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Abstract

Art. 17 of the Kyoto Protocol defines International Emissions Trading exclusively on country level, sub-national entities like industrial installations or households are not included initially. However, there are some arguments for such an expansion, of which the most important ones are a significant increase of the overall efficiency of the trading system as well as an increase of market liquidity. In the first part of this paper, the options for an inclusion of sub-national entities are analysed, concluding that AAUs should not be allocated to participants directly. Instead, there are several options how those entities can be included in International Emissions Trading as defined in the Kyoto-Protocol in an indirect way.

The second part of the paper elaborates on the design options of national trading systems. All governments planning to introduce a domestic emissions trading scheme covering entities need to consider several design parameters, e.g. the characteristics of emission targets, participants of the trading scheme, participation mode, covered gases, non-compliance provisions, etc. We analyse and evaluate the options for each of those aspects, having in mind that the design of a trading system must assure its environmental integrity and keep transaction costs low at the same time.

Zusammenfassung

Der „Internationale Emissionshandel (IET)" wird nach Artikel 17 des Kyoto-Protokolls zunächst ausschließlich auf Staatenebene definiert. Es sprechen jedoch einige Gründe dafür, den Emissionshandel auch auf nicht staatliche Einheiten, wie z.B. industrielle und/oder private Emittenten auszudehnen. Die wesentlichen Vorteile sind die zu erwartende deutliche Erhöhung der Effizienz des Handelssystems sowie der Marktliquidität.

Wir analysieren die verschiedenen Möglichkeiten einer derartigen Ausweitung des Emissionshandels. Eine direkte Einbeziehung subnationaler Einheiten durch die Zuteilung von Emissionsrechten nach dem Kyoto-Protokoll (AAUs) in den IET erscheint nicht empfehlenswert. Statt dessen bestehen verschiedene Möglichkeiten der indirekten Einbeziehung, bei der nationale „Währungen" für Emissionsrechte ausgegeben werden.

Zudem werden die verschiedenen Ausgestaltungsparameter analysiert, die bei der Einrichtung eines (inter-)nationalen Emissionshandelssystems berücksichtigt werden müssen. Dies sind u.a. die Definition von Teilnehmerkreis, Teilnahmemodus, Art der Emissionsziele, Einbeziehung von Gasen, Einbeziehung der projektbasierten Mechanismen sowie Strafregelungen. Die einzelnen Ausgestaltungsoptionen werden evaluiert, insbesondere hinsichtlich der grundlegenden Ziele des Emissionshandels: Sicherung der ökologischen Integrität bei Minimierung der entstehenden Kosten.

1. Background

1.1 Regulations of the Kyoto Protocol

The Kyoto Protocol that was agreed on in December 1997 by 159 Parties of the United Nations Framework Convention of Climate Change (UNFCCC) aims at the limitation of global greenhouse gas (GHG) emissions. The so called Annex-B-Parties have committed themselves to limit and/or reduce their emissions of six categories of GHGs– resulting in an overall reduction of Annex-B-emissions by 5.2 percent in the first commitment period 2008-2012 compared to 1990s levels. Individual quantitative emissions ceilings have been defined for those countries.

In order to minimise total costs of achieving the above mentioned reduction goal, the Kyoto Protocol offers three flexible mechanisms to merge economical and ecological objectives: "*Joint Implementation (JI)*", "*Clean Development Mechanism (CDM)*" and "*International Emissions Trading (IET)*".

The project based mechanisms Joint Implementation and Clean Development Mechanism give Annex-B countries an incentive to invest in GHG-mitigation projects in other Parties and thus reduce their compliance costs. Emission reductions will be quantified and can be transferred to the investor's emission budget – as so called "*Emission Reduction Units (ERUs)*" in the case of JI or as "*Certified Emission Reductions (CERs)*" in the case of CDM. JI projects are limited to Annex-I-countries of the UNFCCC, whereas CDM projects can be realised in non-Annex-I-countries (developing countries).

International Emissions Trading allows Annex-B Parties to trade with *assigned amount units (AAUs)*[1]. A country emitting less than it is allowed to might sell unused AAUs to other Parties. Alternatively, AAUs can be banked into the next commitment period. It must be emphasised that Art. 17 of the Kyoto Protocol defines emissions trading on Party-level (i.e. country-level), not on entity level. However, the negotiation texts state that Parties can authorise legal entities to participate in IET according to Art. 17 while the Party remains responsible for the fulfilment of its obligations under the Protocol (UNFCCC 2001, p. 42)

In summary, the usage of the flexible mechanisms enables Parties to profit from global differences in mitigation options and costs.

[1] The emissions budget of Annex B countries consist of AAUs denominated in tonnes of CO_2 equivalent.

As the Kyoto Protocol itself only gives a broad definition of those mechanisms, proposals for detailed rules have emerged during the last four years of negotiations. While some principles and details have been listed in the Bonn Agreement and Marrakech Accords, the process of rule setting will go on. The challenge will be to establish a system that assures environmental integrity on the one hand and keeping transaction costs low at the same time. This is not only true for International Emissions Trading, but also for the establishment of national or regional trading systems.

1.2 Current political developments

The first half of the year 2001 was characterised by a political struggle on the provisions of the Kyoto Protocol. After the "suspension" of COP 6 in The Hague in November 2000 and the US announcement not to be part of the Kyoto process any longer, there was a severe situation of uncertainty concerning the future of international climate policy. Several political leaders tried to convince the Bush administration to rejoin the process – without any success. Thus, the question arose whether the Protocol could be saved or if totally new, time consuming negotiations would be needed.

However, due to the initiative of many European Member States, the European Union itself and some further Parties, the resumed negotiations, *COP 6 bis* in Bonn, successfully resulted in a general agreement which makes the ratification of the Kyoto Protocol become realistic. In Marrakech, this agreement was transferred into a detailed text. Whether this positive development will proceed strongly depends on the future approach of the Annex-B-Parties. A rapid enforcement of the Protocol would provide guidance both for industrialised countries and those without emission obligations.

Annex-B-Parties need to take responsibility for their earlier commitments. This especially is valid for European Member States of which many have played a proactive role in the last months. They should continue to take the lead in being an example for hesitating nations. Preparations for the ratification process already have started in many Parties. However, intensive discussions are to be expected on national levels. If those countries indeed ratify the Kyoto Protocol within the next months, a clear signal would be set for the remaining nations.

In order to make international efforts to reduce global GHG emissions become more effective, the medium-term objective must be to cap absolute emissions in as many countries as

possible. This goes both for developing countries and industrialised nations that currently are not participating. Historically, the former group has rejected to accept quantitative emissions obligations due to the fact that industrialised countries have caused overwhelming parts of emissions in the past. Consequently, those countries call for serious efforts by the past polluters before they accept any obligations. The USA on the other hand argue that the Kyoto Protocol is ineffective as long as developing countries do not accept an absolute target. Those positions represent a vicious circle which needs to be broken. Initiatives to enforce the Kyoto Protocol and/or to implement national emissions trading schemes even before the first commitment period could serve as a basis for new, productive talks both with developing countries and the USA.

1.3 Initiatives to establish national emissions trading schemes

In the last 1 ½ years, several Parties of the Kyoto Protocol have taken the initiative and evaluated options of how domestic emissions trading systems could be designed. Among those states are Norway, Australia, Canada, the Netherlands and Germany. Other Parties even went a step further and implemented such national trading schemes. The most famous ones are the United Kingdom and Denmark. The Netherlands started the so called "ERUPT" programme last year, focussing on the project based mechanism Joint Implementation (JI). The programme currently is revised and extended to Clean Development Mechanism (CDM) projects (Senter Internationaal, 2001).

Also, the European Commission has taken the initiative concerning a potential Community-wide emissions trading scheme. Since the green paper on emissions trading was published in March 2000, the Commission intensively has been evaluating implementation options and a possible design of a such an emissions trading system. A first proposal for a directive "*Establishing a framework for GHG emissions trading within the European Community and amending Council Directive 96/61/EC*" (European Commission, 2001) was released on October 23rd, 2001. The trading scheme is supposed to start on January 1st, 2005 and concentrates on CO_2-emissions from energy intensive industrial branches.

Those plans provide a clear signal that the European Union takes the issue of climate change seriously and views the Kyoto process as an appropriate mean to combat climate change. The implementation of a EU-wide trading scheme would be an active first step to take

responsibility. It also shows that the EU is willing to continue its leadership-role on the Kyoto process – an important signal both to Parties and Non-Parties of the Protocol.

The plans of the Commission also provide a clear signal for entities. European industry will have a clear perspective on future legal instruments concerning climate policy. Such a perspective is very important for affected entities in order to adapt medium and long term investment plans. This also became obvious within the USA: the rejection of the Kyoto Protocol by the Bush administration was judged negatively by parts of the US industry due to the assessment that in the medium term one face reduction obligations anyway. Those stakeholders would have preferred a clear signal today instead of causing a situation of uncertainty by delaying such a decision for maybe some years only (Connole 2001).

The main objectives of the initiatives mentioned above are to prepare for a future carbon regime and to get familiar with the mechanisms and provisions of the Kyoto Protocol. However, all governments planning to introduce a domestic emissions trading system that also covers entities - e.g. single installations emitting significant amounts of GHGs or companies as a whole – need to decide on the same crucial design parameters. Those parameters will be discussed in chapter 3. Beforehand, some general aspects that need to be considered when including entities to International Emissions Trading will be analysed in the second part.

2. Participation of entities in International Emissions Trading

As pointed out above, the Kyoto Protocol exclusively defines International Emissions Trading on Party level, not on the level of entities. Including those entities is a very pragmatic and useful approach that can be expected to increase the efficiency of the trading system significantly.

The more entities participate in emissions trading, the more liquid the market. Due to higher differences in mitigation potentials and costs, total compliance costs will decrease. Furthermore, if International Emissions Trading was restricted to country level, national governments intending to sell certificates would need to determine minimum selling prices. Those prices should be oriented on national mitigation costs. A national authority would have to aggregate mitigation costs of all emitters to calculate a national price of carbon. This generalisation will incorporate several assumptions leading to inaccuracies. Contrary, entities are able to determine their individual reduction costs precisely.

Finally, braking down emissions trading on entity level is the best way to give direct incentives to reduce GHG emissions. Many other policy instruments – energy taxes, efficiency standards, etc. – only give an indirect incentive. Thus, the inclusion of entities supposedly will have positive effects on overall efficiency and effectiveness of an (inter)national emissions trading system.

However, expanding Party-level emissions trading to sub-national entities implies the need of some structural adaptations. The two levels of trading need to be made compatible with each other.

