Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

25-Oct-2006

English text only

ENVIRONMENT DIRECTORATE
INTERNATIONAL ENERGY AGENCY

COM/ENV/EPOC/IEA/SLT(2006)6
Unclassified

LINKING GHG EMISSION TRADING SYSTEMS AND MARKETS

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JT03216580

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FOREWORD

This document was prepared by the OECD and IEA Secretariats in September-October 2006 in response to the Annex I Expert Group on the United Nations Framework Convention on Climate Change (UNFCCC). The Annex I Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. In a collaborative effort, authors work with the Annex I Expert Group to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the Annex I Expert Group. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

The Annex I Parties or countries referred to in this document are those listed in Annex I of the UNFCCC (as amended at the 3rd Conference of the Parties in December 1997): Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, the European Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. Korea and Mexico, as OECD member countries, also participate in the Annex I Expert Group. Where this document refers to "countries" or "governments", it is also intended to include "regional economic organisations", if appropriate.

ACKNOWLEDGEMENTS

This paper was prepared by Jane Ellis and Dennis Tirpak of the Organisation for Economic Co-operation and Development. The authors would like to thank Richard Baron for his input and ideas, as well as Erik Haites, Andrew Howard, Bill Irving, Katia Karousakis, Cédric Philibert, Julia Reinaud, Peter Zapfel and delegates of the Annex I Expert Group for their helpful comments on an earlier draft.

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Executive Summary

The entry into force of the Kyoto Protocol has stimulated the development of a carbon market through a number of different emission trading schemes (ETS), as well as through the development of project-based mechanisms such as the Clean Development Mechanism (CDM) and Joint Implementation (JI). Several different ETS are currently operating, and a number of other national and sub-national schemes are likely to emerge in the near future. Most existing or planned ETS allow for entities to meet their emissions targets by using credits from CDM, JI or other project-based "offsets", as well as through trading. The emerging schemes will further the development and improve the economic efficiency of the market.

Current and planned ETS have different sizes, design characteristics and geographical/sectoral scopes. The EU ETS is by far the largest of current or proposed schemes. Some ETS are designed to be used for compliance with emission commitments under the Kyoto Protocol, while others are planned or in use in non-Kyoto Parties. Some emission trading systems are mandatory, while others are voluntary. Some cover direct emission sources only, while others include e.g. electricity retailers or users. Compliance provisions also vary significantly between the different schemes. Further, there are differences in the time-period over which the system extends, as well as the time period over which any emission commitments/targets are set. In addition, there are sometimes differences in the amount and type of "offset" credits that may be acceptable to the various ETS.

There are currently only a few links between different emissions trading schemes and markets. These links are predominantly unilateral (one-way). There are no conceptual reasons why links between emission trading systems and markets cannot be expanded. Indeed, further links are planned prior to 2008 and many others are likely after 2008. These planned links can be direct, both bilateral (two-way) as well as unilateral. Indirect links between different emissions trading markets are also planned, and include transfers via offsets from project-based mechanisms or via governments that may sell/transfer large blocks of allowances, such as assigned amount units (AAUs).

To encourage linking between different emission trading schemes, some technical "fixes" may be needed, as well as a greater degree of harmonisation (particularly for direct, bilateral links). The design features that need special attention include:

- How targets are expressed (e.g. fixed or indexed). For example, care would be needed to ensure that linking does not change the environmental integrity of either system by allowing more emissions than originally intended.
- Price caps. Linking a scheme with a price cap to one without a cap could reduce the incentives to deploy innovative technologies in the system not subject to a cap if the price is set too low.
- Non-compliance provisions. These can affect the environmental effectiveness of a particular scheme by encouraging (or not) its targets to be met. Stakeholders in a scheme with rigorous non-compliance provisions may be reluctant to link to a scheme with less stringent provisions, and thus a lower perceived environmental effectiveness.
- Banking/borrowing provisions, commitment period lengths and starting points. Care would be needed if linking an ETS that allows borrowing with one that does not. Different commitment periods, lengths and banking provisions might also require more sophisticated emissions accounting processes.
- Eligibility of offsets. Credits from CDM projects are accepted in several ETS. Other types of eligible offsets vary widely in terms of project types/host countries.
- Permit allocation methods in different countries. These could have competitive implications thereby affecting the political acceptability of linking different national systems.

Within the next few years there could be many more interactions between different GHG trading systems and different types of offset mechanisms. Greater numbers of unilateral links between some emissions offset schemes in non-Annex I Parties and those in Annex I may also occur – e.g., the use of CDM credits by members of the Chicago Climate Exchange. Links to expanded state-based or national trading systems of Annex I countries that have not ratified the KP are also possible. Finally, links between the different "non-Kyoto" systems could emerge, although these may not necessarily be straightforward. Given the early stage of development of this market, and the special interest of different governments, some amount of innovation should be encouraged while bearing in mind that a well-functioning global market will need clear rules and some degree of harmonisation.

1. Introduction

Market mechanisms are increasingly being used to achieve cost-effective GHG emission reductions, both within and external to the Kyoto Protocol. The carbon market resulted in an estimated $11 billion of transactions in 2005 (World Bank and IETA 2006). This market is dominated by transactions under the EU emissions trading scheme (EU ETS) and the Kyoto Protocol's Clean Development Mechanism (CDM). Indeed, the EU ETS and CDM accounted for 98% of the total value and 95% of the total volume of transactions in the carbon market in 2005 (WB/IETA 2006). Several other emissions trading and project-based mechanism transactions also occurred during 2005 (and the first half of 2006), albeit at a much smaller scale.

An extensive body of literature on different aspects of greenhouse gas emissions trading has developed since the inclusion of the emissions trading provision in the Kyoto Protocol (e.g. Teitenberg et al 1999, CEPS 2002, IEA 2005). Assessments of potential economic, environmental and equity issues arising from linking different emissions trading schemes (ETS) and the benefits of doing so is part of this. Previous analyses on linking different ET schemes (e.g. Haites and Mullins 2001, Baron and Bygrave 2002, Blyth and Bosi 2004) have indicated the potential benefits this could bring, such as increasing size and fluidity of carbon markets. Since then, several ETS have been developed, and some are already in operation. It is therefore timely to re-examine the linking issue – this time, from a practical viewpoint. However, this paper is not intended to be a comprehensive survey of all emission trading proposals. Rather, it draws on a few examples to illustrate issues relevant to the design, implementation and evolution of future systems.

This paper outlines key characteristics of current and proposed ET schemes and assesses current, or possible pre-2012, links between them. This includes direct links between different ETS, as well as indirect links between ETS and emissions credits generated from project-based mechanisms such as the CDM. Thus, this paper focuses on the interaction between different sub-national, national and international ET systems and the generation and use of project-based credits. It does not focus on the institutions (e.g. exchanges) or technologies (e.g. registries) needed to actually carry out trades.

Section 2 describes different emission trading schemes and other GHG trading markets that are developing: Kyoto and non-Kyoto; mandatory and voluntary; emissions trading and project-based transactions. Section 3 highlights the possible direct and indirect links that are or could occur between different centres of carbon supply and demand – links that could help improve the liquidity of the market as a whole. Section 4 examines to what extent linking of emissions trading markets implies harmonisation in the underlying rules, which policy choices regarding emissions trading system design may reduce the desirability of linking, and the distributional effects of linking. Conclusions are outlined in Section 5.

1.1 Background: what is linking?

Several different types of links are possible between different GHG-mitigation systems. These include:

- Linking two or more emission trading schemes so that emissions trading can occur both within and between different schemes ("direct links");
- Linking emission trading systems to registries/mechanisms and systems that generate offsets from project based mechanisms or from direct purchases/transfers of AAUs ("indirect links").

Individual links can be:

- Unilateral (one-way), i.e. where units from system A can be used in system B, but not *vice versa*; or
- Bilateral (two-way), i.e. where units from systems A or B can be used for compliance in both systems A and B.

Bilateral links will increase the liquidity of the linked system, increase the scope of potential emission reduction opportunities and thus maximise economic efficiency. However, bilateral links can also have negative effects. For example, they could reduce a system's overall environmental effectiveness (e.g. if a system with a fixed emissions limit is linked to a system with no such limit[1], or if a system with limited monitoring and verification procedures and/or covering difficult-to-quantify emission sources is linked to one with more stringent levels of monitoring and verification). Bilateral links could also reduce the likelihood of overall compliance, e.g. if a system with no/weak penalties for non-compliance was linked with one with stronger penalties for non-compliance. The desirability of bilateral links between two systems will therefore differ depending on their designs and the aims of the systems' participants.

If the aims and designs of two different systems vary significantly, a unilateral link might still be acceptable to participants in one system. For example, a system with indexed emission targets, or with fixed but voluntary targets, may decide to accept (acquire) Kyoto-compliant credits even though they could not sell (transfer) credits back into a Kyoto-compliant system. Indeed, this is the case for the currently-operating Chicago Climate Exchange (which will accept CDM credits), and the planned Regional Greenhouse Gas Initiative (RGGI) – which may also accept CDM credits under certain conditions.

