

National and International Economic Instruments for Climate Change Policy

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Abstract

Policy instruments addressing sources and sinks of climate change can be applied at two levels: the national and the international level. The international focus on cost-effective policies points at the need to evaluate the merits of "economic" or incentive based instruments in particular. An overview is given of experiences with such instruments at the national level and prospects for applying similar instruments internationally are explored. Although a tradable system of (net) emissions quota may have high potential benefits, its acceptance meets with relatively large problems. Carbon taxes or charges may be a better alternative. An important recommendation is that countries and regions could move ahead in locally optimal but partial ways, to be extended and harmonised after some more trial-and-error. Experimentation with joint implementation is a promising avenue for the long run.

1. INTRODUCTION

Global environmental issues arise when specific forms of environmental degradation turn into a problem in which a large number of countries have a stake: they may be the results of activities in specific individual countries but often the welfare of other countries is adversely affected, potentially or factually. In the absence of a global environmental regulator international coordination through voluntary agreements is required. Such co-ordination may extend to the principles to be collectively applied, targets with respect to environmental quality to be achieved, individual countries' shares in these targets, and instruments to be applied. On the latter issue, a distinction can be made between instruments to be applied at the international level, and instruments to be applied within national jurisdictions. Below, we shall look at possible instruments at both levels and their relative merits and demerits. We will look at some more promising instruments at the international level in particular: a carbon/energy charge and tradable emission quota.

2. INTERNATIONAL ENVIRONMENTAL POLICIES: PRINCIPLES AND INSTRUMENTS

2.1 International Environmental Policies: General Principles

Transboundary environmental issues are the results of actions in individual countries that adversely affect the welfare of other countries. In the case of significant transboundary externalities, one possible approach is that some countries undertake

unilateral action (see Hoel 1991 for some caveats in this respect), but normally international coordination through agreements is more effective. This requires decisions by countries to become part of such agreements, which may imply a weighing of costs and benefits by the countries concerned. Individual countries might opt for not entering such agreements and to become free riders: then they would not share in the costs of measures whilst enjoying the benefits of the collective efforts of the other countries. In the case of unidirectional externalities such free riding behaviour cannot be countered by others polluting more in order to punish the free rider (OECD 1991a); hence other forms of establishing reciprocity would have to come in force. Even in cases of reciprocal externalities, countries might decide to not participate in a collective effort, if their valuation of environmental quality is relatively low. In such cases, incentives may be needed to make such countries engage in the agreement, such as side payments (compensations in one way or another). Also, efficiency arguments might be raised in favour of some countries financing environmental measures in other countries. Generally, therefore, some sort of international cooperation is needed if global issues such as climate change are to be addressed effectively and this may include a mechanism for burden sharing.

The main perimeters of international environmental policy in the decades ahead, have been set by the principles as laid down in the Rio Declaration on Environment and Development (UN 1992) and specific international agreements such as the Framework Convention on Climate Change. The principles of the Rio Declaration most relevant to the development of national and international policy instruments, are:

- the sovereign right of states to exploit their own resources and the responsibility to ensure that activities within their jurisdiction do not cause damage to the environment of other states or areas beyond the limits of national jurisdiction (Principle 2);
- the duty to cooperate (with common, but differentiated responsibilities) to conserve, protect and restore the health and integrity of the Earth's ecosystems (Principle 7);
- the application of "the precautionary approach": where serious or irreversible damage may occur, cost-effective measures to prevent environmental degradation must be taken (Principle 15);
- the promotion of the internalisation of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution (Principle 16).

The Framework Convention on Climate Change aims at stabilising concentrations of greenhouse gases in the atmosphere at levels that would prevent dangerous anthropogenic interference with the climate system are prevented, in a time frame that allows ecosystems to adapt and economic development to continue sustainably (Art. 2). Developed countries have to take the lead (cf. Principle 7) and proceed (cf. Principle 15) with cost-effective measures and policies so that they generate global advantages at least cost (Article 3); efforts to abate climate change may be implemented jointly by parties to the treaty (ibid.).

2.2 Environmental Policy Instruments

So far, agreements and conventions have often sought consensus about

national efforts in terms of targets for emission reductions (e.g. the SO₂-"clubs", CFCs). Given such agreed targets it would be a matter for national policies to decide how these targets would translate into national policies and instruments. However, from an economic perspective such agreed and fixed national targets might be a costly way of achieving overall environmental quality (Hoeller et al 1992), especially when (marginal) abatement costs differ between countries or regions. We thus have two levels at which climate change policy instruments should be considered: the national and the international. These shall be discussed in Sections 3 and 4; here we proceed with a general introduction to environmental policy instruments.