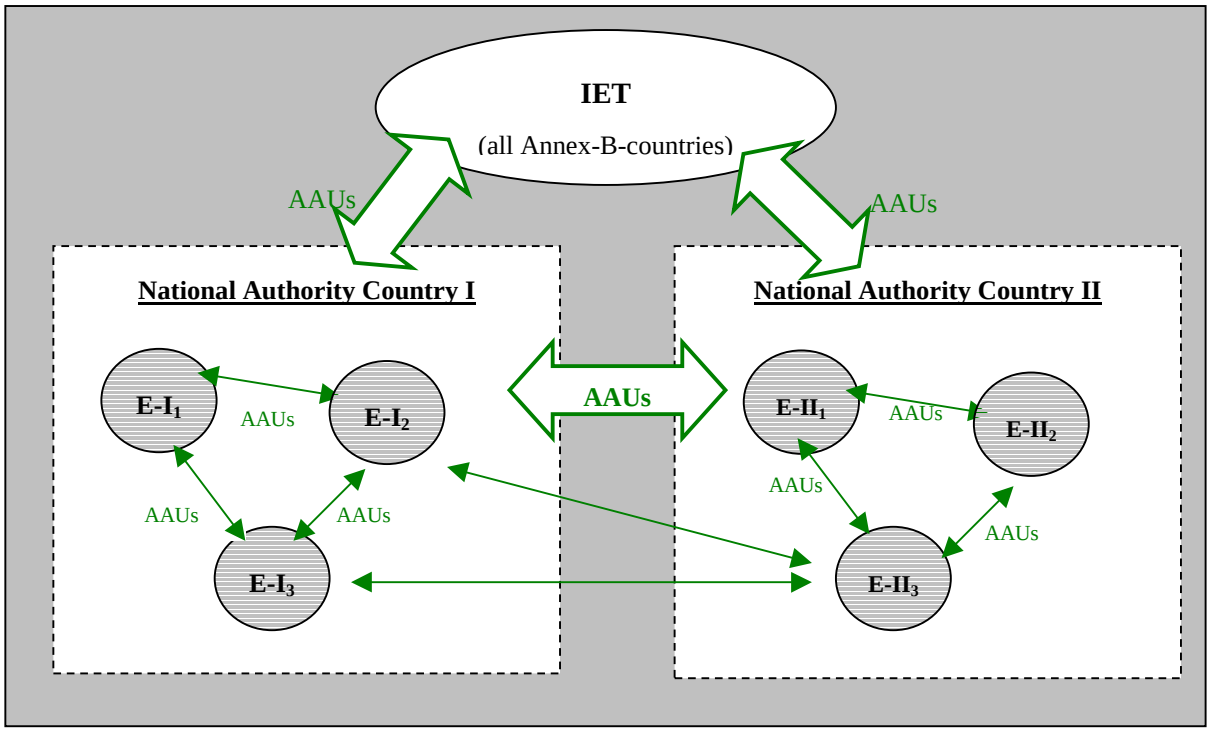
2.1 Options to include entities to IET

There are several options how to include entities in International Emissions Trading:

a) direct participation

Direct participation may be defined as the allocation of AAUs to entities. As a consequence, participating entities will transfer AAUs directly – both when participating in intra- and international trades.

figure 1: direct participation of entities



Many stakeholders discussing the issue assume this form of participation. However, the direct approach causes several problems that must be solved in advance. Those issues include:

- Eligibility requirements for participation in International Emissions Trading.
- Compatible design of national and international trading systems
- Accounting and compliance issues if a national trading system starts before 2008

Parties of the Kyoto Protocol have to fulfil several eligibility criteria in order to engage in emissions trading, e.g. reporting requirements or provisions of the Commitment Period Reserve. In the case of direct participation, there is the threat of sudden restrictions of trade due to interderence of the eligibility criteria. As a result, there would be a situation of uncertainty for participating entities.

Example: provisions of the commitment period reserve (CPR)

The CPR is an internationally agreed instrument to avoid overselling of AAUs by the individual Parties of the Kyoto Protocol. The CPR obligates any Party to maintain at least 90% of its emissions budget for the commitment period or 5 times of the last valid inventory in their national account (whichever is the lower). A Party must not sell any AAUs if this transfer of certificates would violate CPR provisions.

This restriction will have to be passed on to entities if those handle AAUs. As a result, participating entities would not be allowed to sell any further certificates, neither. This is even more problematic as entities can hardly influence the total national account, which is affected both by actions of the government and other entities included in the trading scheme. Participating entities therefore face a situation of severe uncertainty, not knowing if planned sales will be settled or not. This in return increases risks for potential buyers, also.

However, the significance of this problem will depend on the quantitative impact of the commitment period reserve: The CPR temporarily gives flexibility to sell 50 % (five times 10 % of the annually assigned amount) of the assigned amount. On small countries like Luxembourg the restriction will most likely have a higher impact than on countries as Germany or the United Kingdom. For example, if one large emitter closes down and sells its remaining AAUs abroad, consequences on CPR provisions could be higher in Parties of the former category since emissions from that entity might correspond to e.g. 12% of national emissions, while in a large country, the same amount of emissions only corresponds to e.g. 1% of the national budget.

If participants expect restrictions from the CPR or other eligibility criteria, a forward market of AAUs may have problems to develop. Forward trades will not only be an essential instrument of risk management for participants but also contribute to the overall liquidity of the market. Strong political aversion is to be expected if entities are faced with a policy instrument exposing them with such a high level of uncertainty[2].

[2] In some scenarios this problem could be mitigated by setting the date for AAU-forwards into the true-up period (directly following the commitment period). At the date of the true-up final emissions inventories will have been established, the CPR will no longer be relevant and all surplus AAUs be freely available.

A second point is that a national trading system needs to be fully compatible[3] with the international trading system if AAUs are to be allocated to entities directly. One can assume this will not be a problem if detailed rules for the international regime have been defined before the designing process of national systems starts. If the domestic system is to start before rules have been defined - which would be the case for the British and Danish systems – severe problems of compatibility may arise and result in high adjustment costs.

If a national trading system starts before 2008, i.e. the first Kyoto commitment period, further problems concerning the allocation of allowances result. Annex-B-Parties will get AAUs according to their emissions budget for the period 2008-2012. Any Party implementing a national trading system before 2008 has to allocate certificates for the pre-Kyoto period as well. If trading is based on AAUs and the AAUs available for a five-year period have to cover a longer period, the government will be faced with a situation of "AAU-shortage". - According to the rules of the Kyoto-Protocol, AAUs may be traded after an Annex-B-Party has demonstrated that it fulfils the eligibility requirements. However, since the commitment period is limited to 5 years, the direct allocation of AAUs to entities from e.g. 2005 onwards might cause a shortage. For these reasons, an overall allocation of AAUs to entities will hardly be applicable if the trading scheme is to start significantly before 2008.

As a conclusion, the direct allocation of AAUs to entities cannot be recommended. Instead, using national carbon currencies would eliminate some of the above discussed problems.

[3] crucial aspects are for example a compatible registry as well as consistent monitoring and verification requirements

b) Indirect participation

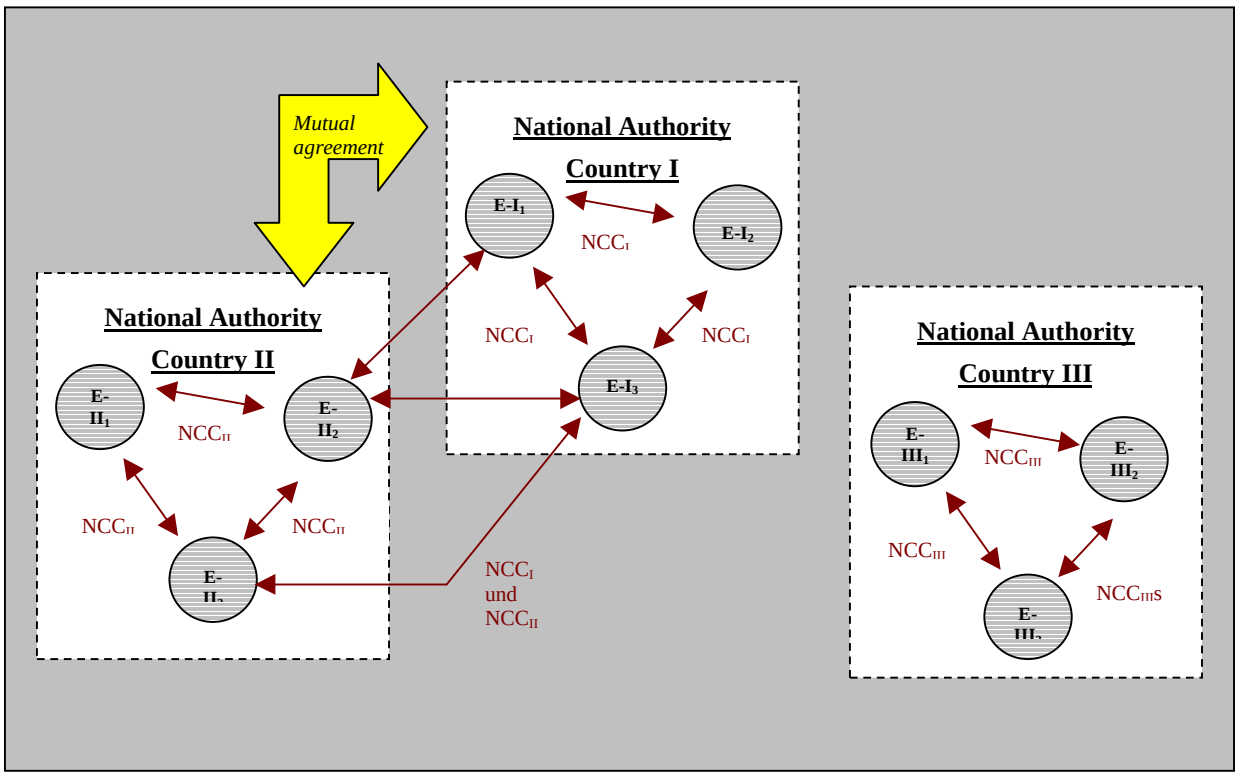
In contrast to direct participation, entities would not get allocated any AAUs but a *"national carbon currency (NCC)"* - e.g. "German- NCC" or "British-NCC". Within that country, national carbon currencies can be traded without restrictions. Participation in International Emissions Trading requires some provisions, though. Additionally, international trading only seems reasonable if NCCs are based on AAUs. Some options to enable participation in IET are discussed below:

b1) mutual agreement-approach:

Under this approach, entities are enabled to trade directly with entities from "accepted" partner countries. Prerequisite is the mutual recognition of different national currencies. A country needs to sign a *memorandum of understanding (MOU)* with all those countries it wishes to co-operate with. Trading with entities from countries that did not sign a mutual acceptance clause would not be possible.

