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I. INTRODUCTION

On 11 December 1997, 160 countries reached an historical agreement on limiting greenhouse gas emissions in Kyoto, Japan. In comparison with the United Nations Framework Convention on Climate Change (UNFCCC) at the Earth Summit in June 1992 that only committed Annex I countries[2] to "aim" to stabilize emissions of carbon dioxide (CO_2) and other greenhouse gases at their 1990 levels by 2000, the so-called Kyoto Protocol sets legally binding emissions targets and timetables for these countries. Together, Annex I countries must reduce their emissions of six greenhouse gases by at least 5% below 1990 levels over the commitment period 2008-2012, with the European Union (EU), US and Japan required to reduce their emissions of such gases by 8%, 7% and 6% respectively (UNFCCC, 1997). Although proposals had been made for differentiation of allowed emissions on the basis of indicators such as population, GDP, or carbon intensity of the economy, the differentiated targets agreed upon at Kyoto were purely political. The Protocol will become effective once it is ratified by at least 55 parties whose CO_2 emissions represent at least 55% of the total from Annex I parties in the year 1990.[3] Pushed by the US, the Kyoto Protocol also accepts the concept of emissions trading in principle under which one Annex I country will be allowed to purchase the rights to emit greenhouse gases (GHG) from other Annex I countries that are able to cut GHG emissions below their assigned amounts (i.e. their targets), but leaves the design of the market and its rule entirely to subsequent conferences. Structured effectively, the market-based emissions trading approach, pioneered in the US Sulphur Allowance Trading Program (McLean, 1997), can provide an economic incentive to cut GHG

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

[3] Although the 55% ratification threshold is lower than 75% of the total Annex I emissions in 1990 proposed in earlier negotiation drafts of this article, it seems to be high. This threshold confers on the US a *de facto* power of veto, since the US accounted for nearly 40% of the total Annex I emissions in 1990. Besides the US insistence on the high threshold, the EU was partly responsible for this because it was unwilling to assume any obligations without the US signing on, just as its previous proposal for a carbon/energy tax was subject to whether the US took similar actions.

emissions while also allowing flexibility for taking cost-effective actions. It is generally acknowledged that the inclusion of emissions trading in the Protocol is in line with the underlying principles in Article 3.3 of the UNFCCC, which states "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost", and reflects an important decision to address climate change issues through flexible market mechanisms.

As the successor to the General Agreement on Tariffs and Trade (GATT), the World Trade Organization (WTO) was created in 1994 upon the completion of the Uruguay Round of multilateral trade negotiations (WTO, 1995). Its Committee on Trade and Environment has been established to coordinate the policies in the field of trade and environment. The Committee's work programme includes a review of "the relationship between the provisions of the multilateral trading system and trade measures for environmental purposes, including those pursuant to multilateral environmental agreements" (WTO, 1995, p. 470). Although emissions trading has been identified for future discussion in the Committee, it has not thus far been examined. It remains unknown whether WTO provisions would cover an emissions trading scheme, in part because no interpretation exists on whether a legal definition of emissions trading would be interpreted as either trade in a good or trade in a service (Vaughan, 1997). No doubt, the inclusion of emissions trading in the Kyoto Protocol will catalyze the international consciousness for the potential of emissions trading. Clearly, this will provide a stimulus to addressing the market-based instrument in the Committee.

This article will examine the relationship between GHG emissions trading and the world trading system.[4] Section II explains why emissions trading is considered to be the most promising way to control GHG emissions. Section III discusses the basic requirements for setting up a successful emissions trading scheme. Section IV addresses some trade-related aspects of emissions trading, while Section V relates the discussion to joint implementation with developing countries. The article ends with some conclusions.

II. WHY EMISSIONS TRADING?

Greenhouse gases are uniformly mixed pollutants, i.e. one ton of a greenhouse gas emitted anywhere on earth has the same effect as one ton emitted somewhere else on earth. Translated into the language of abatement strategies, this means that it does not matter where reductions in GHG emissions take place. What matters is whether we are able to reduce the emissions effectively on a global scale. Given the fact that the costs of abating GHG emissions differ significantly among countries (see, for example, IPCC (1996)) and that, unlike SO_2 emissions, there are no local "hot spots" for GHG emissions,[5] GHG emissions trading seems to

[4] The design of a workable emissions trading scheme is the very important issue because it is essential to the success of emissions trading. This has been the focus of the UNCTAD Greenhouse Gas Emissions Trading Project (UNCTAD, 1998), the Annex I Expert Group on the UNFCCC, Zhang (1998), and Zhang and Nentjes (1998).

[5] The "hot spots" here refer to those localized areas of high pollution concentration. This has been major concern in designing a sulphur emissions trading scheme because of the spatial nature of that pollution.

enjoy an even better prospect for trading than SO_2. This large potential of efficiency gains, backed up with the widely-regarded successful Sulphur Allowance Trading Program in the US,[6] conveys the message that emissions trading is a very attractive abatement option. How does then emissions trading compare with carbon taxes, another economic instrument that is widely believed to be able to achieve the same emissions target at lower costs than the conventional command-and-control regulations?

In economic theory, the two instruments can achieve identical results given both perfectly competitive markets and certainty (Weitzman,1974; Pezzey, 1992). In practice, however, there could be quite different between these two instruments.

Probably the most valid arguments in favour of tradeable permits rather than taxes so far are as follows:

Tradeable GHG emissions permits, unlike carbon taxes, are a form of rationing and the great advantage is that in this way one can be sure of achieving the target agreed.[7] This feature seems to be appealing more than ever because Annex I parties to the Kyoto Protocol are obligated to comply with their legally binding emissions targets. This also makes the "ecological transparency" argument against emissions trading not valid anymore.[8] By contrast, the actual achievements in reductions of CO_2 emissions by a proposed carbon tax remain uncertain because of imperfect knowledge of the price elasticities of demand and supply for fossil fuels, especially for the large price increases caused by carbon taxes for major emissions cutbacks (Cline, 1992). This implies that setting the initial tax will be a hit-and-miss affair, and could thus induce hostile reactions from countries, industries, and consumers although it is not clear how serious an objection this is (Pearce, 1991). Moreover, in the context of global warming, the delays in adjusting the insufficient carbon tax to the desired level will imply more CO_2 emissions emitted into the atmosphere than what would otherwise have occurred, thus leading to additional committed warming.