2. Possible Types of Emissions Trading

Emissions trading can take different forms. The most common form of trades to date is that within emissions trading systems. In the case of the EU ETS, this involves transfers of "EUAs" (European Union Allowances). However, acquiring/transferring other types of emissions units (or credits) is also possible – either inside or outside an emissions trading scheme.

This section outlines the characteristics of different emissions trading systems, both national and regional, and the types of project-based credits that they accept. It also describes different potential types of assigned amount unit (AAU) transfer.

2.1 Characteristics of different emissions trading schemes

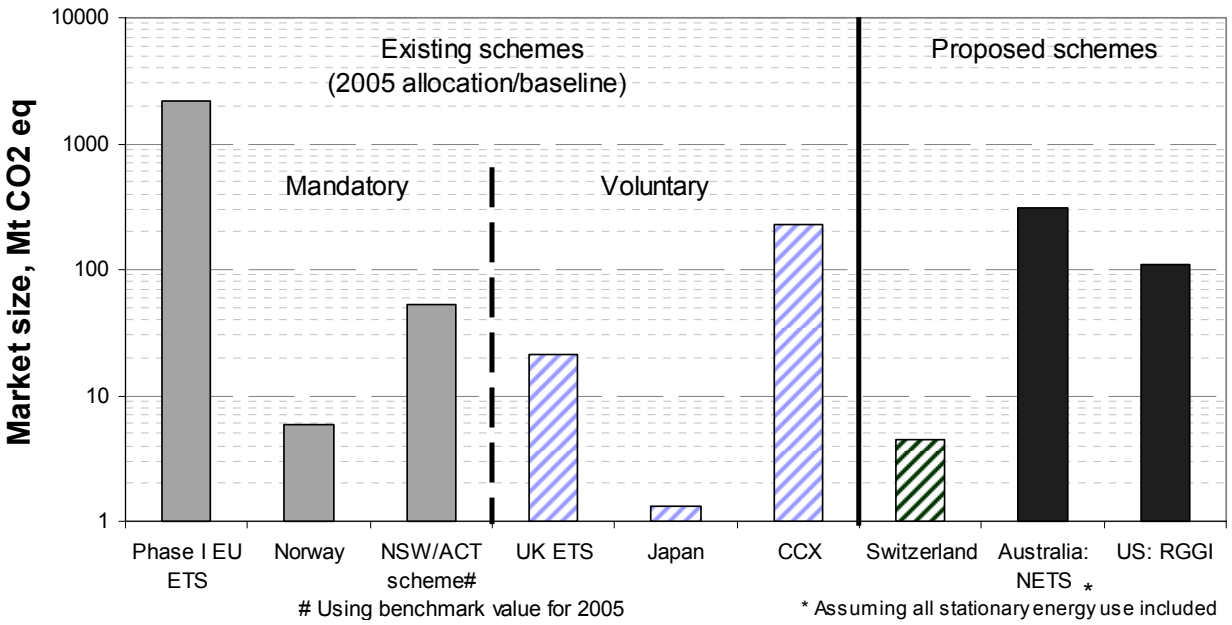
Several different emissions trading schemes have been established, or are planned to be implemented within the next few years. The EU ETS is by far the largest of these, with participating installations allocated an average total of 2.2 billion t CO_2-eq per year during 2005-07. Of the other currently-operating schemes, the Chicago Climate Exchange (CCX) is the next largest, with baseline emissions of 230 million t CO_2-eq in 2005[2]. Figure 1 illustrates the relative sizes of different systems that exist: EU ETS, Norway, New South Wales (NSW), UK ETS, Japan voluntary system, Chicago Climate Exchange (CCX); or that are proposed: Switzerland, Australia's national ETS ("NETS"), Regional Greenhouse Gas Initiative (RGGI), California. Phase 1 of the EU ETS is more than double the size of all other existing and proposed systems combined[3].

[1] This need not be the case, however. There are cases where linking a fixed cap regime with an indexed cap one can lead to a lowering of the overall environmental goal.

[2] http://www.theccx.com/environment/complianceReports.html

[3] Excluding California, the size of which is not known.

Figure 1: Size, type and status of different emission trading systems (NB: log scale)



Sources: various (see footnote below[4]).

As well as very different sizes, these emissions trading schemes can also have very different design characteristics and scopes. Some are designed to be used for compliance with emission commitments under the Kyoto Protocol, while others are planned or in use in non-Kyoto Parties. Some emission trading systems are mandatory, while others are voluntary. Some cover direct emission sources only, while others include e.g. electricity retailers or users. Compliance provisions also vary significantly between the different schemes. Further, there are differences in the time-period over which the system extends, as well as the time period over which any emission commitments/targets are set. Key characteristics of different emissions trading schemes are outlined in Table 1 (for schemes currently in operation) and Table 2 (for schemes where planning is relatively advanced[5]).

[4] Sources for Figure: EU (2003), SFT (undated), NSW (undated), ABC (2003), Defra (2006), Ninomiya (2006), CCX (2006), Keckeis (2006), UNFCCC (2006), RGGI (2005).

[5] Schemes at a feasibility-study stage only (e.g. in France) are not included.

Table 1: Key characteristics of different emissions trading schemes (currently operating)

	Eligible gases	Sources	Mandatory (M) or (V) Voluntary?	Participants	Target: indexed or fixed	Time scale	Non-compliance penalty?	Use of offsets?	Banking	Unit
EU ETS (Phase I)	CO_2	Combustion plants, oil refineries, coke ovens, I&S, cement, glass, lime, brick, ceramics, pulp and paper	M	Emitters	F	2005-2007	Y: EUR 40 (+ shortfall to be made up in following year)	Y: CDM (excluding forestry)	(Allowed in some countries)	1 metric ton CO_2-eq
EU ETS (Phase II)	CO_2 + opt-in (e.g. N_2O)	As above, + possible "opt-in" for some gases/sectors (e.g. industrial N_2O in the Netherlands)	M	Emitters	F	2008-2012	Y: EUR 100 (+ shortfall to be made up)	Y: CDM (excluding forestry) , JI	Y	1 metric ton CO_2-eq
Norway ETS	CO_2	As for EU ETS Phase I	M for plants not under CO_2 tax	Emitters	F	2005-2007	Yes – same as EU Phase I.	Yes –as EU Phase I.	Y (2005-07 only)	1 metric ton CO_2-eq
NSW/ ACT scheme	6 GHG	Production and use of electricity	M	Electricity retailers, large elec. users	I	Initially 2003-12 (yearly), extended to 2020	Y: AUS$11.5/t shortfall if over-emission not made up in subsequent year	Y: some project types	Y[6]	1 metric ton CO_2-eq
UK ETS (direct participants)*	6 GHG	Various industrial sectors and energy use.	V	Emitters and users	F	2002-2006	Y: GBP30 + make up credit in next year + non-payment of subsidy	N	Y	1 metric ton CO_2-eq

[6] In the NSW/ACT scheme, an offset remains in force unless cancelled by the system administrator. "Borrowing" of up to 10% of the subsequent year's target is also allowed. See Part 8A of the Electricity Supply Act 1995 (http://www.legislation.nsw.gov.au/view/inforce/act+94+1995+FIRST+0+N)

Japan JVETS	CO_2	Industry: food, breweries, pulp, chemicals	V	Emitters[7]	F	FY2006 FY2007	Y: return of subsidy, "naming and shaming"	Y (CDM)	Y	1 metric ton CO_2-eq
Chicago Climate Exchange	6 GHG	Electricity generation, manufacturing industry	V	Emitters (and offset providers)	F	2003-6, 2007-10	No defined penalty[8].	Y: certain countries/sectors	Y	100 metric tons CO_2-eq

* Provisions for direct participants in the UK ETS are different from those that have Climate Change Agreements. These latter are not included here.

Sources: EU (2003), EU (2004), Anonymous (2005), Rosland (2005), Stiansen (2006), NSW (undated), Defra (2005 and 2006), Ninomiya (2006), CCX (2004), CCX (2006c)

[7] 32 installations were covered by JVETS in its first year, and 38 in its second year.

[8] There are no defined penalties for entities with emissions targets under the CCX. However, there are make-good and penalty provisions for some "offset providers".

