The impact of emissions trading on the coal industry

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Abstract

This report summarises the current status of emissions trading and the implications for coal producers, traders and users. In practical terms, emission trading should ensure that emission reduction takes place where the cost of the reduction is lowest and is particularly suited to the emissions of greenhouse gases, which have the same effect wherever they are emitted. This allows governments to regulate the amount of emissions produced in aggregate by setting the overall cap for the scheme but gives companies the flexibility of determining how and where the emissions reductions will be achieved. The report describes a number of useful lessons learned from pilot greenhouse gas trading schemes conducted in Canada, Denmark, the UK, some US states and by private companies such as BP, Shell and the Chicago Climate Exchange. The European Union is establishing an EU Emissions Trading Scheme in up to 28 countries with a first phase in 2005-07 and then another phase in 2008-12. The number of allowances each company or installation with emissions will receive will be based on each member state's National Allocation Plan and the European Commission is facing a difficult task in assessing the draft plans for overly generous allocations which could constitute illegal state aid. Forward trading prices had halved in just four months to April 2004 when it became clear that an oversupply of allowances was likely. This early market reaction to allocation developments has served to demonstrate the critical nature of this stage in the establishment of an emissions trading scheme. One trading advisor's 'most likely' scenario has a price estimate for 2010 of 9.90 US$/t$CO_2$-e and estimates that the greenhouse gas markets will be worth around US$10 billion by 2007.

The major impact of climate change policies will be the increased prices faced by users of fossil fuels (particularly coal). The challenge for the coal industry will be to ensure that governments provide energy users with sufficient flexibility to achieve abatement by cost effective means (such as emissions trading) rather than by direct regulation. The main conclusion from a simple comparison of price impacts of a 10 US$/t$CO_2$ emissions tax is that coal would remain the most competitively priced industrial fuel in five developed countries where coal currently has the lowest price.

Acronyms and abbreviations

AAU	Assigned Amount Unit (for IET)
CDM	Clean Development Mechanism
CER	Certified Emission Reduction (for CDM)
CO_2	carbon dioxide
EAU	European Allowance Unit (for EU-ETS)
ERU	Emission Reduction Unit (for JI)
EU-ETS	European Union Emissions Trading Scheme
IET	International Emissions Trading
IETA	International Emissions Trading Association
JI	Joint Implementation
$MtCO_2$	million tonnes of CO_2
$MtCO_2$-e	million tonnes of CO_2 equivalent
MW	megawatt
NAP	National Allocation Plan
NOx	nitrogen oxides
PCF	(World Bank) Prototype Carbon Fund
SO_2	sulphur dioxide
tCO_2	tonnes of CO_2
tCO_2-e	tonnes of CO_2 equivalent
UK-ETS	United Kingdom Emissions Trading Scheme
VER	verified emission reduction

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1 Introduction

The aim of this report is to summarise the current status of emissions trading and the implications for coal producers, traders and users. Emissions trading is one of the flexible mechanisms within the Kyoto Protocol and the European Union will launch an Emission Trading Scheme (EU-ETS) in January 2005. The EU-ETS and other emissions trading schemes internationally will impact on the operation of the coal industry, arguably reducing the costs of complying with greenhouse gas emission reduction policies.

Emissions trading is a key instrument in the drive to reduce greenhouse gas emissions. In practical terms, emission trading should ensure that emission reduction takes place where the cost of the reduction is lowest thus lowering the overall costs of combating climate change. This instrument is particularly suited to the emissions of greenhouse gases, which have the same effect wherever they are emitted. This allows governments to regulate the amount of emissions produced in aggregate by setting the overall cap for the scheme but gives companies the flexibility of determining how and where the emissions reductions will be achieved. By allowing participants the flexibility to trade allowances the overall emissions reductions are achieved in the most cost effective way possible.

1.1 International climate change developments

The first major international response to potential climate change was the signing of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. The UNFCCC objective is to stabilise greenhouse gas concentrations in the atmosphere at a level that prevents dangerous human interference with the climate system. Since then there have been ongoing annual Conference of Parties meetings to further the ongoing development of international policy instruments to reduce anthropogenic human sourced emissions of greenhouse gases. A major step in the development of policy instruments was the signing of the 1997 Kyoto Protocol (UNFCCC, 1997).

If the Kyoto Protocol enters into force, it will establish legally binding greenhouse gas emission allowances for all developed countries that have ratified it. These are known as Assigned Amount Units (AAU) for the first target period of 2008-12 and were set as targets related to a baseline of emissions in 1990. In order for the Kyoto Protocol to come into force it will require ratification by Russia (in order to meet the threshold of 55% of 1990 CO_2 emissions).

Entry into force would require ratifying developed countries to make quantified emission limitation or reduction commitments in the 2008-12 target period for six greenhouse gases considered responsible for climate change. Those gases are:

- carbon dioxide (CO_2);
- methane (CH_4)
- nitrous oxide (N_2O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs);
- sulphur hexafluoride (SF6).

Many ratifying developed countries would face difficult decisions on what policy options to implement in order to limit their emissions to the level of their Assigned Amount Units. International debate on the policies and measures that should be allowable to meet these targets has been highly contentious because of the uncertainty over the effects increasing greenhouse gas emissions will have on the environment and the economic impacts of those policies.

The Kyoto Protocol allows the opportunity for international initiatives to reduce greenhouse gases emissions cost effectively through the use of its three flexible mechanisms:

- Joint Implementation (JI, between two developed country governments);
- the Clean Development Mechanism (CDM, between a developed and a developing country government); and
- international emissions trading (potentially a wide range of participants).

The European Union, Japan, Canada, New Zealand and other ratifying developed countries are implementing a range of policies to meet their Kyoto Protocol commitments. Those policy options may include the three flexible mechanisms, domestic tradeable emission allowance systems, carbon taxes, or expansion of voluntary agreements with industry to reduce greenhouse gas emissions. In addition, there are also several complementary measures that include research and education into mitigation of greenhouse gases.

Many countries and companies have taken a precautionary approach to the issue of climate change and invested in pilot projects to reduce greenhouse gas emissions. One approach is the development of a market-based instrument in the form of pilot emissions trading systems. An example of this is BP Amoco, which introduced internal emissions trading across all its businesses with the aim of reduction of greenhouse gas emissions by 10% of 1990 levels by 2010 (BP, 2003). Other companies and countries are also exploring the option of emissions trading as a prudent risk management strategy and preferable option to a government regulatory system for industry.

Emissions trading offers an opportunity for industrial and other sectors to establish tradeable allowance systems that allow suppliers and users of energy to minimise the cost of greenhouse gas reduction through trading. The development of an emissions trading system offers a pragmatic approach to a complex issue with successful precedents.

2 How emissions trading works

Emissions trading is based on the concept of tradeable allowances or permits or environmental quota on the use of resources. The rationale behind emissions trading is establishing property rights for the emission of greenhouse gases. For instance, the creation of property rights for CO_2 emissions will give them monetary value and encourage efficiencies through trading of those rights. In order for this to happen, a market in CO_2 rights must be established, usually by a government regulatory agency.

A successful emissions trading system, based on the performance of precedent programmes, will contain the following features:

- total emissions for the whole trading system will be limited in stages (say 3–5 years each) that participants will perceive as achievable at reasonable cost;
- trading will produce cost savings if participants face a range of abatement costs through improved process efficiencies and development of lower emission technologies;
- actual emissions will be verified (and potentially audited) for each participant;
- an efficient compliance regime will check that each participant holds sufficient allowances for the actual emissions and enforce penalties where appropriate.

There are two main types of emissions trading systems: baseline and credit and cap and trade.

2.1 Baseline and credit

This system requires a baseline emission profile of all participants. There are several ways baselines can be projected, such as emissions growth or technological change. The implementation of a specific project would create an alternative projection generating credits when emissions are below the baseline. Consequently, the credits can be traded with companies that exceed their baseline. However, without a binding cap on emissions the regulatory authority must provide an incentive for trading to occur. Such an incentive could be created by recognising early abatement action in awarding credits for participation in a scheme such as a voluntary agreement.

2.2 Cap and trade

A cap and trade system has the main feature that the total supply of emission allowances is capped. When the supply is plentiful, the allowance trading price will be low and when allowances are scarce, their price will be high. Initially, allocation of allowances can occur by free allocation, auctioning or a combination of both. Free allocation (sometimes known as grandparenting or grandfathering) is based on a set of criteria, the most common being a level of historical emissions over an agreed period. In auctioning, a regulatory authority sells the allowances by various methods of auction or tender.

Because it does not matter geographically where emission reductions are made within the trading scheme, participants have three choices. They can:

- meet their cap by reducing their own emissions;
- reduce their emissions below their cap and sell or bank the excess allowances; or
- let their emissions remain above their cap, and buy allowances from other participants.

Internationally, nearly all environmental trading systems are cap and trade. They have the attraction to regulators of certainty of environmental outcome by limiting the total number of allowances.

Clearly, the establishment of the system is crucially important because issues such as coverage (which gases and which sources), total emissions level, baselines and allocation have major equity implications for the participants' compliance costs.

The Australian Greenhouse Office (AGO, 2002) considers that a mandatory cap and trade system lends itself to much lower levels of verification cost than voluntary arrangements that trade in project based abatement credits defined against a 'business as usual' baseline. For project based credits, abatement monitoring relies on judgements about the level of emissions that would have occurred in the absence of an abatement action, and the future period over which that action should receive credits. Therefore, under baseline and credit (particularly with a project based scheme) a much greater level of effort is required to establish confidence that a systematic emissions constraint is being applied.

2.3 Coverage

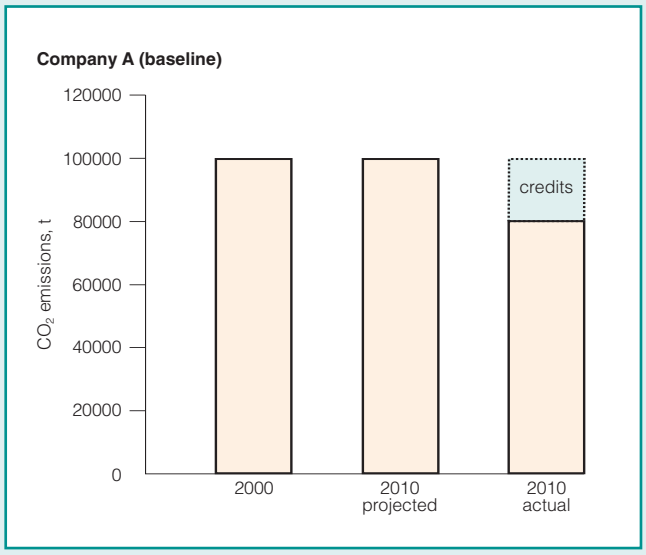
The effectiveness of an emissions trading system achieving least cost abatement will be highly dependent on coverage – the greenhouse gases covered by the system and the sources of those gases. If a trading system can achieve widespread and consistent price signals, it will drive emission reductions in those areas of the economy where this can be accomplished most cheaply. The Australian Greenhouse Office (AGO, 2002) considers the key objective of a trading system should be to extend coverage to as many emission sources as is cost effective. Cost effectiveness should be judged on the basis of individual participation costs (measurement, reporting, verification) relative to the cost saving that is likely to be achieved by requiring that emitter to participate in the system, accounting for risk, incentive and efficiency considerations.

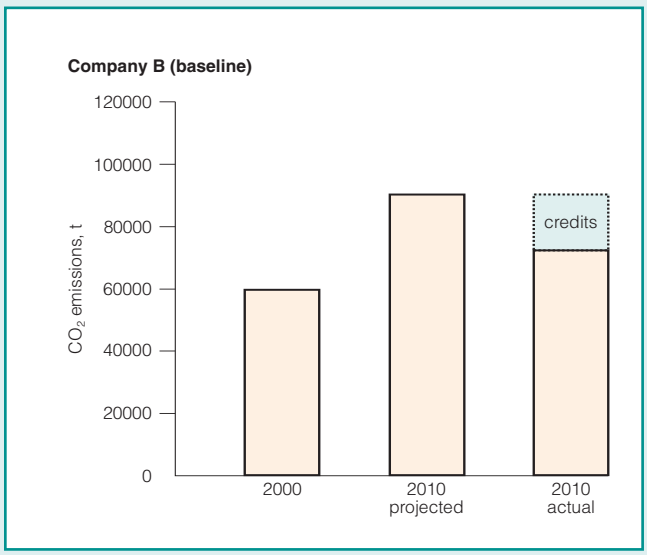
Combustion related emissions represent a fairly straightforward target for an emissions trading system, and these can be covered very effectively by arrangements focusing on emissions from fossil fuel use. The AGO states that the economics of extending a trading system beyond combustion related CO_2 emissions are less clear, because

Example of emissions trading systems: baseline and credit, and cap and trade

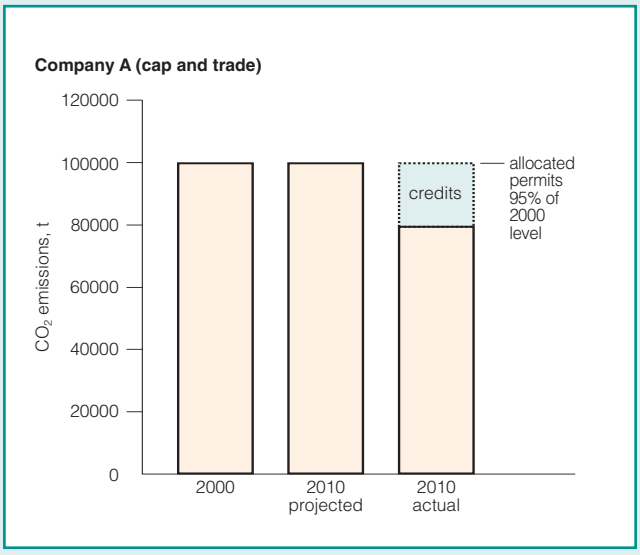
Company A's production and emissions are projected to remain steady at 2000 levels while Company B's production and emissions are projected to grow 50% between 2000 and 2010.