Another complication of the carbon tax is the initial difference in energy prices. As a consequence of existing distortions by price regulations, taxation, national monopolies, barriers to trade and so on, there are initially great differences in energy prices, both between fuels and across countries (Hoeller and Coppel, 1-992). If CO_2 emissions are then to be reduced by similar amounts in two countries, *ceteris paribus*, lower taxes

[6] As a reflection of its success, the Program has cut the compliance costs to less than $100 per ton of SO_2 removed from early estimates of the expected costs ranging from $180 to $981 per ton during Phase I and from $374 to $981 per ton during Phase II (McLean, 1997).

[7] The Kyoto Protocol adopts the "commitment period" of five years that was originally proposed by the US as the "budget period". The multi-year compliance is designed to avert the danger that a single-year target may pose due to fluctuations in economic performance or certain extreme weather conditions, and to provide countries with additional flexibility in meeting their targets. While enjoying such advantages, the multi-year compliance might undermine the actual scope of a country achievement in meeting its Kyoto obligations if monitoring, reporting and enforcement would not be adequate. This underlines the importance of setting up a very strict institutional framework to ensure stringent monitoring, frequent reporting and vigorous enforcement. The same holds for banking and borrowing of permits, which are another two ways to increase intertemporal flexibility and lower the cost of abating GHG emissions.

[8] What I mean by the "ecological transparency" argument is that if there were no the Kyoto Protocol, some governments would not be keen to adopt emissions trading because the quantity-based instrument would provide the public and their political opponents with a very clear reference to judge their performance.

are required for the country with low prices before the tax imposition than for the country with the higher pre-tax prices. Thus, an eventual cost-efficient regime of international carbon tax would presumably need to remove existing distortions in international energy markets. Otherwise, countries with the lower pre-tax prices would enjoy free-rider benefits.

Third and most importantly, emissions trading offers a built-in feature of resource transfers by emission sources to developing countries. Such transfers are crucial to getting developing countries engaged in controlling GHG emissions (Wiener, 1997). Of course, it is not impossible to include transfers in an international scheme of carbon taxes, but the trouble with it is that we need an international agency to collect carbon taxes. Given the fact that the United Nations (UN) still have the difficulty in collecting their membership fees and that no other institution is of higher international jurisdiction than the UN, this will leave some doubt about its capacity in collecting international carbon taxes. Even if such agency manages to obtain the proceeds and uses them as transfers, there are still serious doubts as to whether it can efficiently manage such transfers.

Fourth, emissions trading is more attractive to firms than carbon taxes, because the latter scheme extracts revenues from firms without offering any compensation, not to mention the political difficulties of introducing such taxes in countries such as the US. So, even if a firm has to buy permits 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 is allowed to emit. This in turn creates an incentive for firms to comply with their caps.

III. BASIC REQUIREMENTS FOR SETTING UP EMISSIONS TRADING

Even if international emissions trading is considered to be the most promising way to control GHG emissions (IPCC, 1996; UNCTAD, 1995), then, what are the basic requirements for setting up a successful scheme?

First, there should be legally binding national emissions targets and timetables for reducing GHG emissions for countries that would wish to participate in an international emissions trading scheme. Those coutries should be committed to the binding obligations.

Second, there should exist a reliable national registration of individual emissions sources that will participate in an emissions trading scheme. Without such an inventory of sources and their present emission levels, it would be impossible to design schemes for permit allocation by way of grandfathering permits. Moreover, since countries (not sources) sign the Kyoto Protocol and it is the responsibility of the governments to ensure that their countries are in compliance with the national emissions 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 and reporting emissions. This is to ensure, among other purposes, that when banking of permits were allowed, emissions permits to be sold by any

sources would at least represent part of their real emissions reductions from the allowed emissions levels. This, combined with the above requirement for good emissions inventories, would provide certainty about the validity of permits traded, thus increasing confidence and incentives for inter-source trading.

Fourth, there should be effective enforcement aimed to detect those in non-compliance and apply 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 emissions trading because under an emissions trading 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 exceeded emissions in the sellers' country. By contrast, when charges or regulations are used, firms which defraud cannot sell permits to sources in other countries. Clearly, if enforcement were not adequate, it would be easy for a firm to sell permits or refrain from buying permits without taking adequate measures to reduce its emissions. Consequently, an emissions trading 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.

Annex I countries would so far qualify for engaging in emissions trading according to the first condition, but not all Annex I countries would do so if the other three conditions need to be fulfilled. Strictly speaking, this suggests that an emissions trading scheme might initially start with only a handful of Annex I 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 would bring more emission sources into an international emissions trading scheme, reduce the leakage effects which occur when reduced GHG emissions in countries with caps are counteracted by increased emissions elsewhere in other countries without caps; it would lower the costs of abating emissions, and increase the scope for efficiency gains.