Table 2: Key characteristics of selected proposed emissions trading schemes[9]

	Switzerland	Proposed "NETS" scheme in Australia	Regional Greenhouse Gas Initiative (RGGI)	Proposed California scheme
Gases	CO_2	6 GHG	CO_2	Initially CO_2 only
Sources	Cement, I&S, aluminium, pulp and paper, glass, ceramics, other industry	Stationary energy (initially electricity generation> 30MWe, potentially extended to CH4 from natural gas by 2015)	Electricity only, possible extension to other sources in future	Entities that provide electric power to consumers, potentially also natural gas sector
Mandatory/ voluntary	Voluntary (but legally binding once a participant)	Mandatory	Mandatory	Mandatory
Participants	Emitters	Emitters	Emitters	Emitters and retailers
Target: indexed or fixed?	Fixed	Fixed (currently two scenarios: 150 or 176 Mt CO_2-eq)	Fixed (at the same level to 2014, decreasing 2.5% p.a. from 2015-18).	Fixed (level not yet determined)
Timescale	2008-12	Possible start 2010 (no end date)	1.1.2009 (to 2018)	Not yet defined
Non-compliance penalty	Y: CO_2 tax since exemption+ interest	Y (level not specified. However, there is no "make-good" provision).	N	Y – but not yet defined
Use of offsets	Y	Y ("should be consistent with JI". CDM credits can also be used)	Y (extent increases with the 12m rolling average spot price of carbon: if <$7/t then max. 3.3%; if >$10/t (adjusted annually for consumer price index + 2%) then maximum 10%)	Not yet defined (but a state-wide GHG limit will become operational on 1.1.2012)
Banking	Y	Y (unrestricted)	Y (unrestricted)	Not yet defined
Unit	1 metric ton CO_2-eq	1 metric ton CO_2-eq	1 short ton CO_2-eq	1 ton (not defined) CO_2-eq

Sources: FOEN 2006, NETT 2006, RGGI 2005 (and 2006 amendment), CPUC (2006)

The impact of these different characteristics on the ease (or otherwise) of creating links between different systems is examined in section 3.

[9] A number of other proposals have been introduced or are being considered by different governments. For example, in the US several bills have been introduced in the US Senate. The McCain-Lieberman Climate Stewardship Act of 2003 (S.139) which was defeated by a vote of 43 to 55 would have caped the 2010 aggregate emissions level for the covered sectors at the 2000 level and provided for the trading of emissions allowances and reductions through a National Greenhouse Gas Database. Other provisions addressed the use of offsets and penalties. See: http://www.pewclimate.org/policy_center/analyses/s_139_summary.cfm More recently, in the US Senators Jeffords and Feinstien have introduced similar bills. See: http://jeffords.senate.gov/climate_bill_summary.pdf and http://feinstein.senate.gov/06releases/r-global-warm320.pdf

The Canadian "Large Final Emitters" scheme was introduced by the previous government and was in an advanced stage of planning at the end of 2005. The current government has signalled an intention to change directions, but has not yet indicated whether, and if so specifically how, this scheme may be modified The New Zealand "Projects to reduce emissions" scheme allows tradable offsets to be generated from individual projects, it does not include emissions caps for other projects or for sectors. Korea is also assessing emission trading through a simulation study. See: http://times.hankooki.com/lpage/biz/200608/kt2006082718121111890.htm

2.2 Other types of emissions trading

Trading of emissions units is not restricted to trading within an emissions trading scheme. Parties to the Kyoto Protocol have a certain number of "assigned amount units" (AAUs) for the commitment period 2008-12. For some Kyoto Parties, a certain proportion of these AAUs will be allocated to installations who will be able to trade on the open market (e.g. as for the EU ETS in EU member states[10]). However, governments could also retain a portion of their AAUs in a central registry/depository and directly trade in AAUs. This could be done in several ways:

- Direct government trade in AAUs, without or with conditions associated with such a trade (e.g. via a Green Investment Scheme);

- Transfers of AAUs linked to individual emission-reduction projects. Joint Implementation (JI) projects that have started prior to 2008 and for which the host country promised to deliver allowances for reductions achieved prior to the beginning of the commitment period.

2.2.1 Direct AAU trades

Information on current and planned direct trades between governments is currently scarce[11]. However, it appears that the volume of AAUs currently affected by such trades is relatively limited.

Government-to-government transfers would be implemented through the national registries of the Parties concerned, and would thus be recorded there in the first instance. All such transfers, being international in nature, would be monitored and checked by the international transaction log (ITL). The ITL is a central communications hub, and ensures that all transactions are compliant with (a) the technical standards of such registry to-registry communication and (b) the policy rules decided by the COP/MOP.

Any international transfers, irrespective of size, will need to also be reflected in the "supplementary information" in all Parties' annual reports. However, only national totals will be recorded, not individual transfers. It would to some extent be up to the Party itself to determine how much (and how up-to-date) information on individual transfers they want to make available on their own registry websites.[12]

There are at least two examples of agreements for direct government trade in AAUs, from Slovakia and Romania. Slovakia agreed in 2002 to sell 200,000 AAUs to a private company[13]. Romania has also agreed to sell 10m AAUs to the Netherlands (Henkemans 2006), and had previously indicated that all such trades would be via investments to the Romanian Green Investment Scheme (Ministry of Environment and Water Management, undated).

The expected surplus of AAUs (compared to Kyoto targets) is significant in some countries. For example, some estimate Russia to have a potential AAU surplus of 2-3 billion tons CO_2-eq for 2008-2012 (Golub et al 2006, Gorina 2006) and a further 2-3 billion tons of low-cost reductions in the same timeframe (Golub et al 2006). Ukraine is estimated to have a surplus of 1-1.5 billion tons over 2008-12 (Veremiychyk 2005).

There is thus significant further potential for direct AAU trades. However, it is unlikely that countries with surplus AAUs would devolve all of them to entities, leaving it to these entities to trade the country's surplus AAUs on the international market. Under the assumption that all Kyoto Parties would meet their 2008-2012

[10] EU countries do not trade directly in AAUs. Rather, in tradeable allowances (EUAs) that are derived from AAUs.

[11] Although presumably such trades will be tracked by registries once they have occurred.

[12] See paragraphs 44-47 of decision 13/CMP.1 regarding what should be published, including provisions on confidential information.

[13] See *"Greenhouse Gas Emissions Trading Under the Kyoto Protocol Kicks Off with Historic Allowance Transaction",* http://www.evomarkets.com/scripts/pr_full.php?pr=14

emissions commitments and rely on trading when their emissions are above their assigned amount, IEA (2005) stresses that government-based transactions are likely to account for the bulk of *net* transfers across registries[14]. Trade in Russian AAUs via any domestic Russian emissions trading scheme is also unlikely to occur in the short or medium-term (Pluzhnikov, 2006). If countries with a significant AAU surplus do not set up an allocation system for their AAUs, direct government transfers are likely to be the primary means of trading.

The likelihood of this potential for AAU trades being achieved is small, however. For example, while Russia is actively pursuing the Green Investment Scheme (GIS) option (Pluzhnikov 2005) and expects to have implemented its first GIS deal by 2010 Gorina 2006), indications are that it is unlikely to sell its whole stock of surplus AAUs in the first commitment period (Novosti 2006). Also, if the sectors covered by EU ETS NAP2 have a "commitment gap" during 2008-12, this can be filled only with EUAs, CERs and ERUs (although there are also restrictions on the use of project-based credits)[15].

2.2.2 Transfers of AAUs linked to emission-reduction projects

Transfers of AAUs can also be directly associated with the performance of an emissions-reduction project. The most common example of this would be a Joint Implementation (JI) project. JI projects occur between two Annex I countries, and generate "emission reduction units" (ERUs) corresponding to the level of emission reductions of a project[16]. Projects under the New Zealand "Projects to reduce emissions" scheme can also opt to generate AAUs, which can then subsequently be traded.

JI projects can only generate emission reduction units (ERUs) from 2008. However, for JI projects that start prior to 2008, many different host countries[17] indicate a willingness to transfer AAUs corresponding to the project's pre-2008 emission reductions.

It is difficult to estimate the total magnitude of such transfers that are already in the pipeline, as not all proposed JI projects are public. However, it is likely to be less than half the total JI portfolio, currently estimated to generate 82.3 million credits to 2012 from 131 projects[18]. Although such transfers can, and will, happen, their importance is therefore likely to be limited

2.3 Linking trading with project-based offsets/credits

There are two project-based mechanisms under the Kyoto Protocol: the Clean Development Mechanism (which generates credits called "certified emission reductions", CERs), and Joint Implementation (which generates ERUs). Structuring an ETS so that entities within it can use project-based credits to help achieve

[14] The alternative would be for governments to devolve the bulk of their assigned amounts to entities, for instance through an upstream allocation of CO_2 from fossil fuels to oil, gas and coal importers and producers. No country has seriously considered this option to date.

[15] Further, there may be political pressure in some potential buyer countries to only buy credits that are associated with GHG emission reductions.

[16] The level of the JI host country's AAU is reduced by the number of ERUs it transfers (an AAU has to be turned into an ERU before it can be transferred). Typically, but not always, JI host countries are those "with economies in transition".

[17] This can be seen from proposed JI project design documents for projects in e.g. Bulgaria (http://www.dnv.com/certification/climatechange/Upload/PDD_%20Vacha%20Cascade_2003-09-17.pdf), Estonia (http://www.nefco.fi/documents/tgf/projects/PDD_for_Viru_Nigula_Wind_Farm.pdf), Russia (http://www.nefco.fi/documents/tgf/projects/PDD_TEKOS.pdf), Ukraine (http://www.dnv.com/certification/climatechange/Upload/PDD-Donetsk%20Gas%20Utilisation_ver2.pdf).