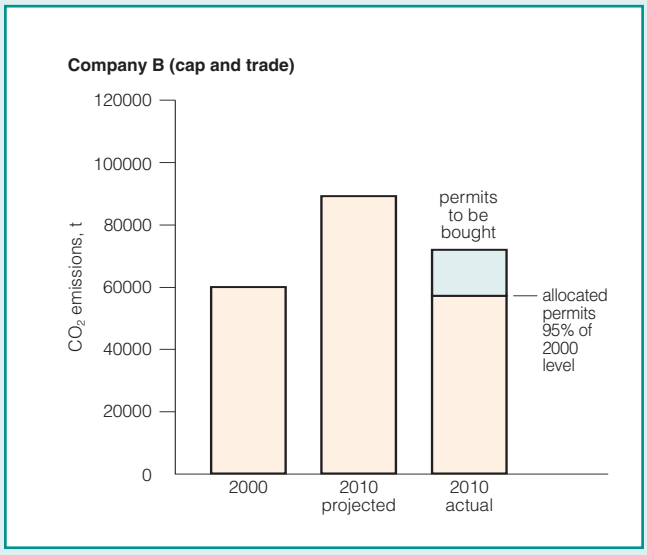
Under a baseline and credit scheme, a regulator offers credits to both companies for introducing efficiencies and reducing emissions 20% below their 2010 projected levels.





Under a cap and trade scheme, the regulator issues permits equivalent to 95% of the 2000 level of emissions. In saving 20% of its emissions, Company A has excess permits equivalent to 15% of its 2000 emissions. In saving one fifth of its emissions compared with its projected 150%, Company B has only to purchase permits equivalent to 25% (relative to 2000) instead of the 55% if no savings had been made.





reliable estimation and attribution of these emissions can be expensive. While it might be economic to include leakage emissions from pipelines and other readily monitored point sources (for example, cement production), in general the inclusion of emissions from industrial, agricultural and waste activities would need to be considered on a case by case basis. The AGO considers another benefit of a trading system is that it offers scope for the voluntary participation of emitters engaged in these activities, and those seeking to earn credits for sequestration activities (for example, through biological, chemical or geological means).

The efficiency and equity considerations of coverage are key issues in policy design. For the purposes of this study of implications for the coal industry, it is assumed that CO_2 emissions from the combustion of coal will be covered under any emissions trading scheme and at some point methane emissions from underground coal mining will also be

included. It is assumed that monitoring of lower level methane emissions from opencast coal mining would not be technically feasible and would be of limited value because there are limited abatement options.

2.4 Market features

As well as those who are required to hold allowances for their emissions, there are other potential emissions trading participants who may choose to enter the market. An important design principle for the market's efficient operation is that allowances should be freely transferable and able to be held by anyone (NZMFE, 1998). Investors could acquire allowances in the belief that they will appreciate in value over time. Environmental groups could purchase allowances and 'retire' them to prevent the equivalent amount of greenhouse gases being emitted. Most importantly, brokers can facilitate the market by bringing together buyers and sellers who may not want to undertake the actual trading operation (as with the share market). Brokers would accept the risk of buying, holding and selling allowances, which some companies may be reluctant to do.

As for other traded commodities, the integrity of the market would require that some basic rules are adhered to in relation to contracting, settlement, credit risk and insurance (NZMFE, 1998). There is currently some debate in various countries as to whether allowances will be treated by financial regulatory authorities as commodities or financial instruments (with more rigorous requirements).

Forward markets play an important role in price discovery, since they provide an indication of the future value of the commodity and its future availability. They also allow investors to hedge against the risk associated with allowance price variability.

A concern that is bound to arise is that speculative and/or strategic trading could reduce the liquidity of the market. However, such behaviour would simply mean that other investors value allowances more than those obliged to hold them for offsetting emissions. The degree and duration of this behaviour would depend on a number of factors including the rate of interest and a risk premium associated with the price volatility of allowances compared with other investments. Any instances of anti-competitive behaviour would be dealt with under existing commercial law (NZMFE, 1998).

2.5 Definitions

Many of these definitions are related to the EU Emissions Trading Scheme discussed in Chapter 4. They are likely to be illustrative of concepts included in any other scheme involving a group of countries. It is assumed in these definitions that governments of these countries are organising the scheme. Other schemes may operate on a voluntary basis initiated by individual companies or organisations.

2.5.1 Emission reductions and permits

The brokerage firm Natsource makes a useful distinction between emission reductions and permits (allowances or credits), although the terms are sometimes used interchangeably (Cogen and others, 2003). Emission reductions refer to a quantifiable change in emissions resulting from a specific activity not required by existing law or regulation and which may be usable against future compliance requirements. Emission reductions carry only the possibility, but not a guarantee of future government recognition as a permit that can be utilised for compliance with an emissions limitation.

Emission permits represent a legal authorisation from a government or international authority to emit a given amount within a legally established emission trading framework, or an instrument that can be used by a regulated entity to demonstrate

compliance with a binding emissions limitation. In cap and trade programmes, emission permits are often known as 'allowances'. Project based permits are often called 'credits'.

2.5.2 National allowance allocation plans

The main objective of national allowance allocation plans is to ensure the group of countries meets its emission reduction target in a fair manner that does not significantly affect international competitiveness. Each government is likely to be given control of the way it issues its allowances in its national allocation plan provided that there is sufficient consistency among different governments' plans to achieve this objective.

2.5.3 Free allocation or by auction

Governments can allocate allowances for free ('grandparenting' or 'grandfathering', usually based on historical emissions) and/or by auction. To achieve consistency among different countries' allocation, there may be limits placed on the proportion of allowances that are to be auctioned. Different countries may choose to use an early base year (such as 1990) for free allocation to reward early abatement action or a later year (such as 2000) to allow for expanded output. For a new entrant or where there has been substantial growth in output since the base year, a free allocation might be based on an emissions rate (that is, per unit output).

The boxed example shows how the choice of a free allocation baseline using absolute emissions or using emission rate (sometimes called an updating approach) might impact on a hypothetical steel producer.

An absolute emissions baseline would mean that if production is higher than the base year, allowances must be purchased (unless the abatement level exceeds the output

increase). In contrast, if production is lower than the base year, the steel producer receives windfall allowances as well as abatement allowances.

An emission rate baseline would provide approximately the same abatement incentive whether output was higher or lower than the base year. The advantage to the regulatory authority would be that industrial expansion is not penalised. The disadvantage would be that the environmental outcome is not as certain as with an absolute emissions cap.

There would also be administrative differences in that an absolute emissions allocation is known in advance of the compliance period while an emission rate allocation could not be verified until after the end of each year's emissions.

In July 2003, Natsource released two discussion papers on 'rate based' or 'emissions intensity' trading programmes (Natsource, 2003). The Canadian Government is currently developing a rate based greenhouse gas emissions trading scheme and in February 2003 President Bush announced a US greenhouse gas emissions target expressed in emissions intensity terms. The first discussion paper examines the key features of rate based trading programmes and evaluates the performance of several past and existing trading programmes. The second paper consists of an in-depth analysis of design approaches that may help to maximise permit market liquidity in rate based trading programmes. Low permit market liquidity in some past and existing rate based trading programmes has resulted in a loss of potential environmental and economic benefits.

Free allocation baseline comparison for absolute emissions and emission rate

This is an example to illustrate how a CO_2 emissions trading baseline choice would impact on the free allowance allocation for a hypothetical steel producer. It is proposed that the regulatory authority chose for all installations a base year of 1995 as the historical emissions level for the allocation of allowances. This was seen as a compromise between those industries who argued for a 1990 base year to recognise early abatement action and those who argued for a 2000 base year because their industries had expanded output significantly since 1990.
It is proposed that in 1995 the steel plant emitted 2.5 $MtCO_2$ in producing 1 Mt of steel. Currently, cost effective abatement measures have led to a 5% reduction in emissions per tonne of steel.

Absolute emissions baseline
If the regulatory authority chose to allocate on the basis of the 1995 absolute emissions baseline, the steel producer would receive an annual allowance of 2.5 $MtCO_2$ regardless of current output.
If the plant's output is currently 10% higher than 1995, the producer would emit 2,500,000 x 1.10 x 0.95 = 2,612,500 tCO_2, requiring 112,500 allowances to be purchased (fewer than would have been needed without the abatement).
If the plant's output is currently 10% lower than 1995, the producer would emit 2,500,000 x 0.90 x 0.95 = 2,137,500 tCO_2, freeing up 362,500 allowances to be banked for future compliance or sold to other emitters.

Emissions rate baseline
If the regulatory authority chose to allocate on the basis of the 1995 emissions rate baseline, the steel producer would receive an annual allowance of 2.50 tCO_2 for every tonne of current output.
If the plant's output is currently 10% higher than 1995, the producer would emit 2.50 x 0.95 x 1,100,000 = 2,612,500 tCO_2 and receive 2.50 x 1,100,000 = 2,750,000 allowances freeing up 137,500 allowances.
If the plant's output is currently 10% lower than 1995, the producer would emit 2.50 x 0.95 x 900,000 = 2,137,500 tCO_2, and receive 2.50 x 900,000 = 2,250,000 allowances freeing up 112,500 allowances.

2.5.4 Opting out

If the emissions trading scheme is mandatory for ranges of installations, the group of countries may agree that governments can choose to 'opt out' individual installations or industry sectors if it can be demonstrated that they are subject to measures equivalent to the impact of the scheme. International competitiveness issues might arise if this provision was not applied consistently in different countries.

2.5.5 Opting in

An emissions trading scheme may operate on a voluntary basis, particularly in a pilot phase. In that case, individual installations or industry sectors may choose to 'opt in' to the scheme.

2.5.6 Trading periods

A trading period would be set to create certainty about the rules to be used for the scheme over that period. Typically, the period might be set as 2008-12 to coincide with the first Kyoto compliance period, although a pre-Kyoto period might also be set as in the EU case of 2005-07. The trading period should not be confused with the individual trading years for which emissions have to be balanced with allowances. The length of the trading period may be relevant if limits are placed on the ability to carry forward excess allowances to the next period.

2.5.7 Liability

An allowance buyer needs certainty that an allowance of a particular type and from a particular country will be recognised as complying with the trading system. The liability issue determines whether the buyer should have full exposure to the risk of traded allowances being non-complying ('buyer beware') or the seller carrying the full

risk ('seller beware') or the risk is shared. Within the Kyoto Protocol, if a country is found to be non-complying in 2013 (that is, has oversold its Assigned Amount Units), buyers of those units might have their value reduced in proportion with the degree of non-compliance. Verified Emission Reductions (from a baseline and credit scheme) or 'green credits' (certificates for planted forest sinks) may not be recognised within a particular cap and trade scheme because of difficulties in managing the cap and the risk of undercutting the value of allowances.

2.5.8 Compliance and penalties

For voluntary schemes, compliance would rely on the goodwill of participants and the risk of public exposure, assuming that the process was transparent. For mandatory schemes, it is reasonable to expect the regulatory authority would allow a grace period of a few months after the end of the reporting year for verification of actual emissions and acquiring the equivalent quantity of allowances. To ensure the integrity of the scheme, the enforcement of penalties would be expected for various aspects of its operation. For instance, as well as penalties for insufficient allowances, penalties would be imposed for failure to report emissions or maintain adequate monitoring systems (NZMFE, 1998). The form of the shortfall penalty could be a fine several times the allowance price and in addition, non-complying emissions could be deducted from the next period's allocation. The form of penalty for inadequate monitoring data could be to assume that the plant was operating at its theoretical maximum output level (NZMFE, 1998).

2.5.9 Banking

Allowances not used in the trading period for which they are issued may be banked for use in a later trading period. Restrictions may be placed on the number of allowances that may be banked from one period to another because of the difficulty in managing the emissions cap for the second period. However, the only way an allowance can be banked is if an emission reduction is made in the first period, so the issue is simply one of timing rather than certainty of the environmental outcome.

2.5.10 Transaction costs

In establishing an emissions trading scheme, the regulatory body will have an important role to help potential participants decide if the transaction costs of emissions trading will be cost effective for their operations (assuming there is an opt-out alternative such as an emissions tax). An important aspect of this would be informing participants on the significance of any free allocation as the basis of their historical emissions.

Unlike the costly monitoring requirements for sulphur or nitrogen oxides emissions trading, CO_2 (and some other greenhouse gas) emissions are relatively easily calculated from fuel inputs and other process information. Thus, monitoring and verification is affordable for small to medium scale plants. Many of the owners of such plants are likely to avoid the complexities of allowance trading by employing brokers to handle the contractual and risk issues.

In terms of the system costs, the assessment of compliance is inherently a government function while a trading registry could be operated by an accredited third party. Some of the administration functions of a trading scheme could be made contestable to provide ongoing incentives to reduce administration costs.

2.5.11 Verification issues

A number of international organisations are developing guidelines or standards for reporting and verifying greenhouse gas emissions. The Greenhouse Gas Protocol (WBCSD/WRI, 2003) and the Global Reporting Initiative are frequently used for corporate greenhouse gas reporting and the International Standards Organisation is currently developing standards for this purpose. A 'Verifiers Guidance' publication has been issued by the UK Emission Trading Scheme for the purpose of rigorously verifying emission reductions in order to receive incentive payments.

The independent verification report on BP's 2002 emissions demonstrates the difficulties in achieving consistent reporting as best practice and principles have emerged (BP, 2003). The report noted environmental data are subject to inherent limitations given both their nature and the methods used for determining such data. 'Greenhouse gas emissions data for the years 1990, 1998 and 1999, as reported on the BP website, have not been prepared on the basis of BP's Environmental Performance Group Reporting Guidelines, dated 26 June 2000 and are therefore not directly comparable to the data reported for 2000 and 2001. 2002 data are also reported in accordance with the addendum (dated 5 December 2002), which provides additional guidance on reporting greenhouse gas emissions from non-operated properties and greenhouse gas emissions from sources based on ownership.'

The reporting process involved:

- visiting selected sites to test BP's greenhouse gas data management systems and the associated data reliability (completeness, accuracy and consistency);
- conducting desk-top reviews of 2002 greenhouse gas data for other selected sites, based on an understanding of these sites' current year business activities, independent environmental certification processes, the quality of their greenhouse gas data management systems (as documented in a self-assessment questionnaire), results of internal audit processes and the status of prior year greenhouse gas audit findings;
- performing a high level desk-top review of greenhouse gas emission data reported by all BP sites;
- correlating findings from the site audits and reviews with the auditors' knowledge of the industry;
- testing the integrity and accuracy of the central level greenhouse gas emission data aggregation process.

BP commented that the audit opinion is based on its direct

equity emissions only and demonstrates the progress towards its greenhouse gas target. Reported indirect emissions, those associated with imported electricity and steam, make up around 11% of the total 2002 group greenhouse gas inventory. BP regards the reporting of all associated greenhouse gas emissions as vital and continues to report against its Group Reporting Protocol.

