

Dutschke, Michael; Michaelowa, Axel

**Working Paper**

## Issues and open questions of greenhouse gas emission trading under the Kyoto protocol

HWWA Discussion Paper, No. 68

**Provided in Cooperation with:**

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)

*Suggested Citation:* Dutschke, Michael; Michaelowa, Axel (1998) : Issues and open questions of greenhouse gas emission trading under the Kyoto protocol, HWWA Discussion Paper, No. 68, Hamburg Institute of International Economics (HWWA), Hamburg

This Version is available at:

<https://hdl.handle.net/10419/19185>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# **Issues and Open Questions of Greenhouse Gas Emission Trading under the Kyoto Protocol**

Michael Dutschke  
Axel Michaelowa

HWWA-Diskussionspapier

**68**

HWWA-Institut für Wirtschaftsforschung-Hamburg

1998

ISSN 1432-4458

## Contents

<b>1. Flexible mechanisms in the Kyoto Protocol</b>	<b>7</b>
1.1 Bubbles	7
1.2 Emission trade	8
1.3 Joint Implementation between Annex I countries	8
1.4 Clean Development Mechanism	8
<b>2. Goals of emission trading</b>	<b>8</b>
2.1 Economic sustainability	9
2.2 Ecological sustainability	9
2.3 Initial allocation of emission permits	11
<b>3. Institutional needs</b>	<b>11</b>
<b>4. Interaction of international emission trade with domestic instruments</b>	<b>13</b>
4.1 Emission trade	13
4.2 Emission taxes	14
4.3 Other fiscal measures	15
4.3. Voluntary agreements	15
1	
4.3. Regulation	15
2	
<b>5. Recommendations for the Fourth Conference of the Parties</b>	<b>16</b>
5.1 Stress on systems integrity	16
5.2 Institutional framework	17



## **1. FLEXIBLE MECHANISMS IN THE KYOTO PROTOCOL**

For the first time, the Protocol negotiated by the third Conference of the Parties to the U.N. Framework Convention on Climate Change in Kyoto sets legally binding emission targets for the commitment period 2008-2012 for the industrial countries and countries in transition listed in Annex I. These targets encompass a basket of six greenhouse gases and do not have to be reached by domestic emission reduction alone. The Protocol allows the use of less costly emission reduction potential abroad through four mechanisms: common targets or "bubbles" (Art. 4), emission trade (Art. 17), Joint Implementation (Art. 6) and projects of the "Clean Development Mechanism" (CDM) with countries without emission targets (Art. 12). Bubbles withstanding they shall be "supplemental" to domestic measures. Supplementarity has not been defined in the Protocol, though. If average emissions in the commitment period are lower than the emission target the difference can be banked for the next commitment period.

Due to time pressure during negotiation of the Protocol rules for the use of flexibility mechanisms remain vague. Thus the next Conference of the Parties has to settle many details. This study makes suggestions for the solution of these open issues on the base of the goal of economic efficient emission reduction. It also considers the political feasibility of these suggestions.

### **1.1 Bubbles**

Countries that want to set a common target can set up a bubble and have to declare it at the latest when they ratify the Protocol. The bubble remains binding throughout the commitment period. So far the EU is the only bubble. Ongoing negotiations between Russia on the one hand and the U.S., Canada, Japan and New Zealand on the other hand could lead to the creation of additional bubbles. This could lead to a reduction of the potential for international emission trade. Bubbles minimize transactions cost. Policies and measures in the bubble nevertheless have to be designed in a way that they achieve emission reduction at minimum cost. This presumes a minimum of harmonization of policies or the possibility for internal emission trade. Bubbles may set differentiated targets for participating states as long as the overall target will not be surpassed. If the target is not reached by the bubble, each state individually is responsible for the target allocated by the bubble agreement. In the case of the EU, which also is a Party to the convention, binding sanctions against member states that fail to reach their target would be necessary.

### **1.2 Emission trade**

Article 17 which allows emission trade is only valid for countries with emission targets. As it was only inserted in the Protocol in the last minute it contains few rules and regulations. It was only stated that "emission reduction units" (i.e. permits) are to be added to the budget of the buyer and to be deducted from the budget of the seller. Trade has to be based on common methods for inventories using IPCC methodology and verification to prevent trade with fictitious emission reduction. Sanctions have to be used to avoid violation of methodology.