[18] Source: UNEP/Risoe database www.cd4cdm.org (updated 20 October, 2006) This volume reflects JI projects that have PDDs. However, not all such projects may successfully complete the procedures needed to generate credits.

their emissions target can have several advantages, including increasing the scope of potential emission-reduction activities and reducing the overall cost of meeting a given emissions target.

The "linking Directive" (EU 2004) explicitly allows entities with emissions commitments in the EU ETS to use credits from CDM projects (and JI projects, post 2008) – although with some restrictions as outlined in Table 3. The two next-largest currently-operating emissions trading systems (i.e. CCX, NSW/ACT system) also allow for emissions targets to be met by using credits from certain types of projects, although also place restrictions on the number and/or type of credits allowed in a particular system. The UK ETS is the only currently-operating emissions trading system that does not allow participants to use project-based credits.

Table 3: Types of offsets accepted by different emissions trading schemes[19]

Name	Can be used in…	Eligible gases	Eligible project types	Eligible project countries
CDM	EU ETS Phase I and II, Norway, Japan, CCX, proposed Swiss system, proposed Australian NETS system	6 GHG	All "additional" emission-reduction and re/ afforestation projects. Countries are to "refrain from" using credits from nuclear facilities. "Sinks" credits are temporary, and are not currently accepted by the EU ETS.	Non-Annex I countries (NAI)
JI	EU Phase II, proposed Swiss and Australian NETS systems	6 GHG	All projects that "[aim] at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks… in any sector of the economy" that produce "additional" emission reductions.	Annex I countries
"offsets"	CCX	6 GHG	Agricultural practices (mainly US), Renewable energy projects (US, Brazil), Forestry practices, Methane reduction from landfills/livestock operations, CDM projects	US, Canada, Mexico, Brazil and other NAI
"offsets"	NSW/ACT system	Not specified	"Low-emission" electricity generation (includes CHP), reduced electricity consumption, other GHG reductions at electricity-generating sites, re/afforestation	NSW/ACT only (+grid-connected elec. generators in other states)
"offsets"	RGGI	CO_2, CH_4, SF_6	Capture/use of landfill gas; reduced fugitive emissions from natural gas transmission/ distribution; CH_4 capture from livestock operations; end-use efficiency for natural gas, propane, heating oil; SF_6 capture/recycling; afforestation. Other project types may be added later.	US (and, if carbon price above pre-defined threshold, "international trading programs")

Sources: EU (2004), Anonymous (2005), Stiansen (2006), NSW (undated), Defra (2005 and 2006), CCX (2006c), NETT (2006), RGGI 2005 (and 2006 amendment)

As outlined in Tables 1 and 2, most current/planned ET systems allow participants to offset a proportion of their emissions by using credits generated from certain types of GHG-reduction projects. Offsets may be restricted to those generated in certain countries or project types. Table 3 outlines the different project types that are eligible to generate credits/offsets in current and proposed emissions trading systems. Offset providers will therefore need to be aware that not all project types are accepted in all schemes.

The CDM is currently the largest and most diverse source of project-based credits allowed in different trading systems[20]. CDM credits represent "additional" emission reductions of the 6 GHG covered by the

[19] Offsets can also be used in sectors of an Annex I Party not covered by a national emissions trading scheme, meeting targets under different forms of voluntary agreements or in other schemes, e.g. section 1605(b) of the US Energy Policy Act. In general, these offsets cannot be traded. (although they can e.g. in the New Zealand PRE scheme).

Kyoto Protocol. Currently the majority of expected credits result from reductions of: HFC23 and N_2O from industrial sources; methane emissions from landfills, coalmines and oil/gas production; and CO_2 by substituting renewable electricity generation (for further information see Ellis and Karousakis 2006).

3. Current and Potential Links between Different Systems

At present, none of the different emissions trading schemes in operation are officially linked. The Kyoto Protocol envisages a seamless system for the Parties to the Protocol, but provides for no links with non-Parties[21]. The EU ETS also envisages links with other emissions trading schemes, under certain conditions. However, whether and how to link schemes in the future is in most cases at a very early stage of exploration. (The exception is the EU ETS and the Norwegian ETS, as outlined below).

Indirect and/or unilateral links between different GHG-mitigation systems are possible, e.g. via transfer of project-based credits/offsets, even if the trading systems themselves are not linked directly. This section outlines the current and potential links pre-2008 and pre-2012

3.1 Current/likely pre-2008 links between different markets and emission trading systems

The current interaction between various emissions-mitigation systems are outlined in Figure 2 below. This figure shows that although several schemes have been set up, and although transfers have occurred within the separate systems, pre-2008 links between the systems are relatively limited.

Some separations between different systems are intentional, such as the separation of the UK and EU ETS, and the non-acceptance of project-based offsets in the UK ETS. However, there are other linkages and/or transfer types that have been agreed upon, but have yet to occur. This is because some agreed transfers cannot (under the rules agreed in the Marrakech Accords) occur prior to 2008. It is also due to technical reasons (e.g. as the international transaction log, ITL, is not yet functioning).

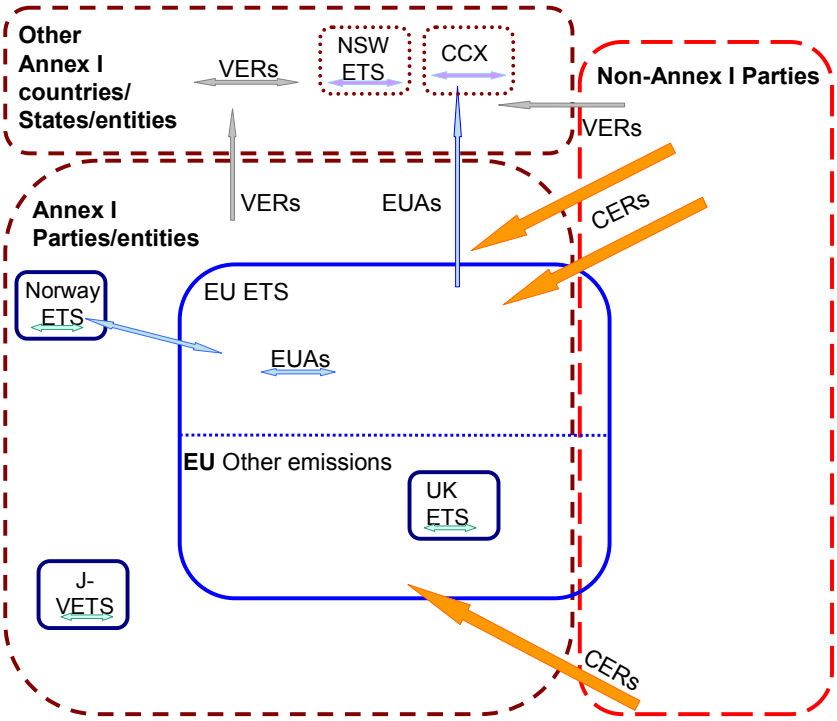
Nevertheless, the number of interactions between different emissions-mitigation systems should increase somewhat pre-2008. For example, both the EU and Norway have indicated that they would like to link their trading systems together. This is planned to be done by implementing the emissions trading Directive in the European Economic Area (EEA) agreement (MD 2006). However, this has not yet happened[22]. The expansion of the EU ETS to include Romania and Bulgaria will also increase the scope of the EU ETS (although does not represent a "link" as such).

[20] For example, in 2005 there were $2.5 billion of transactions corresponding to 346 Mt CO_2-eq (WB 2006) and expected credits from planned/actual CDM projects currently exceed 1.4 billion credits pre-2012, up from just over 0.5 billion (portfolio in November 2004) Ellis 2006a and 2006b.

[21] Article 17 of the Kyoto Protocol indicates that "The Parties … may participate in emissions trading…". Article 25 of the EC Directive indicates that "agreements should be concluded with third countries … which have ratified the Protocol to provide for the mutual recognition of allowances…".

[22] Were any installations in Lichtenstein or Iceland also covered by the Directive, this approach would require the Directive to be implemented in these countries too.

Figure 2: Current/likely pre-2008 links between different GHG-mitigation systems*



Source: authors' summary

* Malta and Cyprus are EU members, but not in "Annex I", which is why there is an overlap between the EU ETS "box" and non-Annex I Parties.

Unilateral links are possible where Kyoto-compliant units are transferred to the US and/or Australia-based systems[23]. The extent to which such links are likely varies according to the individual system. For example, as outlined in Table 2, unless the carbon price is above a set threshold, only project offsets from the US are allowed into the RGGI system. Under these conditions, participants in RGGI cannot use credits from the EU ETS, or from CDM or JI projects, in order to comply with their obligations. In contrast, transfers from other systems are allowed in the CCX. Indeed, a transfer from the EU ETS to the CCX has already occurred[24].

Beyond the technical issues and the recognition by one system that another system's units are acceptable, it is eventually the relative price of traded units that should drive transactions across systems. This explains why purchases of EUAs by entities outside the system have been extremely limited, as these allowances are currently the most expensive compliance units[25].