3 Emissions trading schemes in operation

A number of emissions trading schemes (such as the sulphur dioxide one in the United States) have been operating for many years. Together with the more recent pilot greenhouse gas emissions trading schemes, they provide some useful lessons in relation to the future of emissions trading.

3.1 US SO_2 allowance trading

The US sulphur dioxide (SO_2) allowance trading system was introduced in 1995 to reduce acid rain. The introduction of this cap and trade programme had the objective of capping total SO_2 emissions from electric utilities at around 9 Mt by 2010, representing less than half their total emissions in 1980 (UNEP/UNCTAD, 2002). The US Environmental Protection Agency (USEPA, 2004) established a trading system with legally binding emission limits for individual utilities, continuous monitoring of emissions and high penalties for non-compliance. The result was to stimulate industry into finding innovative and cost effective ways of reducing emissions. The system is claimed to have low transaction costs for participants once the expensive monitoring systems were installed and low administration costs for government.

The second phase from 2000 includes more than 2500 electricity generating units with an output capacity of 25 MW or more that use fossil fuels with a sulphur content exceeding 0.05%. In this phase, free allowances are allocated based on the actual SO_2 emission rate from 1985 to 1987 up to a rate of 0.52 kg SO_2 per gigajoule input. For the standard tonne of coal equivalent (29.3 gigajoules per tonne) this is equivalent to a 0.8% sulphur level, assuming about 97% is emitted. This emission rate is multiplied by the average energy input over the same period and there are a number of special provisions in addition to this basic formula.

Sources built after 1995 receive no allowances and must purchase their requirements from existing sources. In contrast, those operating in 1990 continue to receive allowances even if they cease to operate. Allowances can be banked for future years. To ensure that local ambient air quality is protected, emissions must not exceed local restrictions even if a source operator holds an excess of allowances.

Table 1 is a useful summary of the trading activity from 1995 to 2001 (UNEP/UNCTAD, 2002). Actual emissions were well below the allowance allocation during each year of the first phase. The banked allowances are being used for compliance during the second phase. Full compliance was achieved from 1995 to 1999 and there was a tiny amount of non-compliance (less than one thousandth of a per cent) during an electricity crisis period in 2000 and 2001.

Allowance prices have been lower than predicted when the system was being established. The most common means of achieving compliance has been the switch to lower sulphur coal (but higher ash and higher moisture) from the western USA. Eastern USA power plants have generally required modifications to the boiler, coal handling systems and particulate controls to burn this coal, costing 50-75 US$/kW. Rail transport deregulation also contributed to lower freight rates to make the fuel switch a competitive compliance option. Emissions trading is also credited with the achievement of a significant reduction in the capital cost of SO_2 scrubbers from 249 US$/kW in 1995 to about 100 US$/kW in 2000 while also improving their performance.

Table 1 SO_2 allowance trading programme activity*

Year	Number of participants	Allowances allocated (million)	Actual emissions by participants (million tons)	Actual emissions by all sources† (million tons)	Allowances banked‡ (million)	Allowances traded§ (million)	Price range ($/ton)¶
1995	431	8.74	5.30	11.87	3.44	1.92	108–138
1995	445	8.30	5.44	12.51	6.30	4.41	68–95
1997	423	7.15	5.48	12.98	7.96	7.9	87–114
1998	408	6.95	5.29	13.13	9.63	9.5	98–198
1999	398	6.99	4.95	12.45	11.62	6.2	153–214
2000	2262	9.97	11.20	11.20	10.38	12.7	126–155
2001	2792	9.55	10.63	10.63	9.30	12.6	150–214

* Annual compliance reports for 1995 through 2001 compiled for UNEP/UNCTAD (2002)
† Emissions by sources participating in the programme in 2000
‡ Allowances banked at the end of the year
§ Allowances traded between unrelated parties. The allowances traded may be for the current year or any future year. Allowances may be traded several times during a year
¶ Price range is determined from monthly market prices and the clearing price for the annual auction. A chart of more recent prices may be viewed at the USEPA website (USEPA, 2004)

The cost of using SO_2 allowance emission trading is estimated to be approximately US$1 billion (45%) less than equivalent, efficient regulations (UNEP/UNCTAD, 2002).

3.2 Company schemes

3.2.1 BP

BP piloted its own greenhouse gas emissions trading system in 1999 and operated it across the whole company in 2000 and 2001. The emissions trading scheme was based on a cap and trade system in which each of the approximately 150 base units set an emissions target and was given an allocation of allowances which permitted the unit to emit greenhouse gases. Each unit was required to match its annual allowance with its actual emissions by buying allowances or selling any excess. BP set an overall annual group cap that moved it towards its 2010 target of reducing emissions to 10% below the 1990 baseline. Allowances were allocated for free based on each unit's 1998 emissions of CO_2 and methane emissions. Each tonne of methane emissions converted to 21 tCO_2-e for trading (using the Kyoto Protocol conversion factor). Individual business unit leaders were responsible for meeting their targets on an annual basis and greenhouse gas performance was reported in the financial performance indicators of the company. In the first year of the scheme, 2.7 $MtCO_2$-e (million tonnes of CO_2 equivalent) were traded at an average market price of 7.60 US$/t (Green, 2001).

The scheme provided practical experience of trading CO_2 equivalent emissions and helped maintain focus on meeting BP's target. At the beginning of 2002, BP decided to suspend the trading system to make space for the transition to emerging external greenhouse gas trading systems.

In April 2002, BP joined the UK emissions trading scheme and has carried out a number of trades in that market, including the very first trade (Dutton and others, 2003).

All of BP's UK operated oil and gas processing assets (including joint ventures) have been able to participate directly in the scheme, representing a major opportunity for the sector to learn-by-doing, as well as a means of sharing best practice and innovative ideas to help reduce emissions at lowest cost. The intention is that any incentive money received via participation in the scheme will be used to reward emission reduction projects that are implemented over the 2002 to 2006 timeframe.

BP's UK Chemical operations were unable to enter into the scheme's incentive auction as a 'Direct Participant' as they already have a Climate Change Levy Agreement with the UK government. However, they will also participate in the scheme as this will allow them flexibility to meet their obligations in the most cost effective way. The scheme also provides an incentive to try to over-achieve those targets.

BP's UK Refining and Retail operations hope they will be able to participate in the scheme via the 'project entry' route once the rules for project entry have been defined. BP Energy has developed a service designed to support the UK's Emissions Trading Scheme, helping customers lower their emissions by accessing information on the emissions trading market and tracking their own environmental performance against targets.

BP states it will participate in other voluntary external trading systems where it makes good business sense and where real reductions in greenhouse gases can be achieved (BP, 2003).

3.2.2 Shell

Shell has stressed for many years the importance of gaining early experience in emissions trading. Shell and Elsam, the largest electricity producer in Denmark swapped CO_2 emission allowances in 2002 (JIQ, 2002). The deal between Shell and Elsam was the first link between the British and Danish CO_2 emissions trading schemes. Elsam had excess allowances in Denmark that could not be carried forward when the Danish trading scheme was due to end. Elsam effectively converted this excess into UK allowances that are bankable until 2007, and can be sold on the London market. Shell had operations under both the UK and the Danish schemes. The deal was not large in volume, but it showed that CO_2 trades were possible between different national emissions trading schemes. Actual transfer of rights is not allowed between the schemes, but since the companies swapped rights, this was not a problem.

Shell operated a voluntary cap and trade system for CO_2 and methane from 2000 to 2002 as an attempt to reduce Shell's overall emissions by cost effective means. Six business units representing about one third of Shell's total emissions participated but the programme was abandoned because of a lack of success. It was considered that voluntary participation was part of the problem, creating a great excess of supply compared with demand for credits (De Coninck and Van der Linden, 2003).

3.3 Canadian pilot emissions trading

Canadian companies have been interested in emissions trading partly because of the recognition that Canada would have difficulty achieving binding national emissions limitation without the possibility of trading. In the context of the Kyoto Protocol, Canada is expected to be a large net buyer because it is estimated that it will be an annual 240 $MtCO_2$-e short of its target by 2008 (Rosenzweig and others, 2003).

Two pilot credit trading programmes have been operating in Canada - Pilot Emission Reduction Trading (PERT; now CleanAir Canada) trading for nitrogen oxides and volatile organic compounds emissions, and Greenhouse Gas Emission Reduction Trading Pilot (GERT) trading (launched in 1998). These programmes established rules defining tradeable emission reductions and procedures for external review of proposed trades in order to ensure their environmental integrity. GERT is a multi-stakeholder partnership where

participants can register emission reduction projects and trade the carbon offsets. The review was designed to confirm whether the projects' emission reductions satisfy established criteria set out by GERT:

- whether the project resulted in actual emission reductions from a baseline, taking into account effects on emissions elsewhere;
- whether the emission reductions were measurable and verifiable; and
- whether the reductions were over and above what was required by law.

As of mid-2002, the 4 projects traded through the GERT registry at Voluntary Challenge & Registry (VCR) Inc have total lifetime reductions of approximately 325,000 tCO_2-e. There are five other projects registered that have not attracted buyers. Reviewed projects and registered emission reductions will be maintained by VCR Inc. in the future (IETA, 2004).

3.4 Denmark CO_2 quota system

In Denmark, an emissions trading system for electricity generators has been operating since April 2001. The system sets limits on total CO_2 emissions from power production for 2001-03, allocates emissions allowances to eight individual power companies and allows emissions trading and banking. The emissions cap is set at 22 $MtCO_2$ for 2001, declining to 20 $MtCO_2$ for 2003. The sector emissions in 1997 were 28.9 $MtCO_2$. The cap covers emissions by about 500 electricity producers, most of which are very small CHP plants that are not part of the emissions trading programme. The penalty for failing to hold sufficient allowances is about 4.90 US$/$tCO_2$ but this does not apply to 'small' plants (less than 100,000 tCO_2 per year). To avoid disruptions and loss of competitiveness, allowances were allocated free to existing power generating companies, based on the average historical emissions in 1994-98. It is unlikely that new production capacity based on fossil fuels will enter the Danish market in the near future, as capacity is well above 150%.

The Danish scheme differs from the UK-ETS in that it involves only the electricity generators while the UK scheme explicitly excludes electricity generators. Elsam welcomed the prospect of the EU-ETS because it had found the Danish market very inefficient with only one other dominant player (receiving 93% of the allowances between them). It is generally acknowledged that such a small number of participants does not constitute a competitive market. Selling allowances in the same industry sector could be interpreted as providing market share to a competitor (UNEP/UNCTAD, 2002).

3.5 New South Wales, Australia

At the state level interest and activity related to emissions trading has been continuing to grow. From January 2003, NSW electricity retailers must participate in the NSW Electricity Benchmarks Scheme that will be extended to wholesale and direct sale customers. It built on an existing emissions benchmarking programme and requires participants to submit annual emissions accounts for the six greenhouse gases. They can then comply with their regulations by switching to less carbon intensive electricity generation, by reducing the electricity consumption of their customers, or by purchasing carbon sequestration credits (from forests planted in Australia after 1990). The benchmark system requires electricity retailers to reduce their emission rate to 5% below 1990 levels per capita and to maintain this level until 2012, or until reviewed on the basis of population growth. The system will operate with a financial penalty of up to 8.50 US$/$tCO_2$-e (IETA, 2004).

3.6 US examples

3.6.1 Individual states

Although the US federal government has declared that it will not ratify the Kyoto Protocol, individual states in the USA are developing their own policies.

American Electric Power (AEP, the largest US generator) assessed in December 2003 that there had been a significant amount of greenhouse gas emission reduction activity at the federal and state government level as well as under voluntary partnerships (Braine and Francis, 2003). However, greenhouse gas market activity in the US remained relatively quiet, reflecting the lack of mandatory requirements in the US and only the initial phases of voluntary reduction and trading schemes.

The Bush Administration announced the 'Global Climate Change Initiative' in February 2002, proposing to slow the growth of greenhouse gas emissions and fund substantial climate change research to evaluate the need for more aggressive actions.

The initiative's central philosophy is that private industry should be provided with an opportunity to meet voluntary goals with flexible approaches. Only if these goals are not achieved are the concepts of prescribed government mandated targets to be imposed. The 18% greenhouse gas emission reduction goal over 10 years is intensity based, linking emission levels with the nation's economic output. There has been fierce debate over this approach, with opponents stating intensity based, voluntary goals are weak and the claimed environmental improvements depend on assumptions made about the business as usual baseline. Several industry sectors have developed programmes or targets to meet the President's voluntary initiative. Under the 'Electric Power Industry Climate Initiative' a coalition of electricity industry organisations have pledged to reduce CO_2 emissions per kWh 3 to 5% below 2002 levels by 2012 (Braine and Francis, 2003).

AEP stated there have been a number of notable state legislative actions regarding CO_2 and greenhouse gases. As of December 2003, five states had actually passed legislation mandating emission reductions (California, Maine, Massachusetts, New Hampshire, and Oregon). Another five states were considering some type of mandatory limits

through state legislation or regulatory action (Hawaii, New York, Rhode Island, Vermont and Washington). A further 14 states had some form of greenhouse gas related legislation or proposal, whether it was a voluntary registry, a sequestration programme or merely a study of the issue (Braine and Francis, 2003).

Since 1997, Oregon has required new power plants to meet CO_2 emissions standards by contributing to the Climate Trust established by Oregon to implement CO_2 offset projects. The standards are set 17% below the most efficient base load gas plant currently operating in the US. In 2002, the compliance costs were 0.85 US$/t$CO_2$. The offsets purchased through the Climate Trust may be used in future greenhouse gas regulatory or trading systems (IETA, 2004).

In 2001, Massachusetts enacted legislation setting emissions standards for power plants. In 2005, participants will be capped at their historical 1997-99 CO_2 emissions and later emissions standards will be set at a level corresponding to a 10% reduction per kilowatt-hour. In addition, new power plants with a capacity of 100 MW are required to offset 1% of the facility's CO_2 emissions and this offset requirement can be met by contributions to CO_2 mitigation programmes of 1.50 US$/t$CO_2$ (IETA, 2004).

In April 2002, New Hampshire enacted legislation aiming to reduce CO_2 emissions from the state's three fossil fuel power plants by 7% below 1990 levels from 2006. Caps are also placed on SO_2 (75% reduction), NOx (70%) and mercury (75%). The legislation allows the power plants to buy credits from other companies outside New Hampshire to meet their obligations (IETA, 2004).

In October 2002, the California Climate Action Registry was established by the state government as a private, non-profit voluntary registry for US-wide greenhouse gas emissions. It was intended to help companies and organisations measure their greenhouse gas emissions and establish baselines against which any future emissions reduction requirements may be applied.