Environmental policy can make use of two basic strategies (Fig. 1, routes a and b). Firstly, public projects and programmes can be set up that aim at preventing, compensating and eliminating environmental degradation or at providing substitutes for traditional behavioural patterns, such as: collective treatment facilities, environmental sanitation and (re)construction programmes, afforestation, etc.; the costs of such programmes would have to be borne by the relevant agents (governments, firms, individuals) according to some mechanism for burden sharing (e.g., from public funds, through levies and charges, etc.).

Secondly, the decision making process may be influenced at the micro level through policy intervention. The second strategy is discussed in more detail below.

Rational decision makers will base their decisions about their activities on a comparison of the various options open to them. They will compare the costs and benefits of these options, defined as all (dis)advantages relevant to the decision maker as aggregated by his/her individual weighing system. In such a situation, decisions can basically be influenced in three different ways (Fig. 1, left hand side):

- 1) alteration of the set of options open to agents;
- 2) alteration of the cost and/or benefits relevant to agents;
- 3) alteration of the priorities and significance agents attach to environmental change (i.e. changing the structure of agents' costs and benefits).

Route 1) is referred to as *direct regulation*, defined as: institutional measures aimed at directly influencing the environmental performance of polluters by regulating processes or products used, by abandoning or limiting the discharge of certain pollutants, and/or by restricting activities to certain times, areas etc. The polluter is left no choice: he has to comply, or face penalties in judicial and administrative procedures.

Route 2) entails economic incentives or market stimuli. The motivation relied upon here is that if environmentally more appropriate behaviour is made more rewarding in the eyes of the agent involved, then attitudes and behaviour will 'automatically' shift in favour of these socially more desirable alternatives. Options can be made more or less (financially or economically) attractive by applying charges or levies, granting subsidies, implementing tax differentiation etc. Such instruments will be referred to below as *economic instruments*. In this way environmental concerns can in a certain sense be 'internalised' by altering the agent's context rather than the agent's value structure or preferences.

Route 3) includes approaches such as: education, information extension, training, but also: social pressure, negotiation and other forms of 'moral suasion' leading to a change of perceptions and priorities within the agent's decision framework. It aims at full 'internalisation' within the preference structure of the agent.

In this paper we will concentrate on economic instruments, i.e. route 2. Basically, one may distinguish the following categories of economic instruments: 1) charges, 2) subsidies, 3) deposit-refund systems, 4) market creation, and 5) financial enforcement incentives (OECD 1989). *Charges* may, to some extent, be considered as a "price" to be paid for pollution. Polluters have to pay for their implicit claim on environmental "services", which thereby enters at least in some part into private cost-benefit calculations. There are various types of charges, including charges on emissions (e.g. CO₂), and charges on products (e.g. fossil fuels, CFCs, cars). In *deposit-refund systems* a surcharge is laid on the price of potentially polluting products. When pollution is avoided by returning these products or its residuals to a collection system, a refund of the surcharge follows. *Markets* can be created where actors might buy "rights" for actual or potential pollution or where they can sell "pollution rights" or their process residuals (for reuse or recycling). In emissions trading, dischargers operate under some multi-source emission limit and trade is allowed in permits adding up to that limit. Given certain quota under agreed emission reductions, also countries could trade.

Criteria for selecting specific instruments relate to (Opschoor and Turner 1994; OECD 1994): (environmental) effectiveness, economic efficiency, and (social and political) acceptability. Amongst the acceptability criteria distributional considerations are especially important, particularly in the context of global environmental issues.

Economists have argued that economic instruments are to be preferred to especially direct regulation, as they tend to invoke least cost technical and economic responses; moreover, it is believed by many of them to also generate a more effective incentive for technical innovation. Using simple models, it can be shown that a pro rata agreed emissions reduction approach is less efficient in economic terms, than applying either charges or trade in permits to achieve the same reduction (e.g. Barrett in OECD 1991b) - but this is theory: it ignores much of the lack of data and knowledge on effectiveness and efficiency, and overlooks the acceptability problem and all that it stands for (Opschoor and Turner 1994). Environmental policy instruments typically come in "cocktails" or "mixes" of the pure elements described above. Thus, a carbon trading system is a combination of a regulatory measure (i.e. the total volume accepted) and an economic one (trading quota within that maximum).

Economic instruments do have a part to play in tackling global environmental issues. The wider the geographical extent within which they are applied, the larger the efficiency and flexibility-benefits of applying these instruments are likely to be. However, it is also fair to observe that economic instruments meet with a number of problems. In fact, one can discern a set of different dilemmas:

Firstly, the 'administrator's'-dilemma: direct regulation may be inefficient but yet efficient economic alternatives may be unacceptable to the policy makers for cultural or political reasons. Charges and trading schemes will then not be used where this could be practical and socially advantageous.