3.2 Potential pre-2012 links

While desirable from an economic point of view, the transition towards an emissions trading scheme that extends beyond Europe will take some time. In the interim it is very important that provisions should be made within international, national and sub-national schemes that encourage (or at least do not obstruct) potential future links between different schemes.

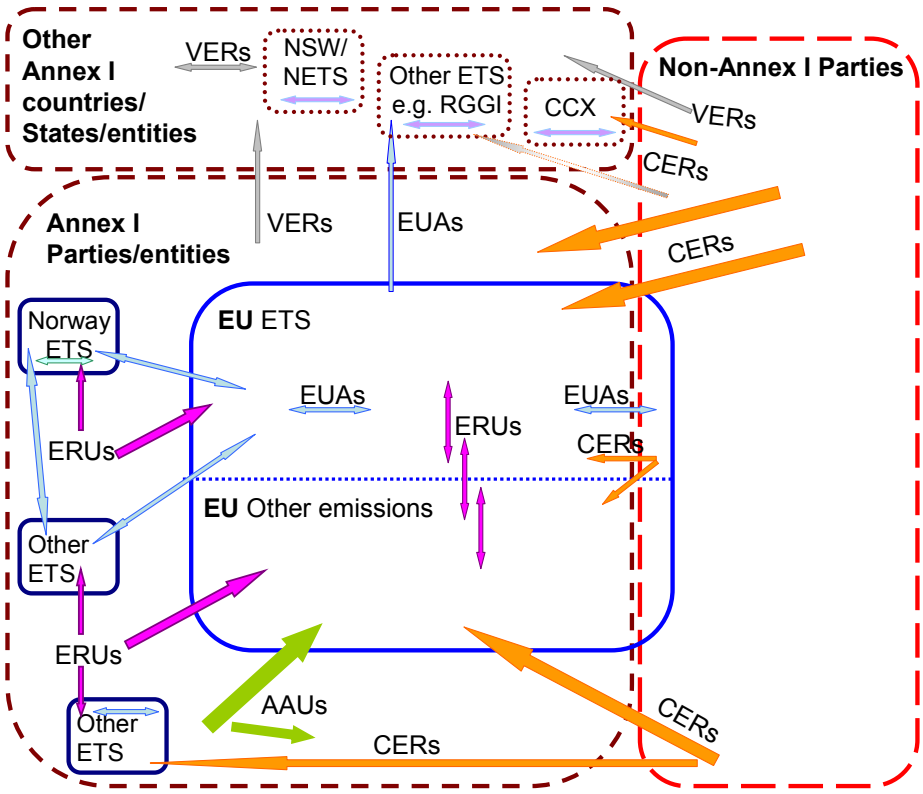
[23] Such transactions are likely to be driven by entities: either those with capped emissions and participating in an ETS, or from CDM project developers/participants.

[24] This transfer was for 100 metric tons. See http://www.theccx.com/news/press/release_20060504_EUETS.pdf. Since the carbon price in the EUA is significantly higher than that in the CCX, it is unlikely that transfers from the EU ETS to CCX will become widespread.

[25] Prices in different trading systems are outlined in section 4.2.

However, within the next few years there could be many more interactions between different GHG trading systems and different types of offset mechanisms than at present. These are outlined in Figure 3 and discussed in section 3.2 below.

Figure 3: Potential pre-2012 links



Source: authors' summary

3.2.1 Links between Annex I Parties

Direct, bilateral links between Annex I Parties could occur between different emissions trading schemes. For example, further emissions trading schemes from Kyoto Parties may be developed, e.g. Switzerland, and possibly Canada[26] and could potentially be linked to one another and/or the EU ETS pre-2012.

An increased number of "indirect links" may also occur between emissions trading schemes and sources of project-based credits or AAUs. This includes transfers[27]/acquisitions of project-based CERs, ERUs and project-based and/or GIS-based AAUs (including those transfers agreed pre-2008) to different Parties, as well as to various emissions trading schemes. As highlighted above, several post-2008 transfers of AAUs have already been agreed. Most of these reflect the levels of pre-2008 reductions from JI projects, but some are from agreements to transfer AAUs that are not directly associated with particular projects.

[26] Depending on what decision is made on their Large Final Emitters scheme.

[27] Thus, for example, the non-Annex I EU members Cyprus and Malta could be a source of CERs within the EU, as well as participating in the EU ETS. Indeed, Cyprus has already submitted two proposed CDM projects for validation (in February 2006). Several EU countries are also planning to be host countries for JI projects, and will thus be a source of ERUs within the EU.

3.2.2 Links between Annex I Parties and non-Parties

Links to expanded State-based or national trading schemes of Annex I Parties that have not ratified the KP are also possible. The possibility of linking under certain conditions is raised in Article 25 of the EU linking directive (EU 2004). This Article indicates that "*the Commission should examine whether it could be possible to conclude agreements with countries listed in Annex B to the Kyoto Protocol which have yet to ratify the Protocol, to provide for the recognition of allowances between the Community scheme and mandatory greenhouse gas emissions trading schemes capping absolute emissions established within those countries*". As such, the text seems to include the possibility to link the EU ETS with trading systems at the sub-national level (such as RGGI and the NSW/ACT scheme).

However, at present, only units from Parties to the Kyoto Protocol (i.e. EUAs, CERs or ERUs) can be used for compliance under the EU ETS and under the Kyoto Protocol. Thus, at present, linking non-Protocol and Protocol trading system(s) would not help a Party to the Protocol to meet its emissions commitments under that Protocol.

Technical and policy-related issues that could impede links between different emissions trading schemes are discussed in section 4.

3.2.3 Links to and/or between Annex I non-Parties

Pre-2012 links between emissions trading schemes and markets in Annex I non-Parties are also possible. For example, both the proposed NETS scheme in Australia and the proposed Californian scheme indicate that they are going to be established in such a way as to enable future links with other schemes. (However, neither scheme is currently operational).

Establishing such links will not necessarily be straightforward. For example, "technical fixes" will be needed to link a scheme with indexed targets (such as the NSW/ACT scheme) to those with fixed targets (such as the CCX) or those using different units, e.g. short vs. metric tons or tons/kWh. Careful monitoring and accounting will also be needed when linking these systems (Philibert 2005).

Unilateral links between non-Annex I Parties and the US or Australia could also occur in future. For example, via the use of CDM credits in the CCX or NETS trading schemes. Such links could also include acceptance of "VERs" (credits from emission reduction projects that have been verified, but that are either outside the requirements for CDM/JI projects, or have not undertaken the required procedures for such projects)[28].

3.2.4 Maintaining links over time

If different trading schemes are linked, some mechanism and/or institution may be needed in order to periodically review and consider the implications of changes in individual systems. This is because the characteristics of the individual emissions trading systems may vary over time. For example, an ETS may alter its coverage (in terms of sectors and/or gases), or the type of eligible offsets that can be used. Alternatively, the procedures for monitoring, reporting and verifying emissions may change. In either case, the administrators of a linked scheme may need to confirm that these changes do not nullify any prior linking agreement.

This type of co-ordination or checking function is less likely to be needed in some cases than others, e.g. if a country decides to implement another country's legislation that establishes the working and functioning of an

[28] Such VERs cannot be used for compliance with Kyoto commitments. However, there may nevertheless be a demand for these units in both Parties and non-Parties to the Kyoto Protocol by companies (and individuals) wanting to purchase voluntary emission reductions, e.g. for corporate social responsibility reasons.

ETS. However, a mechanism and/or institution may be needed to periodically review links between two or more independently-designed schemes.

If developments within two linked schemes create significant divergences over time e.g. in eligibility to participate, price etc, "de-linking" the schemes might need to be considered. For ETS that were "de-linked", units from two individual schemes would cease to be mutually recognised. The provisions of such a "de-linking" agreement may even need to be agreed prior to linking such schemes, and could include e.g. a process for agreeing on revisions to the linked scheme and a procedure enabling either party to terminate a linking agreement (Haites and Wang, 2006).

4. Does Linking Require Harmonisation of Trading Systems?

There are three broad dimensions to the issue of harmonisation:

1) Can linking work at a technical level even if two different systems have different features (i.e. what level of harmonisation in system design is needed in order for transactions to proceed smoothly?);

2) Can linking work at a non-technical level? i.e. what are the key (policy) features of emission trading systems that would influence the desirability of bilateral links[29]?

3) Does linking create negative distributional repercussions, with a particular sector being treated more leniently in one country than another (at the expense of economic efficiency and environmental effectiveness)?

These dimensions are discussed in further detail below, focusing on implications for bilateral links of different ETS designs. Agreeing upon a unilateral link may require a lower degree of harmonisation, in particular if this involves acceptance of verified "allowances" or "offsets" from other systems (such as the use of EU allowances, or of credits from CDM projects).