The actual exchange of AAUs could be postponed to the true-up period. This would not only ease fiscal aspects but also minimise uncertainties due to CPR provisions.

figure 2: indirect participation of entities –mutual agreements



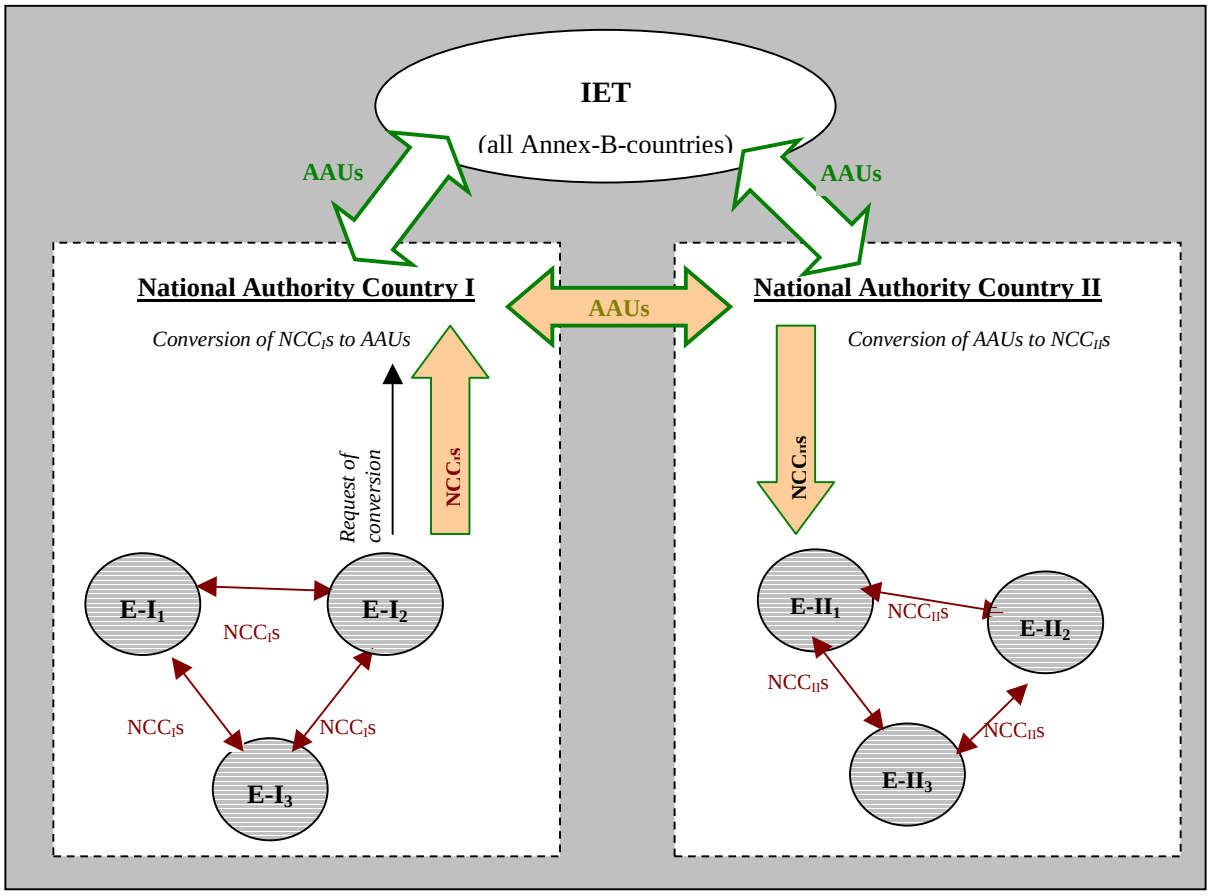
However, this approach does not only result in complex negotiations concerning the MOUs, it might also lead to a dangerous splitting of growing international emission markets. Market distortions as well as prejudices against currencies of different geographical origin could be the result.

For those reasons, the applicability of the mutual agreement approach in a large scale or as a long-term solution is to be questioned. Nevertheless, it might serve as a temporarily mean to start linking different national trading schemes.

b2) conversion approach:

If an entity wants to sell certificates in the international market, it might place a request to convert its national certificates into internationally accepted AAUs. A national institution would have to approve this request and in case of a positive decision transfer the national currency into the responding amount of AAUs. The national authority will deduct NCCs from the account of the entity and sell the corresponding amount of AAUs to the international partner. The same goes for a buying decision: purchased AAUs will be converted in NCCs and added to the entities account.

figure 3: indirect participation of entities – conversion of NCCs into AAUs



Concrete rules on the conditions of conversion would need to be defined in advance, especially the conversion rate of NCCs into AAUs. This might result in intense discussions of the national level.

Example: a government which has given a lavish allocation of NCCs to a specific sector while not including difficult sectors in the trading system at all may not be willing to convert NCCs 1:1 into AAUs whereas a government with a (hypothetical) trading system encompassing all emitters and overall amount of NCC not higher than national AAUs will not see any problem with a 1:1 rate.

However, the CPR problem is not resolved choosing the conversion approach. In case CPR provisions are not fulfilled, trading is restricted to the national level. This will not be satisfactory for domestic participants. To reduce aversions, national contracts between government and entities must assure that entities will be allowed to sell NCCs at any time. In the case that the maximum allowed quantity of allowances has been sold – and therefore no further international sales are allowed – the government should cover related financial losses of the entities.

2.2 Situation of the European Union

The discussion above was focussed on the scenario in which one or several *individual Parties* implement national emissions trading systems. A further scenario would be that several Parties implement one common ETS including sub-national entities. Such a structure would be most suited for the *European Community* which is – additional to its Member States – a Party of the Kyoto Protocol.

In general, the discussions of chapter 2.1 can be transferred to the situation within the European Community. If the EU implements a Community wide trading scheme, the same issues and potential solutions arise as for individual countries implementing national trading schemes.

All Member States of the European Union participating in this trading scheme would allocate emission permits to covered entities. The decision to include a certain sector[4], industrial branch or entity to the trading scheme or not either results from the national strategy or may be harmonised throughout the Union. Emission allowances should not be AAUs – due to the

[4] as houselods, transport, industry, energy production

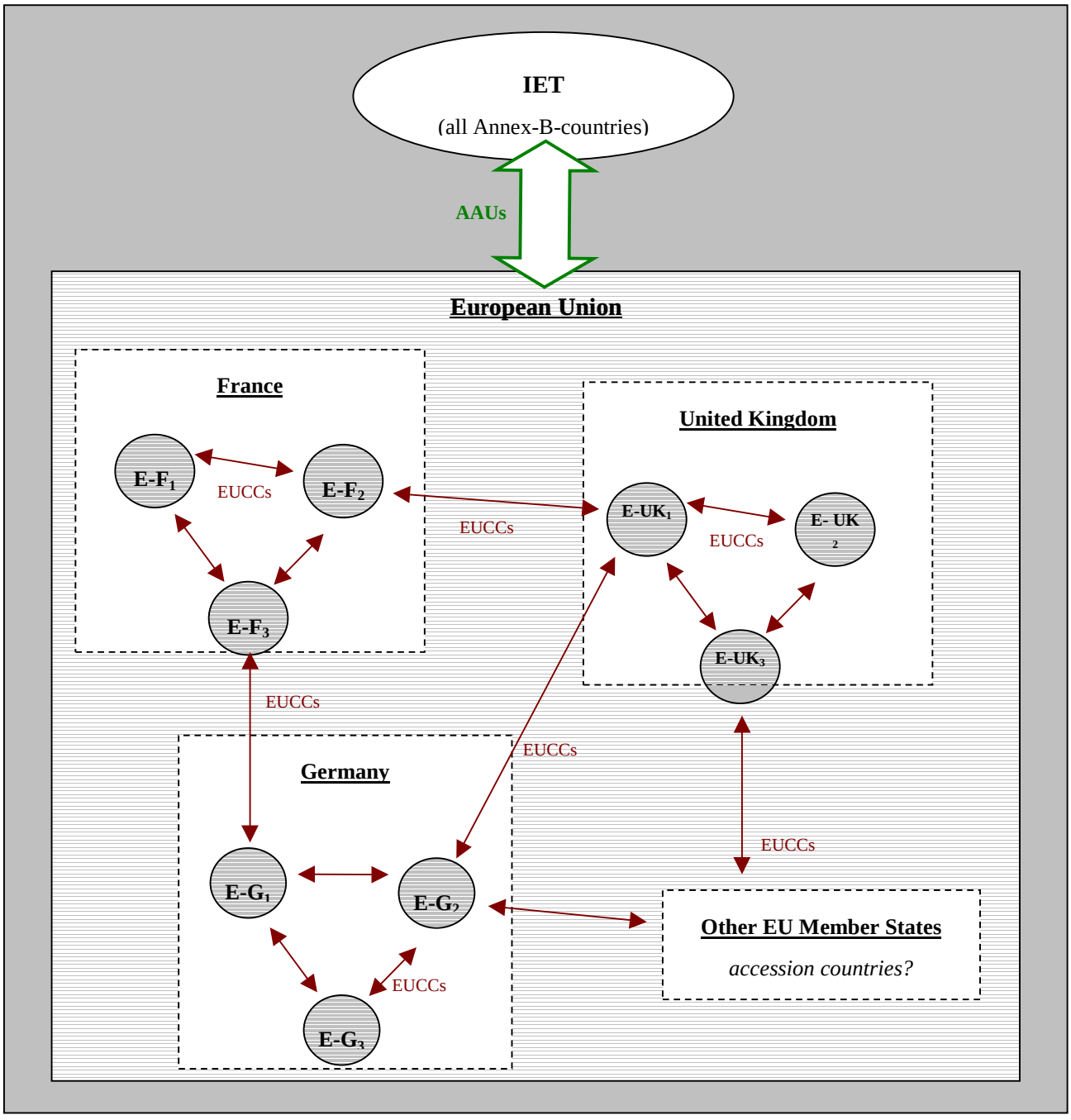
reasons discussed above – but may be a *"EUropean Carbon Currency (EUCC)"*, valid in all participating Member States. The current proposal of the Commission only mentions *allowances* leaving it open if AAUs or different currencies are considered.

Introducing one single emissions trading system within the EU would reduce the administrative effort necessary and can thus be expected to reduce overall transaction costs significantly.

As intra-European-Union trading is decoupled from IET, problems concerning eligibility criteria as the CPR are reduced. Even if one Member State is not in compliance with the CPR-requirements, its entities might continue to participate in emissions trading within Europe, given the assumption that Member States agree on such a rule. Doing so, Member States would need to "back up" allocated EUCCs with national AAUs. A net transfer of AAUs would only need to be done at the end of each commitment period. Thus, failing of eligibility requirements will have no negative impact on entity-level trading. This decreases the level of uncertainty by entities.

Participation of entities in International Emissions Trading could be enabled either by conversion of EUCCs to AAUs or by means of mutual agreements with other Parties of the Protocol (as described in chapter 2.1). The use of both approaches could to be most suitable as their individual advantages could be combined: the conversion approach does not rely on eventually numerous and complex memoranda of understanding but has some limitations concerning CPR trading limitations. Contrary, the mutual agreement approach does not face the problem of potential restrictions of entity trading if national CPR provisions are violated but relies on the acceptance of national currencies by partner countries.

figure 4: "National" trading system within the European Union



3. Design of national ETS

When establishing a national, multi-national or international trading system, decisions on several design parameters need to be made. In most cases, emissions trading will be a new policy instrument brought into a framework of existing environmental policies and measures. Those existing instruments as well as the political and economical situation need to be considered when designing a national emissions trading system.

