REUTERS/Toru Hanai

Carbon Pricing, Emissions Trading and Linking Emissions Trading Schemes

A discussion document for stakeholders in the PETER Project (Preparedness for Emissions Trading in the EBRD Region), a project sponsored by the European Bank for Reconstruction and Development (EBRD)

www.ebrdpeter.info

By

THOMSON REUTERS POINT CARBON

POINT CARBON

THOMSON REUTERS

ABOUT POINT CARBON

Based on research on environmental, energy and resource management politics at the independent Fridtjof Nansen Institute in Norway, Point Carbon was established in 2000 and has since pioneered in providing services in the carbon and energy markets. The company has grown and matured along with the rapidly developing global environmental markets. Starting with an office in Oslo, Point Carbon now has offices established in Beijing, Kyiv, Malmö, London and Washington D.C, with additional international offices planned. Late May 2010, Point Carbon was acquired outright by Thomson Reuters, the world's leading source of intelligent information for businesses and professionals. This acquisition provides access for Point Carbon to a wide range of data and corporate resources that will enhance our services as well as connect us to a wider client and distribution network for our services.

With over 30 000 clients worldwide, Point Carbon is uniquely positioned as the world's leading provider of independent news, analysis and consulting services for European and global power, gas and carbon markets. Point Carbon's in-depth knowledge of power, gas and CO2 emissions market dynamics, positions it as the number one supplier of market intelligence. With clients in over 150 countries, including the world's major energy companies, financial institutions, international organizations and governments, Point Carbon provides its clients with market-moving information through monitoring fundamental markets, key market players and business and policy developments. Reports are also translated from English into Japanese, Mandarin, Portuguese, Polish, French, Spanish and Russian. Point Carbon presently employs around 200 specialists, including experts on international and regional climate policy and regulations, mathematical and economic modelling, forecasting methodologies, risk management, technical project knowledge and price discovery. Point Carbon also runs a number of high-level networking events, conferences, workshops and training courses.

POINT CARBON ADVISORY

Point Carbon Advisory currently numbers around 15 people based in Oslo, London, Washington D.C. and Rio de Janeiro. The department delivers bespoke, fully independent consultancy and multi-client studies to governments and companies in all corners of the world. The department capitalizes on Point Carbon's world class databases, models, networks and teams of highly skilled analysts covering carbon, energy, corporate strategy, finance and economics. These assets uniquely position Point Carbon Advisory to meet clients' needs for customized and in-depth analysis on a wide range of carbon and energy issues. Advisory Services took off as the major provider of bespoke strategic advice by delivering "multi-client studies" on European and global emissions trading back in 2003. The high quality of the work provided by Point Carbon Advisory has been widely recognized internationally. At the Energy risk awards 2010 it received the Advisory firm of the year award.

This report is one in a series intended for informational purposes. News, reports and other informational resources are freely available at the PETER project website: www.ebrdpeter.info.

The PETER project is being delivered for the EBRD by a consortium of partners led by Thomson Reuters Point Carbon. The other partners are Carbon Limits, Baker & McKenzie and Climate Change Coordination Centre, Kazakhstan.

Main authors:

Sumeet Manchanda, Thomson Reuters Point Carbon
Erik Haites, Margaree Consultants

Prepared for:

Jan-Willem Van de Ven and Grzegorz Peszko, EBRD

December 2012

POINT CARBON

THOMSON REUTERS

TABLE OF CONTENTS

INTRODUCTION

This paper has been produced by Thomson Reuters Point Carbon for the European Bank for Reconstruction and Development (EBRD), as part of its role as lead consortium member delivering the PETER (Preparedness for Emissions Trading in the EBRD Region) project. The paper is intended as a discussion document for project stakeholders, and provides a summary of the main carbon pricing options, followed by consideration of emissions trading in more detail, particularly with respect to linking emissions trading schemes (ETSs) – in light of the Kazakh and Ukrainian domestic ETSsbeing developed with the intention of linking with other ETSs in the future. To fully inform the discussion, short descriptions of related policy concepts are also included – such as personal carbon budgets and renewable energy and energy efficiency certificates.

1 CARBON PRICING POLICIES

The Stern Review identified carbon pricing as the first essential element of climate change policy. This is because in economic terms, greenhouse gases (GHGs) are an externality and those who produce them do not face the full costs of their actions themselves: however an appropriate price means that they pay the full social cost of their actions.

In this section we examine the various policy mechanisms related to carbon pricing that have been put forward to achieve reductions in GHG emissions. These include carbon taxes, crediting mechanisms for emission reductions achieved through domestic and international mitigation polices, and emissions trading schemes. We explore emissions trading in more detail to examine why it has proved more popular as a policy tool for achieving the mitigation of GHG emissions than other policy mechanisms. Finally, we discuss the key challenges of introducing ETSs as opposed to other policy instruments, especially taking into account the developing country context.

1.1 CARBON TAXES

A 'carbon tax', or a GHG emission tax, is a policy instrument designed to assist with achieving climate change mitigation. It sets a price on GHG emissions produced by certain economic activities. It is a 'Pigovian' tax, i.e. a tax that aims to correct the outcomes of market activities that cause negative externalities.

There are various advantages to a carbon tax which arise mainly because it is among the simpler policy interventions to understand and implement. In the right circumstances, it can be relatively cost-effective for administrators. A carbon tax can easily provide a continuing incentive for GHG abatement activity, and provide certainty to investors in the form of a stable price signal, which is especially important when encouraging investments in measures with longer payback periods. It provides for costs that are highly transparent, occur immediately and can be concentrated on relatively well-organised groups.

Carbon taxes can also contribute to establishing a consistent price signal across regions and sectors. In theory this is also possible internationally, however all countries would need to feel that common action was being taken – which has proven difficult to achieve in practice.

There are various challenges in relation to cost-effectiveness that need to be considered with regard to a carbon tax, the more significant of which are described below.

The intention of a carbon tax is to encourage emitters to adopt the cheapest GHG abatement measures available to them, thereby reducing GHG emissions in a cost-effective manner. However, this is dependent upon other considerations such as the presence of other market failures, which may distort the incentives. For example, if market participants in one country are subject to a carbon tax and competing participants elsewhere are not, such a tax may have the unintended consequence of lowering the relative competitiveness of market participants in the country that is subject to the carbon tax..

Another consideration is the price level: a correctly priced tax encourages cost-effective investment in abatement measures. A tax that is priced too low may not have any significant effect on emissions; whereas a tax that is too high may force participants to use measures that are overly expensive and inefficient. A carbon tax, when incorrectly priced, can also have the effect of picking winners among the different mitigation technologies.

Furthermore, ETS markets respond quickly to changes in actual emissions, as seen in the EU ETS where stagnation or reversal of GDP growth in European countries has led to a fall in price. This has led to a reduction in costs for market participants, providing some relief in difficult economic times. Conversely, Governments tend to be slow in reacting to market realities in adjusting tax levels, and indeed when government debt is high, the incentive for governments is to maintain tax levels to protect public revenue.

Administration and compliance costs also need to be proportionate. This is most likely to be the case whena tax is applied 'upstream', i.e. when it is applied to the wholesale use of fossil fuels. However, the costs of administrating such a tax effectively may be disproportionately high in countries with less institutional capacity. In addition, certain emission sources such as agriculture may be expensive to monitor, which would mean higher administration costs relative to its effect of achieving the intended mitigation outcomes. If emissions are left untaxed, this may prevent the adoption of potentially cheap emission reduction measures.

Costs can be kept down in target market sectors if carbon tax revenues are used to reduce other taxes for the relevant sectors, such as those applied to employment. Notwithstanding this, market sectors that are monopolistic in nature have a tendency to simply adjust prices in order to pass the taxation costs to the consumer. Such an occurrence may, in effect, disproportionately tax the poor where the tax applies to carbon-intensive goods which make up a high proportion of incomes – such as energy or fuel.

A carbon tax may have less impact on public sector entities than private sector entities, partly because profit maximisation is usually not the primary objective of public entities, and they tend to have less budget constraints than firms in the private sector (OECD, 2009).

In addition to issues regarding cost-effectiveness, other challenges are likely to be faced by the imposition of a carbon tax. For example, the benefits of a carbon tax are widely dispersed and will only be realized at a future point in time. Like some other mitigation instruments, a carbon tax may face opposition from its political constituency, driving affected groups to lobby against the imposition or pricing of the tax (e.g. Olson, 1965) or for alternative offsetting measures to be implemented instead (e.g. taxes on substitutes for carbon or subsidies for complements to carbon).

Although a carbon tax provides a stable price signal, in certain political environments it can be perceived to have an uncertain future and be volatile to change, undermining incentives for investment in R&D.

While providing near-term certainty regarding costs, a carbon tax does not provide certainty about total emissions, or emissions reductions, which result from these costs. Hence, unforeseen events could dramatically increase or reduce emissions, diminishing the effectiveness of the tax. In a cap-and-trade scheme on the other hand, certainty exists from an emissions perspective (due to the binding caps set by policymakers), however unforeseen events can have major impacts on prices.

Norway's Carbon Tax

Norway introduced a carbon tax in the early 1990s, initially covering 60% of all Norwegian energy related CO_2 emissions. Several sectors were exempt from the tax, including cement, foreign shipping, fisheries, natural gas and electricity production (although virtually all of Norway's electricity production at the time was hydroelectric power). Partial exemptions applied to sectors including domestic aviation, shipping, and pulp and paper.

The tax generated substantial revenues and in 2001 it represented 1.7% of total public revenue. The tax is estimated to have reduced CO_2 emissions by around 2.3% between 1990 and 1999.

The tax prompted real innovation – Statoil developed the world's first carbon capture and storage facility at their natural gas production plant in Sleipner West where, since 1996, one million tonnes of carbon dioxide has been stored per annum in an aquifer more than 800 metres below the seabed.

Difficulties faced by the tax include: weakened impact on industry and complications due to select exemptions; an inability to reflect true emissions from different fuels as all fuels were taxed at the same level even though some had lower emission relative to others; and an inability to harmonise carbon price policies with neighbouring countries.