4.1 Impact of different design features on the technical feasibility of linking

Some degree of harmonisation may help if different emissions trading schemes are to be linked. Previous analyses (e.g. Baron and Bygrave 2002) have outlined several issues that are important in order to facilitate the linking of different emissions trading schemes: e.g. a similar scope with respect to fixed/indexed emissions limits; and banking/borrowing (as well as a similar timeline of commitment period and comparable units)[30]. These issues are examined below.

Other issues are also important when deciding if/how to link particular systems. Such issues include accurate monitoring, reporting and verification of emissions. Since this is treated in a broadly similar fashion in the different ETS underway (i.e. third party verification of reported emissions), this issue is not considered further here.

[29] Some issues outlined below include both technical and non-technical aspects. For example, if it is decided to explore possible links between an ETS that has fixed targets with one that has intensity targets, technical "fixes" will be needed (as outlined in section 4.1.1) to ensure that this does not alter the environmental integrity of the two schemes. However, some stakeholders may nevertheless have some policy-related reluctance to link to a scheme with a different "look" to theirs.

[30] Other issues were also highlighted, e.g. scope (direct vs. indirect emissions). Since these are treated in a broadly similar manner for different existing/proposed ET schemes, no further discussion is presented here. The exception is the UK ETS, which allocates electricity-related emissions to the consumer. .

4.1.1 Linking schemes with fixed/intensity targets

Although most emissions trading schemes planned or currently in operation have fixed limits, some express indexed/intensity emissions limit targets for all (e.g. NSW/ACT scheme) or a component (e.g. UK ETS) of their participants. It is possible to link emissions trading schemes with fixed and intensity targets. However, such linking could result in the linked systems emitting more than the individual non-linked systems (e.g. if a generous indexed targets encourages increased production in that country, which then sells its surplus units to the country with a fixed target)[31].

This issue could be resolved by establishing a "gateway" (as in the UK ETS) that ensures net transfers do not occur from a scheme with relative targets to those with absolute targets. However, this would add some complexities to the system design.

In practice, there are likely to be few such links in ETS of Kyoto Parties. For example, the EU has currently ruled out linking its ETS with schemes based on intensity targets. It may therefore be difficult for a country wishing to link to the EU ETS to also link to a scheme based on intensity targets. The UK ETS also limits transfers between its participants having "relative" and "fixed" targets – and currently has no links with other ETS. Nevertheless, some such links could occur, e.g. between schemes developed in non-Annex I countries or in non-Parties to the KP. Although one such candidate for linking (the NSW/ACT and proposed NETS scheme in Australia) is unlikely to occur as the "NSW government is considering means to prepare for a transition to NETS" (NETT 2006).

4.1.2 Direct/indirect accounting for emissions

Most of the emissions trading systems underway and planned account for, and cap, the direct emissions of participants. However, both the UK ETS and the proposed Californian ETS include emissions associated with electricity production from facilities outside the (proposed) trading scheme. For both schemes, this was a deliberate policy choice to reflect the fact that reducing electricity consumption will reduce GHG emissions. This is particularly important in situations (state-wide or for individual companies) where electricity is GHG-intensive but generated outside the boundary of entities included in the trading scheme.

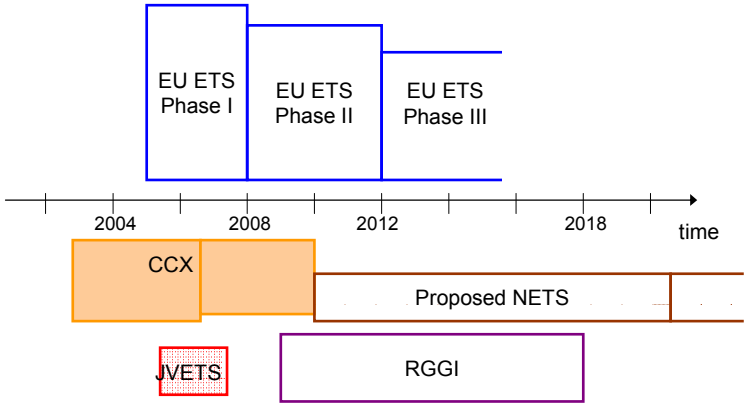
In practice, few - if any - links are likely between ETS that account for emissions directly and indirectly. If such a link were to occur, care would be needed to ensure that emissions (and emission reductions) are not double-counted.

4.1.3 Overlapping compliance periods and banking

Compliance periods for different ETS have different start dates and lengths. For example, the compliance period for EU ETS Phase I started in 2005 and lasts for three years. RGGI is planned to start in 2009, and will last for 3-4 years, depending on the level of average regional spot CO_2 prices over a 12 month period. There are also different start dates for the compliance periods of different existing or planned ETS (Figure 4).

[31] Similarly, emissions could increase by linking systems that have a weak (but fixed) target with a stringent, indexed (intensity-based) target.

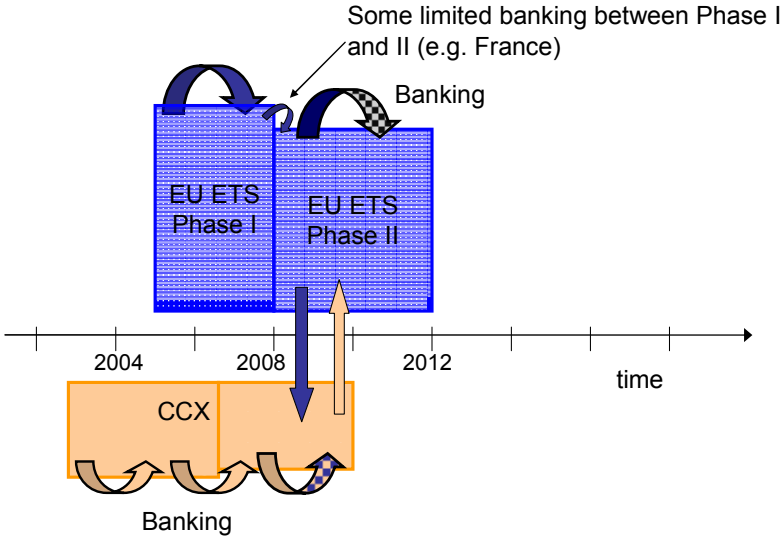
Figure 4: Compliance periods of selected existing/planned ETS



Linking systems with different compliance periods is possible. However, such links could weaken the environmental effect of an ETS which has a later start date by allowing credits to flow into it that were accrued and banked for years prior to the start-up of the ETS. It could require a more sophisticated emissions accounting process (needed e.g. as part of an evaluation of the performance of an ETS).

Sources: As for Tables 1 and 2

Figure 5: Impact of linking and banking on the effective timing of compliance periods



Some EU countries allow for banking in limited quantities between Phase I and II of the EU ETS (e.g. France, as laid out in GoF 2004). This banking will increase the total number of allowable emissions during Phase II of the EU ETS by allowing under-emissions in 2005-07 to offset some emissions in 2008-12. If bilateral links were also made to a system which allowed banking and where the compliance period started before that of the EU ETS it would further increase the length of time over which credits from emission trading systems could accrue and be used to offset emissions in the 2008-12 period[32]. For example, if bilateral links to the CCX were made, it would extend the effective timing of when emission reductions could be achieved to 2003-12.

This effect is likely to be small, unless the volume of credits banked in one system is a significant proportion of the total size of the linked system. Further, any such effect will be "one-off" if the linked systems continue to operate and remain linked.

4.1.4 Coverage of ETS and measurement units

Different ETS cover emissions from different sources and gases, reflecting their importance to different countries[33]. These differences should not provide a technical impediment to linking providing that:

[32] The possibility of using credits from CDM projects (which can accrue from 2000) to offset emissions in Phases I and II of the EU ETS has the same effect (but is explicitly allowed for in the Marrakech Accords).

[33] There are different reasons why ETS may cover different sectors. For example, country A may want to include sector S because it is a key source in its inventory. However, it may not be a key emissions source in country B, which may exclude it. In this case, there should be no policy objection in B to including sector S if the ETS in countries B and A are linked. However, if a policy decision has been made to exclude a particular emissions source from an ETS because

- All sources are monitored with comparable accuracy. If this is not done, there may be more uncertainty associated with emissions units traded in one system than in another and this my impact the political desirability of linking;

- Different schemes use the same values of global warming potential to "translate" from non-CO_2 gases to CO_2-eq.

Even ETS that have the same sectoral scope can cover slightly different groups of facilities. For example, the minimum size threshold for electricity-generating plants is 20 MW in the EU ETS, 25 MW in RGGI and 30 MW in the proposed NETS (Australia). Indeed, differences in which installations are included in an ETS can even be found within an ETS. For example, in phase I of the EU ETS some EU countries had interpreted the term "combustion installation" more or less broadly, resulting in a higher or lower number and scope of installations covered under the scheme[34].

Such variations are not a technical impediment to linking, although they will of course provide different GHG-reduction incentives to similar plants in different countries and could also have implications for competitiveness. Also, in order to be tradeable, units need to be in the same units. However, the proposed RGGI trading scheme will measure emissions in short tons, whereas all other schemes will measure emissions in metric tons.