According to Article 17 (formerly numbered as Article 16 bis) of the Kyoto Protocol, the parties with targets included in Annex B, which lists 38 countries and the European Community, may participate in emissions trading for the purpose of fulfilling their commitments under Article 3 of this Protocol (UNFCCC, 1997).[9] While the Article has a loose stance on the qualifying requirement as we propose, it indicates that

[9] In addition to Article 17, on the insistence of the EU, the Kyoto Protocol incorporates the "bubble" concept into the final text (Article 4). The "bubble" approach is often termed as "trading without rules" because it sets few restrictions on trading between parties. This makes it a potentially attractive instrument. Given great differences in environmental monitoring and enforcement infrastructures among Annex I countries, if it turns out to be too difficult to agree on the commonly-accepted rules and guidelines, the "bubble" approach at least opens the possibility of trading emissions permits within the voluntarily-formed group. However, the approach presents some drawbacks. First, it requires to set a cap on overall emissions for the group as a whole and to work out a specific cap for each member country within the group in an agreement, the terms of which must be notified to the UNFCCC Secretariat at the time of ratification of the Protocol. This has not proved easy for the EU to work out such an arrangement before Kyoto. The EU still

emissions trading is limited to Annex B countries. Even with the scope of participation, given great differences in environmental monitoring and enforcement infrastructures among Annex B countries, however, it will probably take years to agree on the commonly-accepted rules and guidelines "for verification, reporting and accountability for emissions trading" pursuant to the Kyoto Protocol. Even if they could have been worked out after lengthy negotiations, the scope of participation is very narrow, even in comparison with the WTO members which only represent part of the world community.[10] Because non-Annex I countries have not committed themselves to any targets, Annex I countries have been pressured to take trade measures to protect their domestic industries against competition from those countries that do not adopt GHG emissions limits. If so, this will have the far-reaching implications for the international trading system. This brings us to the next issue.

IV. SOME TRADE-RELATED ASPECTS OF EMISSIONS TRADING

The issue of compatibility of using trade measures against foreign environmental practices with the GATT has not been brought much attention until the findings of two GATT disputes panels on trade measures unilaterally taken by the US in the US-Mexico tuna-dolphin disputes were made public (Hudec, 1996). Both panel reports (GATT, 1991, 1994), which are commonly referred to as Tuna/Dolphin I and Tuna/Dolphin II, found the US restrictions on tuna imports from Mexico, which did not meet the US standards on dolphin-safe fishing practices, in violation of GATT. The panel in Tuna/Dolphin I ruled that all trade restrictions directed against environmental harms have to be territorial. Moreover, such restrictions can not be justified under Article III if they relate to the process of production rather than the product itself. The panel explained that, if governments could regulate imports according to the production process by

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has the difficulty in redistributing the joint commitments because the Kyoto Protocol incorporates a basket of six GHG, rather than the EU's originally-proposed three gases before Kyoto, and the uptake of GHG "by sinks resulting from direct human-induced land-use change and forestry activities", at first "limited to afforestation, reforestation and deforestation since 1990" (Article 3.3). Second, it narrows the scope of efficiency gains in comparison with inter-source trading, because it restricts the location where firms or countries comply with their caps and because it is likely to have frightening transaction costs. Third, in the case of the current EU bubble, because the European Community (EC) itself as a party to the Protocol, in addition to its member states, has the legitimate responsibility for reporting on the performance of the EU as a whole and ensuring its declared targets as a whole under the notified agreement are met, the potential advantages of offering double coverage of reporting obligations and double assurance for abatement obligations could be hindered by the need to have complete and early information from individual member states (OECD, 1998). In the event that the EC as a whole would fail to meet its own targets and if a non-compliance procedure would be established, the EC, together with those individual member states that have not achieved their own targets set out in the agreement, would thus be faced with sanctions under Article 4.6. In this case, who bears the responsibility of the EC itself? As such, some clarification for the clear division of responsibility in the terms of that agreement would be needed in the case where a regional economic integration organization itself were a party to the Protocol. Fourth, because Article 4 is framed in general terms and because no mandate to negotiate further rules has been given to the Conference of the Parties to the UNFCCC, it might create potential loopholes in meeting the Kyoto obligations.

which they were made, the rules of the GATT's Article III would allow governments to require imports to conform to any type of social regulation currently imposed on the production process of domestic producers. It would allow governments to condition market access on compliance with domestic laws governing working conditions. The panel in Tuna/Dolphin II concluded that Article XX does not preclude governments from pursuing environmental concerns outside their national territory, but such extra-jurisdictional application of domestic laws would be permitted only if aimed primarily at having a conservation or protection effect. The second panel ruled that the US restrictions were in violation of GATT because they aimed to force other countries to change their own policies in order to comply with the US standards.

The preceding discussion promotes the concern about the compatibility of an international emissions trading scheme with the GATT/WTO. In what follows, I will examine whether such emissions trading scheme has the potential to bring parties into conflict with the WTO provisions in dealing with the allocation of permits, non-compliance with emissions targets, emissions trading system enlargement, and trade measures against non-members of an emissions trading club.

A. Allocation of permits

The Kyoto Protocol has set the caps on aggregate GHG emissions for Annex I countries. If trading among private parties is authorized, the next issue is how these governments allocate the assigned amounts within their countries. The allocation process itself represents the establishment and distribution of private property rights over emissions, and itself lies outside the mandate of the WTO (Vaughan, 1997).

The allocation of permits depends on the structure of national emissions trading systems. Such systems could be modelled as either "*upstream*" or "*downstream*" or "*hybrid*" systems. An "*upstream*" trading system would target fossil fuel producers and importers as regulated entities, so would reduce number of allowance holders to oil refineries and importers, natural gas pipelines, natural gas processing plants, coal mines and processing plants (Hargrave, 1998). For example, if such a system would be implemented in the US, the total number of allowance holders would be restricted to about 1900. Even with such a relatively small number of regulated sources, market power would not be an issue. In the above upstream system for the US, the largest firm has only a 5.6 percent market allowance share. Firms, with each having less than one percent share, would hold the lion's share of allowances (Cramton and Kerr, 1998). Implemented effectively, an upstream system would capture virtually all fossil fuel use and carbon emissions in a national economy. Firms would raise fuel prices to offset the additional cost. In an upstream system the number of firms that has to be monitored for compliance is relatively small, thus it is easier to administer. Moreover, existing institutions for levying excises on fossil fuels, which exist in most industrialized countries, can be used to enforce the scheme (Zhang and Nentjes, 1998). However, one of the drawbacks of an upstream system is that it provides no

[10] Currently, the WTO has 132 members. More than 30 others are negotiating the accessions.

incentive for energy end-users to develop disposal technologies, the aspect that is deemed critical in searching the long-term solutions to solving climate change problems.