Secondly, the 'second best'-dilemma: a first best approach making use of economic instruments may, in a distorted world with government and market failures, create more inefficiency and be less effective than introducing second best instruments such as direct and uniform regulations.

Thirdly, the 'revenue'-dilemma: returning the revenues of charges and levies to

the sector that they came from (e.g. for subsidising CO₂-reduction by fuel shifts) enhances acceptability and effectiveness but is socially inefficient. This often results in discussions between public finance and fiscal experts on the one hand, and environmental managers on the other.

Finally, there is the 'leverage point'-dilemma: policy instruments may affect economic agents and processes in different stages of the product life cycle. Subtle and tailor-made emissions charges may be optimally effective without loss of environmental potentials for economic use, but at the same time they may be administratively costly. However, administratively easier but more clumsy inputs charges (e.g. on energy or Chlorine) may be environmentally and economically inefficient.

2.3 Climate Change and Climate Change Policy Instruments

Climate change, CC-policies and Cooperation

The overall objective of the Climate Convention has been given in Par. 2.1. It is assumed here that under a "Business as Usual"-scenario of global economic development, GHG-concentrations would rise to levels beyond those aimed at within the Climate Convention. This then would imply levels of damage to ecosystems and to development that are to be avoided at least partially. One of the principles of the Convention is to deal with climate change in a cost-effective way; that is, to achieve objectives at least social costs. The costs of climate change include avoidance or abatement costs (cost of emissions reduction and sink enhancement) and accommodation costs (costs of coping with residual GHG-concentration rise). Both abatement and accommodation costs include direct costs (i.e. the cost of measures and of policies aimed at reducing climate change or coping with it) and indirect costs (the net socio-economic effects elsewhere in society as a spinoff of these measures and policies).

One may wonder whether the level of admissible GHG-concentration could not also be determined in a least-cost approach, i.e. by minimising the sum of abatement and accommodation costs associated with alternative levels of abatement (this is one of the hot issues in the IPCC Working Group III at the time of this Conference). This would imply that all relevant elements of accommodation costs can be measured with a reasonable degree of accuracy - including damage costs due to exposure to concentrations- over a very long time horizon. However, according to many researchers (including the present author) the uncertainties inherent in such calculations justify a more political approach, where the overall net emission levels are to be below some negotiated maximum path, satisfying conditions such as those of Article 2 of the Convention. Within such an overall maximum, various different patterns of national net emissions (i.e. emissions corrected for sink enhancement) could be accepted. This allows for negotiation over, or trade in emissions quota, etc., to achieve cost-effectiveness.

Climate Policy-related Economic Instruments

In terms of environmental impact, there are several ways in which environmental policies could operate technically in order to become or remain compatible with some environmental target or standard. One is, to move or relocate sources (i.e.

activities) to areas where they will contribute less to the global issue at stake. In cases such as the climate issue, relocation does not provide a real solution. Environmental degradation can also be avoided by reducing source strengths through reduction of activity levels, diffusion of existing cleaner technology and/or innovation. A final strategy is that of circumventing the environmental impact by enhancing the environment's capacity to absorb or otherwise deal with the pollution. Sink enhancement e.g. through afforestation is one relatively inexpensive method of dealing with notably carbon dioxide emissions -the major greenhouse forcing substance.

In order to trigger economic agents responsible for GHG-sources and sinks to move towards either one of these technical options, they will have to be commanded or convinced, and especially in the global context, economic approaches to this may warrant attention. Prospective modelling work suggests that the impacts of instruments (charges and permits) on revenues and income transfers between countries can be very important (Hoeller et al 1992). In the case of (transboundary and) global environmental problems a special issue arises out of the combination of the criteria of effectiveness and efficiency. It may well be more effective to allocate a certain amount of money to financing environmental activities elsewhere ("joint implementation"). Several types of economic instruments for addressing global environmental issues have been proposed:

- i) Emissions charges or products charges (e.g. taxes on energy use) or combinations such as an international carbon/energy charge;
- ii) Global permitting systems for emissions or for using a global environmental resource, allowing for trade between countries in such permits or in emissions offsets (cf. the Montreal Protocol);
- iii) Sanctions against free riding or non-compliance in relation to environmental treaties, including trade sanctions;
- iv) Motivation to participate in agreements by compensation payments and by so-called "joint implementation" programmes;
- v) Deposit-refund systems.