1.2 CREDITING MECHANISMS

The Kyoto Protocol set up the first crediting mechanisms which led to the creation of an international GHG emissions market, the 'international carbon market'. Under the Kyoto Protocol, countries must meet their targets primarily through national measures. In addition, three market-based mechanisms are available for parties to utilise to meet their targets:

- International emissions trading allows countries with commitments under the Kyoto Protocol (Annex B Parties), to trade their spare allowed emissions (emissions permitted to them but not "used") to other countries that have exceeded their targets, through tradable "assigned amount units" or AAUs)..

- Clean Development Mechanism (CDM) allows emissions reduction projects in developing countries (non-Annex 1 Kyoto Protocol parties) to generate tradable certified emission reduction (CER) credits, each equivalent to one tonne of CO_2. These CERs can be counted towards meeting an Annex B Party's Kyoto Protocol commitments. The CDM has been a successful mechanism with the billionth CER issued in September 2012. However, significant demand erosion in the EU ETS and from governments has led to an over-supply of CDM credits in the international carbon market.

- Joint implementation (JI) allows Annex B Parties to implement emission-reduction projects in other Annex B Parties. Such projects may generate emission reduction units (ERUs), each equivalent to one tonne of CO_2, which can be counted towards meeting an Annex B Party's Kyoto Protocol commitments.

In addition to the Kyoto mechanisms, other crediting mechanisms have been proposed.

Bilateral Crediting Mechanisms

Japan has moved towards a bilateral offset credit mechanism where it deals directly with host countries. The government sees this as a way for Japanese firms to contribute to reducing GHG emissions abroad by providing clean technologies, products, infrastructure and manufacturing facilities. Japan is moving towards formalizing bilateral crediting mechanisms with a number of countries and regions including India, Indonesia, Vietnam and Thailand.

Sectoral Crediting Mechanisms

Europe and other countries have been trying to promote sectoral crediting for many years in the UNFCCC international negotiations. The idea is to create a market incentive for a "broad segment of an economy" to become less carbon intensive relative to a predetermined baseline or benchmark – either in terms of emissions intensity or absolute emissions. Various designs for such mechanisms have been proposed. For example, countries set a benchmark very high and are rewarded with credits if the benchmark is exceeded (the "crediting" approach formerly known as "no lose"), or countries set a benchmark rather like a target that earns credits if not exceeded but requires countries to buy credits if emissions end up above the agreed level (the "trading" approach).

A sectoral crediting mechanism could be a promising policy option for developing countries in the post-2012 climate framework, for several reasons:

• Participation does not need to be binding, and its voluntary nature and in-built financial incentives may prove attractive for a large group of developing countries.

• Mitigation efforts could be scaled up beyond levels that are achievable with a project-by-project approach, such as the CDM.

• The mechanism does not require addressing the question of whether individual projects are additional to business as usual, which has proven to be difficult to assess with reasonable certainty under the CDM and, in some cases, has led to perverse incentives that run counter to the protection of the environment.

• The mechanism enables developing countries to earn credits from implementing policies and measures or by establishing enabling frameworks for enhanced mitigation, which is currently not possible under the rules of the CDM but is a key prerequisite for enhanced mitigation action in some sectors. Some governments may be hesitant to implement GHG reduction policies and measures (as they may reduce the government's potential to earn revenue from mitigation), such a mechanism may also effectively address this lack of incentive..

However, a sectoral crediting mechanism would also face considerable challenges including problems in defining the sector and its boundaries; estimating the sectoral crediting baseline; collecting reliable data; the division of responsibility and reward between companies in the sector and the national government; and its integration in the current architecture of the carbon market. In addition, a sectoral crediting mechanism would have difficulty in addressing carbon leakage due to international competition given that the participation in the mechanism is voluntary.

There is a difference in the views of developing and developed countries with respect to crediting. Developing countries seem to be of the view that the developed countries' use of credits generated should only be allowed for countries that have taken on legally binding targets and not for countries who have simply signed up to a loose "pledge-and-review" system. Furthermore, the developed countries' use of the new credits must be merely supplementary to their domestic action, and that limits must be prescribed for their use of offsets. Developed countries, on the other hand, appear to be against the imposition of such constraints.

Nationally Appropriate Mitigation Actions

Nationally Appropriate Mitigation Actions (NAMAs) are a relatively new and developing policy instrument. They are designed to provide a mechanism for finance, capacity building and technology transfer from developed to developing countries. Originally conceived in the Bali Action Plan in 2007 and later formalised in the Copenhagen Accord and Cancun Agreements, NAMAs are now an important part of the discussions around financing and implementing mitigation activities in developing countries.

At the international policy level many aspects around NAMAs are still undefined. The term ‘nationally appropriate’ implies that emissions reductions activities will be designed at a national level and require some manner of government backing. It is generally agreed that there will be a distinction between ‘internationally supported NAMAs’ (where payment for credits or other performance measures is transferred to the country where reductions have been made), and ‘unilateral NAMAs’ (where funding is sourced domestically and the role of international organizations is limited to recognition of the reductions made).

A number of conceptual NAMA proposals have come forward so far. These range from specific projects (e.g. Bus Rapid Transit lane) and policies (e.g. feed-in tariff systems) to strategies (e.g. solar plan) and targets (e.g. climate neutrality goal). The geographical scope of NAMAs proposed so far is quite varied and includes nation-wide, regional and city level scopes.

One area that is particularly ambiguous is the relationship between NAMAs and carbon markets. The term “credited NAMA” is often used to describe NAMAs which may generate tradable carbon credits. Credits could be generated under a project-based mechanism or programmes of activities (similar to those established under the CDM), thus broadening the concept to whole sectors, i.e. a sectoral crediting mechanism; broadening the concept even further to cover the measured impacts of certain policies. A future market based mechanism could also be linked with the funding of NAMAs, such as creating credits for NAMAs accepted into the NAMA Registry.

In terms of financing there is broad consensus that finance for mitigation has to come from a range of different sources including public and private sectors. Typically, funding mechanisms between developed and developing countries range from ODA (Official Development Assistance) mechanisms, to direct investments and carbon market based financing. Patterns for NAMA financing are not known yet because, according to the online ‘NAMA database’ (www.namadatabase.org), only one NAMA had received funding as at the time of writing of this report: a Chinese transport NAMA that aims to improve transport demand management in Beijing in order to manage traffic density.

The advantages of the NAMA concept are related mainly to their relatively large scope-encompassing policy, types of support and potentially varied financing routes. For instance, ‘supported NAMAs’ may be a way for developed countries to provide expertise and institutional capacity building. With regard to financing, large scale mitigation actions may present direct investment opportunities and perhaps even open new markets for private companies. Many NAMAs aim to establish policies which remove barriers to private sector investment, thus creating the longer term certainty that investors require, and channel public funds into reducing private sector risk. Countries with lower institutional capacity may find it easier to work through supported NAMAs rather than carbon markets.

However, as with any policy, there are many challenges to consider. Some NAMAs are being developed on a project basis whilst others, on a programme basis. These NAMAs build on CDM methodologies but may differ on their approach with regard to MRV methods and additionality requirements. Whilst these approaches are effective, they raise the question of how wider transformative, policy based actions can be integrated into such a process. The risk with developing NAMAs using CDM methodologies as a basis is that they run the risk of repeating the project-based nature of the CDM – this may repeat the exclusion of certain sectors or activities and lead to a failure to achieve a long term transformation of economies.

The broad, transformative nature of some NAMAs and the incorporation of a wide strategy, policy and capacity building measures may make it difficult to measure causal emissions reductions to a level of certainty that may be required for crediting. Markets typically have a focus on direct GHG reductions which may be incompatible with the broad nature of some NAMAs which aim for deep and wholesale transformation.

The potentially broad nature and scale of NAMAs also raise the prospect of a vast number of credits coming to the market, and potentially dwarfing the CDM market at a time when demand for credits is dropping rapidly and future demand remains unclear.

NAMAs and carbon markets are developing in parallel but they need to inform each other so that they complement (rather than distract from) each other where possible. For instance, certain components of NAMAs could be financed through carbon markets: perhaps a specific technology component within a wider NAMA where clear boundaries between the different components and existing national policies can be drawn. The issues of double counting and double funding would clearly need to be resolved in such cases.

Although emissions trading is also a part of the suite of crediting mechanisms, we discuss it in the next section separately, as this is the main focus of the developments in Kazakhstan and Ukraine.

1.3 EMISSIONS TRADING SCHEMES

Emissions trading is an administrative approach used to control emissions by providing economic incentives for achieving reductions by using a system of tradable emission permits. Emissions trading is being increasingly used in many countries and several schemes are at various stages of implementation. The most popular form is cap-and-trade, where a central authority (usually a government or a supranational body) sets a limit or cap on the amount that can be emitted. Companies or other groups are required to obtain an equivalent number of allowances (or credits) which represent the right to emit a specific amount of GHG (emission permits). The total amount of permits cannot exceed the cap, limiting total emissions to that level. Companies whose emissions overshoot their cap must buy allowances from those who pollute less than the amount of allowances they hold. The transfer of allowances is referred to as emissions trading. In effect, the buyer is paying a charge for emitting, while the seller is being rewarded for having reduced emissions below the allowed amount.

In theory, firms will sell allowances as long as the market price exceeds their internal marginal abatement costs; conversely, they will buy allowances as long as their market price falls short of their marginal abatement costs. If the permit market is competitive, the price of permits will eventually ensure that no more profitable trade opportunities exist. Thus, in theory, those who can reduce emissions most cheaply will do so under an ETS, so achieving the reduction at the lowest possible cost to society.

Ease of implementation

Political willingness and credibility

Some of the greatest advantages of emissions trading are political, perhaps partially explaining the increasing popularity of this mechanism. Emissions trading creates a well-defined constituency, in the form of permit holders, with a strong financial interest in enforcing the policy in the future. Commanding support from a range of interest groups always adds significant credibility to any policy.

Emissions trading also provides the flexibility to build political support for the scheme through permit allocation rules. This partly explains the popularity of "grandfathering" (i.e. giving permits for free to existing emitters) among emitters.

At the international level, any income transfers required to encourage large developing countries to join in may be more acceptable to the electorates of developed countries if they take place indirectly, through permit allocation, rather than through direct income transfers. International emissions trading enables some degree of subsidiarity to be maintained in implementation at the country level. An international emissions trading agreement between governments may indeed allow a variety of policy arrangements to meet emission objectives within each country. For instance, the EU ETS allows for opt-outs for some participants if their government has imposed a measure with an equivalent emissions reduction effect.