In contrast, a "*downstream*" trading system would be applied at the point of emissions. As such, a large number of diverse energy users are included. This would offer greater competition and stimulate more robust trading, thus leading to increased innovation. However, such a system would be more difficult to administer, especially concerning emissions from the transportation sector and other small sources. On the other hand, it would avoid that some energy users do not respond to the price signal, which might occur in an upstream system because of market imperfections such as high transaction costs, high discount rates and imperfect information, although the extent of their responsiveness depends on the degree of competition and on whether price increases are actually passed on to the consumers. To keep a downstream trading system at a manageable level, regulated sources could be limited to utilities and large industrial sources. Governments could then address uncapped sources through other regulatory means such as carbon taxes. In doing so, however, the governments need to establish additional programs. This would be administratively burdensome, let alone the political difficulties of introducing carbon taxes in some countries. Moreover, the actual achievements in reductions of CO_2 emissions by a proposed carbon tax remain uncertain because of imperfect knowledge of the price elasticities of demand and supply for fossil fuels, especially for the large price increases caused by carbon taxes for major emissions cutbacks (Cline, 1992). This would put the governments at risk of non-compliance with the emissions commitments.

Alternatively, national trading systems could be modelled as "*hybrid*" systems (Zhang and Nentjes, 1998). A hybrid system is similar to a downstream trading system in the sense that regulated sources at the levels of energy users are also limited to utilities and large industrial sources. On the other hand, like an upstream trading system, a hybrid system would require fuel distributors to hold allowances for small fuel users and to pass on their permit costs in a mark-up on the fuel price. As such, small fuel users are exempted from the necessity (and transaction costs) of holding allowances. 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.

No matter how national trading systems are modelled, importers and domestic producers of fossil fuels should be treated equally in obtaining emissions allowances under the like product provisions in the WTO. Moreover, regardless of whether individual countries choose to empower private trading, the ultimate responsibility for fulfilling the Kyoto commitments would remain with the national government as a party to the Protocol.

Given the great concern about international competitiveness, however, the allocation of permits does have the potential to bring parties into conflict with the WTO provisions. Some fear, for example, that governments could allocate the permits in such a manner to favour domestic firms against foreign rivals. This will violate the WTO principle of non-discrimination. The allocation of permits could also be designed in such a manner to advantage certain sectors over others and further enhance their existing imperfect market competition. This makes the unequal treatment explicit, which can be much easier hidden from the general

public if the conventional command-and-control regulations are used. This in turn would have a similar price distortion effect as a subsidy, and would be in conflict with the WTO rules that prohibit the use of export subsidies for such a purpose. All this clearly indicates that the manner in which countries allocate their assigned amounts should be compatible with these WTO principles and should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade.

However, it should be pointed out that although grandfathering is thought of as giving implicit subsidies to some sectors, grandfathering is less trade-distorted than the exemptions from carbon taxes. To understand their difference, it is important to bear in mind that grandfathering itself also implies an opportunity cost for firms receiving permits: what matters here is not how you get your permits, but what you can sell them for - that is what determines opportunity cost (Zhang and Nentjes, 1998). Thus, relative prices of products will not be that distorted and switching of demands towards products of those firms whose permits are awarded gratis (the so-called substitution effect) not be induced by grandfathering. This makes grandfathering different from the exemptions from carbon taxes. In the latter case, there exist 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 CEC tax on grounds of competitiveness. This not only reduces the effectiveness of the CEC tax in achieving its objective of reducing CO_2 emissions, but also makes the industries, which are exempt from paying the CEC tax, 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, 1997a).

With the great concern that a government that grandfathers permits to a domestic firm could give it a competitive advantage over similar firm in another country where permits are not awarded gratis, some thought that there is a need for the harmonisation of allocation of permits. However, we think that individual governments should be left free to devise their own ways of allocating permits on the following grounds.[11] First, we think this is not necessarily the case, because even if a firm obtains emissions permits by auction, if necessary, 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.

Second, although auctioning at least part of the assigned amounts to sub-national legal entities alleviates to some extent the concern about international competitiveness, any attempts to produce an agreement on a common rate are likely to run into concerns about national sovereignty and thus would encounter significant political difficulties. 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

[11] See Zhang and Nentjes (1998) for other reasons that are not given here.

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).

Third, given great differences in national circumstances, setting a uniform rule of allocation will restrict the rights of individual governments to select the option which is best suited to their own national circumstances. Indeed, the failure of the above CEC carbon/energy tax is to some extent because some member states are loath to restrict themselves to the common CEC-specified policy and measure design to stabilize CO_2 emission and the way how to do it. With second-best considerations, it is conceivable that some countries whose economies are heavily distorted would decide to auction permits, and that the revenues generated through auctioned permits could then be used to reduce pre-existing distortionary taxes, thus generating overall efficiency gains. Parry *et al*. (1997), for example, show that the costs of reducing US carbon emissions by 10% are four times more costly under a grandfathered carbon permits case than under an auctioned case. This disadvantage reflects the inability to make use of the revenue-recycling effect in the former case.

Fourth and importantly, leaving individual governments the freedom to devise their own ways of allocating assigned amounts to sub-national entities would ensure that any individual government maintains its right to determine the domestic policies and measures that would be taken to meet its Kyoto obligations. For example, a government that wants to use taxes or regulations for domestic emissions control could retain the sole right to trade. Alternatively, a government could allocate its assigned amounts to private entities to trade.