Below, we shall first look at national policy instruments (section 3) and then move on to options for climate policy instruments at the international level (section 4).

3. REVIEW OF NATIONAL POLICY INSTRUMENTS

Currently, most countries operate a range of environmental policy instruments including economic instruments. In this section climate change related economic instruments as currently in use or under consideration in OECD countries, will be briefly reviewed (after OECD 1994): charges and trading schemes.

3.1 Charges

Charges on processes and products that generate pollutants contributing to global environmental problems could make these inherently less attractive. Several existing charges on products relate to global environmental problems (e.g. CFCs, fuel-related CO₂). Product charges have several advantages. First, the administrative framework for collecting the charge may be relatively easy to conceive, or may -in some cases, already function in some parts of the world: in most countries and for many fuels, systems already exist for taxing them. Second, changing the level of a charge or

tax is a relatively simple intervention, compared with altering other instruments (such as tradeable permits). In the area of charges on emissions most air pollution charges relate to non-GHG emissions, especially of acidifying substances (US, Canada, France, Japan, Scandinavia, Portugal). One successful example is the Swedish NO_x-charge on heat and power producers: the charge has speeded up compliance to sharper emission standards to be imposed in 1995. The accelerating mechanism was the rechanneling of the charge's revenues to the producers according to their final energy production; thus, heavy emitters subsidised clean energy producers and this provided an incentive for rapid innovation.

More than half of the OECD countries have differentiation in car sales tax rates or annual vehicle tax, according to the levels of emissions (based on e.g. car weight, catalytic converter, emission standards compliance). Several countries have explicit and implicit carbon taxes with an intended incentive impact. Carbon taxes are now applied in the Scandinavian countries (including Denmark), Italy and the Netherlands, but only in the Norwegian and Swedish case are they significant enough to have an incentive impact. All OECD countries have energy taxes, though at different levels and using different operational systems. Some countries have or are considering effective energy/carbon charges, and others look at raising energy tax levels. Charges on Ozone depleting chemicals exist in Australia, Austria, Denmark and USA, possibly with incentive impacts in the latter two countries.

Domestic Policy Impacts

National charges will have nationally relevant policy impacts, notably in the fields of income distribution, sectoral activity levels, public finance, macroeconomic policies (Piacentino 1994).

Energy taxes are applied to a commodity with fairly low short term price elasticities. Hence, in order to achieve a given quantity impact on its consumption, the price rises must be high. In order to achieve a levelling off of CO₂ emissions in 2020 at the 1990 level, calculated emission taxes vary between \$30 to \$150 per ton of carbon. This implies high tax revenues and raises the question as to the distributional impacts of such a taxation policy. There is a case to be made for using these revenues as part of the overall public finance, which, in the case of an assumed fiscal neutrality would imply that other taxes could be reduced accordingly. In addition to the fiscal aspect, the income effects of the charge are to be considered and perhaps compensated.

Emissions reduction efforts may induce significant feedbacks to the economic process. Research has been done to explore the economic costs of e.g. reducing carbon emissions in various countries. Achieving large reductions of energy-related CO₂-emissions may depress growth rates of world GDP by .2 percentage points, but this can nevertheless imply reductions in the long run levels of global GDP of some 3-8% (between 2025 and 2050); some national models (e.g. for Norway, Netherlands, Sweden) predict higher growth rate depressions with higher GDP-impacts earlier on (2000-2010) at much lower levels of reduction (Hoeller et al 1992).

Moreover, charges could lead to shifts in the industrial structure. In one country's exploration of the economic impacts of unilateral and joint action via carbon/energy charges (without exemptions), national (and even some collective)

sectoral implications could be dramatic (CPB 1992); in the very energy-intensive sectors there might be relocation of industries to other countries or regions. Calculated reductions in energy use might result from reduced or replaced activity, rather than from fuel shifts, energy conservation or new (leaner) technology (*ibid.*).

Unless agreements could be reached with all important trading partners, countries will not easily impose extra costs on their industries through high energy or carbon taxes. To protect their international competitive positions, countries usually consider tax schemes only if associated with substantive exemptions for domestic energy-intensive industries operating on international markets. In the context of regionally applied charges, one alternative to such exemptions could be: mitigating measures on transboundary transactions correcting for cost differentials due to non-participation in the charge scheme. The proposals for an EC CO₂/energy tax appears to favour an approach based on such exemptions. Providing exemptions and mitigation may easily lead to different consequences in terms of internal and external support for policies aimed at global environmental issues and little is known of these and other indirect effects of such corrective measures.

3.2 Other Policy Instruments

Apart from charges (or their less efficient and effective reverse: subsidies), countries may use instruments such as trading schemes and of deposit-refund systems.