The results are twofold: first, national discussions on the design and implementation of those schemes are characterised by strongly diverging political and economic interests. Second, due to different national circumstances, individual domestic trading schemes will be designed very differently. This already became apparent in case of the British and Danish trading systems. The most significant differences between those schemes are the participation mode (voluntary participation of companies from different branches in the UK, mandatory participation of companies from the energy sector in Denmark) as well as the treatment of emissions resulting from electricity production. Similar differences can be found in other trading schemes as well.

The challenge proactive countries are facing is to convert the theoretical concept of emissions trading into a practical scheme that resists political pressure and functions appropriately. Regardless the political situation, the basic objective of emissions trading, reaching the international commitments of the Kyoto Protocol at lowest possible costs, needs to be considered permanently.

The parameters listed below need to be evaluated in the design process of a national or multi-national emissions trading system:

- relative or absolute targets
- participants of the trading system - coverage of sectors and branches
- interaction with other policy instruments
- participation modus
- coverage of gases
- allocation
- accounting for emissions from electricity production/consumption
- market access
- banking/borrowing of emission allowances

- monitoring, verification and reporting requirements
- non-compliance provisions
- inclusion of the project-based mechanisms JI and CDM
- interlinkages to other trading schemes

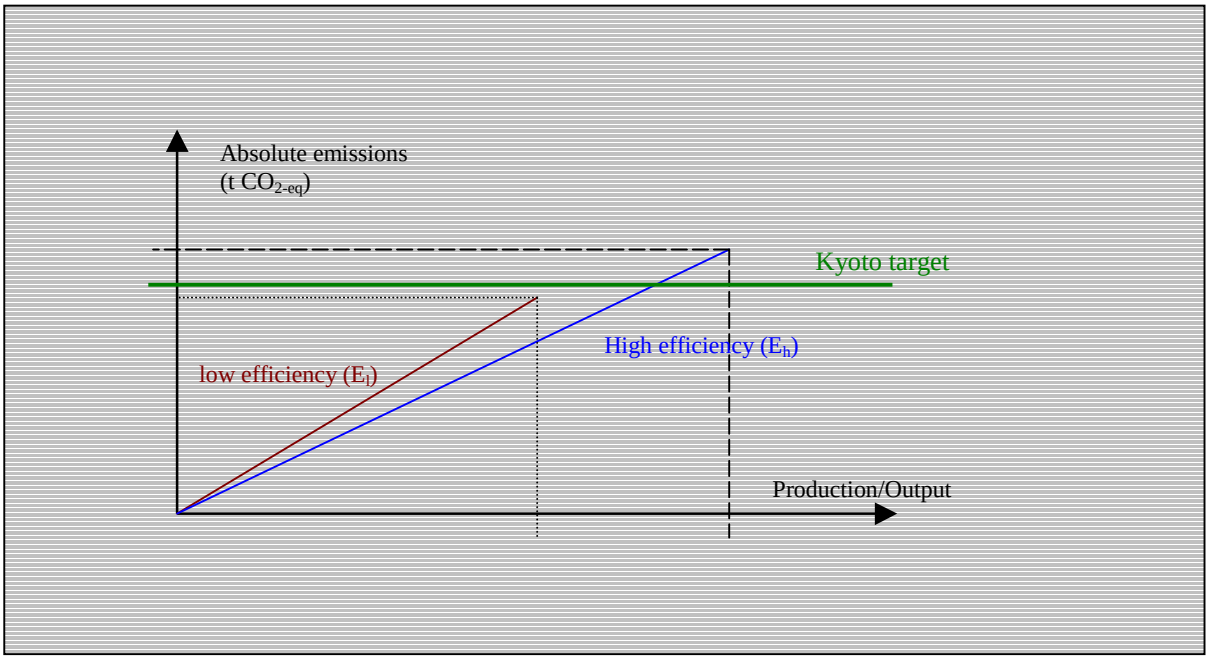
In many cases, those parameters depend on each other and therefore cannot be discussed separately.

3.1 Relative vs. absolute targets

From a government's point of view, the inclusion of sub-national entities in a "cap-and-trade" system increases its certainty in reaching the national Kyoto commitment. Contrary to other environmental policy instruments, an emissions trading system based on absolute emissions targets the environmental objective directly. For example, emissions and energy taxes only have indirect effects – absolute emission reductions that result from an increase in the tax rate by x% are hardly quantifiable in advance. Compared to this and most other climate policy instruments, emissions trading has some incremental advantages. However, this only is true if the trading system is based on absolute emission targets.

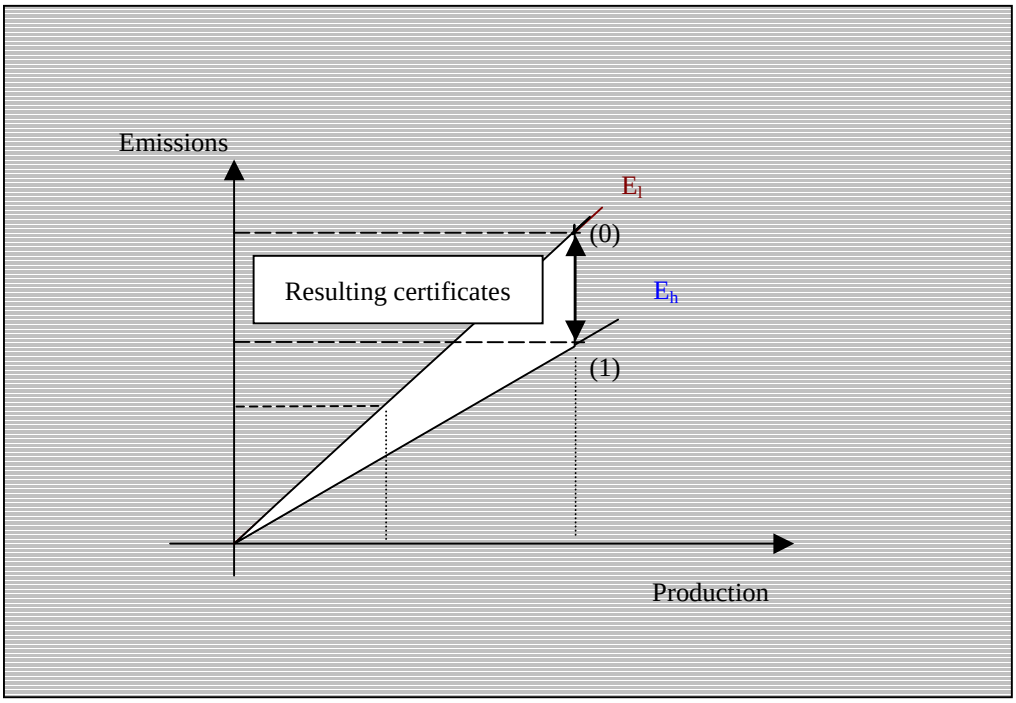
If relative targets are chosen, the environmental objective might not be reached. As figure 5 indicates, increases in production can level off efficiency gains. Therefore, trading based on relative targets is not acceptable from an ecological point of view.

figure 5: environmental drawback of relative targets



Even worse, if relative emission reductions were tradable, increased output could generate a higher amount of emission reduction certificates (also see figure 6) - suggesting environmental benefits whilst absolute emissions increase. Thus, the environmental integrity of the system was not given.

figure 6: calculation of relative emission reductions



Experiences from the British system show the complexity of trying to include both entities with relative targets and those with absolute targets in one common trading system. A "Gateway" was introduced to enable emissions trading between the absolute and the relative sector and to assure the environmental integrity of the system. The gateway will ensure that no more certificates are sold out of the relative sector than vice versa restricting any trades ("closing down") if the prerequisite is not fulfilled. In practice, this mechanism can be expected to cause severe uncertainty for participating entities from both sectors. It is hardly foreseeable if and at what exact time the gateway will close. Whether planned sales of permits from the relative sector will be settled or not might often come close to a lottery. This problem is even more serious concerning derivatives trades,

e.g. in the form of forwards, futures or options. Those means traditionally are used to minimise risks – in this scenario the opposite would be the case.

Finally, if one was to design a trading scheme based on relative targets, the definition of the tradable unit would be an extremely complex issue. Relative emissions are based on production outputs. While units may be defined for homogenous production processes (e.g. kWh of electricity generated), this would hardly be possible for heterogeneous processes (as can be found in the chemical industry). Also, a high-level aggregation of products would be necessary.

In the sum, emissions trading based on relative targets does neither seem practicable nor reasonable and should therefore not be considered when designing a national trading scheme.

3.2 Participants

Several policy instruments exist that can be used to reduce GHG emissions: emissions or energy-taxes, efficiency standards, voluntary agreements, technology procurement competitions etc. Governments will need to decide which set of policy instruments to implement in order to achieve compliance with the national Kyoto commitment. Factors that need to be considered when developing a medium- and long-term "carbon strategy" are effectiveness, efficiency, suitability and practicability, public acceptance, other policy goals (e.g. autarkic energy production), national economic structure as well as existing policies and measures.

As already discussed, an emissions trading system based on absolute targets is the best option to directly target GHG emissions. When the Kyoto Protocol enters into force, parties will need to search for and implement instruments impacting overall welfare in a minimised way while at the same time ensuring that the environmental objective is reached.

Regardless whether a government intends to introduce a national ETS covering sub-national entities or not, it will need to develop a strategy how to reach the international, absolute GHG commitment. Doing so, governments will allocate a budget of GHG emissions to each of the domestic sectors, as industry and energy production, households, transport, etc. This indication can be based on fixed formulas, sectoral emissions in a certain year, mitigation

potentials and costs, other policy goals, and so on. Some examples for a fictive country are given in the table below.

table 1: examples for allocation options

	National (total)	*Industry / energy production*	*households*	*Transport*
Kyoto commitment (2008-2012)	**900 Mill t $CO_{2\text{-eq}}$**			
emissions in 1990	1000 Mill t $CO_{2\text{-eq}}$	450 Mill t $CO_{2\text{-eq}}$	300 Mill t $CO_{2\text{-eq}}$	250 Mill t $CO_{2\text{-eq}}$
Allocation based on emissions in 1990	900 Mill t $CO_{2\text{-eq}}$	405 Mill t $CO_{2\text{-eq}}$	270 Mill t $CO_{2\text{-eq}}$	225 Mill t $CO_{2\text{-eq}}$
Emissions in 2001	1150 Mill t $CO_{2\text{-eq}}$	450 Mill t $CO_{2\text{-eq}}$	370 Mill t $CO_{2\text{-eq}}$	330 Mill t $CO_{2\text{-eq}}$
Allocation based on emissions in 2001	900 Mill t $CO_{2\text{-eq}}$	352 Mill t $CO_{2\text{-eq}}$	290 Mill t $CO_{2\text{-eq}}$	258 Mill t $CO_{2\text{-eq}}$
Allocation based on mitigation costs and other policy goals	900 Mill t $CO_{2\text{-eq}}$	270 Mill t CO_2	310 Mill t CO_2	320 Mill t CO_2
Allocation adapted to political clout of interest groups	900 Mill t $CO_{2\text{-eq}}$	370 Mill t $CO_{2\text{-eq}}$	250 Mill t $CO_{2\text{-eq}}$	280 Mill t $CO_{2\text{-eq}}$

Based on such a sectoral indication, a government will analyse which instruments are best suited to be applied to the individual sectors.