### **1.3 Joint Implementation between Annex I countries**

Article 6 allows Annex I countries to acquire emission permits through investment in projects in other Annex I countries. Emission permits created in that way are to be considered equal to emission permits from emission trade under Art. 17. Emission permits are not created if annual reporting requirements have not been met or the reports do not comply with the binding rules. If a review team has doubts about additionality of emission permits they shall still be tradeable but are "frozen" until the doubts are resolved.

### **1.4 Clean Development Mechanism**

Joint projects with developing countries shall be coordinated through the CDM whose definition remains extremely vague. They create tradeable "certified emissions reductions" (CERs). Contrary to the other flexibility mechanisms CERs accrue already from 2000, not only for the commitment period 2008-2012. It is not clear whether sequestration projects are allowed. The CDM shall finance its administrative costs through a fee on projects. Moreover, a share of this fee shall be used to finance adaptation projects in particularly vulnerable countries.

Generally both bilateral and multilateral organisation of projects are possible under the CDM. The multilateral CDM would either be a fund or a clearinghouse.

## **2. GOALS OF EMISSION TRADING**

Trade in emission permits can be derived from the principle of sustainable development which encompasses the following goals:

- Economic sustainability, e.g. cost efficiency
- Ecological sustainability, e.g. at least attainment of the set emission target

- Distributional equity, e.g. allocation of emission permits which does not unfairly disadvantage a party.

## **2.1 Economic sustainability**

Greenhouse gases are distinguished from most other pollutants through their exclusively global impact. Thus it does not matter where emission reduction takes place. Environmental economics thus concludes that an instrument is efficient which leads to a globally equal marginal reduction cost. The scale of possible efficiency gains is illustrated by studies that calculate cost savings through change from national to international emission targets. The 1997 comparison of seven economic models by the Stanford Energy Modeling Forum calculates cost savings of 20-90% through global emission trade. So far only the U.S. has developed longer-term experience with tradeable, period-based emission permits (e.g. for SO<sub>2</sub>) that shows the general applicability of the instrument and large potential for efficiency gains. Emission trade will only realize its full savings potential through participation of the private sector. Moreover, all participants have to know the rules beforehand. Without participation of private companies emission trade is limited to countries. Under this limitation we envisage no liquid market but a series of bilateral transactions without transparent prices. The participation of the private sector complicates the system as the national instruments of climate policy have to be taken into account. Efficiency of international emission trade can be further enhanced if these instruments are also efficient. Emission targets have to be set in a way that they are reachable. Their update and strengthening in future commitment periods has to be foreseeable and should then really take place. Sanctions that are applied in case of violation of rules have to be reliable.

## **2.2 Ecological sustainability**

Emission trade shall not lead to a rise in global emissions. This also concerns dynamic aspects - e.g. innovation must not be reduced.

Problems arise if forecast emissions lie below the target (creation of "hot air"). This currently applies to countries in transition and could apply to developing countries in the future ("tropical air"). It seems to be very difficult to prevent the sale of "hot air" through special rules for emission trade. The abolition of interim periods without target would be helpful. The admission to emissions trade could only be granted if comparable inventories and systems of verification as well as demonstrable progress in emission reduction until 2005 exist.

The CDM allows Annex B countries to extend their aggregate emission budget before the start of the first commitment period. Therefore stringent international minimum standards for the construction of baselines for CDM projects are very important. The choice of overstated baselines would lead to fictitious emission reduction and thus an overextension of the emission budgets of investing countries. Taking recent research results into account project specific baselines on the base of sectoral project typologies can be recommended for the CDM. Otherwise the CDM would be a loophole which allows "tropical air" to enter the system.

A limitation of the use of flexible instruments cannot be advocated from a short-term perspective as it would drive up the costs to reach the Kyoto target. In the long run it has to be assessed if the short-term rise in costs can be matched or even surpassed by cost reduction due to induced innovation. Economic theory cannot answer this question up to now. On the base of the Kyoto Protocol there are few practical possibilities to set a ceiling. On the one hand there is the possibility to substitute one flexibility instrument for another that is subject to quotas. On the other hand such a limitation of flexibility seems politically very unrealistic as major Parties have not even ratified the Kyoto Protocol.

Bubble members can trade with other states after they have agreed their internal burden sharing. A prohibition of external sales makes no sense.