In 2001, the governors of six northeast states and five eastern Canadian provinces committed to cut CO_2 emissions to 1990 levels by the year 2010 and 10% below that by 2020. However, a non-government organisation coalition report in 2003 claimed that the group is on track to achieve only one-third of its target. In September 2003, state leaders from the 10 state 'Northeast Governors Climate Action Plan' began meeting to establish an implementation agreement by April 2005 on a regional cap and trade emissions trading programme. The initial goals are to reduce CO_2 emissions from power plants to 5% below 1990 levels by the year 2010, and 10% below by the year 2020. They hope to develop protocols that allow international trading (Braine and Francis, 2003).

3.6.2 Chicago climate exchange

In December 2003, American Electric Power described the Chicago Climate Exchange (CCX) as the first US voluntary pilot programme for trading emission reductions in all six greenhouse gases. It is a self-governing, peer reviewed organisation with 21 member companies including Ford, IBM, International Paper, Motorola, Waste Management and AEP, representing about 5% of US CO_2 emissions. These companies have committed to reduce their greenhouse gas emissions by 1% below their average 1998 to 2001 baseline during 2003, increasing steadily to a 4% reduction in 2006. They will be allowed to trade emissions allowances to help them meet their targets, including investing in 'emissions offsets' generated by agriculture, landfill, reforestation and other sequestration projects. The CCX conducted its first 'price discovery' auction at the end of September with 100,000 allowances selling for approximately 1 US$/t$CO_2$ (Sandor, 2003).

In April 2004, CCX and the International Petroleum Exchange (IPE), the London-based energy futures and options exchange, announced they will work together to provide a marketplace for EU emissions trading. As part of the agreement, CCX will grant IPE a licence to list and market its EU products on IPE's electronic trading

platform. They intend to offer future contracts as well as cash products, and aim to have the system running by the end of 2004. IPE stated it chose the CCX as its partner because of its expertise in emissions trading. When coupled with the IPE's exchange infrastructure and broad customer base, IPE considered the combination would help to build liquidity in the emerging EU allowance market. Other organisations have announced plans to set up emissions trading exchanges, but the timeline for the CCX/IPE development is considered fairly ambitious and should put them slightly ahead of other proposals (Point Carbon, 2004d).

3.7 UK emissions trading scheme

In April 2002 the UK government set up a voluntary pilot emissions trading scheme (UK-ETS) that covers a broad range of sectors. The UK Department for Environment, Food and Rural Affairs (DEFRA, 2003a) has described the objectives of the scheme:

- to achieve a significant amount of absolute emission reductions at a reasonable cost;
- to enable business to gain practical experience of emissions trading ahead of a European and international system; and
- to help the City of London establish itself as a global centre for emissions trading.

There are several types of participant in the UK-ETS:

1. The UK government provided a financial incentive for organisations that agreed to take on voluntary targets. These Direct Participants (DPs) are required on a cap and trade basis to make absolute annual reductions in emissions against a 1998-2000 baseline in each of the five years of the scheme 2002-06.

2. CCA Participants (CCAPs) are companies that already have emission or energy targets set through Climate

Change Agreements. Companies meeting their targets receive an 80% discount from the Climate Change Levy, a tax on the business use of energy. They are able to use the trading scheme either to help meet their target or to sell any over-achievement. Targets refer to a 12 month target period one year in every two. Many of these targets are relative i.e. related to output rather than absolute emissions or energy use. A gateway controls the flow of allowances from this sector into the rest of the trading scheme.

3. Anyone is free to enter the market and trade allowances on a speculative basis.

4. It is intended to include companies that enter specific emissions reduction projects under rules developed by the Department of Trade and Industry.

There are different types of transfers that occur within the registered accounts of the various UK-ETS participants:

- an allocation will not have a seller attached to it. The 'buyer' organisation receives allowances following baseline or annual verification in the case of DPs and following the verification of any over-achievement in the case of CCAPs;
- a cancellation occurs when an organisation in possession of allowances wishes to cancel them, meaning that they can no longer be used for compliance purposes within the scheme;
- a retirement occurs when DEFRA retire allowances against a participant's obligation, as either a DP or CCAP, to surrender allowances equal to their emissions (DPs) or the difference between emissions and target (CCAPs);
- the vast majority of transfers will be from one organisation account to another. However, a transfer should not be confused with a trade. Transfers will include the transfer of allowances between different types of accounts within the same organisation (for example trading accounts, compliance accounts). They will also include any intra-company transfers (for example a parent company transferring to its subsidiaries). It is not necessarily the case therefore that where allowances have been transferred and a transaction recorded on the registry that any money has changed hands in a trade concluded for immediate delivery.

The potential complexities in handling allowances are illustrated in this example from the UK-ETS registry. 'It should be noted that allowances exist as blocks specified by a start and an end serial number. So a single transfer request may have more than entry on the transaction log. The smallest block possible is 1 allowance, and in this instance the start and end serial numbers are the same. When a request is made to transfer allowances in the registry, allowance blocks are selected on a last in first out basis. Where the number of allowances requested is smaller than the size of the next available block of allowances in the account the block is split. This splitting process can not be reversed. For example account A (total balance 100) contains 100 allowances numbered 1-100, a request to transfer 20 allowances to account B results in a split creating 2 blocks, 1–80 and 81–100, the latter is transferred to account B. If these allowances are then transferred back into account A, account A will hold 2 blocks, 1–80 and 81–100, with a total balance of 100. Every block that is transferred is treated by the registry as a single action, so that a transfer involving 3 allowance blocks will show 3 consecutive entries on the transaction log. These blocks can be identified because the time and date associated with each action will be the same.

3.7.1 Assessing the UK-ETS

As one of the companies actively involved in all aspects of the UK-ETS, BP considers all participants have an incentive to innovate and invest in reducing the cost of complying with the targets (BP, 2003). A company which reduces its costs relative to the costs of other traders in the system should be able to make a profit from trading.

An auction for entry of Direct Participants into the UK-ETS took place in March 2002 resulting in 34 auction winners. The auction cleared at a price of about £53. In March 2002, £1 = US$1.57, which is the price the UK Government will pay per tonne of additional emission reductions delivered. Fullfilment of these targets will result in an additional 4 $MtCO_2$-e reductions by 2006. This is approximately a 12% average emission reduction from organisations' baselines (DEFRA, 2003a). Allowing for tax and the fact that participants' targets increase steadily over five years, the auction price equated to a market price of about 12–15 £/tCO_2 equivalent (Blyth, 2002).

Shell Environmental Products Trading Business has calculated (Campbell-Colquhoun, 2003) a price of 18 £/tCO_2-e but noted a number of reasons why this was not a good indicator of the marginal abatement cost for the Direct Participants. Since the UK-ETS was the first scheme of its kind, companies had limited experience in terms of managing a compliance position and were unwilling to take on targets with an associated risk of non-compliance. Companies therefore generally offered conservative volumes that could be comfortably be achieved. In some cases the necessary reductions had been achieved before the start of the scheme. Overall, Direct Participants were considered to have little incentive to trade if the target had already been met. This meant that the incentive payment was not a good reflection of the predicted market price.

In reviewing its experience with the UK-ETS, Shell concluded it was an ambitious piece of legislation which has allowed UK companies to gain experience and understand the business processes necessary for managing a position within an emissions trading scheme (Campbell-Colquhoun, 2003). The complexity of the scheme has resulted in a large administrative burden on the UK Government for establishing how the UK-ETS will run in parallel with the EU-ETS. The UK-ETS can be classed as a success in that it did encourage a large amount of trading activity. From a design standpoint, Shell considered the UK learned that cap and trade systems allow efficient management of compliance positions, whereas baseline and credit systems encourage concentrated periods of activity with no degree of constant liquidity on both the buy and the sell side. This can significantly affect the price, making compliance management more difficult.

In May 2003, DEFRA published the results of the UK-ETS, claiming they confirmed it had been a very successful first year as companies began to make use of the flexibility of trading to meet their targets and make cost effective emission reductions (DEFRA, 2003a). It was also stated that UK business had gained valuable experience of trading in environmental markets, using specialist brokers, an online Registry, and undergoing verification and compliance procedures. 866 out of around 5000 companies with Climate Change Agreements entered into the UK-ETS either to buy allowances to meet their target, or to sell any over-achievement. 31 out of 32 Direct Participants were in compliance and had met their emission reduction target while 35 non-target holders such as brokers had bought or sold on the market. A total of nearly 32 million allowances had been allocated to companies, 7.2 million of which had been transferred over the first year in about 2000 individual transactions.

3.7.2 Windfall incentives controversy

In June 2003 the National Audit Office confirmed that it would investigate the UK-ETS over allegations of windfall incentives. The investigation was likely to focus on whether the £215 million incentive payments offered to 34 direct participants represented good value for money. When the UK-ETS was launched, environmental groups and others pointed out that nearly half of the cash would go to three chemical companies which had already met their eventual emission reduction targets because of regulatory requirements. Targets for many other participants appeared to offer little more than business as usual operation. Such windfall gains resulting from the incentives system (sometimes termed 'hot air') had arguably badly damaged environmental effectiveness and market integrity (ENDS, 2003a).

The Environment Secretary responded to this criticism in April 2002 by arguing that the scheme had not paid for emissions reductions that were required by regulation anyway. The chemical companies that had regulatory requirements had their baseline emissions adjusted to prevent them receiving any benefit from that legal requirement. As a result, Ineos Fluor's baseline was 25% below the legal emissions limit set by the Environment Agency, and DuPont's baseline was 45% below. All emissions reductions from these baselines were additional to those required by regulation. An 11% overall projected reduction from incentive funded companies' provisional baselines suggested more than business as usual. Another argument given was that the UK scheme, like all emissions trading schemes, would provide some credit for early action to reduce emissions, represented by the Government's choice of an average baseline covering 1998-2000. The choice of a three year period meant companies were not given a baseline which was potentially unrepresentative of usual business, reducing the possibility of random windfalls (ENDS, 2002a).

The ENDS Report answered these arguments with some detailed analysis to back its criticism (ENDS, 2002a). DEFRA's claimed reduction of 4 $MtCO_2$-e was inappropriate and misconceived and may promote misplaced complacency over the UK's progress towards its target. British Airways offered a particularly vivid illustration of this problem because its emissions were likely to have fallen significantly below its baseline already because it had lost market share to the 'no frills' airlines. Conversely, these airlines could be expected to have a rising emissions profile and understandably chose not to enter the scheme and take on binding emission caps.

Analysis of Ineos Fluor's baseline demonstrated that this company had benefited from a very generous baseline decision on one hydrofluorocarbon gas and the normal regulatory practice to allow a degree of headroom between emission limits and an abatement plant's technical capability to allow for normal fluctuations in performance, especially for new abatement plant. Also, the impact of all this was magnified by the Government's late decision to abandon the intention of prohibiting any particular direct participant from claiming more than 10% of the incentive money, substituting a 20% rule instead.

The ENDS Report argued that another consequence of the inflated baselines awarded to the three chemical companies was to exclude some companies and sources from participation in the scheme, since they were unable to offer as low a price in the auction as those three firms. It was concluded that the dented environmental credibility for the UK-ETS would have important consequences: industry's arguments that trading is more effective than taxation and regulation in reducing emissions was severely damaged and the Government would have difficulties persuading the European Commission that the EU-ETS should be voluntary and include greenhouse gases other than CO_2 (ENDS, 2002a).

In its March 2004 report, the National Audit Office (NAO) praised the UK-ETS as a 'pioneering initiative with significant achievements'. The ENDS Report considered the NAO was not sufficiently critical on crucial issues such as over-allocation to key participants, the interface with pollution control regulations and the difficulty of meshing the scheme with the EU-ETS framework (ENDS, 2004c). ENDS concluded that at least half (and possibly much more) of the claimed emission reductions were either not real, or would have been delivered anyway. The NAO considered that some reductions were likely to have happened without the scheme but most of the reductions were generated by the scheme. The NAO 'meekly' accepted DEFRA's claim that it felt unable to set more demanding baselines because of the need for 'even-handed application of general principles', and to allow some credit for early action. The NAO did not consult with ENDS during the study but it did interview DEFRA officials, direct participants, members of the industry-led UK Emissions Trading Group, the European Commission, sector trade associations, brokers, verifiers and consultants. ENDS argued that none of these groups could be said to have an interest in drawing attention to the scheme's shortcomings.

3.7.3 Verification controversy

In July 2002, the UK Government was hoping to minimise

the costs of verifying emissions data for climate change agreement participants (CCAPs) to help ensure widespread participation in the UK-ETS. Verifiers expressed alarm at what they perceived as a proposed lowering of standards and also warned that they might face unmanageable workloads around December at the end of the compliance period (ENDS, 2002b). About 6000 companies, with more than 10,000 sites, took on energy saving targets under CCAs in return for an 80% discount on the climate change levy. The targets were adopted under negotiated agreements with 45 sectoral trade associations. Before a CCAP could sell credits, or bank them for use in future years, it was required to have its emissions and production data verified.

The Environment Department (DEFRA) issued rules for CCAPs to convert over-achievement into emission credits using one of three models:

- Model 1 had individual companies take full responsibility for meeting their own targets while the sector association's responsibility was limited to reporting overall performance against the sector target;
- Model 2 had all trading being carried out by the sector association, with over-achievement by individual companies being used to ensure sectoral compliance;
- Model 3 gave the sector association the right of first refusal, and individual companies could trade on the market only once the sector had achieved compliance.

Only a few sectors, most notably the glass industry and the Paper Federation, appeared to follow Model 2 because it raised difficult questions of liability and legal status for trade associations, and also many companies were not keen on giving up the right to sell emission credits in order to bail out their competitors. The vast majority of sectors chose Model 1 in order for individual companies to 'ring-fence' their credits from the rest of the sector, even though this approach would require reliable, verified data for each company and could increase verification costs significantly. Many CCAPs would have relatively few credits for sale, so verification costs could be a major barrier to entry (ENDS, 2002b).

With the Government keen to ensure widespread participation and liquidity in the UK-ETS, a 'group verification' process was proposed in draft guidance to verifiers by the Government's UK Accreditation Service. UKAS believed that a single verification process could be carried out for a group of similar companies, potentially covering an entire sector. In most sectors, most sites would be 'simple' in that they import all their energy. UKAS said that in these cases verifiers should rely largely on utility bills and data from the trade association backed up by site visits to only 5% to 10% of the sites in the group. For more complex sites, UKAS suggested that the sampling rate could be increased to 33% or more. Verification fees for a typical medium sized company were likely to be £3000–5000 but group verification could reduce fees by up to 75% (ENDS, 2002b).