In case a Party decides to implement a domestic trading system, there are several possibilities which entities to include. One option is to cover large emitters only, regardless their sectoral origin. The contrary approach would be to expand emissions trading to all emitters of the country. Many other options can be imagined.

In general, it is desirable to include as many relevant emitters as possible into the trading scheme. This significantly increases both efficiency and environmental effectiveness of the instrument.

Also, several other factors need to be considered:

- issues of national and international competitiveness
- practicability of the system / administration costs
- legal requirements
- interaction with existing national instruments

National and international competitiveness:

If emissions trading is introduced "on top" of existing greenhouse-gas related regulations, participating entities might be disadvantaged compared to non-participating companies, leading to national and/or international market distortions. This is not an inherent characteristic of emissions trading only, but also true for all other policy instruments. If a government does decide not to implement a domestic ETS, it will need to make use of other policy instruments in order to ensure national compliance. For reasons of political acceptance, emissions trading should not be introduced as an additional instrument. Instead, it should replace other, less efficient policy instruments, e.g. energy taxes[5].

Practicability:

A coverage of all sectors is desirable in order to increase the system's efficiency and ecological effectiveness. However, the direct inclusion of very small emitters also increases transaction costs. Participation in emissions trading requires the establishment of an adequate and accurate monitoring system for GHGs for all relevant installations. Additionally, capacities will be needed to interact with responding national authorities, to monitor market prices of GHG-certificates and to develop and execute an individual "climate/carbon strategy". Consequently, transaction costs might be unproportionally high for small emitters – especially when compared to the reductions that can be achieved. Thus, including very small emitters, as for example every single household, does not seem advisable although technically feasible. Instead, those emitters should be covered by an "upstream" approach, for which several design options are possible:

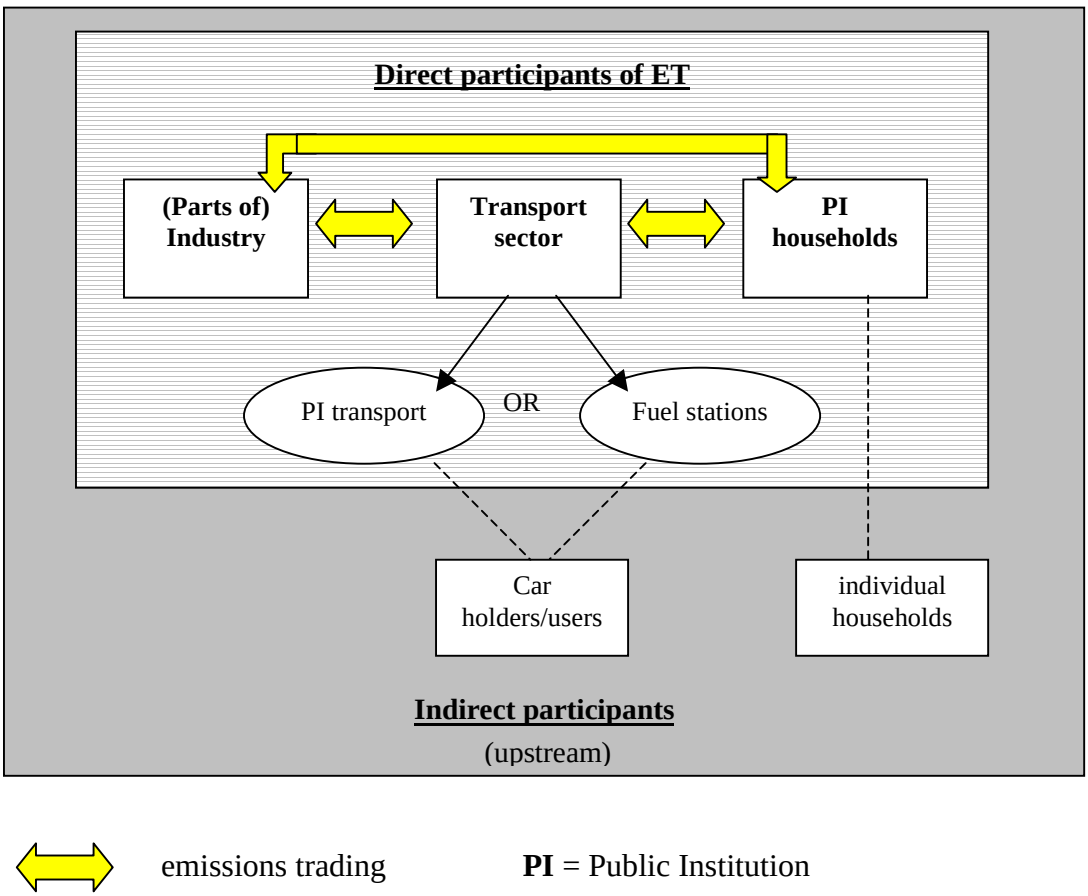
[5] At the same time, it should be assured that technological progress in the development of e.g. future energy systems and/or production processes is not halted. To reach this, policies and measures promoting the application of for example renewable energies should be maintained supplementary, at least in the medium term.

For the *transport sector*, for example, one could include fuel suppliers - either importers or fuel stations - in the trading system. Those entities would have to supply as many certificates to the national authority as the sold fuel potentially results in. Costs resulting from the need to hold such certificates could be passed to the consumer. Thus, the "polluter pays principle" would be taken into account.

Another option for the transport sector is to establish a separate *public institution (PI)* that needs to balance the amount of sold fuel and corresponding emission certificates. This institution – potentially connected to the national ministry of transport – would be responsible for the sector's emissions. It might enforce whatever policy instruments to decrease transport emissions. If emissions are below the sector's assigned amount, the PI could sell certificates to other sectors and/or entities. The PI would also need to buy certificates if transport emissions are too high. In the long run, advances in information technology might allow a downstream system for the transport sector, for example through the use of "smart cards".

The possible status of different emitters in a trading scheme is depicted in Fig. 7.

figure 7: direct and indirect participants of a trading scheme



Theoretically, the same mechanism – the establishment of a public institution responsible for balancing emissions and certificates - could be applied for the *household sector*. However, if utilities are included in the trading scheme directly (also see discussion in chapter 3.6), emissions resulting from electricity consumption by households are already covered. Given the case that emissions from fuel usage (both for transportation and heating) are included in the trading scheme "upstream" as described above, a direct inclusion of households to the ETS is not necessary.

Inclusion of industry: A government deciding to implement a national emissions trading scheme including the industrial sector has several options: coverage could be restricted to individual branches, to energy intensive branches, to large single emitters, etc. The objective must be to cover as many relevant emission sources as possible. From the ecological point of view, the best choice would be to cover all emitters.

However, in practice one also needs to consider practicability and economic reasonability. While the aspect of practicability can be defined in a sufficient way (i.e. meaning administrable), the term economic reasonability provides much space for interpretation. Any entity rejecting an inclusion in the system will find arguments why the application of this policy instrument is not economically reasonable. Often, those arguments will be connected to low profit margins and issues of international competitiveness.

Although in some cases those arguments are purely of political nature, one should also think of policy instruments protecting participants from negative economical impacts resulting from climate policies in the combination with international competition. Such provisions will in any case need to be compatible with World Trade Organisation (WTO) rules which for example restrict an undifferentiated taxation of imported products but also an unequal treatment of national and foreign stakeholders. The introduction of a border tax adjustment accrediting GHG related economic efforts of national entities might be a legitimate approach.

In its "*Green paper on greenhouse gas emissions trading within the European Union*" (European Commission (2000)), the European Commission has identified six branches that might be suitable for an inclusion into a Community-wide trading scheme. Subsequently, in its proposal for a directive on the establishment of a GHG trading scheme within the

European Union (European Commission (2001)), the Commission intends to link the system to the *"Integrated Pollution Prevention and Control (IPPC)"* directive (96/61/EC).

This directive lists 33 industrial activities, categorised in the following six classes and covering about 46% of the Community's carbon dioxide emissions.

- energy industries,
- production and processing of metals,
- mineral industry,
- chemical industry,
- waste management, and
- other activities

Installations that are affected by the IPPC directive - which is determined by an emissions/capacity threshold - are required to monitor and report the emissions of several pollutants, inter alias the six Kyoto gases, from 2003 on.

As discussed above, there is a trade-off between overall environmental effectiveness and efficiency of a system. For this reason, *minimum emission thresholds* for participation could be defined which are valid regardless the sector or branch[6]. Those emissions thresholds could be decreased over time to enlarge the number of participants and to make the system more effective from an ecological point of view.

In the end, the decision which sectors, branches or entities to include into an emissions trading scheme will be a political one. Politicians need to remind the basic objective of emissions trading and should therefore include as many relevant emitters as possible. Non-covered sectors or entities should be subject to other, equivalent policy instruments to avoid inequitable treatment. Also, those entities should get the chance to voluntarily opt in.

[6] There might be one drawback of this approach: if an entity does not want to be included in the system, it might be tempted to rename/restructure its installations in a way that they fall right below the threshold. Developers of (inter)national ETS will need to keep this potential loophole in mind.

Interaction with existing policy instruments:

The interaction of emissions trading with other already existing policies and measures also needs to be addressed. One might differentiate between policies targeting direct participants of an emissions trading systems and those measures targeting non-participating entities.

For the former group, adaptations of existing policies could become necessary in some cases. For example, a co-existence of ambitious efficiency standards targeting GHG emissions and emissions trading does not make any sense as those policy instruments would work counter-productive to each other. Another policy instrument applied in some nations are voluntary agreements (also referred to as "long term agreements", LTA) between industry and the government. Those agreements are preferred by industry as in many cases LTAs do not include any significant sanctions and as targets usually are not going beyond business as usual reductions. Stakeholders might be concerned that the introduction of an emissions trading scheme abruptly annuls the LTA. However, this is not an established fact. In many cases, LTAs - both on the basis of relative and absolute commitments - are compatible with emissions trading.

As could be shown for the case of Germany, the LTA might easily co-exist with a voluntary emissions trading scheme. One would only need to separate monitoring and accounting systems. In a mandatory scheme, technical co-existance would be given as well. However, one might debate on legal/political compatibility.

As stated above, adding emissions trading on top of existing policy instruments will hardly be acceptable for industry. Industry will argue that a reduction of other instruments targeting on GHG-reduction is a necessary prerequisite to implement a domestic emissions trading system.

The situation is easier for entities not participating in emissions trading on a direct basis. All instruments already existing – taxes, voluntary agreements e.g. by manufacturers, support of renewable energies, efficiency standards - can be maintained. However, from a state point of view, non-capped entities increase its uncertainty concerning the achievement of the national Kyoto obligations. The government might therefore chose to impose stricter measures to non-participating entities to ensure the national target can be reached.