On national trading schemes, there is very little experience outside the US and it has been reviewed elsewhere (OECD 1994). Tradable permit systems exist in the US, Canada, Australia and Germany; the Canada and US schemes include trading in CFC-quota, air pollution emissions, and some car and fuel-related emissions. There are no direct climate change related trading schemes. An extensive literature exists on the efficiency of trading and its prospects for air pollution abatement and prevention (see, e.g. NAPA 1994; Klaassen and Pearce 1994). In theory emissions trading is as efficient as charges, and there may be less uncertainty as to its environmental effectiveness than would be the case with charges. We shall come back to this below, in Section 4 on international instruments.

A second approach could be that of deposit-refund systems in relation to greenhouse gases. Deposit-refund systems would imply putting a charge or tax on bringing a unit of e.g. CO₂ into the atmosphere whilst reimbursing for removal, disposal or sequestering of a unit of CO₂. CO₂ removal and fixation might enable economies to seek least cost options for GHG-reductions by comparing the costs of combustion reductions with those of fixation, etc. Compensations for CO₂-fixation could thus be combined with a CO₂ charge into a deposit-refund analogue. This could be done both nationally (e.g. when fixation in new forests is financially facilitated) and internationally (see e.g. Huppel et al. 1993).

4. CLIMATE POLICY INSTRUMENTS: INTERNATIONAL OPTIONS

As in the case of national policy instruments, international instruments may aim at an incentive effect or they could be intended to raise financial resources to

undertake other activities including emission abatement. In fact, the revenue raising character of some of these instruments might appear as an advantage given the large amounts of financial resources needed to address adequately the global problems and the distributional aspects that would be encountered in attempts to obtain global commitments. One argument against this is that if prices are correctly reflecting environmental costs in consequence of a "proper" tax level, then earmarking would lead to a distortion of the optimal allocation.

4.1 Emission charges

Especially in the case of charges there are grounds for engaging in an international dialogue on account of possible repercussions on international trade and investment. In relation to global warming, taxation may be based on energy content or on Carbon content (or some combination of these two). All OECD countries have energy taxes, though at different levels. Some countries have or are considering effective energy/carbon charges, and others look at raising energy tax levels. Carbon taxes are now applied in the Scandinavian countries (including Denmark) and the Netherlands. The European Community is considering a carbon/energy tax on energy raising primary energy prices initially with \$3, going up to \$10 per barrel of oil equivalent some 7 years after the scheme becomes operational. This might result in a reduction of CO₂ emissions in 2000 in the order of 6-7% (DRI as quoted by Carraro and Siniscalco 1993).

The charges/tax option is an appropriate one given the wish to improve market signals and to raise public awareness. Due to the elasticities involved however, they may not be the most effective way to modify behaviour in the short run. Macro economic impacts or the fear for such impacts, might make individual countries reluctant to move ahead of others in introducing such charges, or in making them high enough to have an incentive impact (see par. 3.2). Especially in the case of charges there are very solid grounds for engaging in an international dialogue on them, explicitly taking into account impacts on international trade and investment, on relocation etc., as resulting from a substantial tax.

4.2 Tradeable Permits Systems (TPS)

The main idea of tradeable permits is achieve an environmental target at least cost to society, by setting an emissions reduction target, distributing or auctioning permits up to the total set by the reduction target, and by allowing trade in these permits. Compared with charges, permit trading has the advantage of a more certain result in terms of emissions reductions: the amount of permits issued sees to that, if it is enforced. These permits can be subjected to market forces: there can be more of them for sale if further technological innovation results in cleaner technologies; demand -if mobilised- will competitively force prices down to their appropriate level. There must be an information system (with information about potential buyers and sellers) and an auction procedure. Also, there must be some agreed initial endowment and this is one of the main difficulties with a TPS. In addition, there are operational conditions to be met e.g. on the definition of the market, the 'size' of the market in terms of numbers of buyers and sellers, of real possibilities for trade in terms of actual or potential cost differentials, etc. (see e.g., UNCTAD 1992). Several of these issues will be briefly reviewed.

The commodity in which trading is to occur, has to be defined clearly. For obvious economic reasons the flexibility -and hence the potential cost-effectiveness- of the scheme would be enhanced if apart from emissions also sink-enhancement strategies could be incorporated, and if the whole range of GHgases (i.e., not only CO₂) could be considered. Even in the case of greenhouse forcing alone, there are several options (e.g. fossil CO₂ emissions, *ibid.* plus C-sequestration by plantation, net CO₂-emission, equivalent CO₂ including other gases etc.). The choice of definition is likely to reflect the performance to be expected on a number of criteria, such as compatibility with sustainable development, efficiency, etc. There seems to be a growing consensus that limiting trade to emissions of energy-related carbon dioxide is the most feasible initial option (Swart, in OECD1992a), with that of including other CO₂-sources and sinks as a very promising alternative especially as it may do more justice to the claims of developing countries (Agarwal and Narain 1991).