Differences in the accuracy of emission calculation pose problems. While the standard deviation of energy-related CO<sub>2</sub>-emissions amounts to 5% it amounts to 30-40% in case of agricultural methane and several orders of magnitude in the case of N<sub>2</sub>O. Thus the system of emission trade could be restricted to certain sources and gases, e.g. energy-related CO<sub>2</sub> and methane. The basket approach of the Protocol would even then allow to utilize differences in accuracy if permits are sold that are based on accurately measured emissions and these permits are substituted through domestic emission reduction of highly uncertain gases where calculations err on the high side. An alternative could be to use the lowest estimate as base for trade and to discount estimates according to their degree of uncertainty. It seems that many countries will insist on excluding sequestration projects from flexibility instruments, at least from the CDM.

### **2.3 Initial allocation of emission permits**



Initial allocation of permits on a national level poses problems because it has huge distributional consequences. However, market price does not depend on the allocation mode. Grandfathering, i.e. zero-price allocation to existing emitters, has many disadvantages. Stagnating or shrinking sectors gain compared to growing ones. Moreover, efficient producers are disadvantaged as their past reductions are not taken into account. It is unclear whether grandfathering can be seen as actionable subsidy under WTO rules. Due to the political power of established interest groups grandfathering is likely to be implemented. A number of studies show that auctioning permits and recycling of revenue through tax reduction leads to considerable economic gains. Free choice of allocation modes could lead to a "race to the bottom" and a universal application of grandfathering. Thus it is suggested to prevent distortion of competition hurting countries that choose the auction mode through international prohibition of grandfathering.

### **3. INSTITUTIONAL NEEDS**

Standardization of permits is necessary to create a global market. Permits differentiated according to mode of creation would lead to reduced liquidity and transparency of markets. All permits should be denominated in "CO<sub>2</sub> equivalent" and be issued in tons of CO<sub>2</sub>. To allow market valuation of different risks the name of the issuing country and the date of issue have to be stated. Permits created through JI and CDM have to additionally state the name of the project and the certifier. Depending on the allocation of liability between seller and buyer the market can discount dubious permits if they can be allocated to emitters without doubt.

It has to be made sure that the permit seller delivers the stated emission reduction or that the buyer cannot credit permits towards his national target that are not based on a real reduction. The uniform value of permits should not be touched. Therefore a country should be prohibited to sell permits during the commitment period if serious doubts about its reaching the target exist. Acquisition of permits and the sale of options on permits may be continued.

Confidence in the market for emission permits will only be sufficient if cheating is minimized. thus permits should only be tradeable if they have been verified by independent institutions. Precondition for participation in emission trade is a national emissions inventory (Art. 7 of Kyoto Protocol). Non-Annex-1 countries selling permits from certified CDM projects do not need it.

Trading needs one or several exchanges to be supervised efficiently. If the rules are set, futures trade will arise. Genuine emission trade can start in 2008 or afterwards. To prevent panic buying, high price variability and involuntary non-compliance at the end of the commitment period, a true-up period of at least three months should be allowed after national emissions data are available. Countries that are in non-compliance can use this period to buy permits to reach their target. After the first commitment period true-up would presumably begin in 2014. It would be preferable to reduce the lag of reporting through an improvement in verification systems.

Methods and data for verification have to comply with internationally equal standards, otherwise distortions in valuation and comparability would arise. Thus a nationally uniform, internationally recognized verification system for all JI and CDM projects is absolutely necessary. Full transparency of project reports is important to convince competitors, NGOs and the general public of the advantages related to emission trade.

Each country has to set up a system of double bookkeeping which tracks all trades implicating the country. The system could be an analogue to the U.S. SO<sub>2</sub> monitoring system that is publicly accessible via Internet. An annual report should be delivered to an international monitoring body (preferably the secretariat of the climate convention). Reporting could be done in a uniform manner. The secretariat checks reports and makes spot checks. In case a country does not achieve this transparency it should not be allowed to participate in trading.

The decision which countries should be allowed to participate in trading during the first commitment period should be taken in 2005, with a reprieve for latecomers until 2006. Besides the stated criteria "demonstrable progress" in domestic emission reduction should be shown. A trend showing a significant convergence towards the respective target would have to be demonstrated.