Some verifiers were extremely concerned because a 5% sampling rate would not allow them to justify their legal liability. One auditor stated that where greenhouse gases became an asset or liability, auditing was more crucial than verifying an environmental report – financial auditors would not sign off a company's books without visiting the company. Another said that even if a verifier was prepared to accept a low sampling rate, the value of the auditing would be questionable because it could only state that the overall group figure is free of material misstatement (ENDS, 2002b). One of the verifying agencies pointed to the likelihood of bottlenecks because there are so few verifiers. With the episodic, two yearly peak in CCA verification work, it was difficult for auditors to recruit dedicated teams.

A programme of random site audits was carried out for DEFRA around April 2002 and the Department was said to be disappointed about the standards of data collection after a number of data errors were identified. They were also concerned that many companies did not have adequate data checking procedures in place and a good audit trail (ENDS, 2002b).

4 Developments in emissions trading schemes

4.1 Nitrogen oxides and mercury emissions trading

An IEA Clean Coal Centre report summarising trends in emission standards notes that emissions trading systems have been under discussion for other air pollutants in some countries (Sloss, 2003). In 2002 the UK Environment Agency was considering a SO_2 and NOx trading system for all large combustion plants, including refineries, the iron and steel industry, large industrial boilers and power stations. The trading scheme would fit in with the UK's national plan to comply with EU requirements. Emission limits would be retained to prevent adverse environmental effects.

In the US, the Bush administration has proposed the establishment of a 'flexible, market based programme to significantly reduce sulphur dioxide, nitrogen oxides and mercury from electric power generators.' However, trading in mercury pollution allowances might be prohibited if a multi-pollutant scheme enabled a plant to pollute at a level that damages public health or the environment. A regulatory approach that allowed mercury trading under a cap on total mercury emissions would minimise costs by exempting low emission plants from further control while targeting high emission plants and low unit control costs. A major potential drawback would be the controversial issue of trading an air toxic substance. A trading approach would mean that certain sources would not be required to fit any controls (Sloss, 2003).

NOx trading systems are more advanced. The USEPA has asked 21 states to submit plans on how they intend addressing summertime NOx pollution based on a cap and trade system proposed by the agency. The scheme would apply to emissions over the months of May to September and proposes an overall cap at 75% of the 1995 baseline level (Sloss, 2003). NOx trading is already under way for utilities in 8 northeastern states and prices fell sharply from an initial 8000 US$/ton in May 2003 to 2700 US$/ton in August 2003. The USEPA had originally predicted prices would range from 2000 to 3000 US$/ton (Biello, 2003). A NOx emissions trading system is also being implemented in the Netherlands in 2004.

4.2 Australia

In August 2002, the Australian Government announced that it would not ratify the Kyoto Protocol in the current circumstances. However, in the context of a longer term greenhouse strategy, the Government announced that it remained committed to the emissions target that it had accepted as part of the Kyoto Protocol negotiations: to restrict national emission levels to an annual average of 108 per cent of 1990 levels for the period 2008-12.

The Australian Government is engaged in consultation with business and other stakeholders to develop a strategy to meet its greenhouse response objectives, while maintaining a strong and competitive economy. The Australian Greenhouse Office (AGO, 2002) has stated it is not in a position to speculate on the specific design elements of any national emissions trading system, or whether such a system might emerge from further consultation and work in this area. However, the AGO has advised on the issues that need to be considered in determining an optimally designed system, and the pathways likely to lead to efficient design outcomes.

The AGO released in 1999 a series of four discussion papers highlighting issues and design options for a national emissions trading system for greenhouse gases. The possibility that Australia may, in the future, adopt legally binding commitments under the Kyoto Protocol and participate in an internationally established and monitored system of tradeable national emissions quota formed the background to that study.

The AGO stated the overriding objective of the design process for a domestic trading system would be to develop a system that would impose the lowest total cost on all those involved. The cost assessment would take explicit account of the cost of reducing emissions, the cost of demonstrating this outcome and the costs of participating in and administering the scheme. The system design should be aimed at minimising the overall cost of achieving national abatement outcomes, and this could involve trade-offs for individual elements (AGO, 2002).

The key policy issue of permit allocation would have significant equity implications. Allocation options range from auctioning permits (with possibilities for revenue recycling), performance based allocation arrangements, to a free once-and-for-all allocation of permits. Within each of these options there would be scope to develop allocation arrangements that support consistent abatement incentives among emitters and reflect the market determined cost of CO_2 in their investment, production and consumption decisions.

The equity issues of permit allocation would arise from its potential to act as a major device for wealth transfer. Because the total permit pool is finite and the permit price reflects a scarcity of emissions within the economy, over-allocating permits to one group necessarily means that there are fewer permits available to provide support for the costs faced by others. For this reason, permit allocation represents a set of decisions about who will be compensated for their exposure to a domestic CO_2 price, and by how much. An allocation of permits without any corresponding obligation could be expected to have little influence on production or pricing decisions.

The AGO concluded that strong equity dimensions of permit allocation indicate the need for extensive consultation with industry and other stakeholders on this issue. Shareholder, employee and consumer interests would need to be independently dealt with in addressing equity concerns. Key business concerns were likely to be:

- likely magnitude of CO_2 costs;
- ability to absorb or pass on costs;
- availability of low cost abatement and adjustment opportunities;
- commercial opportunities and benefits generated by the carbon price; and
- longer term prospects.

The AGO predicted it was likely that a 'tailored' approach to permit allocation, possibly involving a process of intensive analysis and negotiation, could only be adopted for large individual players with a high greenhouse gas exposure and few opportunities to absorb or pass on costs. For less affected entities within the economy, more generic allocation approaches could be considered, including the possibility of a permit auctioning arrangement with revenue recycled through adjustment assistance or tax relief packages. To date, the Australian Government has sought to leave options for permit allocation (and other greenhouse policy design elements) open, but has endorsed 'no disadvantage' as a principle in designing policies that do not detract from incentives for ongoing abatement effort. This is represented in a commitment to '…take great care to avoid greenhouse policies and measures that disadvantage those companies which had moved early in undertaking emission abatement actions, or that discriminate against new entrants' (AGO, 2002).

The Australian Government has also endorsed the notion of 'credit for early action' as an approach to allocating permits in anticipation of a national emissions trading system. This would allow 'credits' to be earned through identified abatement actions, which could later be converted to emission allowances under a trading system.

A significant development in the policy debate was the recent report of the Council of Australian Governments Independent Review of Energy Market Directions, also know as the Parer Review. Among other reforms the Review recommends the establishment of a national emissions trading programme to replace what they see as an uncoordinated and inefficient mix of state and federal greenhouse policies (AETF, 2003).

In September, the secretary of the Department of Environment and Heritage put an end to widespread speculation that Australia might implement a national emissions trading scheme. He stated a move to emissions trading was not needed to achieve Australia's 108% target so that it was not currently under consideration. In July, it is understood that Cabinet discussed the introduction of a trading scheme from 2013. The Prime Minister is believed to have been unconvinced by the environment minister's arguments that industry was prepared to accept an emissions trading scheme (Griffin, 2003).

In November 2003, the New South Wales Premier warned Australia's coal export industry it must embrace greenhouse gas offsets if it wants to do business with Europe and Japan in the future. A large European bank revealed there are two Australian coal suppliers who have been told by European buyers that they should present their coal supply contract with greenhouse offsets (Point Carbon, 2003b).

In December 2003, the state government for Western Australia announced a regional emissions trading scheme as one of the elements of a greenhouse gas emissions reductions plan. It was not prepared for reasons of industrial competitiveness to set targets without federal government support. Victoria and New South Wales have commenced discussions on the potential for a bilateral emissions abatement scheme. A representative of a federal government minister has commented there did not appear to be any advantage in establishing a state based scheme (Point Carbon, 2004c).

4.3 Canada

Voluntary trading activity in Canada has slowed as most companies have focused on the Government's development of a domestic emissions trading system (DET). The scheme would impose emissions intensity targets on 670 large industrial emitters and is considered a key policy in Canada's climate change strategy. Emissions intensity targets define companies' allowable emissions in terms of tCO_2-e per unit of production. The DET is designed to reduce the large industrial emitters group emissions from a business as usual projection of 334 $MtCO_2$-e in 2010 by 55 $MtCO_2$-e or 16%. The Government has also committed not to require additional reductions from this group of industries without providing some form of incentives, and to cap compliance costs at 15 C$/$tCO_2$-e (11 US$/tCO_2-e) (Rosenzweig and others, 2003)

Other key features of the DET are being detailed in five Government 'non-papers', three of which had been released by December 2003. The released papers discuss allocation and credit for early action, a system of domestic offsets and covenants and a legislative 'backstop'. The two papers yet to be released at that stage would discuss measurement and verification and issues to consider in the implementation of a cost cap. Once consultation with industry and other stakeholders is complete, the Government will develop more formal proposals on these subjects (Rosenzweig and others, 2003).

The first non-paper on allocation of greenhouse gas targets and credit for early action was released in April 2003. With respect to competitiveness issues, the non-paper states that it should be addressed at the sector level and not at the company level; it is a financial concept and will reflect a firm's ability to cost effectively purchase compliance instruments in the market as well as make internal reductions; and the Government will consider the normal useful life of facilities in determining competitive impacts. The Government has identified potential qualifying tests for a company to receive credit for early action: its early emission reductions resulted from direct company activities where the investment resulted in a financial disadvantage; the company is a world leader in terms of its emissions intensity and achieved a minimum intensity improvement from 1990 beyond business as usual (Rosenzweig and others, 2003).

The second non-paper outlining the key elements of the domestic offsets system was released in May 2003. This

system would be based on the principles of enhancing market liquidity, being as open as is practical, and contributing to achievement of Canada's Kyoto commitment. Under this approach, any project activity outside of the larger industrial emitters system that conforms to eligibility criteria could create a domestic credit. The Government proposes a three stage process of validation, verification and certification for the creation of offsets credits. Through early projects validation, the Government hopes to facilitate forward transactions of offsets and improve liquidity in offsets trading (Rosenzweig and others, 2003).

The third non-paper on the structure of covenants and their relationship with a legislative 'backstop' was released in August 2003. Such a backstop would consist of a generic regulation that applies to large industrial emitters that do not wish to negotiate a covenant. Under a 'sectoral model with company specific covenants,' sector associations will facilitate negotiation of sectoral emissions intensity targets, which will be activity or process specific and these targets will be applied to each company based on a common formula. Companies would either accept the targets agreed in sector level negotiations or seek to negotiate their own target in a company specific covenant with the Government. It is anticipated that compliance will be assessed annually, and penalties for non-compliance with covenant obligations could be financial in nature. The Government has indicated that it would consider negotiating company specific emissions intensity targets to address issues of capital stock turnover and the timing of breakthrough technology, or to account for early action (Rosenzweig and others, 2003).

Industry trade associations have played a significant role in the DET policy development process, though many individual companies remain active in this process. One key point regarding the design of the DET system that has been emphasised by many corporations is the need to ensure that the system creates a market with adequate liquidity. Liquidity in emissions allowance markets is important because it facilitates achievement of the cost savings that make emissions trading a desirable policy instrument. While companies generally support the emissions intensity based design of the DET system, some commentators have noted that the effectiveness of some such programmes has been limited by low liquidity. Several means of ensuring adequate liquidity have been suggested (Rosenzweig and others, 2003).

Concerned about the US's non-participation in the Kyoto regime and the potential for loss of competitiveness for Alberta's oil sands petroleum, conventional oil and gas and other products, the Alberta provincial government advocated the creation of a long term commitment to achieving greenhouse gas reduction goals rather than signing on to the Kyoto goals. As well, Alberta implemented requirements for new coal fired electricity production to obtain greenhouse gas offsets to make such facilities as emission efficient as natural gas state of the art production facilities. Alberta has threatened to set up its own independent system for dealing with emission reductions and is considering legislation that would require reductions in emissions by 2020 to 50% or less of 1990 levels relative to Alberta's Gross Domestic Product. This is considered an example of the constitutional and legal issues that may be encountered as efforts are made to implement a climate change plan in a federal country like Canada (Rosenzweig and others, 2003).

4.4 Japan

Japan's total greenhouse gas emissions during fiscal 2001 was 1299 $MtCO_2$-e, an increase of 5.2% over 1990 levels. Japan's Kyoto commitment is to reduce emissions to 6% below 1990 levels (Katagiri, 2003). Japan continues to promote voluntary initiatives of businesses as part of its general emission reduction policy. The Japanese government currently stresses the importance of its energy conservation legislation, encouragement of alternative energy sources and the Kyoto Protocol flexible mechanisms to achieve its commitments. Energy security, the delay in building nuclear power plants and highly uncertain economic forecasts are likely to be prominent issues in a 2004 review of climate change policy. Some have urged the government to give policy direction as soon as practicable for promoting business use of the Kyoto mechanisms, perhaps in the form of a trial trading period before 2008 (Kudo, 2003).

It is believed there is fundamental disagreement among officials on whether a domestic trading scheme should be established. METI (Ministry of Economy Trade and Industry) and MOE (Ministry of Environment) are leading initiatives in the area of emissions trading. METI will start an experimental use of a national registry, using project based domestic emission reductions from the end of 2003. Its aim is to support industries' efforts to mitigate their greenhouse gas emissions and to improve the quality of the emissions inventory. MOE has designed a cap and trade emissions trading model simulation with 30 companies. The objective of this trial is for the companies to become accustomed to using the inventory and the trading system (Katagiri, 2003).

It is expected that the Japanese Government will introduce further regulatory measures early in 2005, possibly including a carbon tax (opposed by the Business Federation), emission regulation on each industrial group and/or emission regulation on each company. This would encourage greater participation by the Japanese private sector in CDM and JI.

4.5 Norway

Norway is one of the European countries that has chosen not to be part of the European Union and consequently is not bound by the EU Emissions Trading Scheme directive (discussed in detail at the end of this chapter). The Norwegian Parliament approved in June 2002 a proposal for a mandatory domestic emissions trading system that will start in 2005. The proposal is to establish a cap and trade system that would cover as many industrial sources as possible that are not subject to the current CO_2 tax. A full implementation of the EU directive in Norway would mean a major reduction of the coverage mainly due to the fact that the aluminium industry and the chemical industry are not covered by the EU-ETS. Some degree of integration with the EU scheme is expected and required for a Norwegian trading scheme to

function well. A realistic scenario would be either a mutual recognition of the two schemes (establishing a gateway) or alternatively nearly full implementation of the EU directive, but with some 'special' Norwegian opt-in/outs to reflect the atypical structure of the country's industry (Tynjälä and others, 2003).