Another factor in support of emissions trading is that it provides the opportunity to raise revenue through the auctioning of allowances, as with carbon taxes, but still allows flexibility for participants to reduce emissions and/or procure allowances.

Predictability and stability of framework

An ETS can provide a predictable and stable framework. The various parts of the framework are now well known and established e.g. regimes for tradability, banking and borrowing, compliance modalities, registry and other functions. The establishment of the framework creates a series of stakeholders (such as participating companies, brokers, legal experts, consultants etc.) who act as a supporting constituency.

While the framework may be stable and predictable, what can create uncertainty is an unpredictable price signal that is influenced by market forces and policy-makers' responses to them e.g. the slow response to the over-supply of CDM credits in the EU ETS or the opposition to, and postponement of, full enforcement of EU emissions reduction legislation related to aviation.

Adaptability to changing market conditions

Emissions trading can have mechanisms built in to respond to different market conditions. For example, the existence of "flexibility mechanisms" – such as the CDM – enable emission reduction commitments under the ETSs to be met by undertaking project-based reductions in other geographical areas, thus reducing price and liquidity related risks in countries participating in the scheme. There is, therefore, some basis for developing linkages between existing schemes and scaling-up and improving the use of flexibility mechanisms.

Another significant flexibility in ETSs is the ability to incorporate a price floor as well as a price ceiling, in order to introduce stability and facilitate R&D and investment. Of course, in international schemes, if countries introduced their own price floors and ceilings, there would be a risk of carbon leakage and unintended transfers across jurisdictions with different price ranges. Since the inception of the EU ETS, there has been a perception that price has been volatile. Based on this perception, some participants (the government of Poland in particular, in 2008) have called for both price floor and price ceiling bands on the secondary markets of GHG allowance. In fact, Prada (2010) finds that the volatility of GHG allowance prices on the European market could not be described as excessive compared to other markets.

Suitability in addressing various GHGs and sources

Emissions trading can be used for any GHG or other polluting gas. In fact, the first form of emissions trading was for sulphur dioxide to combat acid rain, in the USA from 1990.

International outreach and harmonisation potential

International tradable quota schemes, such as an international ETS, have been acknowledged as the most straightforward way of establishing a price signal across sectors and countries (Stern, 2006). Combined with flexibility in how, where and when reductions are made, it is considered a powerful way of creating a 'level playing field' between countries and encouraging cost-effective mitigation at the same time.

Coverage of different sectors of the economy

ETSs can easily cover those parts of the economy where participants are largely stationed within the country boundary, such as domestic power, heat and heavy industries. Emissions trading is proving difficult for aviation however in the EU ETS, as many airlines are based outside EU ETS countries and some of the 'home' countries of airlines (such as China and the USA) are unwilling to support or enforce the EU rules which affect their airlines. Based on this experience, it appears that international emissions trading applying to certain sectors of the economy may be highly dependent upon international agreements for that sector.

Interaction with existing policies

ETSs can affect, and be affected by, existing policies and programmes in a given situation. For example, where a country already has incentives in place for the development of renewable energy technologies or installation, or for energy efficiency enhancements, it would be essential to model the effects of an ETS on these policies and vice versa, the effect of such policies on the ETS.

Assessing necessity of supplementary policies

In the development of an ETS, it is important to assess the necessity for complementary and supplementary policies that support the effectiveness of the ETS in delivering its objectives. For example, policies relating to the redistribution of revenues from auctioning of allowances should be considered from the very beginning.

Importance of monitoring and verification

ETSs rely on robust, transparent and independently verified emissions accounting. The application of a robust system has several advantages; it lends credibility to the scheme and confidence to the market; and it provides a wealth of data that becomes a critical tool for policymakers in the countries concerned.

The standard process across existing ETSs is to require participants to monitor their emissions according to a system that is prescribed or approved by the authorities. After each calendar year, the participants produce a report according to a prescribed format. Accredited verifiers are then employed by the participants to determine that the methodology was applied correctly and that the statement of tonnes of CO2 emitted is a fair and accurate account. Once the verified report is accepted by the authorities, participants are then required to surrender an equivalent number of allowances.

For the linking of two ETSs to occur, one critical factor must be considered. Namely that all parties that are linking their schemes must trust that the other party's systems for monitoring, reporting and verification –

as well as the accreditation of the verifiers – meet the same standard, so that one allowance is equal across the schemes. This is discussed further in the section below on linking.

Economic and environmental effectiveness

The economic and environmental effectiveness of ETSs relies largely on pricing: when prices are at an appropriate level, there will be high incentive for participants to make reductions to either sell permits or avoid having to buy them. If the price is too low, this incentive will fade; if the price is too high it may damage competitiveness. Price in turn relies primarily on supply and demand. The EU ETS has been oversupplied for a large part of its existence and therefore there are not many lessons to be learned regarding environmental or economic effectiveness. Studies have found that while the EU ETS may have led to abatement in the power sector, the evidence on its impact on participating industrial firms' GHG emissions is not conclusive. Several studies found that, in the aggregate, emissions across all regulated sectors declined by around 3% in Phase I and during the first two years of Phase II, relative to estimated business-as usual emissions. A recent analysis of firm-level data revealed that the transition from Phase I to Phase II triggered emission reductions in a few industrial sectors and that the firm-level allocation of permits influenced this effect.

There is no conclusive evidence on the economic effectiveness of the EU ETS either. One study found evidence that the EU ETS increased profits as firms priced in the opportunity costs of permits they had obtained for free. Furthermore, there was no compelling evidence that the EU ETS adversely affected the competitiveness of regulated firms. There was fairly robust evidence based on price data that a number of sectors were able to pass through the costs of emission permits onto final product markets. However, there was no evidence regarding whether the EU ETS reduced market shares or changed the composition of supply of regulated firms (Martin et al, 2012).

Incentives for businesses to innovate and invest in cost-effective low carbon solutions

Studies show that the EU ETS has helped in technology adoption. However there does not seem to be any strong evidence that the EU ETS in Phases I and II had a causal impact on (new-to-the-market) innovations by directly regulated firms. While clean patent applications increased rapidly from 2005 onwards, the evidence so far cannot rule out that this was due to other factors such as concurrent increases in the oil price or the implementation of other climate change policies.

Effectiveness in reducing emissions

Emissions trading provides far greater flexibility in mitigation strategies than most other approaches would. To the extent that a scheme embraces different sectors and countries, it establishes a common price signal which facilitates efficiency in the reduction of carbon emissions. To the extent that trading is allowed, it will ensure carbon reductions are made in the most cost-effective location and will automatically drive private-sector finance flows between regions and countries.

Cost of mitigation and implementation

The cost of implementing an ETS falls both on the authorities who administer it, and on the participating firms. The cost to the authorities may be recouped, for example, through the auctioning of allowances or the taxing of transactions (e.g. Value Added Tax). Similarly, the registry in which the allowances are created, housed and transferred between buyer and seller, may charge a fee to holders of an account. Therefore, most of the costs that fall upon the authorities may be covered through the scheme over time.

The entities in the scheme face two costs; firstly, the cost of complying by implementing a monitoring system, and secondly, paying fees to the verifiers and developing appropriate internal resources. The cost for smaller emitters therefore can be high and most ETSs target the larger emitters and may allow some firms to opt out of the scheme if they meet an equivalent measure or charge. For the larger emitters, in many sectors the cost is passed through to a greater or lesser extent to the end customer.

The cost of procuring the allowances represents the channelling of finance from the bigger or less efficient emitters to the more efficient emitters. As the market seeks out the lowest marginal cost of abatement in the sectors that are involved in the scheme, the capital in the system flows to those cheaper abatement options. To the sectors covered and the economy as a whole, therefore, emissions trading drives the cheapest emissions reductions. This is not the case with other policy instruments, as explored below.

Accuracy in target achievement

Among all carbon pricing approaches discussed, emissions trading provides the greatest certainty regarding emissions abatement levels due to the existence of a fixed cap on emissions from installations covered. Further, it is a cost-effective way to achieve emissions reductions as the price signal ensures that abatement takes place where it is most cost-effective, thus optimising costs to society. The European Commission in 2000 suggested that a comprehensive trading scheme could reduce the compliance costs associated with meeting the Kyoto Protocol by a third, if compared to a scenario with no trading instrument.

Key Challenges of Introducing ETSs

There are also a set of key challenges of introducing ETSs as opposed to other policy instruments, especially taking into account the developing country context. These are set out below.

New institutions and capacity

New processes and institutions are required to implement a new domestic or international ETS. Unlike a tax, a truly international scheme cannot easily be implemented through existing legal frameworks and institutions. In practice, the rules of existing national and regional schemes are all fairly different, thus hindering possible future integration. The system therefore lacks the flexibility to incorporate new participating countries quickly. It may also be somewhat more vulnerable to lax monitoring and enforcement in some countries.

New teams will need to be set up within government departments to administer ETSs. Affected companies will need to appoint officers to create the internal and external processes to ensure compliance, including to collect, verify and submit historical data on emissions; companies also need to set up monitoring, reporting and verification systems in line with the guidelines developed for the schemes they are part of.

In addition, several other functions are required to underpin and facilitate a liquid trading market, including some that may be performed by third parties:

- Registry services: these are required in order to set up, administer and manage access to registry accounts that allow for the transfer of allowances in trading, and that hold allowances necessary for surrender to the regulator.

- MRV (monitoring, reporting and verification) services: these will be required to ensure that one tonne of carbon emitted or reduced in one place is equivalent to one tonne of carbon emitted or reduced elsewhere, and underpin compliance in an ETS.

- Trading services and platforms: carbon markets behave similarly to commodities markets and any new market will create opportunities for trading activity including under different contracts, such as futures trading and the development of derivatives markets. The European market freely and progressively structured itself around standardised trading platforms, which represent approximately 60% of volumes traded late in the last decade. Another 25% of volumes were OTC trades, cleared centrally through organised clearing houses – thus transactions in 'organised markets' accounted for approximately 85% of volumes traded (the remaining 15% were bilateral OTC trades).
- Intermediaries: they are needed to facilitate trading between individual firms or groups within a scheme, as well as offering services to firms not covered by the scheme who can sell emission reductions from their projects.
- Carbon asset management and strategy consultancy services: as companies will need support in visualising and managing the complex new processes required and involved in order to reduce carbon and report successfully, new opportunities for expert advice are created.
- Legal services: such services are needed to facilitate contractual relationships in trading.
- Corporate and project finance: developing and installing new technologies to meet the compliance requirements of ETSs require significant investment, and corporate and project finance services will be required to help structure this.