In summary, it will be appropriate to establish an emissions trading system mainly covering relevant emitters in the beginning. All sectors should be included. Due to reasons of practicability, households and transport sector should be included under an upstream approach primarily. For the industry sector, emission thresholds could be defined. Over time and with falling transaction costs, the system could be expanded to cover small and mobile sources directly.

Basically all existing policies and measures might co-exist or be combined with emissions trading, although in some cases, adaptations might be necessary.

3.3 Participation mode

Emissions trading can be an efficient and appropriate instrument to reach emission reductions with minimum economical impacts. Reductions will take place where they can be achieved at lowest costs. The practical efficiency of an emissions trading systems does, however, strongly depend on its design.

Two basic preconditions must be fulfilled: a **high number of *relevant* emitters** is essential to establish a functioning and liquid market. In contrast, a low number of participants increases the chance that only periodically trading activities will appear – presumably at the end of each commitment period. There would be no reliable spot market prices, resulting in a high level of uncertainty for participating entities. An **inhomogeneous pool of participants** also is needed in order to increase the efficiency gains of the system. If there are no differences in mitigation costs, trading will not be a more attractive option for participants than reducing internally, neither will it be a means to co-finance installations of mitigation technologies. In such a case, a regulative approach would have had the same effect in terms of efficiency.

If a trading system is of voluntary nature, those two prerequisites certainly will not be fulfilled. One might differentiate the case in which incentives – be it of financial or legal nature – are given from a no-incentives-situation. In the former case, only entities that expect to be in a seller position will join the trading system. If incentives are given, the number of participants can be expected to increase, but the system would still not be designed optimally.

The best option to fulfil the basic requirements for an appropriate trading system identified above is to establish a *mandatory trading system* covering a high number of emitters from different industrial branches.

One has to acknowledge that emissions trading is quite a new instrument and that participants have to learn how to apply this instrument. For this reason, one might call for a voluntary pilot-phase without any substantial non-compliance sanctions. However, one can also argue just the other way around: the international commitments resulting from the Kyoto-Protocol will need to be fulfilled. Emissions trading can help to significantly reduce overall compliance costs. Considering those objectives, governments might do quite well imposing a mandatory scheme – possibly with some special pre-Kyoto characteristics like e.g. lower non-compliance provisions - before the first commitment period. By so doing, they can assure that all relevant emitters are well prepared for future international requirements.

Finally, when deciding on the question of voluntary or mandatory participation, one should keep in mind the following: Experiences show that systems - once in place - have a tendency to stay in existence for longer times than anticipated since resistance to changes usually is quite strong. This is why one should focus on mandatory schemes already in the pre-commitment period phase in order to have an appropriate system in place from 2008 onwards.

Additionally, there should be an option for a voluntary opt-in for small emitters included initially. If there was not such an option, entities that are excluded in such a first “phase” would not be able to gain any experience with this new policy instrument and thus be disadvantaged compared to participating entities. This is especially true if rules, such as compliance provisions, would be strengthened in following phases of the scheme.

Entities that are not included into the system need to be targeted by other policy instruments to “equally” share the burden of reducing GHG emissions.

3.4 Coverage of gases

The Kyoto Protocol includes six types of greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6) as well as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Using so called global warming potentials as defined by the Intergovernmental Panel on Climate Change (IPCC), emissions of those gases can be converted to $CO_{2\text{-equivalents}}$.

Of those six categories of gases, CO_2 is the quantitatively most important one.

table 2: Global warming potentials and relevance of the Kyoto gase

	CO_2	CH_4	N_2O	HFC	PFC	SF_6
Global Warming Potential ($CO_{2\text{-equivalent}}$)	1	21	310	140 - 11700	6500 - 85000	23900
Contribution to global anthropogenic greenhouse effect	81%	10%	6,5%	1%	0,5%	1%

Source: IPCC (1996)

As table 2 indicates, the total contribution of HFCs, PFCs and SF_6 to the greenhouse effect is relatively small – regardless their high global warming potentials.

It is desirable to include as many gases as feasible into an emissions trading system from the very beginning to increase its environmental effectiveness. However, a prerequisite for this approach is the establishment of adequate monitoring systems for each of the gases. Due to the high global warming potential of N_2O, HFCs, PFCs and SF_6, monitoring requirements for those gases need to be considered very carefully. Only high-quality procedures should be eligible.

The efforts needed to establish such monitoring systems strongly differ between the individual gases and emission processes:

Energy related CO_2 emissions can be calculated relatively easy and with the required accuracy using fuel input and responding emission factors. In those cases, the installation of cost-intensive direct measurement systems is not necessary. However, an indirect calculation of process-related CO_2 emissions (e.g. cement or steel production) will in many cases result in significant inaccuracies. Those are due to, for example, slightly differing process structures, input of ressources and the quality of process output. One will need to decide what level of

inaccuracy can be accepted in order to establish an integer GHG regime. In cases where inaccuracies resulting from calculations reach an unacceptable level, one would either need to exclude those processes and sources or to make use of direct measurements. Such direct measurements significantly increase the level of accuracy but also overall costs of monitoring. Resulting costs must be reasonable for participating entities and must also be in a reasonable relation to GHG mitigation potential.

For a small emitter costs of direct measurements might not be reasonable while for a medium-sized emitter periodically direct measurements (which could then be used to calculate process specific emission factors) could be. For some large emitters, even continuous measurements might be reasonable. The challenge is to draw the lines and to specify the term reasonable.

This is true also for many CH_4 emission processes/sources. Quantification problems primarily arise for diffusive sources where direct measurements may hardly be practicable.

As indicated above, quantification procedures of the remaining Kyoto-gases needs to be very precise due to their high GWPs. In most cases, only direct measurements will be acceptable, which might be hard to achieve for some sources. For example, HFC emissions from refrigeration devices can only be quantified broadly by using statistical data and a "best guess approach". One should also distinguish between diffusive and point sources. While accurate monitoring is hard to achieve for the former ones, this should be feasible for the latter sources.

As a conclusion, an appropriate system to quantify GHG emissions accurately is a basic requirement for participation in emissions trading. Both direct measurements - be it continuous or periodically - and indirect calculations can an appropriate means as long as those methods result in high quality data that can be verified by independent organisations.

As far as accurate monitoring can be realised, at least CO_2, CH_4 and N_2O should be included from the very beginning on a mandatory basis. Exceptions may be made for small, diffusive sources and/or emissions that are hard to quantify. Additionally, large emitters of HFCs, PFCs and SF_6 should be integrated into an emissions trading regime wherever high quality measurements are feasible.

Again, there should be an option for voluntary opt-in for emitters not covered on a mandatory basis.

3.5 Allocation

The issue of allocating emission certificates to entities is a very sensitive one from a political point of view. As already described above, in the process of developing a national carbon strategy governments from Annex-B-Parties will to some extent indicate emission objectives to each of its domestic sectors.

> *Governments of Annex-B-Parties need to develop a national climate strategy to reach their Kyoto commitment. This is usually done in a "top-down" approach: the government will evaluate emissions as well as reduction potentials and costs of each sector and relevant industrial branches. Based on such an evaluation, an emission objective will be assigned for each of the national. Afterwards, a government will decide on the policy instruments to be applied for each of the sub-sectors and branches in order to achieve the indicated emission objective.*

As the overall amount of emission certificates available to a Party is fixed by the international provisions of the Kyoto Protocol, the method of allocation does not affect the environmental integrity of the ETS[7]. Instead, allocation of emission permits to entities primarily is a distributional issue.

Next to the determination of the total amount of certificates to be allocated, two basic questions need to be answered:

1. *Are certificates allocated free of charge or charged (e.g. auctioned)*
2. *In case of free allocation: On what basis are certificates allocated?*

[7] Given the fact that the state needs to be compliant with its Kyoto obligations, it will allocate permits in a way that maximises the chance of national compliance [sum of all sectors]. Allocating more permits than needed is not a rational option. In case of the EU, such a behaviour might additionally conflict with regulations e.g. on state-aid.

Shall certificates be allocated free of charge or should there be a charge?

This primarily is a distributional issue but very crucial in the political context. The options are:

- "grandfathering" (cost-free allocation),
- auctioning (as one form of charged allocation) and
- "hybrid-systems" (mixture of grandfathering and charged allocation)

Grandfathering is highly preferred by industry since it does not cause any additional costs. However, this approach lacks to provide a price signal for emission certificates. Such a price signal is crucial for investment decisions and strongly influences the behaviour of the participants. A missing price signal therefore increases uncertainty significantly.

Environmental Non-Governmental Organisations (NGOs) usually call for a charged allocation - e.g. in form of auctioning - to honour the "polluter pays principle". Of course, there is strong political resistance by the addressees, arguing this a-priory cash loss decreases funds available for investments in mitigation measures. Furthermore it is argued that abruptly charging a good that was free in the past would violate the legal principle of protection of property rights, although experts have not discussed this issue finally. To reduce this aversions, the allocation system could be designed in a way that the income is redistributed to the participants of the trading system. The most positive characteristic of an auctioning system is that it provides a price signal which is a very important basis for investment decisions of participating entities. Additionally, under a pure auctioning system the integration of "newcomers" would be unproblematic from a legal point of view since there was no inconsistent treatment of existing emitters and new participants. Also, there would not be any incentive for already existing emitters to rename or restructure their installations in order to benefit from free or discounted allocation – which would be the case if newcomers were treated separately.

A hybrid approach offers an attractive compromise. If a major part of certificates allocated to individual entities based on an ex-ante determined formula is distributed free of charge while a smaller but still significant part - e.g. 15 to 20 % of available certificates - is auctioned, participants will not suffer severe financial burdens – especially if revenues are recycled - while at the same time the essential price signal will be set.

Alternatives for using generated income:

If a charged allocation system is applied, one needs to decide on the usage of generated income. As stated above, one option is to directly redistribute funds to the participants of the trading system to minimise their financial burdens. Auctioning theory suggests that for an efficient auction the redistribution must be independent of the amount of certificates purchased by auction: participants should show their real valuation of the good.

An alternative to this direct redistribution would be to use generated income to buy additional emission certificates on the international market as "spare certificates" for domestic newcomers: the government would need to take provisions to ensure market access to new emitters, anyway. This might happen in form of a "newcomer reserve". When developing a national carbon strategy, the government might hold back certificates for potential newcomers. This reserve will be subtracted from the permits indicated for all or parts of the national sectors. Thus, using income to buy extra certificates on the international market reduces the need to subtract certificates from intended permits for participants. Existing entities will indirectly benefit by getting more GHG certificates. Depending on the overall design of the allocation method, this approach could also support the accreditation of early actions as it entails a distributional effect. An entity that already has invested to reduce its GHG emissions will not need as many certificates as a comparable entity without early actions. Thus, it will not need to auction as the same amount of allowances. At the same time, it would benefit from the reduced newcomer reserve financed by income from the auction.

On what basis are certificates allocated in case of free allocation?