4.6 Russia

Several options for an emissions trading programme have been under consideration. These include:

1. Trading emission reduction units (ERUs) under Joint Implementation;

2. Management of trades through authorised organisations. The principal feature is obligatory reinvestment of the seller's benefits to new or current projects;

3. Development of a quota trading process, where the investor splits the ownership of the total emission reduction with the host country. The host country can use the benefits of sold quotas for other emission reduction projects; and

4. Use of international organisations (for example the Prototype Carbon Fund of the World Bank) as a 'broker' which independently works with quota sellers and buyers.

Priority appeared to be leaning in favour of (2) management of trades through authorised organisations, and (3) the quota trading system. It was expected that the former would lead to the latter.

Russia's electricity monopoly, RAO UES has established a commercial Energy Carbon Fund to attract funds for emissions trading and has an independently verified emissions inventory to administer its future emissions trading. In addition, a Green Investment Scheme is being developed jointly by Russian and European academics and policymakers. This scheme could channel funds and limit supply to regulate the price on the emissions market, while obtaining real investments. It may end up as the only way to conduct JI and emissions trading with Russia (Vrolijk, 2002). The idea for the scheme is based on recycling revenues from emissions trading to activities which achieve further emission reductions in Russia. The rationale is to contribute to the environmental legitimacy of trading Russian surplus AAU in the international emissions trading market, and, therefore, attract additional investment into the country (Korppoo, 2002).

4.7 United States

In recent years, a number of legislative bills have been introduced or advanced within the US Congress. While the majority of these bills proposed appropriations for greenhouse gas studies, tax incentives for sequestration R&D, and voluntary or mandatory emission reduction registers, some recent bills have proposed mandatory CO_2 emission legislation. American Electric Power considers that current prospects for passage of greenhouse gas legislation are slim. The current Administration has indicated its intent to veto any such legislation with mandatory targets, and supporters simply do not have enough votes to pass a bill and counter a Presidential veto (Braine and Francis, 2003).

Most notable of these has been the Climate Stewardship Act co-sponsored by Senators Lieberman and McCain. The US Senate voted 55–43 to reject the bill in October 2003, although proponents hailed the vote as a symbolic victory that will have a good chance of returning in the form of other legislation. The Edison Electric Institute, an industry association, considered the Senate was right to reject the bill, whose mandatory cap and trade and reporting requirements were the wrong approach to addressing concerns about climate change. The right approach was to emphasise technology based solutions, as embodied in a recently passed comprehensive energy bill (EF, 2003b).

The bill included the following major provisions:

- it covered broader sectors of the US economy than just power generation, including about 85% of US emission sources from the electricity, industrial, and transportation sectors;
- petroleum emissions resulting from transportation were covered through an upstream cap and trade system (with oil refiners or importers receiving the emission allowance);
- emissions from combustion of coal and natural gas were covered through downstream caps on the electricity and industrial sectors;
- certain sectors were not covered at all, such as residential and commercial gas and fuel oil use;
- the bill covered all six Kyoto greenhouse gases;
- emission reductions were proposed in two phases, the first limiting greenhouse gas emissions to 2000 levels by the year 2010 and the second (removed before the vote) limiting emissions to 1990 levels by the year 2016.
- the bill directed the Environmental Protection Agency to establish a CO_2 allowance trading system.
- additional flexibility would be allowed through the banking of credits, use of offsets (such as project specific offsets of non-CO_2 gases), international emissions trading, carbon sequestration, and other reductions from non-covered sectors;
- use of emission offsets, international trades, carbon sequestration and other reductions from non-covered sectors would be restricted to only 15% of the required emission allowance target through to 2010, and only 10% through to 2016;
- the Commerce Department would determine the optimal approach for allowance allocations.

A Massachusetts Institute of Technology study estimated that the implemented bill would annually cost less than US$20 per household. It also dispelled criticism that the bill would prompt a 'dash for gas' in power generation, when gas prices are high across the US. According to MIT, coal use would still rise 12.5%, while natural gas use would be reduced under the bill. The overall impact on the US GNP would be no more than 0.01%, with no net job loss (Point Carbon, 2003a).

AEP noted there have been a number of regulatory and judicial challenges in the US with respect to greenhouse gas emissions. One group petitioned the EPA in 1999 to regulate CO_2 as a pollutant under the Clean Air Act. After EPA requested public comment, the petitioners filed suit to force the agency to rule on the issue. In August 2003, claiming it had no legislative authority to do so, the EPA finally rejected the initial petition. Several states and environmental organisations have re-filed a suit challenging the rule making, however AEP considered the prospects of success appeared to be remote in light of the legal standards required to regulate an emission as a 'criteria pollutant' under the Clean Air Act (Braine and Francis, 2003).

4.8 European Union

The European Union is establishing an EU Emissions Trading Scheme (EU-ETS) in a response to increasing greenhouse gas emissions and the potential threat of climate change. The EU-ETS is a useful illustration of the concept of emission trading because it will establish the world's largest ever market in emissions. This section provides general discussion and some of the detail of the proposal and the progress being made in some of the key EU countries.

This cap and trade scheme is intended to begin on 1 January 2005 with a first phase from 2005-07 and then another phase coinciding with the first Kyoto Protocol commitment period 2008-12. The scheme is then expected to continue after 2012 in 5-year phases. The first phase of the scheme will only cover emissions of CO_2 but individual member states will be able to incorporate other greenhouse gases from 2008. The EU-ETS will include power generation, oil refineries, offshore installations and other heavy industrial sectors in the first phase. It is intended to cover the 15 present member states of the EU together with 10 accession states seeking to join the EU and may also cover the non-EU states of Norway, Switzerland and Liechtenstein.

The EU Greenhouse Gas Emission Allowance Trading Directive was agreed in July 2003, following discussions between the European Commission, the European Parliament and the European Council. Also published was a proposal to link credits from Clean Development Mechanism and Joint Implementation projects to the EU scheme to meet targets from 2008. This proposal was negotiated between the Council and the Parliament and was finalised in March 2004.

The EU collectively took on a Kyoto target to reduce greenhouse gas emissions by 8% from 1990 levels by 2008-12. This 8% was then split in a 'burden sharing' arrangement around the EU member states. The EU will first set a total emission level for the 2005-07 phase and then negotiate with member countries to distribute, allocate or auction allowances up to the set emission limit. Once the allowances have been allocated they would be freely tradeable. Theoretically, companies that are able to reduce their emissions inexpensively will have an incentive to do so and sell excess allowances to other companies. The number of allowances each company or installation with emissions will receive will be based on each member state's National Allocation Plan.

4.8.1 National Permit Allocation Plans

The Directive required each member state government to submit to the European Commission by 31 March 2004 its National Allocation Plan (NAP). In the 2005-07 phase of EU-ETS, at least 95% of these allowances must be allocated free of charge to installations. Individual governments

EU-ETS Coverage of CO_2 emissions sources

Energy activities
- combustion installations with a rated thermal input exceeding 20 MW (excepting hazardous or municipal waste installations);*
- mineral oil refineries;
- coke ovens.

Production & processing of ferrous metals
- metal ore (including sulphide ore) roasting or sintering installations;
- installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2.5 t/h.

Mineral industry
- installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 t/d or lime in rotary kilns with a production capacity exceeding 50 t/d or in other furnaces with a production capacity exceeding 50 t/d;
- installations for the manufacture of glass including glass fibre with a melting capacity exceeding 20 t/d;
- installations for the manufacture of ceramic bricks by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 t/d, and/or with a kiln capacity exceeding 4 m^3 and with a setting density per kiln exceeding 300 kg/m^3.

Other activities

Industrial plants for the production of:
- pulp from timber or other fibrous materials
- paper and board with a production capacity exceeding 20 t/d.

* where one operator carries out several activities falling under the same subheading, in the same installation or on the same site, the capacities of such activities are added together for the purpose of determining whether the thresholds are triggered.

decided whether up to 5% of the allowances will be auctioned. 14,000-plus installations are expected to fall within the scheme.

The NAP sets a cap on the total allowable CO_2 emissions for 2005-07 from the installations covered by the scheme and allocates allowances equal to this cap to the operators of individual installations. To avoid penalty charges, these installations will have to surrender allowances equal to their emissions every year but they will be able to trade allowances to meet this obligation. Excess allowances for an installation in one year could be held for its own compliance in a later year during the first phase of the scheme regardless of the year in which they are allocated. Similarly, there is the potential for borrowing across years within any particular phase as installations will have received their allocation of allowances for 2005 and 2006 by the time they have to surrender allowances for 2005. Installations will be required to have their annual emissions verified by an independent accredited agency (DEFRA, 2003b).

Member states will have some flexibility in determining how closures should be treated following the final decision on the allocation of allowances. If an installation closes before the allocation for a particular year has been made, it would be possible to withhold those allowances. However, member states will want to avoid creating an incentive for plants to remain open in order to receive their free allocation.

4.8.2 EU-ETS criteria for National Allocation Plans

1. The total quantity of allowances to be allocated for the relevant period shall be consistent with the member state's Kyoto commitment and the burden sharing arrangements within the EU.

2. The allocation must account for the proportion of overall emissions that these allowances represent in comparison with emissions from sources not covered. It must also account for national energy and climate change policies and prior to 2008, the quantity shall be consistent with a path towards achieving or over-achieving Kyoto and EU commitments.

3. Quantities of allowances to be allocated shall be consistent with the potential, including the technological potential, of activities covered by this scheme to reduce emissions. Member states may base their distribution of allowances on average emissions of greenhouse gases by product in each activity and achievable progress in each activity.

4. The plan shall be consistent with other EU legislative and policy instruments. Account should be taken of unavoidable increases in emissions resulting from new legislative requirements.

5. The plan shall contain information on the manner in which new entrants will be able to begin participating in the scheme in the member state concerned.

6. The plan may accommodate early action. Benchmarks derived from reference documents concerning the best available technologies may be employed by member states in developing their NAPs, and these benchmarks can incorporate an element of accommodating early action.

7. The plan shall contain information on the manner in which clean technology, including energy efficient technologies, are taken into account.

8. The plan shall include provisions for comments to be expressed by the public, and contain information on the arrangements by which due account will be taken of these comments before a decision on the allocation of allowances is taken.

9. The plan shall contain a list of the installations covered with the quantities of allowances intended to be allocated to each.

10. The plan may contain information on the manner in which the existence of competition from countries or entities outside the EU will be taken into account.

Essentially these criteria mean that each member state will have considerable control over the way it allocates its allowances even though the European Commission will attempt to encourage consistency. This is creating enormous concern in some industries that allocation inequities among different countries will affect their relative competitiveness.

4.8.3 Opting out

The scheme is mandatory for those installations covered by the Directive, basically those over 20 MW thermal, although there are some major differences among countries as to what sectors should be included. However there is the possibility of some installations and sectors within each country 'opting-out' of the scheme in the 2005-07 phase only. This provision is only available for those installations that can demonstrate that they will be undertaking equivalent emission reduction measures through national policies. The ability of industries to opt out of the EU scheme is creating significant international competitiveness issues because national schemes are not likely to be equally stringent.

4.8.4 Opting in

From 2008, member states may unilaterally include additional installations and greenhouse gases, subject to approval of the Commission.

4.8.5 Pooling

In its NAP, a member state will be able to allow a group of companies or operators carrying out the same activities to participate by pooling their allowances together for the three year period 2005-07 and the five year period 2008-12. Pooling must be transparent and is subject to a number of

conditions (including a size limit because large groups will limit the liquidity of the market).

4.8.6 Penalties

The proposed EU penalty for non-compliance is 40 €/tCO_2-e between 2005-07 rising to 100 €/tCO_2-e from 2008. National schemes may have different penalties and the EU member states will be responsible for establishing and enforcing company compliance. Payment of any such penalty does not release that operator from the obligation to surrender the required amount of allowances the following calendar year. Member states will also ensure that that the names of any operators not surrendering sufficient allowances are published. In addition, member states are required to introduce penalties for other infringements of the EU-ETS legislation, including the operation of an installation that has not received an emissions trading permit.

4.8.7 Banking

Banking within the EU-ETS refers to the choice of an installation to retain surplus allowances from the first 2005-07 phase and set them aside for use or trading in the second 2008-12 phase. The EU-ETS allows unlimited banking of allowances within periods, but limited banking (decided by member states) into the 2008-12 Kyoto commitment period. Banking reduces the number of allowances available to cover emissions in the present and increases the number available for use in the future. The EU will give member states discretion as to whether or not to allow full banking from the first phase into the second phase of the EU-ETS. Full banking between phases is assured for subsequent phases.

Full banking would give operators an additional incentive to reduce emissions earlier than is required and gives them maximum flexibility regarding the timing of emission reductions. Banking restrictions can also increase the complexity of the scheme. The second phase of the EU-ETS will coincide with the first Kyoto Commitment Period. EU-ETS allowances in this phase will therefore need to be backed by Assigned Amount Units (the Kyoto Protocol currency). Full banking from the first to the second phase of the EU-ETS may jeopardise a member state's ability to meet its Kyoto commitments.

Already there are different banking abilities for different Kyoto mechanisms, for example, the newly introduced Removal Units for forest sinks cannot be banked.

4.8.8 Timetable

The timetable is very tight for public consultation, registering for an allocation and completing the NAP. Public consultation on the UK draft NAP closed in January 2004 and installation operators had to apply for permits to operate under EU-ETS by 31 March 2004 in order to be included in their NAP and receive an indicative allocation. This was also the date for member states to submit their NAP to the European Commission for approval. A final decision on allocation of allowances will be made by 30 September 2004 and the deadline for actual allocation for the first year of the scheme will be 28 February 2005. Once operators have verified their 2005 emissions, they have a deadline of 30 April 2006 to surrender the equivalent number of allowances.