Market design issues, such as establishing effective emission caps, determining coverage, ensuring compliance, and addressing the issues of competitiveness and leakage

One of the most significant risks in a cap-and-trade scheme is the risk of setting the cap at the wrong level. A very strict cap may increase costs to an unsustainable level, whereas a loose cap may be ineffective in reducing emissions from a business as usual perspective. There will always be uncertainty around this, as business as usual emissions levels are influenced by a wide variety of factors which are not always predictable. This is borne out of the experience of the EU ETS, where the Phase I (2005-7) was oversupplied due to an ineffective cap and the price ended close to zero. In the Phase II (2008-12) the cap at first appeared effective, however the phase was then oversupplied with allowances following a reduction in overall emissions. Much of this can be ascribed to the financial crash of 2007-08 and economic developments since then, which resulted in carbon emissions dropping in the covered nations regardless. This can happen in any country, and the carbon price will fall if recessionary or other forces keep emissions within a cap at any rate.. While this may render the scheme less effective in driving investment in low-emissions technology, a low carbon price provides relief to companies at times of macro-economic difficulties. This is not the case with a carbon tax.

There are uncertainties with regard to administrative and compliance costs. Compared with a tax, an emissions trading system yields more certain environmental outcomes but has more uncertain economic costs for participants. From a short-term perspective this is not efficient, as the welfare consequences of unexpectedly high abatement costs are likely to be higher than those from unexpectedly high emissions. Administrative costs may also be high, especially for 'downstream' schemes, where multiple small emission sources may only be covered at a significant cost (unless they are exempted), thereby hampering the overall cost-effectiveness of the system.

There are also technical requirements, such as availability and access to data to correctly determine the installations' baseline emissions, measurement, reporting and verification requirements, and requirements for establishing a registry and a record-keeping system for transactions.

Other challenges to effective operation of a trading scheme, such as its exposure to market abuse and manipulation

According to Prada (2010), the main objective of regulation and oversight of the GHG market is to guarantee the robustness of the price signal, making sure it reflects market fundamentals without distorting them and guaranteeing a sufficient level of information of and to market participants.

This is because market distortion is a major risk. Within a domestic ETS for example, a large company with significant power in the permit market can undermine cost-effectiveness. A monopolistic permit seller would create an artificial difference between the permit price and its own marginal abatement cost, thereby forcing permit buyers to buy more expensive permits or abate more at a higher cost. This risk is unlikely to occur if permits cannot be stored for future use as part of a multi-phase programme; and it is even more unlikely in an international scheme where a single company, no matter how large, would be unlikely to possess market changing power.

The European Commission, which has a regulatory function in the EU ETS, has proposed amendments to various directives to counter the risk of market abuse, as well as to bring the market into more extensive and deeper financial regulation, such as the Market Abuse Directive (MAD) and Market in Financial Instruments Directive (MiFID). The legal status of a tradable allowance, for example as a financial instrument, should be set with these factors in mind when designing new ETSs.

A domestic ETS runs the risk of low liquidity in the market, which can be a factor in market abuse cases as well as in low liquidity which in turn increases transaction costs and hampers efficient risk management through trading. However linking with or joining international schemes would bring this risk down even though other risks could arise.

1.4 SUMMARY

The following summary table describes the main advantages and challenges of each main carbon pricing policy mechanism considered in this report.

Policy Mechanism	Advantages	Challenges
Carbon tax		
Sets a price on GHG emissions produced by certain economic activities.	Simple for administrators and affected parties to understand Can be cost-effective for administrators Can provide certainty as a continuing, stable incentive Costs are transparent	Finding optimal tax level can be tricky Slow to respond to market occurrences Costs can get passed-on to consumers especially in monopolistic markets Benefits can be too widely disbursed to make for supporting constituency Can be perceived to be easy to remove Does not provide certainty regarding total emissions reductions
Sectoral Crediting		
Countries can earn credits by implementing policies and programmes across sectors rather than projects	Significantly larger scale potential than project by project approach used in CDM.	Difficult to define boundaries, baselines, collect data May be difficult to assign causality
NAMAs		
Not well defined as of yet, but intended to be a nationally or regionally-led initiative package designed for finance, capacity building and technology transfer from developed to developing countries.	Large scope Encompasses policy, different types of support and varied financing routes	Broad nature of mechanism may make measurement and causal reporting very difficult especially at national levels Mechanism still ambiguous to some extent
Cap and Trade Emissions Trading		
Participants' emissions are limited, emitting rights are distributed in the form of permits. Companies that need to increase their allowances must buy from companies that	Politically attractive for many reasons Flexible and allows for response to market occurrences Predictable and stable	Can be perceived as complicated Requires new institutions, new capacity Difficult to set optimal emission caps Market distortion possible

Policy Mechanism	Advantages	Challenges
have surplus.	framework Can cover many sectors Provides certainty in targets	Market abuse possible Domestic schemes can suffer from low liquidity

2 BENEFITS, CHALLENGES AND RISKS OF LINKING EMISSIONS TRADING SCHEMES

This section discusses the benefits, challenges and risks of linking ETSs. The benefits, challenges and risks depend on how the schemes are linked; unilaterally, bilaterally, multilaterally, or indirectly.

- A unilateral link exists if one scheme permits the allowances of another scheme to be imported and used for compliance, but the second scheme does not permit the use of allowances from the first scheme. For example, if a Kazakh/Ukraine scheme permits EUAs to be used for compliance but the EU ETS does not recognize Kazakh/Ukraine allowances for compliance. A unilateral link may apply to allowances from another ETS, such as the EU ETS, or credits issued by another scheme, such as CERs and ERUs. Some of the benefits, challenges and risks may differ for a link to the allowances of another scheme or to credits whose total number is not capped.
- A bilateral link exists if both schemes permit the allowances of the other scheme to be imported and used for compliance. Therefore allowances from either scheme can be imported from or exported to the other scheme and an entity covered by either scheme can use allowances issued by either scheme for compliance. For example, if a Kazakh/Ukraine scheme permits EUAs to be used for compliance and the EU ETS accepts Kazakh/Ukraine allowances for compliance. A multilateral link involves bilateral links among more than two schemes.
- If two (or more) schemes have a (unilateral, bilateral or multilateral) link to a common allowance or credit, but not to each other, they are indirectly linked. For example, the EU ETS and the New Zealand Emissions Trading Scheme (NZ ETS) are indirectly linked because both allow the use of CERs but neither accepts the allowances of the other scheme.

In practice, links are often subject to qualitative and/or quantitative restrictions. For example, the EU ETS accepts the use of CERs for compliance but there is a limit on the quantity of CERs that can be used and CERs from certain projects, such as forest projects, are not accepted. Such restrictions constrain the benefits and risks of linking.

In this section, the potential benefits of linking ETSs are described first. Then the potential benefits, challenges and risks specific to a unilateral link and to a bilateral link are examined in turn.[1] The potential benefits, challenges and risks of an indirect link are not discussed separately. However it is important to realise that the implications of an indirect link to another scheme must be considered when a scheme is evaluating a possible unilateral or bilateral link. Thus, one of the considerations in a unilateral or bilateral link between a Kazakh/Ukraine scheme and the EU ETS is the indirect link with the NZ ETS created by the acceptance of CERs in both the EU ETS and NZ ETS.

2.1 POTENTIAL BENEFITS OF LINKING EMISSIONS TRADING SCHEMES

The following analysis is based on the assumption that linking two ETSs leads to the convergence of the prices for the allowances of the two schemes. Although, as explained below, that does not always happen,

[1] The benefits, challenges and risks of a multilateral link are the same as those of a bilateral link so they are not discussed separately.

the potential benefits are easier to explain if one accepts that assumption. If the prices do not converge, the potential benefits of the link are not fully realized.

One benefit is improved economic efficiency. Initially, sources in the two schemes face different allowance prices which reflect the different marginal costs of reducing emissions in the two schemes; i.e. the marginal abatement costs of the two schemes. If linking leads to a common price for the allowances of the two schemes, all of the sources face the same marginal compliance cost – the new, common allowance price. That encourages more reductions by the sources in the scheme that have the lower allowance price initially and fewer reductions by the sources in the scheme that have the higher allowance price. This enables sources in the scheme that have the higher allowance price to comply at a lower cost. The total emission reduction is the same, but the abatement cost is lower; and thus an improvement in economic efficiency.

Linking creates winners and losers in each scheme when the allowance prices converge. In the scheme that has the higher allowance price before linking, the buyers benefit from lower compliance costs once the prices converge while sellers lose due to the new, lower market price. In the scheme that has the lower allowance price before linking, sellers benefit from the higher price after convergence, while buyers pay more for the allowances they need to achieve compliance.

It is probably easier to link a new scheme to an existing scheme from the outset. In this case the allowance price of the existing scheme may be affected,[2] but linking the schemes would not transform participants in the new scheme into 'winners' and 'losers'. The equity (burden sharing) issues associated with the implementation of the ETS and the implementation of the link can be addressed at the same time.[3] In the case of a bilateral link, where considerable commonality of the design is essential, the new scheme can be designed to be compatible with the target scheme, thus facilitating establishment of a link.

A second benefit of linking is lower allowance price volatility. With convergence of the prices for the allowances of the two schemes, any development that affects the supply of, or demand for, allowances has a smaller impact on the price of the combined pool of allowances. In other words, any development that would affect the allowance price in one of the schemes has a smaller effect on the allowance price after linking because the effect is spread across the larger pool of allowances of the linked schemes.

Even if the allowance prices do not converge, there can be price attenuation benefits. Consider a scheme in Kazakhstan or the Ukraine that is linked with the EU ETS but with allowance prices that are lower than the price of EUAs. In such a scenario, the price of the Kazakh/Ukraine allowances is likely to be "capped" by the price of EUAs. If the price of the Kazakh/Ukraine allowances rises to the EUA price (whatever that price is at

---

[2] The effect on the allowance price depends on the relative size and marginal abatement costs of the two schemes. If the marginal abatement costs are equal there would be no impact on the allowance price. If a small, new scheme is linked with a large existing scheme, such as the EU ETS, the difference in the marginal abatement cost is likely to only have a small effect on the price of EUAs.