B. Emissions trading system enlargement

The Kyoto Protocol allows Russia to emit the same volume of greenhouse gases as the then Russia did in 1990. Given the fact that CO_2 emissions in Russia declined over the past years after the collapse of the Soviet Union in 1991 and are expected to continue declining, that means that Russia should be left as the biggest seller of emissions permits among Annex I countries once emissions trading takes place. The US has reached a conceptual agreement with Australia, Canada, Japan, New Zealand, Russia and Ukraine to pursue an umbrella group to trade emissions permits (USDOS, 1998). It is believed that the US is counting on emissions trading with Russia to achieve half of its 7% reduction target set in the Kyoto Protocol.[12] Although the US insists on bringing non-Annex I countries into an emissions trading scheme, which has widely been seen as creating a source of such permits for the US to buy and therefore achieve its own agreed reductions through offshore compliance,[13] it might seem that the US does not want the EU to breathe Russian "hot air"[14] because the addition of the EU to the group would raise the prices of the

[12] "Emissions Trading Discussions to Exclude EU", *Japan Times*, 25 February 1998.
[13] See Section V for a further discussion.
[14] When emissions trading were allowed, a country whose legally binding GHG emissions limits set by the Kyoto Protocol exceed its actual or anticipated emissions requirements would be able to trade these excess

Russian emissions permits that the American firms would have to pay.[15] On the other hand, Russia would not welcome the addition of non-Annex I countries, such as China and India, to the group because these new entrants would raise the supply of overall permits on the market and depress the prices of those permits held by Russia. This is also one of the reasons for the developing countries' opposition to emissions trading because they feel that it leaves them out of the system at this stage, although for some legitimate reasons these countries do not want to join in an emissions trading club at this moment. Although these are just political speculations, they underline the importance to establish clear rules of procedure about admitting new entrants before emissions trading begins.[16]

There are two avenues to establish such rules of procedure. One is based on voting to admit new entrants. So far any decisions made by the Conference of the Parties to the UNFCCC have been generally adopted by consensus. If admitting new entrants requires consensus by all current Annex B countries eligible for emissions trading, this confers on Russia a *de facto* power of veto. Thus, if avenue to admit new entrants rests on voting, a three-fourth majority vote of the current Annex B countries present and voting at the meeting could be adopted to prevent exploitation of market power.

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emissions, thus creating the "hot air" that would otherwise have not occurred. The "hot air" problem is particularly acute in Russia whose emissions are not expected to rise to its 1990 level until 2008. The "hot air" forms a "reservoir" from which some advanced Western countries, if not all, can simply buy emissions permits to make up any shortfall, instead of taking any serious domestic actions. This is one of the reasons why some countries have called for imposing a percentage limitation on the use of emissions trading. Indeed, such limitation was included in earlier negotiation drafts of the article about emissions trading, but on the insistence of the US does not appear in the final Protocol. The only leftover from this debate is the provision that "such trading shall be supplemental to domestic actions". If a country like the US would count on emissions trading with Russia to achieve half of its reduction target set in the Kyoto Protocol, emissions trading would then not be regarded as a "supplemental" means according to the common sense. As such, some clarification for interpreting the terms is needed. Besides, it should be pointed out that although emission trading makes the "hot air" problem explicit, the problem is related to targets setting, not to emissions trading per se. Even if such a flaw has now been built into the Kyoto Protocol, however, we have to deal with it in designing an effective emissions trading scheme in order to minimize its damage. Instead of imposing a percentage limitation on the use of emissions trading, we propose a transaction tax on trades involving "taxable" allowances, with the tax rate to be set by the Conference of the Parties. Such a tax rate could be imposed only on the buyer and could differ to reflect the direction of emissions trading flows, with a uniform zero or low rate for transactions within the advanced OECD countries themselves but a uniform high rate for transactions between them and countries with economies in transition. Setting a uniform low and uniform high rate is to prevent countries from attracting more trade by setting an even lower transaction tax rate of their own. An alternative strategy would allow emissions reductions below internationally accepted national baselines for the pre-2008 period within the jurisdiction of the advanced OECD countries prior to the beginning of the first commitment period to be credited for later use. This would also reduce their demand for the "hot air" during the commitment period.

[15] That the EU was not invited to participate in the meeting of the above umbrella group, on March 5-6, 1998, Washington, DC, which aimed to discuss the specific ways to implement emissions trading, has triggered the speculation.

[16] The interpretation that the relevant rules and guidelines should be established first before emissions trading begins is in line with Article 17 of the Kyoto Protocol, which puts the text of establishing the rules prior to who are eligible for emissions trading. This clearly indicates that those claims that emissions trading can start immediately are in violation of Article 17.

The second avenue rests on automatic phase-in once one prospective country meets pre-determined criteria. In our view, the second is superior to the first avenue. Such criteria should include under what conditions, how and when new entrant could be incorporated into the emissions trading scheme. Once such criteria are set, they should remain stable in the short run although it by no means precludes any adjustments that might be required in the future.

Similar reasons hold for expansion to include other greenhouse gases than CO_2 and the uptake of GHG by sinks[17] because a comprehensive coverage of both gases and options will induce more cost-effective abatement options. On the other hand, a workable emissions trading scheme requires that emissions of whatever a pollutant to be included have to be measured with reasonable accuracy. This requirement implicitly precludes including all gases in the initial trading scheme. However, limiting trading to a subset of gases is not likely to be effective unless the Protocol is further amended to partition the assigned amounts into two categories—tradable and non-tradable gases with separate goals being assigned for each (UNCTAD, 1998). Without a separation of categories, it seems to be lack of a legal basis to reject the legitimate claim from those countries that use the flexibility inherent in the equivalence process to substitute freely among the gases, because Article 5.3 of the Protocol has authorized that the global warming potentials are used to translate non-CO_2 greenhouse gases into carbon equivalent units in determining each Annex I party's compliance with its assigned amounts.

No matter what kind of rules are established, they would, no doubt, have profound implications for the world trading system.