With limited numbers of market actors there is the risk of parties being capable of manipulating permit prices, or to influence prices in related commodity markets (Tietenberg, OECD 1992a) in order to affect the distribution of rents. According to Roland (in OECD 1992a), this risk is relatively low (see also Bohm 1991). Yet, there is another distributional issue related to market power: with unequal purchasing power and in a buyers' market, the possession of permits might concentrate in the portfolios of a few rich nations. One solution to the problem of market power confusing the performance of trading schemes would be to limit the period during which rights to emission remain valid: under such circumstances hoarding and accumulating emission rights would be much less economically rewarding (Boorsma et al 1988, OECD 1994).

The question of how to distribute initial rights is a crucial one in obtaining international support for any large scale trading system. This initial endowment or distribution could be based on e.g. current emissions level, past responsibility, equality of effort, GDP, population, etc. The initial allocation will have to be a compromise, based e.g. on both a per capita allocation and current emission levels.

4.3 Deposit Refund Systems

Countries, apart from being sources of substances or other interventions giving rise to global environmental problems, may also engage in activities that enlarge the environment's capacity to absorb (or otherwise handle) human activities. In the case of climate change, sink enhancement e.g. through agricultural and reforestation policies is a case in point. Economic instruments may support such activities. In the case of charges: if only net emissions are charged, or emissions corrected for the annual impact in terms of sink enhancement, then the latter would be economically attractive; and so would, of course, innovation. A similar argument holds for allowing trade in credits built up by sink enhancement or technological innovation. However, the issue of the measurement of the contribution to resolving global environmental problems through sink-enhancement is such an intricate one, that it might preclude advancement in international environmental agreements, unless put aside until better monitoring is possible. In principle, however, if countries engage in activities that enhance their environments' capacities to absorb or buffer global pollutants, then they could be compensated for that within a trading system if such activities would yield additional permits or credits to them that could subsequently be offered on the

permits market. Future extensions of the Climate convention might include provisions for compensating countries for carbon removal and fixation, presumably certified, or by allowing these to be credited to in the form of equivalent additions to their allowed emissions.

4.4 Joint Implementation

A step towards a full permit trading situation, may be that of "joint implementation". Under a regime of joint implementation, countries might find it in their interest to participate in an agreement and to take on emissions reductions responsibilities, whilst the financial consequences would be shared with or adopted by other participants. From Western Europe, acid deposition offsets are being sought and financed in Central and Eastern Europe as an alternative to carry out costly abatement programmes in e.g. the Netherlands (1993). The Climate Convention allows certain parties (notably OECD countries and economies in transition) to implement jointly with other parties (including developing countries) to the Convention, of activities to reduce GHG-emissions and enhance sinks ("joint implementation", Article 4.2.a). For countries that have accepted emissions targets, joint implementation would effectively allow more efficient emissions reduction within the total target. If joint implementation is undertaken with countries that are not (yet) committed to any target, then the effectiveness becomes more dubious, whilst no doubt average (and most likely total) emission abatement costs would be lower. From the side of the developing countries a risk of joint implementation would be, that it might be a disincentive to developed countries to change their patterns of production and consumption. Special attention should be given to the conditions under which such schemes are appropriate (see e.g. Kuik et al 1994). Criteria to be applied include: (i) additionality of net emissions reduction, (ii) certified environmental effectiveness, (iii) complementarity to reduction of own emissions.

In a way joint implementation schemes can be regarded as justified by the fact that often the countries providing these compensations are those that now and in the past have been largely responsible for the present state of the environment; they could be regarded as paying their 'environmental debt'. In fact, joint implementation enables one category of polluters to engage in environmental policies when its income constraint is an over-severe impediment. Such schemes, while avoiding some of the problems posed by straightforward trading schemes, may lead to other difficulties:

- i) In as far as co-operation of developing countries is required, these might show reluctance in going along with programmes that apparently imply financial transfers with "new conditionalities" (the proviso that they be spent on specific activities targeted to deal with specific reductions in emissions) involved.
- ii) Difficulties in establishing the environmental effectiveness are likely, as this involves difficult assessments of time paths of emissions with and without the programmes, against the background of often relatively unpredictable developments at the level of the underlying economic activity levels. Certification arrangements may at least partially address this issue.
- iii) Some of these schemes entail the exchange of property rights on natural resources in other countries; it could be difficult to disentangle environmental effectiveness from considerations in terms of expected capital gains.