[3] Equity (burden sharing) issues that are associated with an ETS are typically addressed when the scheme is implemented through mechanisms such as free allocation of allowances. A subsequent link creates winners and losers which changes the equity arrangements. Implementing a link from the outset enables these burden sharing issues to be addressed at the same time.

the time), the Kazakh/Ukraine sources will buy EUAs for compliance thus preventing further increases in the price of Kazakh/Ukraine allowances.

If the link is subject to qualitative and/or quantitative restrictions on the use of imported allowances or credits, the likely effect is a lowering, rather than a capping, of the price of allowances. Assume there is a restriction on the quantity of EUAs that can be imported into the Kazakh/Ukraine scheme in the above example. When the price of Kazakh/Ukraine allowances rises to the EUA price, EUAs are imported until the limit is reached. The price of the Kazakh/Ukraine allowances would then likely rise above that of EUAs, but it would be lower than in the absence of a link. This is the case in the EU ETS. The EU ETS is linked to the CDM and JI, but the quantity of CERs and ERUs that can be used for compliance is limited. The price of EUAs is higher than the price of CERs and ERUs, but the CERs and ERUs have reduced the price of EUAs despite the constraint on their use.

Greater liquidity in the allowance market is a third benefit of linking as the pool of available allowances is larger. A larger market should make it easier to buy and/or sell allowances and should reduce the risk of an entity not being able to purchase or sell the desired quantity of allowances – liquidity risk. A small ETS may be dominated by a few firms large enough to influence the allowance price. The larger market created by linking reduces the market power of the large firms in both schemes. A large allowance market attracts additional financial instruments, such as options and forward contracts. Such instruments can help sources manage their compliance cost risks. A larger market also is more likely to offer exchange trading of allowances and other financial instruments which typically lowers transaction costs. As a result, a larger, more liquid market can lower allowance prices (if either scheme has firms large enough to influence the market price) and transaction costs.[4]

Lower economic losses and emissions leakage are a fourth benefit of linking. When an ETS is implemented some of the activity shifts to countries that have less stringent emissions control regulations. In particular, some output of emissions-intensive, trade-exposed industries may shift from the country that implements an ETS to countries with less stringent emissions controls. As a result output and exports of such industries decline in the country with the ETS. Conversely, output and exports of such industries increase in other countries. Hence some emissions are shifted from the country with the ETS to countries with less stringent regulations (“leakage”). Linking helps reduce such economic losses and emissions leakage by reducing the compliance costs for firms covered by an ETSs (thus reducing the need for those firms to shift their emissions to a country with less stringent regulations).

Linking can also reduce aggregate emissions. This is because lower compliance costs reduce leakage, and so aggregate emissions by sources covered by the linked trading schemes, as well as the emissions of sources outside those schemes, are lower to the extent that leakage is reduced. Over time the lower compliance costs and lower economic losses may encourage the linked schemes to adopt more stringent emissions caps and so reduce emissions. However, as discussed below, a bilateral link also creates an incentive for each scheme to adopt less ambitious adjustments to its emissions cap.

[4] Transaction costs often decline with the volume traded, so lower transaction costs may benefit larger sources primarily.

2.1.1 *Potential Benefits of a Unilateral Link*

An ETS has a unilateral link with another scheme when sources are permitted to use the allowances of the other scheme for compliance, but not vice versa. A Kazakh/Ukraine ETS could establish a unilateral link with the EU ETS by permitting sources in the Kazakh/Ukraine scheme to use EUAs for compliance. Such a unilateral link would not allow installations in the EU ETS to use Kazakh/Ukraine allowances for compliance.[5]

A unilateral link allows specified external units to be imported into an ETS for compliance use. A Kazakh/Ukraine scheme may allow allowances to be exported, but there is no defined export market for Kazakh/Ukraine allowances unless and until another scheme establishes that those allowances may be used for compliance in its scheme through a unilateral or bilateral link with the Kazakh/Ukraine scheme.[6]

An ETS can establish a unilateral link with another scheme or with credits such as CERs and ERUs. Only two schemes have established a unilateral link with another scheme, but several schemes have established a unilateral link to CDM and JI credits.

From 2005 through 2007 Norway's scheme had unilateral links with the EU ETS and the CDM.[7] Some EUAs, but no CERs, were used for compliance by participants in the Norwegian ETS. The Chicago Climate Exchange (CCX) also had a unilateral link with the EU ETS. It terminated the link when the price of Phase I EUAs fell to a price that was too close to the price of CCX allowances. As EUAs were always more expensive than CCX allowances, none were used for compliance.

The EU, Japanese, New Zealand and Swiss schemes have unilateral links to the CDM and JI. This will also be the case for the Australian scheme after 2015. The schemes have different restrictions on the types and quantities of units that can be used. The EU, for example, has a limit on the quantity of CERs and ERUs that can be used for compliance between 2008 and 2020. Forestry and land use CERs cannot be used at all and, after April 2013, CERs from HFCs and N2O from adipic acid projects cannot be used. While New Zealand currently has no restrictions on the type of CERs, ERUs and RMUs that can be used, the government has considered placing similar restrictions to those of the EU ETS.

During 2005 - 2007 no CERs were used by participants in the EU ETS because the price of CERs was higher than the price of Phase I EUAs after the first CERs were issued. Since 2008 CERs and ERUs have been used for compliance in the EU ETS and the Japanese voluntary ETS (VETS). The NZ ETS came into effect during 2010. A small quantity of CERs was used for compliance that year. For 2011 about 70% of all units submitted

---

[5] The focus of this report is the options available to a Kazakh/Ukraine ETS. A unilateral link with the EU ETS and/or other schemes and credits is an option within the control of a Kazakh/Ukraine scheme. It is possible that the EU ETS (and/or another scheme) may establish a unilateral link with a Kazakh/Ukraine scheme. That would be a unilateral decision by the EU ETS (or other scheme) outside the control of the Kazakh/Ukraine scheme. The administrators of a Kazakh/Ukraine scheme could encourage other schemes to establish unilateral links with their scheme, but such efforts would be more likely to lead to negotiation of a bilateral link.

[6] Ukraine, as an Annex I party, can export ERUs and AAUs. The same would be true for Kazakhstan if it is accorded Annex I status.

[7] No ERUs or RMUs were issued prior to 2008.

for compliance were CERs, ERUs or RMUs. In short, unilateral links with credits are quite common and are being used increasingly.

Since multiple schemes allow the use of CERs and other credits, those schemes are indirectly linked and provisions of one scheme affect the others. EU ETS restrictions on the use of CERs and ERUs, for example, have contributed to declining CER and ERU prices, increased compliance use in the NZ ETS, and a significant decline in NZU prices. The quantity of CERs and ERUs issued has been rising since 2007 as more projects have become operational.

The EU ETS limits the quantity of CERs and ERUs that can be used to about 1.5 GtCO2 or approximately 16% of total covered emissions for the period 2008-2020. Since 2008 the price of CERs has been lower than that of EUAs. During 2008 and 2009 about 75% of issued CERs were used for EU ETS compliance, but that represented less than 3% of the units used for compliance. Changes to the regulations relating to the types of units that can be used post 2012 created an incentive to use more CERs for compliance in 2010. Compliance use increased to 9% of total emissions, but the growing supply of CERs meant that the share used in the EU ETS (i.e. issued CERs) fell to 50%. With the overall cap on the use of CERs, the price difference between CERs and EUAs has continued to grow and is now over €5.

The NZ ETS allows unlimited imports of CERs (as well as ERUs and RMUs). At the time of the 2010 compliance deadline (May 31, 2011) the price of CERs was about 10% higher than the price of NZUs and less than 2% of the units surrendered for 2010 were CERs. During the subsequent year, the price of CERs fell from about €12.50 to about €3.50, leading to a decline in the price of NZUs from about NZ$20 to NZ$6. At the time of the 2011 compliance deadline (May 31, 2012), the price of CERs was about 10% below the price of NZUs and just over 25% of the units surrendered for 2011 were CERs. ERUs and RMUs, whose prices are closely tied to the price of CERs, accounted for another 45% of the units surrendered for 2011.[8] The supply of CERs is much larger than the supply of NZUs, thus with no restrictions on their use the price of CERs will determine the price of NZUs as long as the former are cheaper.[9]

There are also situations where the existing unilateral link may not be used – i.e. no units are imported for compliance.[10] This happens if the allowance price in the ETS is lower than the price of the linked units. If the Kazakh/Ukraine scheme has a unilateral link with the EU ETS and the price of Kazakh/Ukraine allowances is lower than the price of EUAs, no EUAs will be imported for compliance. In this case, as noted above, the impact of a unilateral link is to “cap” the price of the Kazakh/Ukraine allowances at the price of EUAs or, if EUAs are an economic compliance option and their use is constrained, to reduce the price of Kazakh/Ukraine allowances from what it would otherwise be.

Conversely, a unilateral link will be used if the price of the imported units is lower than the price of the scheme’s allowances. In such a case, the price effects depend on any quantity restrictions and the relative

---

[8] NZUs accounted for slightly less than 27% of the units surrendered for 2011 compliance.

[9] The supply of CERs is much larger than the supply of ERUs and RMUs as well, so CERs largely determine the prices of ERUs, RMUs and NZUs.

[10] This was the case for the links of the CCX, EU ETS and Norwegian schemes to the CDM during 2005-2007.

sizes of the schemes. The quantity restrictions on the use of CERs and ERUs in the EU ETS have led to a growing differential between the prices of EUAs and CERs (and ERUs). In contrast, the absence of restrictions on the use of CERs (and ERUs and RMUs) in the NZ ETS resulted in a smaller differential between the prices of CERs (and ERUs and RMUs) and NZUs. Since the supply of CERs is much larger than the supply of NZUs and there is no other market for NZUs, the price of CERs determines the price of NZUs.

The other potential benefits of a unilateral link depend largely on the extent of the price convergence achieved. If the link is not used, there are no benefits. If the link is used, but restrictions limit the price convergence, the potential benefits are only partially realized. Thus the unilateral link to CERs (and ERUs and RMUs) probably has generated larger benefits for the NZ ETS than for the EU ETS. Between June 2011 and May 2012, the price of EUAs fell by approximately 40% while the price of NZUs declined by over 70%. Therefore the compliance cost savings were proportionally larger for participants in the NZ ETS.