C. Non-compliance with the agreed emissions targets

The Kyoto Protocol itself does not contain stipulations on what actions, if any, should be taken in the events of a country were found to be in non-compliance. Without clear criteria to judge compliance, it is difficult to believe that many of Annex I countries will be willing to ratify the Protocol. The US had proposed to penalise a country that failed to meet its target by imposing ever larger reduction obligations over a subsequent period (the so-called borrowing with a penalty), but negotiators at Kyoto blocked the only compliance mechanism on the table because they fear that would not bring any additional pressure to bear on a country that simply continues to disregard its commitments. It is then natural to think to use trade measures -- usually in the form of a trade restriction -- to enforce a country in compliance with its commitment. In this case, caution should be taken because all WTO retaliation is limited to a "compensatory" amount, that is, an amount equivalent to the value of the trade obligations being nullified or impared by the other party. Its

[17] Sinks here refer to those vehicles for absorbing anthropogenic GHG emissions. Oceans, soils and forests all offer some potential to serve as sinks for net carbon sequestration. For practical reasons, however, the Kyoto Protocol only authorizes the uptake of GHG "by sinks resulting from direct human-induced land-use change and forestry activities", at first "limited to afforestation, reforestation and deforestation since 1990".

main significance is that it rejects a more aggressive approach towards sanctions, the approach under which a legal sanction must be large enough to produce the desired change of behavior (Hudec, 1996).

D. Trade measures against non-members of an emissions trading club

Because non-Annex I countries have not committed themselves to any targets, Annex I countries have been pressured by their powerful lobbying groups to take trade measures to protect their domestic industries against competition from non-Annex I countries. Then what kind of trade measures could be potentially applied against non-members of an emissions trading club in order to counter the trade effects of honouring their Kyoto commitments? One possibility might be that Annex I countries comply with their Kyoto commitments, but use border adjustment taxes based on embodied carbon content of goods imported from non-Annex I countries to keep non-Annex I countries' emissions at their baseline levels. [18] Another possibility is that Annex I countries abide by their Kyoto commitments, but set imports of energy-intensive goods from non-Annex I countries at their baseline levels or set exports of energy-intensive goods from non-Annex I countries at their baseline levels. The third possibility is that Annex I countries abide by their Kyoto commitments, but provide subsidies up to the levels at which their exports of energy-intensive goods remain at their baseline levels. Although these trade measures appear only to include the component designed to reduce GHG emissions leakage, they are in principle in conflict with the GATT/WTO principles of most favoured nation and non-discrimination. Such taxes could fall foul of the like product provisions in the GATT's Article I and Article III that are designed to prevent a country from discriminating against imports on the basis of their territorial origin (WTO, 1995). There are formidable technical difficulties, if not entirely impossible, in identifying the appropriate carbon contents embodied in virtually all traded products unless non-Annex I exporting countries are willing to cooperate in certifying how the products are produced. In the absence of any information regarding the carbon content of the products from non-Annex I countries, importing Annex-I countries may prescribe the tax rates based on their domestically predominant method of production for the imported products.[19] Such a practice will violate the GATT rules that do not allow to take trade measures on a basis of the differences in process and production methods (PPM), and appears to deprive non-Annex I countries of enjoying the very basis of comparative advantage in their production. Moreover, such tariffs would likely violate commitments made by the WTO contracting countries not to raise import taxes above "bound tariff" levels, i.e. maximum tariffs for goods listed in an annex to the GATT (WTO, 1995). The WTO rules also prohibit the use of export subsidies to advantage certain sectors over others.

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[18] The baseline levels in this Section refer to those emissions, imports or exports when either Annex I or non-Annex I countries have not adopted emissions targets. As discussed in Zhang (1997a, 1997b), establishing such future national baselines is not a simple matter.

[19] This practice is by no means without foundation. For example, the US Secretary of the Treasury has adopted the approach in the tax on imported toxic chemicals (Poterba and Rotemberg, 1995).

Are there any potential avenues within the WTO rules to accommodate Annex I countries on this score, should they decide to pursue the above offsetting trade measures? One avenue would be that Annex I countries could claim general exceptions under the GATT's Article XX, which states that:

> "Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be constructed to prevent the adoption or enforcement by any contracting party of measures:
> ... (b) necessary to protect human, animal or plant life or health;
> ... (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption; ..." (WTO, 1995, p. 519).

Article XX itself is the exceptions that authorize governments to employ otherwise GATT-illegal measures when such measures are necessary to deal with certain enumerated social policy problems. Since Annex I countries participating emissions trading are obligated to limit their GHG emissions, while non-Annex I countries are not bound by such commitments, the same conditions do not exist for Annex I countries and non-Annex I countries. Therefore, Annex I countries could argue that the discrimination in the trade restrictions is neither arbitrary nor unjustifiable, thus meeting the requirement in the preamble to Article XX.[20] Under Article 2.2 of the Agreement on Technical Barriers to Trade, technical regulations shall not be more trade restrictive than necessary to fulfil a "legitimate objective", which is defined as including the protection of human health or safety, animal or plant life or health, or the environment (WTO, 1995), the offsetting trade measures could be based on legitimate environmental objective and not merely on formal membership of an international agreement (Brack, 1996). So, if any non-Annex I countries voluntarily assume binding emissions targets, a prerequisite for engaging in emissions trading, through amendment to the Annex B of the Kyoto Protocol,[21] they should be exempted from such trade restrictions. This is of particular importance to newly industrialising countries because they are the countries that are most likely to make such voluntary commitments among non-Annex I countries. This is not without precedent. For example, the Montreal Protocol[22] has included the provision that exempts non-parties from trade measures if they are determined by the parties to be in compliance with the phase-out schedules. Indeed, the US has proposed at Kyoto to allow non-Annex I countries to voluntarily adopt GHG

[20] Brack (1996) has used this argument to justify the discriminatory trade measures applied against non-parties to the Montreal Protocol.
[21] Annex B to the Kyoto Protocol and Annex I to the UNFCCC are now identical in nature, although they are slightly different numerically. This deliberate change from Annex I into Annex B potentially allows a developing country to engage in emissions trading if it voluntarily adopts an emissions target and is inscribed in Annex B.

controls so that non-Annex I countries can also be brought into an emissions trading club. However, the group of 77 and China[23] blocked the US proposal. The underlying reasons for their objections are given below. First, on ethical grounds, non-Annex I countries think that Annex I countries have caused the climate change problem and should thus clean it up themselves before asking non-Annex I countries to take actions. Second, non-Annex I countries insist that the US demand for developing countries' commitments goes against an earlier United Nations agreement, known as the Berlin Mandate adopted at the first Conference of the Parties to the UNFCCC in Berlin in April 1995, which specifically indicated that "a protocol or another legal instrument" adopted at the third Conference of the Parties in Kyoto should "not introduce any new commitments" for non-Annex I countries. Third, there is the widespread fear that the opportunity to trade emissions permits might eventually lure others in the group, especially the Latin American nations, to be drawn into making commitments of their own. Then rich Annex I countries might use emissions trading as a means of buying their way out of responsibility for climate problems and at the same time postponing the radical changes in their own consumption patterns and passing the responsibility on to the poor, while GHG emissions limits grow subsequently tighter on the developing countries.