Concerning the basis of allocation, there are several sub-questions. First, one needs to decide either for an allocation based on a formula or an allocation based on negotiations between participants and national authority. Since the latter option implies intransparency and high transaction costs both for participants and government, a formula-based allocation is to be preferred. The second question to be answered is if any and what year will be used as the basis. The Kyoto Protocol defines 1990 as the reference year. This does not automatically call for 1990 as a basis in all trading systems to be established. The decision rather is a function of

data availability and the political will to recognise early actions. Whereas industry usually calls for an early reference year, data availability and quality can be assumed to decrease proportionally to increasing time distance. This problem might become more serious if the trading scheme is to include small and medium-sized entities. Whereas for large companies, data availability might be sufficient even for early time periods, this probably is not the case for the majority of small companies due to the non-existance of monitoring schemes. As a result, the latter ones would eventually be disadvantaged concerning the accreditation of early actions.

Finally, in some cases the call for recognition of early actions might not be justified. A decrease of absolute emissions can result from active climate investments but also might result either from business-as-usual (BAU) technology advances, no-regret options or decreases of production. In those cases, there is no reasonable argument for the crediting of "early actions". Therefore, one closely needs to evaluate to which extend early actions should be accounted for.

A practicable compromise could be to chose 1997-1999 as a reference year and enable an extra-recognition of early actions if an entity is able to prove its extraordinary efforts in a reasonable manner, e.g. by independent verification.

In summary, the issue of allocation is primarily a political question affecting the distribution of finances. However, stakeholders engaged in the process should remember the importance of a price signal and the need to take provisions to integrate newcomers in a legally acceptable way.

3.6 Accounting for emissions from electricity production / consumption

Since most of the electricity is produced by combustion of fossil fuels and thus its production results in GHG emissions, one has to decide whom to assign these emissions. It may either be the electricity producer (direct approach) or the electricity consumer (indirect approach). The former approach can for example be found in the Danish emissions trading system whereas in the British system the latter one is applied. Interestingly, advocates of both approaches make use of the "Polluter-Pay-Principle": One may argue that the producer (who is actually

releasing the emissions into the air) is the polluter. On the other hand one can claim that the consumer is actually responsible for the release of emissions by his electricity consumption. Assigning emissions to the consumer could probably have a psychological effect in the sense that by clearly indicating environmental externalities of energy consumption, the reduction incentive would be higher than in case a producer simply passes through the costs for emission permits.

A "*50-50 accounting approach*" could be an attractive compromise. 50% of the emissions resulting from electricity production would be allocated to producing utilities, 50% to the consumer. Choosing this approach, there would be a direct incentive both for energy producing companies and end users of electricity to reduce their emissions and their electricity consumption, respectively. This approach would only be possible for large consumers like the heavy industry. Including all small consumers as private households would not be reasonable due to administrative costs as it was already discussed for direct emissions in household and the transport sector (chapter 3.2).

In practice, however, an indirect approach will face some further, severe obstacles. Those are not only due to high transaction costs but primarily resulting from accounting problems concerning indirect emissions. In the following, we discuss the arising difficulties from the indirect approach.

When electricity is consumed, electrons flow through the power supply lines. As there is only one single form of electrons, it is impossible to see from the parts itself whether they originate from nuclear, fossil or renewable sources. Consequently, it is impossible to determine the amount of emissions resulting from the electricity consumption of a certain end-user. In order to circumvent this problem, one might try to track the flow of electrons through the electricity grid in order to see what kind of electricity a consumer has used. However, in large "anonymous" grids, this is nearly impossible because of the following considerations:

Firstly, electricity is imported and exported and traded within the countries of the EU and neighbour states. Secondly, the kind of power plant used strongly depends on the time of production as there are baseload (e.g. nuclear) and peakload (e.g. gas-fired) plants. Finally, the trial to track the flow of electron would require the split of the current homogenous electricity market with one single product into several new ones for different products as for

example in “black”, “grey” or “green” energy. This would have a negative influence on the emerging electricity market (especially the liquidity) what in turn would hamper the development of financial instruments as forwards, futures and option. These instruments, however, allow to handle the risk of changing prices and are thus necessary for risk management in utilities.

As a consequence of the aforementioned the only way to assign GHG emissions from electricity production to the consumer (indirect approach) would be on the basis of an average figure, accepting potential inaccuracies. A significant drawback of this approach would be, however, that using a national/European average figure completely diminishes the incentive for an electricity producer to reduce his GHG emissions. Instead, it supports free-riding since any action - be it positive or negative in terms of emission reductions - will have no direct impact on the single company. Consequently, lots of low cost abatement options that are expected in the energy production sector would be foregone and as a result the price for permits would raise for all participants. Furthermore, the national average of the carbon intensity of electricity produced would be higher in the case of purely indirect accounting than in the direct one increasing the price of electricity once again.[8]

Another problem resulting from the indirect approach arises due to the fact that the system boundaries for the Kyoto-Protocol (territorial principle) and electrical grids (international) are not identical. Electricity is traded between countries and the balance of imports and exports is not inevitably zero.[9] In case a country is a net exporter and emissions are assigned on the basis of the national average the government faces the problem that for some of its national emissions, nobody can be made responsible for. The contrary would be that in a net importing country the government would assign emissions to its entities that actually never were released on its territory.

It remains unclear if the cost increase will result in a reduction of electricity consumption[10] or if the demand of other goods is reduced since the elasticities required for such an analysis are unknown. But it is sure that overall compliance costs increase.

[8] More emission rights are needed per unit of energy.

[9] It is indeed normally smaller or greater than zero, also see UCTE (2000).

[10] In this case the environmental effect of the indirect approach would not inevitably be zero.

To sum it up, a direct approach, i.e. the assignment of emissions from electricity production to utilities, is strongly recommend for both costs and accounting reasons. It could be reasonable to oblige producers to indicate extra costs due to carbon restrictions on their bills to make consumers aware of the negative externalities of the consumption.

3.7 Monitoring, Verification and Reporting

A strict regime of monitoring, verification and reporting will be needed to assure the environmental integrity of any emissions trading system. Due to the highly differing GWPs of the Kyoto-gases, different standards on monitoring and verification seem advisable. However, the definition of respective rules should not be a very problematic issue.

The application of standard procedures, for example in accordance with the already existing international systems ISO 14000 series or the European "Eco-Management and Audit Scheme (EMAS)", can be an appropriate way to satisfy the needs. Independent verification companies could serve to attest the necessary accuracy of submitted data. An accreditation of those verifiers is necessary as well as periodically spot-checks by the (inter)national authority.

3.8 Banking

Allowing banking of emission certificates is an option to give more flexibility to the participants of the scheme. Emission rights that are not needed within a certain commitment period can then be saved for usage in a future period. In the Kyoto Protocol, unlimited banking is allowed during the first commitment period and only some restrictions exist for banking CERs, ERUs and RMUs from the project based mechanisms.[11]

Additionally to increasing flexibility, banking may help to keep market prices more constant: experiences from the BP trading system (Grohmann, 2001) and various emissions trading simulations (IEA, 2000; QETF, 2001) show that there might be severe price drops – so called "*wall effects*" - towards the end of a commitment period if banking is not allowed.

Banking can also have diverse effects, especially if targets are rather weak in the beginning but are strengthened considerably. As the Party's emissions targets for the second commitment period will be negotiated before the start of the first commitment period

[11] According to the Marrakesh Accords, a Party is allowed to bank 2,5 % ERUs and 2,5 % CERs of its Assigned Amount in the next commitment period.

(planned for 2005), stringent second-period targets would likely lead to banking and to an increase in first commitment period prices.

Some severe problems may arise if a national trading system starts before the first Kyoto period and participants are allowed to bank surplus certificates into the first Kyoto Period:

- Problem of allocation for national governments: entities might emit more than the government allocated towards a certain sector due to extra (national) carbon currencies from earlier national commitment periods. This issue needs to be considered carefully by national governments when defining the overall emission target for participants for first Kyoto commitment period.
- Concerning an EU-wide trading scheme and the discussion in chapter 2.2, another important question is whether a government would need to "back up" national allowances with AAUs for all non-retired certificates or only for those that are allocated for the current commitment period. A further analysis of this issue is necessary.

In the sum, due to its beneficial characteristics, banking should be allowed within international commitment periods. A further evaluation is necessary to decide whether banking for companies should be restricted between commitment periods and – most relevant - into the first Kyoto commitment period.

As borrowing significantly weakens the environmental integrity of an emissions trading system, it should not be allowed.

3.9 Non-compliance provisions

Non-compliance provisions are a crucial element of an effective emissions trading system. Only if effective non-compliance penalties are enforced, participants will try their best to stay within their emissions budgets. One needs to differentiate between different types of non-compliance:

- Over-emitting
- „Cheating" when calculating and/or reporting emissions to the state authority
- break of contracts, etc.

There are several options how to prevent non-compliance. In practice, it might be appropriate to combine some of those options and/or to use non-compliance provisions differentiated according to the "type" of non-compliance. Options are:

- Financial penalties (either based on a fixed rate or in relation to market prices)
- Obligation to submit missing certificates in following periods
- Exclusion from future trading/usage of the Kyoto Mechanisms
- Public „exposure"

Financial penalties can be very effective if they are set on an appropriate high level. Penalty rates should not be fixed in advance. If market prices increase to unexpectedly high levels, the level of the financial penalty will define the maximum market price of certificates. Participants would then chose not to comply with their obligations. Of course, this is only true for the assumption that participants will base their decisions merely on economic figures but not on e.g. image effects. For this reason, penalties should be related to average market prices, for example as in the EU directive proposal the twofold of the average market price of the relevant commitment period[12]. This approach assures that the incentive to comply will not disappear due to high certificate prices.

Concerning over-emissions, there should be an obligation to submit missing certificates within the next compliance period. Otherwise, the ecological integrity of the system would not be given. This approach also was chosen by the "Bonn agreement" in July 2001. The provisions of the texts include a submission of missing certificates by a non-compliant Party – increased by the factor 1.3. If there is no explicit obligation to submit missing allowances in the following period, governments should use income from financial penalties to level the ecological damage of over-emitting, e.g. in purchasing certificates equivalent to the extra emissions by the non-compliant entity on the international market[13].

Other options to enforce compliance are potential exclusions from the further use of flexible instruments and a public exposure of "bad guys". While the latter option can be expected to be somewhat effective – depending on the participant´s image strategy - an exclusion from further usage of flexible instruments is somewhat problematic. Definitely, it is a powerful,

[12] i.e. its „true up period"

daunting provision. It would be a suitable approach to avenge breaking contracts or cheating. However, if it is applied in the case of over-emitting, this provision might be counter-productive. Non-compliant entities have failed to reach their emission objective even with the option to use flexible instruments. One can imagine they will struggle even more to reach compliance if they are not allowed to buy extra certificates. Therefore, those entities should be excluded from selling any emissions certificates. But, one should not worsen their chances to reach compliance in the following commitment periods in restricting the acquisition of certificates.

In any case, participants must not be allowed to fail reaching their emission objective again and again.

3.10 Market access

The question is if trading emission certificates should be restricted to the participants of the ETS, i.e. those entities with an emission obligation. The alternative is to define third persons/institutions as eligible for emissions trading as well. This latter option opens the market to financial institutions, traders, non-governmental organisations, associations and private persons.