The aims of an ETS include the increase of energy efficiency and innovation within domestic industry and the effects of a unilateral link on the level of abatement within domestic industry is one of the primary considerations. Unfortunately, comparative data on price volatility, market liquidity and economic losses, and emissions leakage for the EU ETS and the NZ ETS are not available. The economic losses and emissions leakage likely are correlated with the market price; so that lower allowance prices lead to lower losses and less leakage. Thus, the likely benefits have been relatively larger for New Zealand given the sizes of the respective ETSs. Price volatility and market liquidity are likely related to the increase in the supply of compliance units due to the link. The EU ETS link to CERs and ERUs has increased the supply of compliance units by less than 10%. In the case of the NZ ETS, the link has led to a more than doubling of the supply of compliance units, therefore probably benefitting it more when measured relative to its scheme size.

2.1.2 Challenges and Risks of a Unilateral Link

The reasons for implementing a unilateral link should be carefully considered before one is established. A common reason for having a link is to “cap” the price of the scheme’s allowances. A restriction on the quantity of imported units that can be used limits the extent to which the price is capped, and a unilateral link is only one of several price protection mechanisms. The contribution of a unilateral link and an associated quantity restriction on imported units, if any, in providing the desired degree of price protection or other benefits should be carefully analysed.

If a unilateral link is desired, the units to be accepted should be evaluated. A price protection objective is usually related to competitiveness concerns related to major trading partners, so the obvious link is with the ETSs of major trading partners. However, the current and projected market conditions relating to potential linked units should be evaluated. The EU ETS, for example, is currently considering how to deal with a surplus of allowances. It might be wise to defer a decision to establish a unilateral link with the EU ETS until that decision is made. Similarly, the future supply of CERs depends on the future of the CDM which depends on international negotiations.

A unilateral link is easy to establish. The administrator of the scheme implementing the link simply needs to specify the external units that will be accepted for compliance and any restrictions on their use. To accept eligible imported units for compliance they must be transferred into the scheme’s registry or to an account established by the administrator in the exporting scheme's registry. To use EUAs in the Kazakh/Ukraine scheme, the EUAs need to be transferred into the Kazakh/Ukraine scheme registry or to an account established by the Kazakh/Ukraine scheme administrator in the EU ETS registry.

Similarly, a unilateral link can be terminated easily. The scheme administrator simply announces that after a specified date the imported allowances will no longer be accepted for compliance purposes. If a Kazakh/Ukraine scheme has a unilateral link with the EU ETS, that link could be terminated, for example, by announcing on December 31, 2014 that EUAs would not be accepted for compliance after March 31, 2015 and that compliance use would be limited to the units held by Kazakh/Ukraine sources on December 31, 2014. This would allow the Kazakh/Ukraine owners of EUAs to use them for compliance or to sell them to sources in the EU ETS.

The main risk of a unilateral link is unanticipated impacts on the allowance price. With no restrictions on the use of the linked allowances (credits), their price caps the price of the scheme's allowances. This often is the intent of a unilateral link. A unilateral link by a Kazakh/Ukraine scheme to the EU ETS (with no quantitative restrictions) would mean the Kazakh/Ukraine allowance price would not exceed the price of EUAs, so Kazakh/Ukraine sources would pay no more for compliance than their EU counterparts.

However, if the unilateral link causes the allowance price to fall sharply, as has happened in New Zealand, then some of the emission reduction measures implemented by domestic sources may become uneconomic and result in financial losses for the firms involved. Measures implemented by New Zealand firms when the price of an NZU was NZ$20 may lead to financial losses at a price of NZ$6. Such a price may also generate a large bank of allowances. If the imported units have a lower price than the scheme's allowances, the linked units will be used for compliance and the allowances, which may have no other market, will be sold or banked.

The risks of unanticipated price decline are greater if the linked unit is, in turn, linked to other schemes, whether directly or indirectly. A unilateral link to the CDM is riskier than a unilateral link to the EU ETS because several schemes are linked to the CDM and developments in any of those schemes could affect the price of CERs. [11] At present, no other scheme is linked to the EU ETS although it has agreed a future link with the Australian scheme and a desire to link with other schemes.

The risks of unanticipated price impacts can be reduced through the use of quantitative restrictions on the use of imported units[12]. The decline in the price of CERs has had less effect on the price of EUAs than on the price of NZUs because of the restrictions on the use of CERs (and ERUs) in the EU ETS and the absence of

---

[11] Since the EU ETS allows the use of CERs and ERUs, a unilateral link to the EU ETS also established an indirect link to CERs and ERUs. But the quantity restriction on the use of CERs and ERUs by EU ETS installations would largely isolate a scheme with a unilateral link to the EU ETS from the markets for CERs and ERUs.

[12] Existing schemes limit the types and/or quantities of units that can be imported. It is also possible to restrict imports through the use of an "exchange rate" for the units. For example, a Kazakh/Ukraine scheme with a unilateral link to the CDM could require 1.5 CERs for each tonne of CO2 emissions -- an exchange rate of 1.5 CERs for 1 Kazakh/Ukraine allowance. The exchange rate could change over time to reflect changes to the environmental integrity of the imported units.

such restrictions in the NZ ETS. While they mitigate the unanticipated price impacts, such restrictions also reduce the potential benefits of linking. If the intent of the link is to cap the allowance price, then restrictions on the use of the imported units are not appropriate.

Another risk is that another scheme establishes a unilateral link with yours and this drives up the allowance price. The EU ETS, for example, might establish a unilateral link with a Kazakh/Ukraine scheme and this could drive up the price of Kazakh/Ukraine allowances. An export market for Kazakh/Ukraine allowances with higher prices may be considered a desirable development. But a lower allowance price for Kazakh/Ukraine firms relative to their EU counterparts may be preferred. Then the higher price caused by the unilateral EU link is undesirable.

It is difficult to prevent another scheme from establishing a unilateral link with your scheme. The administrator of the other scheme needs only to be able to establish an account in your registry. If possible price increases due to unilateral links by other schemes are a concern, restrictions on eligible account holders can be considered.[13]

Of course, the establishment of any link is a political act as well as an economic one. A unilateral link to the EU-ETS without the agreement, tacit or formal, of the European Commission would be seen as an unfriendly act. Before the establishment of any link it would be near essential for the countries involved to jointly assess the implications of either linking with each other or the EU-ETS on a more concrete level regarding market size, (potential) price level, comparable level of ambition etc.

2.1.3 Potential Benefits of a Bilateral Link

Two ETSs have a bilateral link when sources covered by both schemes are permitted to use the allowances of either scheme for compliance. A Kazakh/Ukraine ETS would have a bilateral link with the EU ETS if sources in the Kazakh/Ukraine scheme could use EUAs for compliance and installations in the EU ETS could use Kazakh/Ukraine allowances for compliance. A bilateral link may be subject to quantitative restrictions. Australia, for example, has announced that it will limit imported EUAs to 50% of emissions when the bilateral link is established in 2015. An exchange rate reflecting the environmental integrity of the two units, for example 1.2 Australian units for every 1 EUA, would be another form of quantitative restriction.

Thus a bilateral link allows each scheme to import units of the other scheme (like a unilateral link) and also to export its units to the other scheme. A bilateral link requires the agreement of the administrators of both schemes. Without an agreement, neither scheme can export its allowances because they will not be accepted for compliance use by the administrator of the other scheme.

With a bilateral link, allowance owners will shift their holdings to the units of the scheme that offers the more attractive treatment, such as the provisions related to allowance banking. Aggregate emissions could

[13] Effective restrictions on account holders to prevent such links are not easy to devise. The administrator of the scheme establishing the link might use a broker or other agent to operate the account.

increase as a result of a bilateral link due to differences in provisions of the two schemes relating to, inter alia:

- allowance lifetime;
- non-compliance penalty;
- “safety valve” price ceiling;
- banking allowances for future use;
- borrowing allowances from future years;
- upstream/downstream treatment of energy;
- absolute and relative caps; and
- eligible offset credits.

To ensure the integrity of the linked schemes, a bilateral link also requires harmonization of many provisions, including those governing:

- registry compatibility and security;
- monitoring requirements;
- reporting systems;
- auditing and verification standards;
- market regulation;
- anti-money laundering regulation; and
- accounting and tax treatment of allowance transactions.

Thus a bilateral link requires considerable, but not complete, harmonization of the designs of the two schemes. So the greater the similarity of the designs, the easier it is to implement a bilateral link.

Furthermore, the compatibility of the two schemes needs to be maintained as long as they have a bilateral link. Ensuring continued compatibility requires a:

- process for agreeing on revisions to the regulations, particularly changes to the caps;
- mechanism to provide assurance of the environmental effectiveness of each scheme; and
- procedure for terminating the linking agreement.

Maintaining a bilateral link is difficult because each scheme has an incentive to make less stringent adjustments to its cap to become a net seller.

No bilateral links have yet been established. The intention to create a bilateral link between the Australian and EU ETSs has been announced. Australia has established (through legislation) a unilateral link with the EU ETS to commence from July 1, 2015 when its scheme shifts from a fixed price to a market price. A full, two-way link with mutual recognition of the respective allowances of the two schemes is expected to begin no later than July 1, 2018. Australia will limit compliance use of imported units to a maximum of 50%[14] of emissions. The EU ETS is a much larger scheme, so the prices will likely converge toward the price of EUAs. An initial estimate places the compliance cost savings for Australian firms at A$2.5 billion over 5 years.

[14] Use of EUAs will be capped at 50% of emissions and use of CERs will be capped at a sublimit of 12.5% of emissions (for a total of 50% from eligible international units).

The EU and Switzerland are reported to be negotiating linking their ETSs, although no details of the nature of the link have been disclosed. Linking discussions between the EU ETS and new schemes in California, China and South Korea have also been reported. It is not known whether these discussions will culminate in bilateral links.

A bilateral link establishes mutual recognition of the allowances of the two schemes. Thus the prices of the allowances of the two schemes should converge, although quantity restrictions or other factors may inhibit complete convergence. Thus a bilateral link should yield most of the potential benefits of linking.