4.8.9 Recent developments

In November 2003, the European Commission claimed the majority of EU member states were on course to meet the deadline for allocating allowances. However, some industries were expressing frustration over what they saw as a chaotic process and they expected key deadlines to slip. The international environment director at cement giant RMC was quoted 'Chaos reigns … It's an incredibly complicated task, it's not surprising it is beginning to fray around the edges.' (EF, 2003b)

Also in November, European business trade association UNICE warned that despite the EU's progress putting in place policies to implement the Kyoto Protocol, the real challenge will be reducing greenhouse gas emissions in rapidly developing parts of the world. UNICE, which represents 35 central industrial and employers federations from 28 countries, said that a unilateral EU approach to reducing greenhouse gases could act against this challenge by encouraging increased manufacture of energy intensive products in developing countries. UNICE advocated the EU should seek full global participation, especially including Russia and the US in future climate change regimes, and should fully link the EU-ETS with Kyoto mechanisms for investment projects in developing countries. UNICE remained broadly supportive of the EU-ETS because of the potential to assist companies to meet commitments cost effectively. However, the group said it is crucial that the scheme be implemented in a consistent and timely fashion throughout the EU (Point Carbon, 2003b).

In a December report, Deutsche Bank believed there was 'limited time available for solving massive problems in the initial allocation of credits' and consequently the planned 2005 launch date was at risk. The bank expected the greatest challenge to be in harmonising the various NAPs. Member states were reported to be keeping a close eye on each others' choice of allocation methodology because of the potential for market distortions. The European Commission was facing a difficult task in sifting the draft plans for overly generous allocations which could constitute illegal state aid (ENDS, 2003b).

One key area of potential distortion is the treatment of new entrants. They could be required to buy all their allowances from the market, or they could be given them free from a pool held back by governments. Manufacturing industry prefers the free allocation approach because it would reduce perceived barriers to entry. However, it would raise the controversial issue of defining what is meant by a new entrant. For example, would increases in production capacity

at an existing factory be treated in the same way as a new facility? France has already decided to hold back a pool of free allowances and other member states may feel strong pressure to follow suit so as not to lose out in the competition for new industrial investment (ENDS, 2003b).

The Commission also issued an important guidance document dealing with monitoring and reporting requirements. It sets out a range of 'tiered' methodologies for each industry sector. In general, the Commission expects operators to use the most accurate tier unless it can convince the relevant authority that this 'is technically not feasible or will lead to unreasonably high costs.' There is some limited scope to apply less stringent standards to minor sources on a site accounting for less than 5% of total emissions (ENDS, 2003b).

The Commission has eased off on the standards of accuracy that it expects operators to achieve. For large emitters using natural gas, uncertainties of less than 2.5% are expected. However, smaller sources using variable fuels such as coal or waste, or with significant process CO_2 emissions, may be allowed uncertainties of 10% or more. Biomass fuels will be zero-rated (including landfill gas, municipal and industrial waste). Third party verifiers will have a key role in ensuring that methodologies are correctly selected and applied (ENDS, 2003b).

In December, commercial and energy law experts Baker & McKenzie summarised the situation in a review by saying the unprecedented timetable will make it extremely difficult for governments to implement the Directive in a timely and considered fashion (Hobley and others, 2003). They believed the tight timetable may cause the incomplete or imperfect implementation of the Directive, which could create fertile ground for litigation challenging either the implementation of the Directive or, more likely, the distribution of allowances in the highly political, technical and complex NAP process. The real or perceived inequalities by companies being unhappy at the allocation that they receive either in absolute terms, or relative to others (perhaps in more generous member states) may lead to legal action. In certain jurisdictions, individuals or corporations may attempt to challenge the constitutionality of the legislation, on the basis that it affects their fundamental rights. These potential claims may delay the timing of the scheme. However, Baker & McKenzie have spoken to some large companies on this issue. Many made it clear they would not consider such legal action or would only take such action reluctantly if there had been clear breaches of competition or state aid rules giving their competitors a clear advantage.

A further pitfall anticipated by Baker & McKenzie would be that if one member state allows unlimited banking from the first period to the second, it may find its registry flooded with banked allowances from operators in other member states which do not allow banking or limit banking in some way. Another problem will arise when devising the NAP for the second period. If banking is unlimited, member states will not know how many allowances are likely to be banked at the time the NAP is due in mid-2006 (Hobley and others, 2003).

In March 2004, power intensive industries announced they were prepared to pay the increased costs of power production (Point Carbon, 2004c). However, the Alliance of Power Intensive Industries in Europe warned that the current price setting mechanism in the power market will cause windfall profits for power producers from the EU-ETS, costing the industries a yearly €2 billion. The group, consisting of the cement, pulp and paper, glass, lime, iron, steel and metal industries, fears that increased energy prices will threaten its competitiveness, leading to a slow-down of investments in Europe and a risk of de-industrialisation. The marginal pricing mechanism implies that the cost of allowances will be passed on to customers as though all electricity is derived from fossil fuels, while they account for only part of the production, according to the energy intensive users. The group was conducting a study aiming to find out how carbon costs can be separated from the ordinary energy costs, ensuring that industry will only pay the real cost of emissions trading to the power producers.

In a letter to the EU member states in March 2004, the European Commission clarified how it will interpret EU state aid rules in its assessment of NAPs. These rules may come into consideration if a member state is deemed to seriously distort competition by allocating more allowances to a company or installation than it is estimated to need for the period. The difficulty for the Commission on this issue would be to prove the over-allocation because it would take a lot of time and resources. The letter said it may also be considered state aid where 'a member state over-estimates emission reductions from non-trading sectors or where it grants allowances generously because it intends to purchase Kyoto Protocol 'Assigned Amount Units' or credits from Joint Implementation or the Clean Development Mechanism later on to cover its emissions.' Denmark, Ireland and the Netherlands are among the countries that have defined such purchases as important parts of their NAPs. The Commission also considers that banking between periods is considered to involve state aid, because 'in the second period, the member state would issue allowances for free when it could otherwise have sold, and thereby obtained revenue from, an equivalent number of Kyoto Protocol Assigned Amount Units' (Point Carbon, 2004d).

4.8.10 United Kingdom

The UK scheme is very different from the proposed EU scheme and will still be in place when EU trading begins. Important transition issues to overcome include voluntary participation in the UK scheme, participation by a much wider range of companies, allocation of indirect emissions from electricity to industry consumers, and inclusion of emissions from upstream oil flaring.

The UK government is sponsoring work by the Royal Institute of International Affairs which is reviewing the approach to the EU-ETS and NAPs by each member state. The research project on the development of the NAP will be evaluating the competitiveness implications of different allocation methodologies. DEFRA will also be assessing the implications of the overall cap on competitiveness of UK

industry and taking account of views expressed in response to the consultation document. DEFRA says that it is working with other member states to ensure that the development of the UK NAP is consistent with other NAPs so that competitive distortions are minimised. The European Commission has three months to assess these plans and will need to ensure that they are consistent with state aid rules and do not distort competition within the European market.

The Emissions Trading Group represents a group of UK industries that have been undertaking advisory work for the UK government on the implementation of the UK-ETS and the EU-ETS. One of the key issues arising during consultation has been to ensure the equal treatment of companies that are subject to the cost burden of emissions trading with companies that are not subject to the same requirements. For instance, the EU proposal excludes installations whose boilers have combined capacities of less than 20 MW thermal.

Another key concern is that absolute allocations restrict companies' ability to grow and the allocation arrangements could limit production and the competitiveness of UK industry. DEFRA argues that installations will be allocated a fixed quantity of allowances and for companies with limited abatement opportunities the market will provide the necessary flexibility to expand production. Installations will be allocated allowances upfront and will have an obligation to surrender allowances equal to their emissions every year, regardless of production levels. Relative targets are based on emission targets for each unit of output and since actual output levels can only be known after the event, relative targets are not compatible with a cap and trade scheme like EU-ETS.

In a UK government report on the first consultation process on its national allocation plan, over a third of UK companies wanted allocation of allowances under the EU-ETS to be based on projections of their greenhouse gas emissions, rather than on a historical baseline. Those preferring historical baselines did not agree on which years to use. Most respondents also favoured a two stage allocation process, with the national allocation being divided among sectors first, and then divided among installations in each sector. This would allow competitiveness issues to be taken into account with regard to other EU countries (ENDS, 2003a).

The consultation process also showed that most companies considered new entrants should be allocated free allowances from a contingency pool. In contrast, the electricity industry, the metal ore and steel sectors and companies already in the UK emissions trading scheme as direct participants generally preferred new entrants to buy from the market. On the related issue of plant closures, a majority favoured retention of allocated allowances on closure of a plant. Companies were strongly anti-auction (ENDS, 2003a).

The UK government was the first to release its draft NAP and it was reportedly greeted with 'howls of protest' from industry (Nicholls, 2004). The UK took on a target of a 12.5% reduction for 2008-12 (compared with its 1990 emissions level) within the EU burden sharing arrangement. However, one controversial NAP issue is that the cap level for the 2005-07 phase exceeds its Kyoto commitments and is in line with reduction targets of 16.3% below 1990 by 2010 and 20% by 2012. The government will hold back 5.7% of the total allowances for new entrants, including an unspecified quantity ring-fenced for new combined heat and power plants. Those not used at the end of each year (expected to be about 5% of total allowances) will be auctioned. UK will not allow banking of excess permits between 2007 and 2008.

The draft NAP (covering around 1500 installations responsible for around half of UK CO_2 emissions) is considered to place much of the emission reduction burden on the power sector. It is expected that industrial power prices would rise by 6% based on a 5 €/tCO_2 allowance price. The other sectors explicitly covered are oil refineries, pulp and paper, non-ferrous metals, building materials and large combustion plants (thermal input over 20 MW). The European Commission argues that chemical processes should be covered in the last category but the UK has chosen not to include such plants (Nicholls, 2004).

Allocations will be based on an average of historic emissions for the years 1998 to 2002 omitting the year with the lowest emissions. There will be no compensation for early emission reduction. Confirmation that climate change levy discounts will be extended to all installations covered by the EU-ETS removed a major incentive for companies under climate change agreements to opt out of the EU scheme. UK-ETS participants that do opt out are on notice that their targets may be revised to satisfy the 'equivalency' requirements of the EU-ETS. The government stressed that all figures are likely to change considerably in light of ongoing work on revised energy projections, improved data from operators and comments from industry sectors.

The Confederation of British Industry warned that the government's aggressive targets could threaten British competitiveness if other European countries did not take similar approaches. Consequently the government was asked to reconsider the proposed NAP (Nicholls, 2004).

Contradicting these concerns, environmental analysts Trucost claimed that warnings about the impact of the EU-ETS on electricity prices and industrial competitiveness had been 'exaggerated' (ENDS, 2004a). Trucost argued that once the proposed allocations for generators were taken into account, a 12 €/tCO_2 price would increase generation costs by just 5%, translating to a price rise of 2.8% for industrial users. Trucost did not believe generators would seek to pass on the full costs. There would be a theoretical opportunity cost that generators could realise by not running their plant - but in practice they are very constrained by decommissioning issues and electricity supply commitments. Trucost claimed that some allocations to individual generators appeared 'anomalous'. Predominantly gas fired generators would be well placed to be substantial sellers of allowances.

The ENDS Report considered that 'ritual complaints over the impact on UK competitiveness need to be filtered carefully'

(ENDS, 2004a). It was argued that manufacturing industry had been given 'business as usual' emission caps at least until 2008. Most other EU member states will need to set stringent caps simply to meet their Kyoto targets. Figures released by the European Environment Agency in December found that only the UK and Sweden were on course to meet their targets. Studies for the European Commission had found that the UK has relatively large opportunities for low cost abatement - mainly by fuel switching in the power generation sector - and is well placed to become a net exporter of allowances.

The ENDS Report considered that two other industry complaints had more merit. Sectors with competitors in countries without controls on greenhouse gas emissions would be disadvantaged. A preliminary regulatory impact assessment highlighted the sugar, coke oven products, non-ferrous metals, stone, wire products and battery industries as being most exposed to trade with such countries. There were legitimate concerns that manufacturers may face a hefty increase in electricity bills. However, any increases had to be viewed in the context of current low energy prices - and the prospect that the trading scheme will also affect prices across Europe. Industrial electricity prices in the UK were among the cheapest in the EU for medium and large users even allowing for the climate change levy (ENDS, 2004a).

While supporting the principle of emissions trading, the UK Petroleum Industry Association described the draft NAP as not acceptable. The sector disputed the government's claim that its allocation represented business as usual and considered no allowance had been made for increases in refinery CO_2 emissions arising from EU legislation on low sulphur fuels. The industry association complained of 'apparent inconsistency and lack of equity' in the treatment of different refineries. Allocations for most of the UK's eight refineries were 'unrealistically tight' at around 14% below the baseline while two refineries had been granted inexplicably large increases (ENDS, 2004a).

The British Cement Association complained that its low allocation resulting from the decision to go beyond the Kyoto target would damage the industry's competitiveness (ENDS, 2004b). Over half of the cement industry's emissions arise from the calcining process and are not covered by the existing climate change agreement (CCA). The association claimed that the government had failed to take account of these 'unavoidable' emissions. The sector was also relying heavily on the use of alternative fuels to meet its CCA target. However, the European Commission insists that tyres and solvent based wastes are not classed as carbon neutral under the EU-ETS. Similar issues arise in the aluminium industry, which is currently able to count reductions in fluorinated greenhouse gases towards its CCA target.

The iron and steel industry had been granted the most room for expansion. A representative explained that the use of 1998-2002 emissions as the basis for comparison was 'misleading because it coincided with a deep trough in the industry's production'. Two steel mills had come out of liquidation and the largest producer is now more optimistic about its prospects for increased output (ENDS, 2004b).

4.8.11 Germany

Germany, Europe's largest economy, has agreed to reduce its 2008-12 greenhouse gases emissions by 21% below its 1990 level. Some have claimed that Germany, France and other European states would probably miss the deadline to turn the EU directive into national law, risking a number of company lawsuits (Bloomberg, 2003). One lawyer described setting up a legal framework by March 2004 as a 'Herculean task' and the result could be a series of legal actions challenging the allocation of emission allowances in Germany.

The government has allocated free emissions allowances to an estimated 4,500-5,000 German industrial installations based on their 2000-02 CO_2 emissions. The auctioning of allowances had been ruled out, but Germany will keep a reserve for new companies setting up in Germany after the NAP is finalised. Germany will mostly use absolute targets, with some use of 'benchmarking', where targets are set in relation to energy efficiency. There will also be allocation for special circumstances such as the exit from nuclear energy.

Companies with operations across Europe are concerned that they may face several different approaches that could contribute to competition distortions, as well as presenting them with administrative difficulties. In March 2004, ThyssenKrupp AG and BASF AG, two of Germany's biggest companies, warned that the environment ministry's NAP allocation proposals would lead to job cuts because of reduced competitiveness (Point Carbon, 2004c). However, the proposed allocation equalled the emissions reduction obligations taken on by German industry through a voluntary agreement signed with the Government several years earlier. One company claimed that its steel business would rather reduce production than purchase allowances for a shortfall of at least 1 $MtCO_2$.