Restricting market access does have some significant drawbacks. Financial intermediaries and professional traders which play an essential role in establishing a stable and liquid market, could not participate. However, a liquid market is the prerequisite of an efficient emissions trading system. If there is no liquid market, participating entities will suffer severe problems in developing a climate strategy and to implement an effective risk management system on their emissions.

The fear that environmental NGOs would buy large amounts of carbon certificates and retire them seems far-fetched. Theoretically, such a behaviour could increase certificate prices. However, the influence of such activities cannot be expected to be significant. Given the large amount of certificates that will be on a national or multi-national market and an assumed price of 1-5 € per t of CO_2 until 2012, enormous funds would be needed to buy off significant

[13] i.e. forwards on AAUs in case an international market does not exist yet

amounts of certificates. Experiences from the American trading systems also show that the absolute amount of SO_2 certificates bought by NGOs was neglectable.

For those reasons, market access should not be restricted to entities with commitments.

3.11 Integration of JI and CDM

An integration of the project-based mechanisms to a national or multi-national emissions trading system can be expected to significantly increase its economic efficiency. Low cost mitigation options in other countries would contribute to reduce overall compliance costs. For this reason, an expansion would be beneficial. However, some difficulties must be overcome before certificates resulting from JI/CDM projects can be accredited.

The Kyoto Protocol entails no provisions for a JI-start before 2008. In contrast, CERs resulting from projects in developing countries (CDM) generally should be accepted from 2000 onwards *if all CDM-rules are fulfilled*.

This precondition is the problem in itself due to missing regulations. Detailed rules for the calculation of emission reductions achieved by a project still need to be defined on the international level. Any country currently implementing a national trading system therefore faces a severe situation of uncertainty. The national objective must be to invest only in those projects generating certificates that will be accountable for future GHG commitments. Therefore, the basic question for those nations is what reduction credits will be eligible according to UNFCCC rules.

Accordingly, a Party implementing a national ETS today may chose between two options: First, it could postpone the integration of CDM projects into the trading system until rules are defined internationally[14]. However, if international decisions are postponed for any reasons, this no-risk option from a national point of view would significantly decrease the relevance of CDM projects in the short- and medium term. This effect is increased by natural project implementation periods: if a CDM project is to generate CERs in the 2008-2012 period, in

many cases the investment decisions will have to be taken several years in advance (project implementation phase).

A second option is to allow CDM projects from the very beginning. Doing so, a national government should chose a very conservative approach both concerning project eligibility and baseline calculation in order to ensure both environmental integrity and to increase the likelihood of later recognition. If the system appears to the public as enabling "indulgence trading", public resistance can be expected.

What can be called a "conservative baseline-approach"?

A conservative approach implies the need to define a strict ***catalogue of rules*** *and parameters, projects will be evaluated on. This catalogue should cover* ***eligible project categories, baseline methodologies****,* ***accreditation times, the issues of equivalence of service and additionality of a project, etc.***

Only project types that do not face significant scientific uncertainties or error-potentials concerning the accounting of emission reductions should be defined as eligible. As an example, all forest and land management projects should be excluded for the time being. Those projects bear high uncertainties – e.g. the calculation of carbon uptake in sight of its permanence, the definition of "forests" and coverage, etc.

Also, effective public participation – e.g. concerning the evaluation of the baseline - should be an integral part of any CDM project as it can deliver beneficial insights to the project.

Such an approach would enable participants of the trading system both to reduce their compliance costs and to gain experience with project based mechanisms. Additionally, host countries (developing countries) would benefit from investments earlier. At the same time, risks connected to a future international accreditation would be kept relatively low.

[14] This can be expected to be mostly finalised by 2003, after the members of the CDM executive board were elected on COP 7 in November 2001. Given the time need to actually implement a national trading system, this might be adequate for most systems currently being developed.

3.12 Other issues

A very important but still unresolved issue is the treatment of "hot air"[15] that primarily exists in eastern European countries and Russia. Under the current political scenario for the first commitment period – no participation of the USA but huge amounts of extra allowances for some Parties – market prices for emission allowances can be expected to be relatively low. Jotzo and Michaelowa (2001) estimate the international quota price to be about 0.9 \$/t CO_2 - under a scenario of allowed banking, medium transaction costs for the CDM and hot air sales of 400 Mt CO_2/y (which is one third of the available amount of hot air). Vrolijk, Grubb (2000) estimated the Carbon price on 2-3\$/t CO_2 for a scenario with US-participation.

Low certificate prices due to the existence of hot air can be expected to decrease the demand for emission reduction projects and resulting certificates significantly. As a result, investments in CDM and JI projects will decrease and/or be postponed, negatively influencing the host countries emissions path. Also, if no active efforts are necessary to reach the overall emission objective, the credibility of the Kyoto Protocol might suffer significantly. For those reasons, the amount of hot air available on the market should be reduced as far as possible. Some plans to do so already exist, among the proposals are:

- "swap for debts" (exchange of international financial debts of the relevant countries against excess certificates)
- "green investment scheme " for Russia
- initiatives of environmental NGOs and privates: buying up and retiring large amounts of hot air (not co-ordinated so far)

A further option would be to enable entities covered by the proposed European emissions trading scheme to buy hot air[16] before 2008 and (partly) accept those certificates on national/European obligations. An exchange rate, e.g. two "hot air-certificates" respond to one NCC, would need to be defined in advance. Such an approach gives an important incentive for European entities to buy and "retire" hot air.

[15] Emission reductions resulting from economical breakdown, not from active climate protection measures.

[16] for practical reasons entities would need to buy hot air options, e.g. in form of futures/forwards.

4. Conclusions

If a government decides to establish a domestic emissions trading scheme, there are several options how to enable sub-national entities to participate in IET. A **direct participation** in International Emissions Trading based on the provision of the Kyoto-Protocol by allocating AAUs straightforward to national entities does not seem practicable. The most relevant problems appearing are:

- Severe situation of uncertainty for participating entities due to potential sudden restrictions of trade if eligibility requirements (e.g. Commitment Period Reserve) on Party level are violated.
- Accounting and compliance issues if a national trading system starts before 2008

An **indirect participation** could be realised either by a *mutual agreement approach* or a *conversion approach.* Combinations of those approaches could be suitable as well. However, concerns of the Commitment Period Reserve and other eligibility requirements for Parties under the Kyoto regime need to be considered carefully.

For the European Union, the introduction of a "*European Carbon Currency (EUCC)*" seems advisable. Member States would need to back up allocated EUCCs with AAUs in order to enable unrestricted Community wide trading and minimise "eligibility-risks" for participating entities. Unrestricted trading is a prerequisite for the establishment of a derivative market which is considered an essential risk-management instrument by participants. Furthermore, since the net compensation of AAUs between Member States will most likely take place only once - at the end of the commitment period – eligibility requirements, e.g. the Commitment Period Reserve (CPR), will have less impact. Taking the conversion or mutual agreements approach, trading on entity level can be expanded to the international level.

When **designing a national emissions trading scheme,** one needs to consider several design parameters. The overall objective of the design process must be to establish an environmentally effective trading system that minimises total compliance costs. Additionally, aspects of international competition and interactions with existing policies and measures targeting at GHG reduction need to be considered.

A trading system that aims to be both effective and efficient needs to be based on absolute emission targets. It should cover as many relevant emitters as practicable. Here, a trade off between effectiveness (overall emissions covered) and an increase of transaction costs

resulting from an inclusion of small emitters must be evaluated. One needs to distinguish between direct and indirect participation. Whereas large emitters should participate in the trading system directly, the situation is somewhat more complicated for the transport and household sector. Both sectors are characterised by a high number of very small emitters. For the transport sector, an upstream inclusion either by means of a public institution or the inclusion of fuel importers/distributors seems applicable. The household sector does not need to be included in the trading scheme if emissions resulting from electricity production are allocated to production utilities (accounting for “direct emissions”) and emissions from fuel combustion are covered in an upstream way as described above.

A high number of participants with inhomogeneous mitigation options and costs is essential in order to establish an effective and efficient trading system. Consequently, participation should be mandatory for relevant emitters. The term “relevant” could be quantified by defining emissions thresholds which should be decreased over time. However, in the introductory phase, provisions could be softened since emission trading is still a new policy instrument for most actors (governments and emitters). Additionally, there should be an option for a voluntary opt-in for small industrial emitters in order to enable equal opportunities.

In general, a trading scheme should cover as many Kyoto-gases as technically feasible and economically reasonable. One prerequisite for the inclusion of a certain gas resulting from whatever source is that emissions can be quantified accurately. As monitoring costs differ significantly for individual gases and sources, one should begin with those emissions that can be quantified accurately with low-cost measures. At the same time, both the total contribution to global warming of a gas and its reduction potential need to be evaluated. For those reasons, one should focus on CO_2, emissions in the early stages of an emissions trading system. Large point sources of CH_4 and N_2O should also be included, expanding coverage over time. A differentiation by sources and monitoring costs will be advisable. Wherever feasible, the remaining Kyoto-gases should be included as well. This might, for example, be realised in a project based approach.

Regardless the type of GHG-emissions, a strict monitoring, verification and reporting system is needed to assure the environmental integrity of a trading system. The application of standard procedures (e.g. ISO 14000 or EMAS) might be an appropriate basis. Monitoring and verification procedures should be accompanied by spot-checks of the responding national/international institution.

The issue of allocation is primarily of political nature. Once the overall emission target has been set, the environmental objective is defined as well. The method of allocation then only results in distributional effects. However, when deciding on allocation one also needs to evaluate early actions and potential newcomers. Here, a pure auctioning system clearly has some advantages in comparison to a grandfathering system, of which the most important one is the provision of an early price signal. Nonetheless, auctioning will face severe political resistance from emitters. As a solution, one might either think of a *hybrid system* – a mix of grandfathering and auctioning - or means to redistribute income from auctions in a way that the net burden for all participants is minimised or even zero.

Due to reasons of practicability, emissions resulting from electricity production should be attributed to utilities.

Market access should not be limited to the participants of the trading scheme as this approach would also exclude traders and financial intermediaries which help to increase market liquidity and reduces price volatility.

Non-compliance provisions should be applied in a differentiated way according to the individual forms of "non-compliance": over-emitting, cheating and breaking contracts. In general, penalties must be deterrent and environmentally effective. Depending on the type of non-compliance, one might chose different combinations of the following penalties:

- Financial penalties as a combination of fixed rates as a minimum penalty rate and variable fees in relation to average market prices of certificates
- Obligation to submit missing certificates in following periods
- Exclusion from future trading/usage of the Kyoto Mechanisms
- Public „exposure"

The overall economical efficiency of a national emissions trading system might be increased by the inclusion of the project based mechanisms Clean Development Mechanism and Joint Implementation. Low-cost mitigation options can be accredited on the participant's emissions account. However, if those mechanisms are to be included, one should chose a conservative approach concerning the compatibility with future international. For the time being, a positive list should be defined for CDM projects assuring that only ecologically integer projects will be eligible for national accreditation.

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