2.1.4 Challenges and Risks of a Bilateral Link

The need for considerable harmonization in design makes a bilateral link very difficult to implement. The design of each scheme reflects relevant legal practices, institutions, traditions and other considerations. Reconciling the design differences can be difficult. A new scheme interested in a bilateral link could emulate many of the design features of the target scheme to make linking easier. For 2005-2007 Norway adopted a design virtually identical to that of the EU ETS, which made integration into the EU ETS in 2008 much easier. Similarly, adopting a design for a Kazakh/Ukraine scheme very similar to that of the EU ETS would make a bilateral link with the EU ETS much easier.

A bilateral link will be easier to establish if allowance prices in the two schemes are similar. If there are no quantity restrictions on the use of imported units, prices of the allowances of the two schemes should converge. The scheme with the lower price prior to linking will become a net exporter. If the price difference is large, the export revenue could be substantial. This may generate opposition to the link on the grounds that the exporting jurisdiction is being rewarded for its weak environmental policy – the relatively low cap that allows it to be a net exporter.

Compatibility of the linked schemes must be maintained over time. Thus almost all changes need to be mutually agreed and be implemented simultaneously. This includes operational changes such as revisions of monitoring rules, changes to reporting and compliance deadlines, upgrades to the registries, adjustments to audit and verification procedures, and modifications of market oversight practices. It also includes, probably less frequently, changes to design features such as rules governing borrowing and adjustments to the scope of the schemes, such as new categories of sources and possibly gases. Of course, scope does not always become a major constraint, especially if the macroeconomic structures of the linking parties differ widely.

Some broader policy changes in a jurisdiction could threaten the continued compatibility. For example, if allowance sales are subject to VAT, a change to the VAT in one jurisdiction could threaten continued compatibility. Changes to financial market oversight arrangements by one jurisdiction could have implications for the allowance market that affect the compatibility of the two schemes. Adjustments to anti-money laundering rules by one jurisdiction could shift trading activity from one scheme to the other. In short, continued compatibility can be disrupted by broader policies as well as changes to the schemes themselves.

Adjustments to the emissions caps present perhaps the most severe challenge to maintaining a bilateral link. Each scheme has an incentive to make less stringent adjustments to its cap to become a net seller. If one scheme consistently is a net exporter of allowances (information that will be readily available), political support for the bilateral link may erode on the grounds that the exporting jurisdiction is being rewarded for its weak environmental policy.

The main risk associated with a bilateral link is that the adjustments to the emissions caps will be less ambitious. Each scheme has an incentive to propose a less ambitious adjustment in the hope of becoming a net exporter or reducing the extent of its allowance imports. Another risk is that control over the design of the ETS is shared with another jurisdiction. The consequences of that risk are unforeseeable. The risk may be offset by the influence the scheme gains over the design of the linked scheme.

A bilateral link can be terminated relatively easily. The scheme administrator simply announces that after a specified date the imported allowances will no longer be accepted for compliance purposes. If a Kazakh/Ukraine scheme has a bilateral link with the EU ETS, that link could be terminated, for example, by announcing on December 31, 2014 that EUAs would not be accepted for compliance after March 31, 2015 and that compliance use would be limited to the units held by Kazakh/Ukraine sources on December 31, 2014. This would allow the Kazakh/Ukraine owners of EUAs to use them for compliance or to sell them to sources in the EU ETS. Such major administrative changes can have a short-term effect of increasing price volatility, for example the price of CERs from HFC-23 projects slumped considerably since the ban on their use for compliance in the EU ETS after April 2013 was introduced.

In short, a bilateral link is challenging to implement and maintain. Perhaps that is why no bilateral link has been implemented yet. Australia and the EU have announced their intention to implement a bilateral link. Implementation will occur over three years. . The first step is a unilateral link of the Australian scheme to the EU ETS, which includes a quantitative limit of 50% on the use of EUAs. That will provide time to adjust the designs and facilitate price convergence prior to implementation of the bilateral link.

The benefits, challenges and risks of linking ETSs are summarised in the following table.

	Benefits of a Link	**Challenges and Risks**
General	Assuming no restrictions so prices converge: • Improved economic efficiency • Lower allowance price volatility • Greater liquidity in the allowance market • Lower economic losses • Reduced emissions leakage	Equity issues due to creation of winners and losers in each scheme
Unilateral link (direct)	Price protection/moderation Benefits listed above subject to restrictions on the use of imported allowances Easy to establish and terminate	Current and projected market for the linked allowances/credits Unanticipated price decline may create large bank of allowances Unanticipated price decline may lead to financial losses for sources that reduced emissions A unilateral link by another scheme could raise

		allowance prices
Indirect link		Risks greater since several schemes influence the market for the linked allowances/credits
Bilateral link	Benefits listed above subject to restrictions on the use of imported allowances Difficult to establish and maintain Easy to terminate	Some loss of control over the design and operation of the ETS, but influence over the design and operation of the linked schemes Possibly some constraints on related domestic policies Incentive for each scheme to seek less ambitious adjustments to its emissions cap Achieving common ambition levels can be difficult

3 RELATED CONSIDERATIONS

In this section we have outlined a few mechanisms and policy tools for policy makers to reflect on, which may in some cases complement, and in other cases provide alternatives to the mechanisms outlined so far in this document.

3.1 COMMAND AND CONTROL

Command-and-control (CAC) approaches are regulatory instruments to dictate abatement decisions. Also referred to as standards or regulations, CAC regulations are the most common forms of environmental policy in both the advanced and developing countries. As the name implies, the CAC approach consists of a 'command', which sets a standard – e.g. the maximum level of permissible pollution, and a 'control', which monitors and enforces the standard. They can be broadly categorised into: i) technology standards, where emitters are required to use specific emission reduction technologies; and ii) performance standards, where specific, compulsory environmental targets are set (such as a certain volume of emissions per unit of output), but without requiring any specific technologies.

There are many advantages to CAC instruments. They are already the most common form of environmental regulation worldwide. Existing institutions can be used for their implementation, and market participants are familiar with their use. CAC is also attractive to politicians as the cost of meeting standards is not immediately visible to voters (OECD, 2009).

CAC approaches work in many situations of market failure – where there is imperfect information, adverse selection and/ or moral hazard. In the property sector, for example, landlords do not have any incentive to install energy efficient equipment as they do not pay the energy bills; while tenants typically have less information about such equipment and moreover are not incentivised to arrange and pay for its installation unless this is made very easy and the payback periods are clearly well within the time of their leases. Such issues can be partially dealt with policy to create information instruments such as public disclosure or a building energy performance certificate which tenants must be shown before a lease can be agreed. However, the processes of creating and disseminating such information instruments may sometimes be too costly and in such cases standards would be justified.

Command and control approaches can work even where emissions cannot be perfectly observed (e.g. fugitive emissions from pipelines, or methane from agriculture). Here, market-based incentives cannot minimise abatement costs because such emissions are not properly monitored. In principle, cost-effectiveness can then be enhanced through the use of technology standards (but not performance standards, as emissions monitoring is also required for their implementation).

CAC instruments can be preferable to market-based incentives when price signals are unlikely to lead to the desired outcomes. For example, some countries may lack the institutional capability to monitor and facilitate the effects of market-based incentives – whereas technology standards may be easier to implement and oversee.

In situations where state owned enterprises wield significant market influence, carbon markets may not be as effective as technology standards in encouraging them to implement abatement measures.

However, there are also risks and issues to be addressed when considering CAC approaches. Standards are meant to be introduced to deal with market failures, and should not necessarily be introduced where high or hidden transaction costs block implementation measures. For example, landlords and tenants could come up with a joint energy efficiency investment plan except that in many cases the transaction costs of doing this would be too high for either or both of them (in addition to the incentive problem mentioned previously). In this case, instruments other than standards may be more appropriate – such as direct policies to reduce the transaction costs. Of course, this argument could be countered in cases where a carbon price may be enough to 'tip the scales' and make the transaction costs less relative to the benefit of the mitigation measure. As such, due consideration should be given to potential effects of price mechanisms even when designing a CAC policy.

Command and control policies require all firms to undertake mitigation measures regardless of their individual abatement costs. Overall mitigation costs are not minimised, as some firms may have more or less abatement options than others, at differing costs.

Technology standards are generally more expensive to implement than performance standards as the latter provide more flexibility in abatement measure. Where emissions are hard to measure, however, performance standards are less relevant and technology standards are more effective.

Standards do not raise fiscal revenues unlike price-based instruments. In some cases this may not be a disadvantage, for example where the fiscal revenues are used to compensate for losses incurred by industries affected by mitigation policies. In extreme cases such as where the compensation arrangements may be distortive or very high in transaction costs, standards may be advantageous.

Differing standards in different geographies would likely cause disproportionate advantages and disadvantages to the affected industries. However, mandatory international standards may not be politically viable nor economically desirable.

Unlike price instruments, standards do not incentivise emitters to exploit cheap abatement options beyond those required to meet the standards. This is especially true of technology standards where there is little incentive for firms to develop alternative technology solutions to those mandated. While standards can be set very high to 'force' innovation, it is difficult for regulators to determine their appropriateness in advance, potentially leading to innovation incentives that are too weak or too strong.

Standards do not react quickly to change. For example, a new, relatively cost-effective technology may come on stream however a technology standard would take significant time to change to allow it. This also means that individual control over abatement decisions would not be incentivised. Price instruments on the other hand would adjust immediately to drive demand for such a solution.

Unlike a cap and trade scheme, CAC instruments do not provide certainty about emissions.

When using CAC instruments, regulators need to make decisions on how stringent standards should be. This can be very difficult in the absence of detailed information regarding individual costs of abatement.

3.2 CARBON IN INTERNATIONAL TRADING OF GOODS AND SERVICES

In a globalised world, a significant fraction of global carbon emissions is transferred between nations and regions, either physically or embodied in production. International trade is continually growing relative to other macro-economic variables (e.g. Gross Domestic Product), and it is increasingly important to understand emissions associated with traded goods and services to help in: understanding emissions drivers; balancing regional carbon budgets; and considering impacts of climate policy initiatives.

A recent study (Peters et al, 2012) found that the largest trade flows of carbon in international trade in 2004 were fossil fuels (2673 MtC, 37% of global emissions), CO2 embodied in traded goods and services (1661 MtC, 22% of global emissions), crops (522 MtC, 31% of total harvested crop carbon), petroleum-based products (183 MtC, 50% of their total production), harvested wood products (149 MtC, 40% of total roundwood extraction), and livestock products (28 MtC, 22% of total livestock carbon).