Without accepting a staged system of sanctions no Party can participate in trading without jeopardizing the system. As in contrast to domestic trading systems an institution supervising international emission trade is not vested with wide-ranging powers instruments have to be developed that lead to sufficient deterrence. Internationally, incentives are preferable to negative sanctions as the latter can only be enforced with difficulties. Finally, a non-exit clause has to be signed to prevent that a country leaves the Kyoto Protocol due to the fear of a financial penalty or a "climate debt" resulting from compul-

sory borrowing from the next commitment period. Borrowing per se is no strong sanction and could lead to a debt trap. It could play an additional role, though.

If insolvency can be forecast, the secretariat could start a consultation mechanism. If the situation does not improve, it will issue a warning against the acquisition of permits of the country. This warning would deter even in case of full seller liability as it would reduce the standing of acquired permits. In case of buyer liability the permit value would collapse immediately until the balance is strengthened again. The loss of value would allow the country to retire its permits at a low price. Finally the sale of permits by the overindebted country could be prohibited fully. Stronger sanctions would lead to conflicts with sovereignty issues.

A deposit refunded in case of compliance could reduce the need for a complicated supranational sanctions mechanism.

#### **4. INTERACTION OF INTERNATIONAL EMISSION TRADE WITH DOMESTIC INSTRUMENTS**

According to the Kyoto Protocol industrial countries are free in the choice of domestic instruments to reach their targets. Efforts failed to make certain instruments compulsory for all countries. Therefore, many different approaches will coexist. Moreover a mix of instruments within each country is probable. International emission trade shall not be distorted through this diversity of instruments.

##### **4.1 Emission trade**

A national permit system can be constructed in an "upstream" or "downstream" mode. The former requires permits at the point of input, the latter with the actual emitter.

In a "downstream" system the acquisition of verified international permits and their cession to the state would lead to a corresponding additional allocation of national permits. The sale of permits internationally would lead to a corresponding decrease of the circulating permit quantity. In the case of grandfathering the allocation would be reduced proportionally while the auction approach would have a reduced supply. Market price for national permits would become equal to the world market price for international permits.

In an "upstream" system the possibility of acquisition and sale of international emission permits is restricted - besides speculators - to companies that have to hold national permits, i.e. producers or importers of fossil fuels. It would only be possible that emission reduction projects of companies that do not belong to this group would lead to an extra allocation of permits that would be saleable. The volume of permits allocated to producers and importers of fossil fuels would have to be reduced accordingly to prevent non-compliance.

A possible gliding transition to the commitment period would occur through a system that credits reductions from a baseline through the allocation of permits. The sum of these permits would have to be subtracted from the budget at the start of the commitment period. The impact of this system crucially depends from the baseline. Thus it leads to high verification costs.

## **4.2 Emission taxes**

A number of countries already has introduced taxes on CO<sub>2</sub> emissions as part of domestic climate policy. These countries presumably will not switch to a system of emission trade. As emission reduction induced through the tax cannot be forecast accurately, international emission trade is necessary at the end of the commitment period: if domestic emission was above the budget, permits have to be bought. If emission was lower, permits can be sold or banked. In the former case there is a risk that the country has to pay high prices due to demand peaks if many countries have a need to acquire additional permits. Obviously, the state can hedge itself through futures markets.

The combination of an emission tax with international emission trade could be achieved through a tax exemption proportional to the number of acquired permits. Companies will invest in permits if their price is lower than the tax rate. The state loses tax revenue but has a lower need for additional permits at the end of the commitment period.

The creation of permits that are saleable on the international market is only possible in this context if an actual project leads to emission reduction that are not leading to a corresponding tax reduction. Then the project could be verified according to rules for JI projects and allocated permits. A company would choose this option if net costs of the project including all transaction cost and the lost tax reduction are lower than the net proceeds from the sale of the permits. The state would have to buy *ceteris paribus* additional permits at the end of the commitment period.

If a debate on competitiveness leads to a tax exemption of energy-intensive companies these can still participate in trading but not create permits.

### **4.3 Other fiscal measures**

If there is no emission tax domestic emission reduction the acquisition of permits could be promoted through direct tax exemption or subsidies. This could lead to distortions as it would not be revenue-neutral. Nevertheless such a solution would be a "second best" if the rate on subsidy would be calculated according to accepted criteria of climate policy such as an implicit tax or subsidy rate per reduced ton of greenhouse gases. Such tax exemptions or subsidies would lead to a loss of overall revenue.

