doing so.
- No restrictions should be placed on the location where permits can be used; no restrictions on ownership and no restrictions on trade apart from the application of anti-trust law.
- Banking and borrowing should be allowed in order to increase flexibility and lower the cost of abating CO_2 emissions. However, borrowing is only warranted if there are

stringent emission targets and should be used with considerable caution. Safeguards should be developed to allow borrowing in such a way that it does not undermine the environmental objectives.

- Grandfathering of permits to fuel-intensive firms will foster political acceptability.
- Permits can be auctioned to other firms and to fuel distributors.
- Distributors should act as agents for small fuel users (e.g. households) and pass on their permit costs in a mark-up on the fuel price.
- Purchasers of fuels should hand over permits to sellers. At the end of the year or the budget period the government monitors the balance between carbon import and production, and permits that have been returned to fuel importers and fuel producers.
- Fines should be imposed for non-compliance. A trade-off between environmental effectiveness and cost-effectiveness should be one consideration in setting the levels of fines. Whatever levels are set, fines from non-compliance can be added to a 'Green Fund'.
- The government should be responsible for organising the auctions; there is no special task for the government in organising the secondary market. When property rights to permits are well defined and certain, a secondary market will develop 'spontaneously'.

For the design of an international TCP scheme, carbon permits should be defined in a homogeneous unit. The other above-mentioned elements of national TCP schemes, although not necessarily uniform, should meet certain 'minimum quality' criteria. Individual governments should be left free to devise their own ways of allocating permits. In addition, two new international agencies -. an international clearing house and an international enforcement agency - have to be established by the Conference of the Parties to the FCCC in order to administer and enforce an international TCP scheme.

In this article, we have argued that a national TCP programme is the basis and precondition for an international TCP scheme. This demands that the countries participating in an international TCP scheme have to first establish their national TCP schemes. However, setting up a national TCP scheme requires that:

- governments have experience with formulating national emission targets and timetables;
- there is a reliable national register of individual emission sources that will participate in the scheme;
- there is an established system of emission monitoring, either direct or indirect; and
- there is a tradition of effective enforcement.

According to the above-specified conditions, not even all Annex II countries would so far qualify for engaging in emissions trading. This suggests that a TCP scheme might initially start with only a handful OECD countries, although it does not preclude its subsequent expansion to include other qualified countries according to the rules of procedure agreed before trading begins. Such an expansion will: bring more emission sources into an international TCP scheme; reduce the leakage effects which occur when reduced greenhouse emissions in countries with caps are counteracted by increased

emissions in countries without caps; lower the costs of abating emissions; and increase the scope for efficiency gains.

For some time to come, however, developing countries will not qualify for participation in an international TCP scheme. This promotes the concern: how can we encourage their participation in achieving the ultimate goal of the FCCC, given the fact that there are a great deal of low-cost abatement options there? One widely recognised option to bring the developing countries on board is by means of joint implementation (JI). Indeed many Annex II parties to the FCCC are keen to see JI as a key part of any protocol, although it is not without conceptual and operational problems (Zhang, 1997). However, the developing country stance on JI would be contingent on whether the North, particularly Annex II countries, have demonstrated once and for all that they are really taking the lead in significantly reducing their emissions within a short time-frame and are living up to their commitments to providing adequate transfers of financial resources, technology and expertise. This in turn raises the question of whether Annex I countries are able to reach an agreement on these issues at Kyoto and subsequent negotiations, which will acceptably draw the developing countries into the battle against global warming. If such an agreement can emerge, and if the four-year pilot phase of JI (referred to as activities implemented jointly) turns out to be a success, then an increasing number of the developing countries will become more positive about the concept of JI. Only then will there be a reasonable prospect of joint implementation of abating greenhouse gas emissions between developed and developing countries.

However, bringing the developing countries on board and integrating JI credit trading into an international TCP scheme promotes another concern about the credibility of the scheme. How can an international TCP scheme incorporate credits from JI projects and at the same time ensure that the confidence in the TCP scheme is not compromised? One option would be to restrict the amount of JI credits that could be bought by Annex I countries for compliance from non-Annex I countries. Another option, which is superior to the first option, would be to discount the credits awarded to JI projects. Such reduced crediting could provide an 'environmental bonus' and at the margin allow for the uncertainty about the reported emission reductions of JI projects. Moreover, we advocate a predetermined discount factor. In order to reflect the characteristics of a JI project and the differing quality of greenhouse gas monitoring and reporting infrastructures across countries, such a discount factor should differ both per type of project and per country and should be accordingly adjusted over time for those countries in order to reflect the improvement in their monitoring and reporting infrastructures. We think that a predetermined discounting approach is superior to a market-driven discounting approach, because the former would protect against the introduction of false credits into the TCP scheme, and provide non-Annex I countries with financial incentives to opt for binding commitments and develop stringent monitoring and reporting infrastructures.

In this chapter, we focus on designing a TCP scheme to control CO_2 emissions. However, it should be pointed out that the greenhouse effect is caused by the accumulation of not just CO_2 but also other greenhouse gases. Thus, some governments may commit to controlling all greenhouse gases in order to ensure that reductions in one gas do not lead to increases in another. Such a comprehensive coverage will also induce more cost-effective abatement options. Because of the difficulties in estimating and monitoring greenhouse gases other than CO_2, however, an international emissions trading scheme would initially begin with CO_2 emissions, although this does not

preclude its subsequent expansion to include other greenhouse gases according to the rules of procedure agreed before trading begins. As for a national emissions trading scheme, its coverage of greenhouse gases could be wider than in an international scheme. Emissions trading could take place for each separate pollutant on the domestic markets; inter-pollutant trading would not be allowed unless global warming potentials that could be used to translate greenhouse gases into carbon equivalent units for trading could be internationally agreed.

NOTES

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[2] Carbon will be used as shorthand for carbon dioxide throughout this chapter.

[3] The US auctions differ from those described here in that participants pay the price that they bid, rather than that of the marginal buyer. The political reasons for this choice are described in Hausker, 1992. While many expected that such a design would undermine the effectiveness of the auction, this does not appear to have been the case.

[4] The size of these costs will depend on how politically contentious the distribution process is. Here we have abstract from the political battles which precede and accompany the introduction of this new market based instrument.

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