A growing literature (e.g. Kuik et al 1994) is geared towards designing effective,

efficient and equitable arrangements for joint implementation.

A tradable carbon quota system could easily arise out of a joint implementation situation, when the countries involved all develop targets for (net) carbon emissions.

5. A TENTATIVE ASSESSMENT AND CONCLUSIONS

Climate change policies may lead to substantial social costs; attempts to identify least-cost approaches can therefore have high social benefits. Economic approaches to global issues are important to build into the emerging conventions and institutions aspects such as flexibility and efficiency. Several types of instrument may be considered. Recently most attention has been given to systems of charges and tradeable permit systems. These systems have different characteristics in terms of their environmental and economic performance (see e.g. IPCC 1994). But their most important common characteristic is that they will help in minimising overall emissions reduction costs by shifting effective emissions reductions to countries with lowest marginal costs; that is, if we are comparing trading in GHG-permits with GHG-charging (e.g. a CO₂-tax) and not with an energy tax. Energy taxes would be relatively inefficient ways of achieving climate-related objectives compared with GHG-emissions charges (Carraro and Siniscalco 1993; Zhang 1994).

Advantages of TPS over a charges system include (Bohm 1991): (i) the relative certainty of meeting emissions standards; (ii) fewer complications with non-convertible currencies than when handling charges' revenues; (iii) TPS does suffer from harmonisation problems with existing national taxes, as carbon/energy charges would. In addition, a tradeable quota regime would put developing countries in a position where transfers would be based on agreed upon rights, whereas a tax-cum-transfers system might keep developing countries in a situation of structural dependency on industrial countries. Finally, a tradable permit system would probably induce a forward market with associated intertemporal efficiency gains.

Relative advantages of a tax system over TPS are (ibid.): (i) the revenue raising nature of the instrument; (ii) the familiarity of governments and other actors with the excise tax principle; (iii) low transaction costs; (iv) tax systems would not give rise to a compromising dominant position of large industrial countries. Furthermore, appropriate international institutional frameworks to operate a charges system are relatively easy to conceive.

Both systems, that of tradeable permits and of charges, suffer from difficulties in obtaining wide support. Obviously, introducing an international system of charges will not be easy, given the differences in the levels at which energy and -implicitly carbon are charged in different countries. Trading schemes appear to, at best, pose a future option only: practical difficulties, especially related to establishing an acceptable initial endowment, provide impediments to their rapid introduction. A rapid and full-scale introduction of any one of these theoretical alternatives is therefore very unlikely. Rather, one should expect experimentation on smaller scales and with partial approaches, from which a broader and harmonised approach might develop later. Various ways can be envisaged:

- 1) Second-best compensatory introduction.

In the case of tradeable permits, side payments, an "equitable" initial endowment and temporary exemption of poorer countries could help in (gradually) introducing a worldwide system. In the case of taxes the revenue raised by it could be (partially) recycled on the basis of income effects of the tax, initial income differentials, efforts in developing or installing cleaner technology or augmenting pollution sinks, etc., so as to enhance international support.

2) A less than across-the-board-approach which focuses on certain main elements of the climate change problem, operates in groups of contributing countries or sources, with selected compounds, gradually building up from there towards a more complete system.

For a number of reasons (OECD 1992b), it appears that a system of national taxes on energy or carbon could be achieved easiest at the regional level. This might hold particularly in the European region (some details on an EC carbon/energy charge were given above). Subsequent introduction of similar charges elsewhere could lead to harmonisation towards e.g. an OECD-wide charge. The larger the geographical scope of the charge, the less need there is to exempt industrial sources on the basis of distortions in long term comparative cost differentials and competitive positions, or to use other complicating additional measures.

A system of trading in emissions permits or offsets would presumably only start with a group of developed economies as well, on the basis of internationally agreed emission targets. Such countries could be allowed to buy reductions elsewhere (offsets). It is important to design procedures that could facilitate the gradual development of a true market for entitlements out of bilateral transfers of such entitlements in the initial phases (Roland in OECD 1992a).

3) Mixed systems might arise with charges in some regions and emissions permit trading elsewhere. Other instruments of a mixed or hybrid nature may exist:

(i) national or international funds drawn from the revenue of national charges for e.g. energy use and/or carbon emission could be set up to finance environmental expenditure in developing countries;

(ii) tradable credits could be built up by abating emissions in other countries, based e.g. on unit rates to be decided in international agreements; etc.