#### ***4.3.1 Voluntary agreements***

Voluntary agreements can easily be linked to international emission trade if their target can either be reached through domestic measures or acquisitions of permits.

#### ***4.3.2 Regulation***

Regulation such as efficiency standards have the same problem as an emission tax: reaching the target is uncertain and a shortfall/surplus of permits at the end of the commitment period can be expected. Acquisition of permits by a company could lead to a temporary loosening of the standards until the additional emission due to the loosening corresponds to the acquired permits. Such a system must not lead to an unwanted loosening of regulation of other pollutants. Permits can be created if the standard is over-complied with. The verification of these activities seems to be problematic and costly, though. Implications for the country's emissions budget are the same as in case of the tax. An interesting form of regulation are externality adders that could be compensated through acquisition of permits.

## **5. RECOMMENDATIONS FOR THE FOURTH CONFERENCE OF THE PARTIES**

Priorities for the fourth Conference of the Parties are the definition of rules for the CDM due to planned crediting from 2000 onwards and the definition of groundrules for international emission trade. Progress concerning sanctions would be very important. As the Protocol will not enter into force before 2001 there remains time for experiments with national emission trade systems. Especially the impact of different allocation modes on international competition have to be analyzed. This also applies to early crediting towards national emission budgets.

### **5.1 Stress on systems integrity**

There is no efficient mechanism to eliminate "hot air" besides buying and retiring permits without using them. All proposed ceilings have arbitrary elements, create uncertainty of private sector participants and can be circumvented through banking of permits for the next commitment period or the creation of bubbles. The EU should thus concentrate on a clear definition of rules and regulations that prevent fictitious emission reduction through JI and CDM.

High uncertainties of measurement and lack of scientific knowledge of possible reduction options of certain gases such as nitrous oxide or methane prevent their consideration for trading for the time being. Even their domestic reduction should be calculated in national inventories only using the most conservative estimate.

Initial allocation of permits is very important. If there is no rule, the lowest standard is likely to prevail: grandfathering. This rewards the biggest polluters and punishes past efforts concerning energy efficiency. Therefore an auction would be preferable. An international central allocation of emission permits could be linked to a deposit per permit sold. This would be the best solution to limit overall creation of permits from all mechanisms.

Regarding systems integrity a voluntary accession of developing countries to the target regime in the next commitment period seems sensible. Target setting would have to be based on criteria that are as objective as possible. This would take the negotiation position of developing countries into account and reduce the probability for the creation of "hot" and "tropical air". Because of unforeseeable structural variations of economic growth they could come into existence any time again.

Both project-related mechanisms, CDM and JI, need a certification of emission reduction to prevent fictitious emission reduction due to the choice of an overstated baseline. Even if both countries have a target in the case of JI and aggregate emissions do not rise in case of fictitious JI we think that certification of JI projects is indispensable. Otherwise the case could occur that a country hosts a number of JI projects with fictitious emission reduction but the state acquires permits to prevent sanctions and finally is in compliance. On the other hand emission reduction of the JI projects would be calculated realistically but the state does not reach its target for other reasons. In this case certification would allow the permits from the JI projects to remain valid in contrast to the rest of permits sold by this country. Baselines have to be project specific but should be based on project typologies decided by the Conference of the Parties. These typologies should take leakage into account. Project types with high leakage are only certified if the degree of leakage has been quantified convincingly. The issue whether a JI or CDM project is profitable should not play a role in the near term as the proof of the profit threshold is difficult if non-monetary barriers shall be taken into account.

## **5.2 Institutional framework**

International emission trade has to comply with rules of double bookkeeping. This entails a multi-layered reporting requirement. Private units have to report to the government of their country of residence. Governments annually report the sum of transactions to the climate change secretariat or an attached monitoring authority which operates the accounts of trading countries. If reported data show that a country selling permits will not reach its target the secretariat can suspend the trade of permits of that country.

Most tasks concerning emission trade can be regulated by market institutions. Exchanges, brokers, banks and insurance companies will play key roles concerning brokerage, finance and hedging of contracts. They guarantee price transparency and market liquidity and thus economic efficiency of trade. Certification of permits CDM and JI projects will be done by private organisations that have been accredited by a accreditation body which reports to the climate change secretariat and concerning CDM to the executive board.