In addition, Annex I countries might argue that to support the operation of an emissions trading scheme that is designed to protect health and conserve depletable fossil fuels, some kind of offsetting trade measures would be required and qualify for the exceptions under Article XX(b) and Article XX(g) because international emissions leakage would otherwise frustrate its intent (Babiker *et al.*, 1997). Furthermore, although such measures would not be the least trade-distorting, they are much less trade-restrictive than the tariff suggested by Hoel (1996), which also includes the optimal trade tariff term.

Another avenue rests on Article 1.1 of the Agreement on Subsidies and Countervailing Measures, under which a subsidy is defined as including "government revenue that is otherwise due is foregone or not collected" (WTO, 1995). Although a narrow interpretation of this clause would limit claims to cases in which taxes are levied but not collected, its broad interpretation would expose the absence of environmental taxes to charges of unfair subsidisation (Esty, 1994). So Annex I countries could argue that the absence of emissions targets for non-Annex I countries would be equivalent to giving an implicit unfair export subsidies biased towards their energy-intensive sectors (the so-called ecological dumping), because the costs of environmental degradation are not part of the prices of those exported products.

Although Annex I countries could justify their offsetting trade measures according to Article XX and the definition of lax environmental regulation as a countervailable subsidy, non-Annex I countries of the WTO would, no doubt, resist such interpretations. Since environmental issue was simply not a public issue in 1947 when GATT was signed, exploring the environmental exceptions to the general free trade

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[22] The Montreal Protocol on Substances that Deplete the Ozone Layer was signed in 1987. The Protocol has since been amended and strengthened in a number of aspects (see, for example, Brack (1996)).

[23] As has been the case in the international climate change negotiations, the developing countries express their consensus views as the group of 77 and China's positions. Divergent or dissenting views are then expressed separately, representing either individual countries or smaller groups, such as the Alliance of Small Island States (AOSIS).

requirements in GATT as much as depends on interpretation as on the actual clauses (Charnovitz, 1991). Given the fact that a three-fourths vote of the entire membership is required for the membership to adopt legal interpretation of any WTO agreement (WTO, 1995), the above interpretations might stand a little chance of being accepted by non-Annex I countries that form the majority of the WTO members.

Besides, lessons from the Montreal Protocol may be instructive. The Protocol prohibits with non-parties trade in ozone-depleting substances (ODS) themselves, products containing ODS, and possibly products made using but not containing ODS. The trade restrictions were used together with financial assistance (i.e., Multilateral Fund in this case) and technology transfer as a means to coerce or force countries to become parties. Although the Protocol has succeeded in securing universal participation by means of the "carrot and stick" approach as the signatories to it make up more than 95% of current world consumption and production of ODS, the fact remains that restrictions are discriminatory. While the restrictions have not been contested by the WTO members, the WTO Secretariat has voiced its opposition to such uses of trade restrictions, and its Committee on Trade and Environment has voiced not to welcome their replication in an emissions trading scheme (Barrett, 1994; Vaughan, 1997), because such measures appear to violate the GATT/WTO principles of most favoured nation, national treatment and non-discrimination. In the Montreal Protocol, this discriminatory restrictions are not that important given the scope of its membership wider than the WTO itself, since most of the potential for trade conflict arises with non-parties to the Protocol. However, if they were used in climate problems, economic implications could be substantial because an emissions trading club is only a small subset of the WTO members, at least at its initial stage. Moreover, there may be some legitimate reasons[24] why many of non-Annex I countries, if not all, might want to remain outside an emissions trading club unless side payments are offered to these countries such that they are not made worse off as members than they would be as non-members. Thus, it seems unfair to discriminate them just on these basis. Then, is there any way out? This leads to another large subject.

V. JOINT IMPLEMENTATION WITH DEVELOPING COUNTRIES

Countries may differ with respect to assimilative capacities and to tastes and preferences for environmental quality. Thus, the harmonisation of environmental policy would not be always necessary from an environmental point of view, and may lead to sub-optimal use of the environment from an economics point of view. On the other hand, from the industrialised countries' perspective, the lack of developing countries' involvement in combating climate change aggravates their short-term concerns about international competitiveness. Non-participation by developing countries increases emissions leakage that

[24] Such as disagreement about scientific evidence, different perspective on the responsibility for climate problems, different priority to divert its limited resources, different risk acceptance thresholds, and disagreement about the burden-sharing of abating GHG emissions.

could arise in the short term, as emissions controls lower world fossil fuel prices, and in the long term, as industries relocate to developing countries to avoid emissions controls at home. In addition, it raises the spectre of developing countries becoming "locked in" to more fossil fuel intensive economy and eliminates the Annex I countries' opportunity to obtain low-cost abatement options. Testifying on 4th March 1998 before the House Commerce Subcommittee on Energy and Power about the domestic economic implications of the Kyoto Protocol, Dr. Janet Yellen (1998), Chair of the White House's Council of Economic Advisers, stated that when there is no emissions trading at all, the cost of complying with the Kyoto target for the US would run to $125 per ton of carbon. With emissions trading only among Annex I countries, the cost would drop to $30-50 per ton. With fully worldwide emissions trading, the cost would further drop to $14-23 per ton. This clearly explains why the US puts heavy emphasis on the involvement of developing countries. Indeed, recent Indonesian bush fires choking Southeast Asia served as a graphic reminder that developing countries have an important part to play in protecting the environment against global warming.