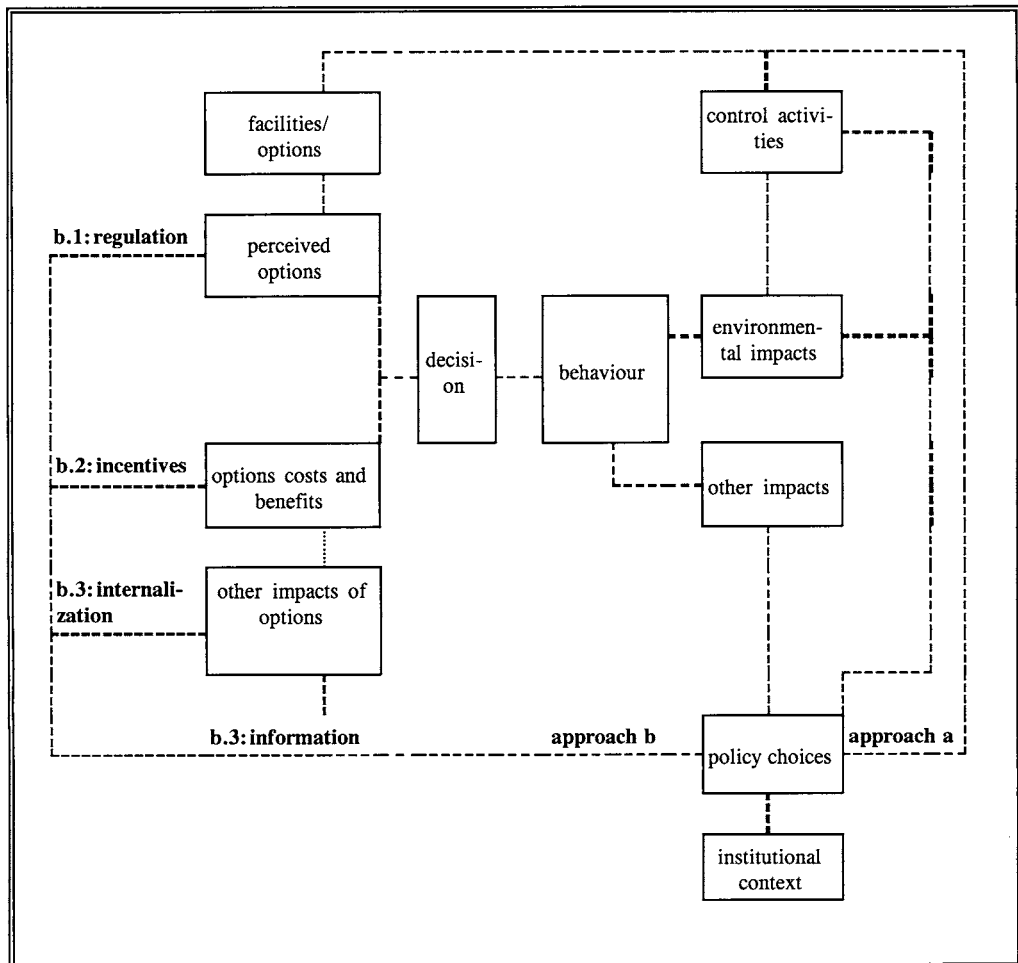
The partial and hybrid systems discussed here, may have institutional advantages in that they often build on well known procedures such as negotiations about reduction efforts.

Conclusion

Looking at the economic efficiency (and disregarding a number of institutional and political impediments), fully fledged schemes of emissions charges or tradeable emission permits appear most (and equally) attractive. If their effectiveness were to be the criterion, tradeable permits hold the promise of more certainty in comparison with charges. However, such schemes are very unlikely to come about in the near future. In terms of environmental effectiveness a step-by-step approach starting with some system applied by a small number of countries, gradually increasing its geographical scale and incorporating more elements of charging and/or trading, with a gradual level of price rise in the case of a charge, appears to be the most promising and practicable avenue for an international climate change policy.

Considering the acceptability of the various instruments, there are difficulties

Fig. 1. Environmental Policy Approaches



After: Opschoor 1991

with the equity aspects (both initial endowments and issues related to accumulation) and the institutionalisation rendering tradeable permit schemes politically ill-acceptable compared with charges or taxes on energy. On-going discussions about a carbon/energy charge in Europe, perhaps to later on be introduced OECD-wide as a second step to a global scheme, are very important in this respect.

"Joint implementation" of emissions reduction where some countries participate financially and technically in other countries' abatement or sink enhancement efforts, could be a way of developing towards an international trading system. However, given the current status of joint implementation it will not be a major instrument in achieving targets for the year 2000.

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