The Kyoto Protocol attempts to reduce climate change by giving countries emissions reduction targets related to emissions from domestic production, and territory-based emission inventories are required for input into climate models. From a climate policy perspective, countries and industries have more power to monitor and regulate their territorial emissions. However, changes in production-related emissions at the domestic level can occur for many reasons, including import substitution (when national governments actively try to replace imports with domestically-produced goods), or conversely by the relocation of production abroad.

A very useful and complementary indicator, therefore, is the embodied GHG emissions figure for goods and services related to domestic consumption. A 2003 OECD study found that consumption related emissions in 24 OECD countries were 5% higher than production related emissions. For many individual countries, the emissions associated with consumption are often +/-10% greater or less than domestic production. According to Peters et al. (2012), it is possible to adjust the territorial-based emissions inventories to create consumption-based inventories by adding the emissions associated with imports and subtracting the emissions associated with exports. Other studies have used a combination of datasets including input-output tables, international trade flows in manufactured products, and estimates of CO2 emissions from fuel combustion by industry and country.

Data and methodologies to improve collection of consumption emissions based indicators are constantly improving, however the next big step to be made is to understand how best these estimates and indicators can be used in international and national policy settings.

3.3 PERSONAL CARBON BUDGETS AND TRADING

Over the past decade there have been various mentions of personal (individual) carbon budgets. For instance, in 2008 the UK government conducted a pre-feasibility into a ‘downstream’ cap-and-trade scheme where all individuals would receive an annual carbon emissions ‘budget’ for their personal use (Parag and Strickland, 2009). Under the scheme, people would be allowed to purchase additional emissions or sell surplus emissions in a ‘personal carbon market’. For those unwilling to trade, a ‘pay as you go’ scheme could be created. It has been suggested that such an instrument could lead to energy demand reduction through new incentives: economic – via carbon price, psychological – via carbon awareness, and social – via new norms for carbon emissions.

Independent industry stakeholders have suggested that instead of setting up a ‘personal carbon market’, the compliance markets could be used to incentivise individuals in different ways. For example, if life expectancy in one country is 80 years, with average emissions per person of 10 tCO2e per year, a person could buy 800 EUAs and surrender these for cancellation to the carbon registry authority. The authority would then issue a climate neutral certificate, which could be used for a tax free allowance (in income tax or inheritance tax).

Such a scheme could link the public interest more directly to the ETS. The tax incentive could be calibrated such that the lost fiscal income would be off-set by an increase in EUA auctioning proceeds. It would be a system with positive feedback-back, as the more an economy is low carbon, the lesser the demand due to slower lower annual carbon impact per person over time. The system could later grow into a more detailed descriptive system, taking into account not the country's average carbon impact per person, but the real lifestyle. Of course, there would be several implementation issues to consider such as how to include children in the scheme, or how to deal with a vehicle used by several people.

Another approach may be to auction allowances equal to the national cap to all producers and importers of fossil fuels plus emitters of industrial gases. The revenue is then redistributed through the income tax and social assistance payment systems (say an equal amount per person). People who generate few emissions benefit financially while larger emitters would pay because the payment would not cover the higher costs of the emitting goods and services they use. This approach would be easier to implement however may not incentivise personal behaviours as much as the alternatives above do.

In a similar way to national carbon budgets (which include 'direct' emissions under the control of domestic businesses and governments), proposals for personal carbon budgets have considered including emissions under the individual's direct personal control, such as household energy use and private transport including aviation. However over time (as alluded to above) the model could move to a whole consumption based calculation including emissions from food and drink, construction, textiles and clothing etc. Towards this, some retailers now include embodied CO_2e figures on the packaging of products, and behavioural studies have been done with consumers to understand their responses.

The UK government pre-feasibility study in 2008 concluded that this was an idea ahead of its time. Even as of now there only seem to be a few individuals and companies working on this concept, and as such the idea still seems very far from realisation.

3.4 THE VOLUNTARY MARKET AND HOW IT CAN BE A PRECURSOR FOR REGULATED MARKETS

The compliance market enables companies, governments and other organisations in Kyoto Protocol Annex B countries to buy carbon offsets in order to comply with limits on the total amount of GHG they are allowed to emit. Under the smaller voluntary market, governments, companies and individuals anywhere can choose to purchase carbon offsets to mitigate GHG emissions arising from the whole or part of their operations (in the case of organizations) or lifestyles (in the case of individuals). Individuals typically choose to purchase carbon offsets to compensate for their travel related emissions, especially air travel.

Funding raised through selling offsets is used to support projects that reduce or sequester GHG emissions, through measures including low carbon/ renewable energy generation, reducing energy use through efficiency or behavioural change measures, reforestation and GHG capture and destruction.

While awareness and acceptance of carbon offsetting is increasing, there have been some criticisms in the past, particularly in the voluntary offset market. These include the following common complaints: poor quality of projects (leading to low confidence in durability); lack of additionality (the allegation that the project would have been completed even if there was no carbon offset mechanism in place); lack of tangible other benefits to the local communities where projects are implemented; a cheap way for consumers, companies and governments in the developed world to propagate high-carbon lifestyles and economies; inaccurate measurement; and poor verification.

In order to address these shortcomings, several voluntary offset 'standards' have been developed. Some are as robust as standards applied by the compliance markets; others are more lenient; while others are seen as being stricter. While the standards are very helpful in increasing the quality of the projects, the variety of standards available and their sometimes slight differences can cause confusion for consumers.

Despite the challenges, the voluntary market has taken a leading position in setting up new financial structures and pioneering new methodologies, insurance schemes and project types that can feed into compliance regimes and serve a wider market. One example is the voluntary market's move to allow for the generation of offset credits for reducing emissions from deforestation and forest degradation (REDD) which is likely to inform policy on their use in compliance markets in the future. Here and in other areas the voluntary market has moved ahead of the systems set up by the UN under the CDM.

3.5 RENEWABLE ENERGY GENERATION AND ENERGY EFFICIENCY CERTIFICATES

Renewable energy generation certificates (also known as green tags or green certificates) are used in several countries such as the USA, the UK and Australia as tradable, non-tangible commodities that represent proof that one unit of electricity was generated from an eligible renewable energy source. These certificates can be sold and traded, and the owner of the certificate can claim to have purchased renewable energy. While traditional carbon trading programs promote low-carbon technologies by increasing the cost of emitting carbon, RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources.

Renewable energy generation certificates are available through the Renewable Obligation in the UK which came into effect in 2002 in England, Wales and Scotland. It places an obligation on UK electricity suppliers to source an increasing proportion of the electricity they supply to customers from renewable sources. Renewable Obligation Certificates (ROCs) are green certificates issued by the relevant authority to operators of accredited renewable generating stations for the eligible renewable electricity they generate. Operators can then trade the ROCs with other parties, with the ROCs ultimately being used by suppliers to demonstrate that they have met their obligation.

Where suppliers do not have sufficient number of ROCs to meet their obligation, they must pay an equivalent amount into a 'buy-out' fund. The administration cost of the scheme is recovered from the fund and the rest is distributed back to suppliers in proportion to the number of ROCs they produced in respect of their individual obligation.

In contrast to 'green' certificates which acknowledge renewable energy production, 'white' certificates typically acknowledge that a certain reduction of energy consumption has been achieved. In most schemes, white certificates are tradable and combined with an obligation to achieve a certain target of energy savings. Under such a scheme, producers, suppliers or distributors of electricity, gas and oil are required to undertake energy efficiency measures that are consistent with a pre-defined percentage of annual energy deliverance. The white certificates are given to producers whenever an amount of energy is saved, whereupon the producer can use the certificate for their own target compliance or can be sold to (other) parties who cannot meet their targets. As with emissions trading, in theory the tradability ensures that the overall energy saving is achieved at least cost, while the certificates guarantee that the overall energy saving target is achieved.

REFERENCES

Aasrud, A., R. Baron & K. Karousakis (2011) *Market Readiness: Building blocks for market approaches*. OECD/IEA. Available from http://www.oecd.org/env/climatechange/46563135.pdf [Accessed 20 September 2012]

Ahmad, N. and A. Wyckoff (2003), *Carbon Dioxide Emissions Embodied in International Trade of Goods*, OECD Science, Technology and Industry Working Papers, 2003/15, OECD Publishing. Available online from http://dx.doi.org/10.1787/421482436815, accessed 12th Nov 2012.

Garnaut, R (2008), *The Garnaut Climate Change Review,* Cambridge University Press.

Martin, M., M. Muuls & U. Wagner (2012), *An Evidence Review of the EU Emissions Trading System, Focussing on Effectiveness of the System in Driving Industrial Abatement.* Uk Department for energy and Climate Change. Available from http://www.decc.gov.uk/assets/decc/11/cutting-emissions/eu-ets/5725-an-evidence-review-of-the-eu-emissions-trading-sys.pdf [Accessed 13 November 2012]

OECD (2009), *The Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012*, OECD. Available from http://www.oecd.org/env/climatechange/theeconomicsofclimatechangemitigationpoliciesandoptionsforglobalactionbeyond2012.htm [Accessed 25 September 2012]

OECD (2004), *Greenhouse Gas Emissions Trading and Project-based Mechanisms*, OECD. Available from http://www.oecd-ilibrary.org/environment/greenhouse-gas-emissions-trading-and-project-based-mechanisms_9789264105775-en [Accessed 22 September 2012]

Parag, Y. And D. Strickland (2009), *Personal Carbon Budgeting,* UK Energy Research Centre, UKERC/WP/DR/2009/014. Available online from http://www.eci.ox.ac.uk/research/energy/downloads/paragstrickland09pcbudget.pdf, accessed 12th Nov 2012.

Peters, G.P., S.J.Davis, and R.Andrew (2012), *A Synthesis of Carbon in International Trade*. Biogeosciences, 9, 3247 – 3276. Available online from http://www.biogeosciences.net/9/3247/2012/bg-9-3247-2012.pdf, accessed 12th Nov 2012.

Prada, M (2010), *The Regulation of CO2 markets - Assignment report by Michel Prada, Emeritus General Inspector of Finance, La République Francaise*, available from http://www.minefe.gouv.fr/services/rap10/101004prada-report.pdf

Stern, N. (2006), *Stern Review on The Economics of Climate Change* , HM Treasury, London.