For some time to come, however, many developing countries would be not qualified for participating in an international emissions trading scheme. This promotes the concern: how can we encourage their participation in combating global climate change, 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).[25] Indeed, many OECD countries are keen to see JI as a key part of the Kyoto Protocol, even although it is not without conceptual and operational problems, such as the form of JI, criteria for JI, the establishment of baselines against which the effects of JI projects can be measured, and the verification of emissions reductions of JI projects (Zhang, 1997a, 1997b). In brief, JI means that the investor in one country invests in emissions abatement projects in another (host) country where the costs of abating GHG emissions are lower than trying to achieve an equivalent abatement within the own country and is credited, in whole or in part, for emissions abatements in its own GHG accounts. By shifting the burden of carrying out abatement into non-Annex I countries, JI thus offers the potential for lowering the global costs of abating GHG emissions and succeeds in reducing GHG emissions leakage without discriminating against such countries (Barrett, 1994). In the WTO jargon, JI offers a positive incentive for countries to participate in an international agreement:

> "when cooperation is not voluntarily forthcoming, positive incentives are the best way to achieve sustained inter-governmental cooperation. Positive incentives can include offers of financial assistance and transfers of environmentally friendly technology directly related to the problem at hand, as well as more broadly based offers, for example, to increase foreign aid, to lessen debt problems and to make non-discriminatory reductions in trade barriers." (GATT, 1992).

[25] This kind of joint implementation between one Annex I country with emissions targets and one non-Annex I country without emissions targets has now been termed as the Clean Development Mechanism (CDM) under the Kyoto Protocol (UNFCCC, 1997). However, we still use the customary terms JI instead of the CDM.

However, bringing the developing countries on board and integrating JI credit trading into an international GHG emissions scheme promotes another concern about the credibility of the scheme. How can such an international scheme incorporate credits from JI projects and at the same time ensure that the confidence in the scheme is not compromised? One option would 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 reported emission reductions of JI projects. Moreover, I advocate a predetermined discount factor, a view shared by the CCAP (1997). In order to reflect the characteristics of a JI project and the differing quality of GHG 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. I 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 an emissions trading scheme, and provide non-Annex I countries with financial incentives to opt for binding commitments and develop their stringent monitoring and reporting infrastructures. In addition, only verified and certified JI credits would become part of the emissions trading scheme. Once certified, these credits could be treated as homogenous in quality to all other permits.

It should be pointed out that the group of 77 and China have not proved very receptive to the concept of JI for some legitimate reasons. It is also unclear if the US Congress will support such a mechanism, although for reasons very different from those used for the group of 77 and China. Given the fact that JI, by definition, will not shift the burden of paying for abating GHG emissions into non-Annex I countries, which could result in a large outflow of investment capital from the US to non-Annex I countries, some influential congressmen in the US have already begun to regard JI as foreign aid.[26]

VI. CONCLUSIONS

The Kyoto Protocol, despite its apparent flaws in its current form, is the first international environmental agreement that sets legally binding GHG emissions targets and timetables for Annex I countries. Its Article 17 authorizes emissions trading between Annex I countries. If properly designed, emissions trading can effectively reduce their abatement costs while assisting Annex I countries in achieving their Kyoto obligations.

This article has examined the compatibility of an international emissions trading scheme with the GATT/WTO. It has been found that in dealing with the allocation of permits, non-compliance with emissions

targets, and emissions trading system enlargement, emissions trading has the potential to bring parties into conflict with the WTO provisions. WTO will also have to resolve the very difficult question of what to do about Annex I countries of the WTO, should they decide to pursue the offsetting trade measures against non-Annex I countries of the WTO, who for some legitimate reasons have decided to remain outside an emissions trading club. In this regard, JI may offer the way out because it succeeds in reducing GHG emissions leakage without discriminating against such countries. However, the prospect for JI depends on how JI is implemented and on whether mutual mistrust between Annex I and non-Annex I countries can be removed. In any case, breakthroughs in low-cost energy efficient technologies and the ways to transfer such technologies play a key role in acceptably drawing developing countries into the battle against global climate change. The ozone experience has shown that when low-cost substitution technologies start becoming available and when their transfers to developing countries takes place on fair and most favourable conditions, there is little difficulty in persuading developing countries to join. This underlines the importance for governments to enhance energy R&D and for the WTO Committee on Trade and Environment to explore the possibility of envisioning a more flexible patenting and intellectual property rights scheme that allows developing countries to acquire such technologies on preferential terms under the Agreement on Trade-Related Aspects of Intellectual Property Rights.

It should be pointed out that although greenhouse gases offer an even more attractive case for application of emissions trading than many local pollutants already well handled with emissions trading, the US Sulphur Allowance Trading Program cannot just be transplanted to the international terrain where legal and institutional ingredients differ substantially from those in the US. It will probably take years, if not decades, of setting up such an international scheme. This raises the political question about the credibility of achieving Kyoto commitments and, at the same time, promotes the necessity of investigating effective national policies that can influence the behaviour of firms and consumers and establish the credibility of long-term goals. As such, interim measures before the beginning of the first commitment period in 2008 warrant special attention. They include national emissions trading scheme with looser controls than are required by the Kyoto Protocol, crediting early emissions reductions below internationally accepted national baselines prior to 2008 within the jurisdiction of the advanced OECD countries, tax incentives to promote energy efficient technologies, signals of carbon taxes to be levied at a specific future date, and government's role as a larger buyer to create stronger demand for energy efficient technologies. Indeed, taking interim measures are necessary because Article 3.2 of the Kyoto Protocol requires Annex I countries to "have made demonstrable progress" in achieving their commitments by 2005.

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