4.2 Impact of policy choices on the desirability of linking

As outlined in Tables 1 and 2, some of the emissions trading schemes in operation or under development have very different characteristics. They can also have different aims, environmental ambition, scope and stringency. For systems where there are no technical issues that would preclude linking, there are nevertheless some elements of ETS relating to the policy choices inherent in their design that are likely to be carefully scrutinized by systems' stakeholders before they engage in a negotiation to link systems, These are outlined below.

4.2.1 Price of carbon

There can be significant differences in the price of carbon across different ETS (Table 4). The price can reflect several factors, related to both demand and supply of credits/allowances, as well as to the characteristics of the trading system. Important parameters include the stringency of the emissions cap, the compliance provisions (including penalties), energy prices, any price cap, as well as the perceived availability and cost of project-based credits/offsets that can be used for compliance.

As illustrated in Figure 1, the sizes of currently-existing and proposed ETS are very different. The large size of the EU ETS compared to other systems means that prices within the EU ETS are likely to set the prices in other ETS that it links to, i.e. that the EU ETS is likely to be the "price maker" while any systems linking to it will be a "price taker". Thus, schemes with lower prices that link to the EU ETS may see their carbon price rise significantly, and may also see increased price volatility. However, because of its size, any corresponding carbon price reduction in the EU ETS is likely to be very small. This means that the carbon price in a scheme linked to the EU ETS may not necessarily reflect factors specific to that country/scheme. This could reduce the desirability of linking from the "price-taker"'s point of view, particularly if the linked scheme (or certain entities within it) expects to be a net buyer.

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e.g. it is too difficult to monitor accurately, it may be politically difficult to link with a system that does encompass this source.

[34] Clarification on how this term is to be interpreted is included in guidance for Phase II of the EU ETS.

Table 4: Different prices of carbon and offsets in selected trading schemes

ETS	Vintage	Price/t CO_2	
EU ETS	Spot (June 06)	13.65-16.00 EUR (average 14.99)	
EU ETS	Futures (Dec 08)	15.20-18.25 EUR (average 17.20 EUR)	
CCX	2006	$3.85-4.6	(3.0-3.6 EUR)
NSW/ACT scheme (price of offsets)	2005	A$ 11-15	(6.5 -8.9 EUR)

Sources: Caisse des Dépôts, 2006b, CCX 2006b, Fowler 2005

4.2.2 Allocation levels and modes

Emission permits can be allocated free of charge, auctioned or be a combination of the two. How emission permits are allocated to existing and new installations can vary within an ETS, as well as between different ETS. Indeed, draft NAP2s from different EU countries provide for different levels of auctioning during the 2008-12 period[35] with e.g. Ireland planning to auction 0.5% of its AAUs, and the UK 7%.

The costs to entities of meeting an emissions target in an ETS that delivers all permits for free will obviously be lower than the costs to a similar entity of meeting a similar emissions target in an ETS that auctions all emissions permits. However, in systems where only a small proportion of permits are auctioned, the relative stringency/level of the "cap" in these systems can have as much (or more) impact than the allocation mode. For instance, a free allocation of allowances corresponding to 100% of a stringent target may result in higher entity costs of compliance than a free allocation of 95% of a less stringent target.

4.2.3 Non-compliance provisions and borrowing

Differences in non-compliance provisions between ETS are another issue that could potentially impede links. This is because non-compliance provisions can affect the environmental effectiveness of a particular scheme by strongly encouraging (or not) its targets to be met. Stakeholders in a scheme with rigorous non-compliance provisions may be reluctant to link to a scheme with less stringent provisions, and thus a lower perceived environmental effectiveness.

There are considerable differences in the non-compliance provisions of some existing/proposed ETS. For example, Phase I of the EU ETS and the Norwegian ETS both have a "make good" provision as well as a financial penalty of 40 EUR/t CO_2-eq over-emitted. The UK ETS has comparable provisions ("make good" plus GBP30 (approx 45 EUR)/t CO_2-eq over-emitted. None of these systems allow "borrowing" from future targets.

In contrast, penalties in some other systems are much less onerous. For example, the NSW/ACT scheme has a penalty level of AUS$11.5/ t CO_2-eq over-emitted – unless this over-emission is "made good" the following year. The proposed NETS scheme does indicate that there will be a non-compliance penalty, but does not indicate what level this will be. However, the current NETS proposals indicate that the scheme will not have a "make good" provision. Penalties for entities with emissions targets in the CCX scheme have not yet been established. Further, the NSW/ACT and the proposed NETS scheme in Australia both allow borrowing. RGGI also allows this to a certain extent, by allowing for the compliance period to be extended by a year under certain conditions.

[35] Under EC guidelines, a maximum of 10% can be auctioned.

4.2.4 Price Caps

Some ETS currently under consideration may include a price cap to limit the cost of compliance. Setting a price cap at a low level may encourage participation, but may not be environmentally effective and may limit the introduction of innovative technologies (although more costly) technologies. If however a price cap is set at the upper range of costs estimated for advanced/innovative technologies, it could encourage the deployment of such technologies.

If a system without a price cap is linked to one with a price cap, the latter will set the compliance cost for permit holders in both systems, as permit holders in the system without the cap would be able to buy unlimited credits from the system with the cap. Special provisions would be needed between such systems to ensure that the environmental effectiveness of the system without a cap is not unduly affected.

4.2.5 Allowable "offsets"

Some ETS have made policy decisions to include or exclude credits from particular project types/countries. For example, offsets from forestry projects are not currently accepted in the EU ETS whereas they are accepted in the CCX and the NSW/ACT schemes. The proposed NETS scheme indicates that carbon capture and storage projects in Australia will be eligible to generate offsets, whereas RGGI has initially limited the types of projects eligible to generate offsets (as laid out in Table 3). Nevertheless, many existing and proposed ETS accept (or plan to accept) credits from CDM projects. This gives some degree of "common currency" between systems.

The eligible location of offset projects also varies in different systems. The EU currently requires that originate in Kyoto Protocol Parties. The RGGI stipulates that offset providers are to be US-based, under certain carbon price conditions.

As well as limiting the type of eligible offsets, some ETS also limit their potential use – e.g. to a proportion of the "cap". This proportion can vary within and between ETS. The effect of one scheme's offsets on another system is likely to be a function of the relative amount of offsets each allows of a particular type. While it is technically feasible to create gateways for certain offsets, if credits are fungible such measures may be artificial. However, if the participants in one scheme are strongly opposed to a particular type of offset-generating project, even a small effect may be a political impediment to linking schemes.

4.3 Distributional impact of different allocation methodologies

Countries can allocate permits as they see fit. If they wish to favour one industry over another it is their choice. However, permit allocation decisions in different countries could affect the credibility of an ETS and the volatility of markets, and hence, the political acceptability of linking different national systems. For example, if the effort asked of sector S in country A is not comparable to the effort asked of sector S in country B.

To date, the only ETS which allows exchanges across national borders is the EU ETS. Although this is a single scheme, examining differences in allocation within this scheme can highlight issues that are also relevant to linking considerations between two (or more) different schemes.

In practice, free permit allocations to any given sector/company begins with a review of historical and projected emissions. Some factors needing consideration such as historical production rates that can be partially linked to GDP are easier to predict than other factors, such as, weather and the price of fossil fuels. The recent experience of the EU ETS market illustrates the importance of the weather on power sector emissions. Differences between allocated and actual emissions emerged, partially as a result of the effects of atypical rainfall patterns in 2005 in different parts of Europe (e.g. higher in northern Scandinavia and much

lower in Spain and Portugal), that affected the availability of hydropower (Caisse des Dépôts, 2006) and the demand for thermal power production in the interconnected European electricity system.[36]

The industrial sector is not directly affected by such factors, but large differences between allocated and actual emissions were nevertheless also noted in the cement and iron and steel sectors in 2005 (see Table 5, and footnotes in this section)[37]. In most countries examined, the cement and iron/steel sectors emitted less than anticipated, both in countries that were "long" and "short" in terms of overall ETS emissions. The largest differences between permit allocations and actual emissions in percentage terms were in the iron and steel sector[38]: this difference was more than 100% for two of the countries examined and between 60-80% for another four. Furthermore, the variation in such differences is significant, even in countries where there are several individual installations (e.g. Poland, Belgium and Spain). These differences were often several times greater than the year-to-year changes in production volumes. Assessing why such large differences have occurred in sectors is an important step if differences between allocations and emissions (and consequent distributional impacts) are to be reduced in future.

The volume of the difference between allocation and emissions means that trading may have brought considerable economic benefits to some sectors and installations[39]. For example, it is estimated that the UK power generators have made a 1.2 billion EUR profit/year from the EU ETS, that sales of EUAs accounted for 50% (EUR 74 million) of profits of the Estonian utility and that an individual cement manufacturer has sold over 1 million EUAs (McClellan, 2006). This can in turn lead to economic distortions within a sector, as well as between countries.[40]. It is therefore not surprising that the European Commission indicates that "more coherence" is needed between different Member States when establishing their NAP2, and that "further harmonisation is desirable beyond 2012" (CEC 2005).

If a similar allocation approach is used in the 2008-12 time period, it will increase the compliance burden on the sectors not covered by the EU ETS, e.g. transport and households, although will also reduce the importance/likelihood of "carbon leakage". Nevertheless, if one sector of an economy with capped emissions is over-allocated, either other sectors will need to assume larger emission reductions or the government will need acquire offsets, e.g. from the CDM/JI, with financial implications for taxpayers.

[36] Oil/gas/coal prices also play a significant role.

[37] Data is presented for 2005, as this is the only year of the ETS for which data are available. Examining data for a single year may over-state any differences in allocation versus emissions that will occur over the three-year trading period. However, large differences between allocation and emission may also highlight systematic biases, trends or errors in allocating and/or reporting emissions. For example, some countries have allocated higher (or lower) numbers of emissions permits in 2006 and 2007 than in 2005. Data for Table 5 were, however, calculated by comparing emissions in 2005 with allocations for the same year (rather than an average value over 2005-07).

[38] The iron and steel sector is a special case, as distortions can arise from how blast furnace gas (BFG) is accounted for. BFG is a waste gas in the blast furnace process, and can be used to generate electricity either on-site or off-site. If used to generate electricity off-site, emissions are reported at the off-site facility. However, the allowances associated with BFG production and combustion can be allocated either to the operator of the external combustion plant, or to the operator of the blast furnace, or a combination. Thus, the difference calculated between emissions and allocation can reflect reporting choices, as well as other factors, such as a drop in European steel production in 2005. For example, the Swedish EPA (2006) indicates that 2005 emissions from the iron and steel sector were 6.2 mt CO_2-eq, whereas data for the same country, sector and year in the CITL indicates emissions were 4.1 mt CO_2-eq. Spain also indicates that there is to be a transfer from the iron and steel sector to the electricity sector, to account for electricity generation from iron and steel waste gases (OECC, undated).

[39] Whether such benefits are actual or "on paper" depends on whether (and when) any surplus has been sold.

[40] Distortions within a country (i.e. where a sector of the economy not covered by the emissions trading system has to bear a disproportionate burden) are less of a concern pre-2008, as Kyoto commitments only start in 2008.

Table 5: Percent difference between NAP allocations and emissions for cement and iron/steel sectors in selected countries, 2005

	% difference between actual emissions in and emission allocation for 2005 (excluding new entrants) A positive number means allocation > emissions			Change in production 2005/04 (%)		Total actual emissions 2005 (Mt CO_2-eq	
	Total ETS	Cement	Iron & Steel	Cement	Iron & Steel	Cement	Iron & Steel
Belgium	5.3	15.4	67.1	**-2	-10.9	8.0 (11 plants)	9.0 (26 plants)
Finland	34.9	20.8	11.2	n/a	-1.9	1.6 (8 plants)	6.3 (4 plants)
France	14.6	1.6	7.2	0.7	-6.2	16.3 (41 plants)	26.6 (23 plants)
Germany	4.4	15.7	10.1	-4.0	-4.0	28.1 (108 plants)	30.6 (34 plants)
Greece	-0.2	1.7	107	n/a	15.2	11.6 (24 plants)	0.4(4 plants)
Hungary	16.2	16.9	74.6	n/a	0.1	2.3 (7 plants)	1.3 (8 plants)
Ireland	-16.4	-4.8	(0 plants)	n/a	n/a	4.1 (6 plants)	(0 plants)
Italy	-3.9	-4.7	6.9	0.8	3.0	29.5 (81 plants)	13.9 (43 plants)
Netherlands	7.6	26.2	60.3	**-2	1.0	0.6 (2 plants)	6.5 (2 plants)
Norway	4.6	13.9	19.3	n/a	-2.8	1.1 (2 plants)	0.05 (1 plant)
Poland	26.3	58	158.8	n/a	-20.3	52.9 (33 plants)	5.0 (4 plants)
Portugal	1.3	2.2	40	n/a	0.0	7.0 (12 plants)	0.2 (2 plants)
Slovakia	16.9	14.3	5.8	n/a	0.7	3.0 (10 plants)	9.1 (3 plants)
Slovenia	5.0	-1.2	-6.1	n/a	3.1	0.9 (4 plants)	0.2 (3 plants)
Spain	-6.0	1.8	41.6	8	1.2	29.2 (57 plants)	7.9 (29 plants)
Sweden	15.4	6.7	76.4*	n/a	-4.2	2.1 (5 plants)	4.1* (15 plants)
UK	-13.2	-4.4	0.1	-1.6	-3.8	6.8 (25 plants)	6.6 (7 plants)

Sources: CITL 2006 (accessed 11-23 October 2006), SFT not dated, IISI 2006, Cembureau 2006, author's calculations.

* Information from the Swedish EPA (2006) gives a substantially different estimate emissions from this sector: 6.2 (not 4.1) mt CO_2-eq.

** aggregated production change for Netherlands, Belgium, Luxembourg

5. Conclusions

The entry into force of the Kyoto Protocol has stimulated a significant expansion of the global carbon market through a number of different emission trading schemes (ETS), as well as through the development of project-based mechanisms such as the Clean Development Mechanism (CDM) and Joint Implementation (JI). Several different ETS are currently operating, and a number of other national and sub-national schemes are likely to emerge in the near future. These schemes can vary widely in their size, coverage and scope, with the EU ETS by far the largest of the schemes. Most existing or planned ETS allow for entities to meet their emissions targets by using credits from CDM, JI or other project-based "offsets", as well as through trading. The emerging schemes will further the development and improve the economic efficiency of the market.[41]

Currently there are only a few links between different systems, although some additions are planned prior to 2008 and many others are likely after 2008. In practice, pre-2008 bilateral (two-way) links between emission trading schemes are likely to be limited to that between the EU ETS and the Norwegian ETS. Unilateral (one-way) links e.g. from the EU ETS to the Chicago Climate Exchange have already occurred and are set to continue. However, the importance of such transfers is likely to be limited given the significantly higher prices in the EU ETS. CDM credits are the most widely accepted form of "offsets", and their use as a "common currency" between Kyoto-compliant and non-Kyoto GHG mitigation systems is set to continue.

There are no conceptual reasons why links between emission trading systems and markets cannot be expanded. Such links can be direct -with trading occurring both within and between different systems. Links can also be indirect, via e.g. systems that generate offsets from project based mechanisms or via governments that may sell/transfer large blocks of allowances, such as AAUs. Links can also be unilateral (one-way) or bilateral (two-way).

There are several technical and non-technical (i.e. policy/political) issues that could affect the speed at which systems are linked. Elements that are important include: target types (i.e. fixed or indexed limits); accurate monitoring and reporting; banking/borrowing provisions and the length and starting point of the commitment periods. In addition consideration needs to be given to differences in carbon prices in different ETS, price caps, allocation methods, and policies relating to "offsets". Linking different emissions trading schemes can also have distributional impacts if entities within a sector in one ETS are treated more stringently or leniently than their competitors in a different ETS.

To encourage bilateral linking of different ETS, a further degree of harmonisation may need to be encouraged. In contrast, such harmonisation is less likely to be needed when establishing unilateral links between different GHG markets, such as deciding to accept certain types of allowances or credits. Given the early stage of development of some ETS it is very important that the designs of all systems do not set precedents that may hinder the linking of different systems in the future.

[41] Emissions trading schemes can have widespread economic impacts – including on sectors not directly covered by such schemes. For example, an overly generous allocation of permits to one sector makes it more difficult for other sectors to comply or requires the government to acquire offsets which has a financial implication for tax payers.

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Glossary

AAU	Assigned Amount Units
ACT	Australian Capital Territory
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism (as established in Article 12 of the Kyoto Protocol)
CERs	Certified Emission Reductions (credits generated from CDM projects)
CITL	Community International Transaction Log (used to track trades within the EU ETS)
ETS	Emissions Trading Scheme
ERUs	Emission Reduction Units (credits generated from JI projects)
EUA	European Union (emission) allowances (i.e. the units allocated to entities with a cap under the EU ETS).
GHG	Greenhouse gas
GIS	Green Investment Scheme
HFC23	A by-product of HCFC22 (R-22) production which has a very high global warming potential, and reduction of which is the basis of several large CDM projects.
ITL	International Transaction Log
JI	Joint Implementation (as established in Article 6 of the Kyoto Protocol)
KP	Kyoto Protocol
mt	Million metric tons
NAP	National Allocation Plan
NETS	National Emissions Trading Scheme (as proposed for Australia)
NSW	New South Wales (an Australian State)
RGGI	Regional Greenhouse Gas Initiative (in North-Eastern US States)
VER	Verified Emission Reduction (corresponds to a reduction of 1 ton of CO_2-eq, but cannot be used for compliance with commitments under the Kyoto Protocol as it may have been generated by a project not eligible under the Kyoto framework, or by a system not recognised by Kyoto)