The Minister of Economy had vetoed an agreement in mid-March that had been made between the secretaries of state in the ministries of economy and environment. The two ministries were not far apart in their proposed caps for the 2005-07 period but there were still disagreements on the total cap for the 2008-12 phase, rules for transferring allowances from old to new installations, new entrants and how to establish disincentives for old, inefficient installations. The minister said he would order a review of the government's energy tax programme, or ecotax, and of official support for renewables and combined heat and power in 2007, the end of the EU-ETS first phase. He stated that Germany could not afford additional burdens on industry during a time when it faces its toughest competition (Point Carbon, 2004c).

The German NAP was finally announced as proposing to cap emissions of the energy and industry sectors at 503 $MtCO_2$, effectively releasing industry from its voluntary agreement to reduce emissions to the level of 488 Mt by 2010 as proposed in an earlier draft. In market terms, it was acknowledged that Germany would create far less demand for allowances than originally expected, if this allocation survives the European Commission's review. The final result was well received by the companies themselves and some observers considered it a

great victory for German business.Nevertheless, the German Electricity Association cautioned that even with this improved framework, there may be a big difference between the NAP as a whole and how it would affect individual companies and installations. The Hamburg Institute of International Economics observed that the electricity producers, steel and cement industries are the big winners of the German NAP because of their lobbying abilities (Point Carbon, 2004d).

4.8.12 France

The French NAP was delayed several weeks beyond the end of March deadline. New finance and environment ministers were appointed after regional elections and they were reviewing their predecessors' draft NAP in April. France plans to pool the allowances for its factories for tax reasons, because French companies would have to pay value added taxes on every transaction separately. France is understood to be considering creating a reserve of allowances for new French entrants to the EU-ETS (Point Carbon, 2004c).

It is understood that France's NAP will allow its industry and energy sectors to increase CO_2 emissions by up to 2% from 2001 levels by 2007. Greenpeace said the plan would require industry to cut CO_2 by 3.4% from 1990 levels by 2010, significantly less than the 4.8% cut specified in the government's 2000 national climate change programme (Point Carbon, 2004c). The environmental group claimed the government had taken a very narrow approach by applying the EU directive to only 700 installations instead of the potential 1100. In addition, France will be the only country to allow banking of unused credits from the first phase (2005-07) for use in the second (2008-12). Greenpeace called the draft plan 'lax and ineffective'. It risked undermining the EU-ETS as French industry would become net sellers and could flood the EU market, thereby lowering CO_2 allowance prices and reducing the incentive to cut emissions.

4.8.13 Italy

Italy is the third largest emitter in the EU-ETS, and its NAP will have large implications for the initial demand and supply side in the market. Point Carbon's analysis indicated that the NAP was in conflict with the allocation criteria as it is above baseline (Point Carbon, 2004d). It was noted that several other countries with published NAPs could not claim to bring emissions into line with their Kyoto obligations (for example, Austria and Ireland), but for these countries the NAPs were at least at or below the expected baseline. In reality the Commission will necessarily have to show some flexibility as it can not check every installation. However, for Italy the over-allocation was considered to be systematic, resulting in a total allocation for the sectors in the scheme that is likely to be above the baseline.

The announcement of the Italian NAP created considerable doubt over whether NAPs overall will create the necessary scarcity for an efficiently functioning market. At an international emissions trading conference, a representative of the Italian Ministry of the Environment surprised delegates by commenting that there is no such thing as over-allocation. The NAP is believed to reflect Italy's concerns regarding security of electricity supply and its expectation to cover increasing power demand at least inpart with new power plants built in Italy. The NAP includes a statement that the marginal cost of national measures to improve Italy's carbon intensity would be much higher than in the other European countries. It adds that national measures to reduce emissions must consider the requirement not to have a negative effect on the competitiveness and efficiency of the Italian economy (Point Carbon, 2004d).

4.8.14 Other countries

At the end of February 2004, the Dutch and Irish governments issued their draft NAPs. The Dutch government will hold about 4% of total allowances in a reserve fund to be allocated free to new entrants. Companies will be allocated 96% of what they are estimated to need in 2005 to 2007, adjusted for efficiency to reward early emission reduction. The Dutch NAP also included an opt out clause for small installations emitting less than 25,000 tCO_2 a year. The Dutch government reasoned that 152 of the 329 installations covered by the EU-ETS account for less than 1.5 Mt/y of CO_2 and so the administrative burden of the scheme outweighed the benefits of the emissions reductions. The Irish NAP will hold back 1.5% of total allowances for new entrants and 0.75% will auctioned to pay for administrative costs of the EU-ETS. All sectors will be allowed growth from the 2000-03 period (Point Carbon, 2004b).

In December 2003, EnergieNed, the federation of Dutch Energy Companies, feared that the Dutch allocation plan may bring the secure supply of the electricity market into jeopardy. The intended allocation for power production was not in line with the expected developments for the Dutch electricity market. Government projections were significantly lower than what was required according to the market. While the electricity sector in general is widely expected to profit from the EU-ETS, this may not be the case for the Netherlands. CO_2 emissions in the sector are up almost 25% since 1990, and the Netherlands is struggling to reach its Kyoto target. The Dutch NAP will be based on 2001 and/or 2002 emissions. There is a concern that the EU-ETS could distort the electricity market especially when domestic producers have to compete with foreign companies (Point Carbon, 2003c). EnergieNed listed the following actions for the Government to take in order to set up a fair NAP:

- set the growth rate of the electricity market in line with economic growth;
- take into account a realistic portion of imported electricity;
- enable sufficiently new base load capacity in order to maintain the security of supply;
- respect the contents of the voluntary agreements that have been signed earlier on CO_2 emission reduction.

The Spanish Confederation of Business Associations (CEOE) highlighted to the Spanish Government in November 2003 that the country will not reach its Kyoto target without the

use of the flexible mechanisms under the Kyoto Protocol (Point Carbon, 2003b). The CEOE said that after implementing the National Energy Efficiency Plan, the Spanish per capita emissions in 2010 would be equal to the EU average, which corresponded with the economic objectives for that timeframe, but would still be far over the target set for Spain in the Kyoto Protocol. The CEOE recommended the Spanish Government follow the initiative of some countries by purchasing the necessary emissions allowances to assure the activity level of their economic sectors. The sectors with activities included in the EU-ETS have an immediate threat to their competitiveness if the reduced quota of national emissions available for complying with the Kyoto target is applied as a deficit of emissions allowances. The CEOE argued that the risk of loss of employment, retaining market share and the national relocation of Spanish industries should be considered as a very possible scenario in the absence of the appropriate policies and measures.

After the change of government, the newly appointed Spanish General Secretary for climate change announced in April that Spain would not renegotiate its Kyoto target (+15 per cent) and its NAP would have to put Spain on its Kyoto path without hurting industry. This has been interpreted as a bad sign of tough allocations for the Spanish energy sector (Point Carbon, 2004d).

Finland's industry was reported in December 2003 to be opposed to the EU-ETS, claiming it will be at a disadvantage with countries that have not ratified the Kyoto Protocol. A report by the Ministry of Trade and Industry admitted that committing to limits on greenhouse gas emissions will have a negative impact on the national economy (Point Carbon, 2003c).

The Austrian NAP is considered by observers to be even more generous than the German one and did not appear to create any shortfall, a claim denied by an Austrian business association. The Austrian NAP is one of those believed to be the least likely to be approved by the European Commission (Point Carbon, 2004d).

Brokers Evolution Markets assessed in December 2003 the market positioning of the EU accession countries in the Central European region (Ertel, 2003). They noted some countries were further ahead than others in building the requisite knowledge base and then implementing an emissions trading strategy. Slovakia has the most developed infrastructure in the region for emission trading because of its existing SO_2 trading scheme and its active participation in greenhouse gas emissions trading. The country conducted the first trade of Kyoto allowances and is also home to one of the parties in the largest trade of EU allowances to date.

Poland has a huge volume of surplus allowances under the Kyoto Protocol and perhaps the EU-ETS but recent economic growth is moving the country closer to its cap (Ertel, 2003). The Polish government is well behind some of its neighbours in developing its National Allocation Plan for the EU-ETS. Hungary is considered to offer an excellent investment climate and an efficient bureaucracy, but currently the nation is falling behind in setting up the systems to facilitate trades.

The Czech Republic is the only Central European nation whose greenhouse gas emissions levels are projected to fall in the period between 1999 and 2012, positioning the country well for both Kyoto and EU allowance markets, but the government has been slow to formulate an emissions market strategy. In contrast, Slovenia is the only nation in Central Europe whose economic growth projections may make it a buyer of emissions credits and allowances. Estonia and Latvia have large surpluses compared with 1990 emissions and growth projections show that from 1999 to 2012 these countries will only use 50% or less of their remaining surplus AAUs. Lithuania, while well below its cap, relies heavily on power from an aging nuclear facility. The country may tightly manage its allocation as a contingency against an upcoming shutdown of this plant, which would necessarily increase emissions from fossil fuel generation.

Overall, the accession countries will cover around 395 $MtCO_2$ spread over approximately 2300 installations. It is clear that the new members will allocate well above current emission levels (by around 5-8%) and this will be justified as taking future growth into account rather than surplus allocation. However, it has been demonstrated that economic growth since the mid-1990s has decoupled from CO_2 emission growth to such an extent that CO_2 remained almost constant while GDP grew by 4–5 per cent annually. Assuming the lower 5% allocation number and a modest growth in emissions of 0.5% annually, installations in the accession states can generate a surplus of about 47 $MtCO_2$ over the first phase (Point Carbon, 2004d).

European companies hoping to purchase large quantities of these surplus allowances have been cautioned to lower their expectations. The ownership structure in the four biggest countries, Poland, Czech Republic, Hungary and Slovakia, is such that over 90 per cent of the companies might be very late entering the market, or possibly not entering at all. These are either owned by multinationals (meaning trade will be administered through the Western European head office), state-owned (which so far has shown extremely low or no interest), or very small emitters, lacking proper incentives to trade (Point Carbon, 2004d).

5 Future prospects for emissions trading

The success of emissions trading schemes for sulphur and nitrogen oxides will ensure a secure future for such programmes as cost effective methods of achieving environmental outcomes. The future prospects for greenhouse gas emissions trading schemes will heavily depend on the future of the Kyoto Protocol. If the treaty does not enter into force or has limited participation, the future of the EU Emissions Trading Scheme (EU-ETS) might also be in doubt because of the impacts on international competitiveness.

5.1 Future scenarios for the Kyoto Protocol

A number of alternative scenarios are considered for the future of the Kyoto Protocol. They are not intended to cover all possibilities but they illustrate the range of factors that will influence its future:

1. Kyoto enters into force after Russian ratification and the EU-ETS expands to link with domestic trading schemes in Russia, Canada, Japan, New Zealand and eventually Australia. This drives technological innovation in these countries and the results spread to developing countries. International momentum grows for further commitments for 2013-17 but the USA and developing countries continue to take actions outside the Protocol.

2. Kyoto enters into force after Russian ratification and the EU-ETS expands to link with domestic trading schemes in some other countries. After seeing a loss of competitiveness in many industries compared with non-Kyoto countries, some countries withdraw from Kyoto and from the EU-ETS and others accept only limited 2013-17 commitments.

3. Kyoto does not enter into force but the EU-ETS expands to link with domestic trading schemes in some other countries. In the absence of American, Australian and developing country preparedness to negotiate a compromise solution, the EU-ETS becomes a de facto international trading scheme.

4. Kyoto does not enter into force and the EU-ETS is suspended while an alternative to Kyoto is negotiated. This encourages wider participation by focusing on emission rates per unit output rather than the environmental certainty of an emissions cap. Its supporters claim it will maintain the international economic growth required for the major technology development to achieve significant abatement.

5.1.1 Russia's key role

The Kyoto Protocol cannot enter into force without ratification by Russia, since the USA has withdrawn and the Kyoto participants must represent a total of 55% of the 1990 level of CO_2 emissions. In Russia, fossil fuel consumption in 1998 was 35% below the 1990 level. However, the decline in energy and fuel consumption has been considerably less than that of economic activity. Thus the energy intensity of the Russian economy has increased, from a level that was already high in 1990 so the potential for large energy savings has also increased (Moe and Tangen, 2001). This means that Russia will play a key role in the future emissions market because of its size, its large emissions reductions to date compared to its stabilisation target, and its substantial potential for increased energy efficiency.

Russia is weighing up its economic costs and benefits from the Kyoto Protocol as it moves towards a decision on ratification. The main benefits will be the potential credit sales using the Kyoto mechanisms and related investments in the energy sector. Further benefits will include capacity building and the potential growth of demand from the international gas market. However, some Russian officials have been cautioning that if current strong economic growth continues, the quantity of surplus allowances may be much lower than originally projected. When coupled with the lower credit prices resulting from the US withdrawal from Kyoto, it is no longer certain that Russia will ratify. Some observers believe such factors represent an attempt by Russia to seek concessions in exchange for ratification. They consider that Russia is very likely to ratify by the end of 2004 and ensure that the value of its surplus allowances is realised some time by 2012.

In a mid-December 2003 response to recent conflicting signals from Russia, the EU Energy Commissioner told national energy ministers meeting in Brussels that it would be 'suicide' for the 15 nation bloc to follow the Kyoto Protocol if Russia does not come on board (Point Carbon, 2003c). Some strong statements from the Commissioner were quoted: 'The time has come for us to face to reality… We can't go on pretending that everything is fine when it's not.' EU ministers also expressed concerns that European competitiveness could be harmed if it pushes ahead without major trading partners. The remarks contrasted to Europe's official position from the EU Environment Commissioner just one week earlier that Europe would continue to lead the world in fighting climate change.

5.2 Expanding the EU scheme to an international scheme

Currently, with some of the major EU-ETS participants suggesting a delayed start to the scheme and a number of the accession countries unlikely to be ready for the 2005 start, speculation on the readiness of other countries to link to the EU scheme is difficult. Nevertheless, non-EU countries like Norway, Switzerland, Canada, Japan and New Zealand may wish to establish domestic trading schemes to link to the EU scheme for a number of reasons. Apart from the over-riding concern to demonstrate early action on the climate change

issue, there may be the more practical benefits of learning-by-doing and maximising opportunities from early participation in emissions reduction and sinks enhancement.

There is much speculation on how different national governments will implement the EU scheme in their countries. On the grounds of ensuring industries are not subsidised relative to other EU industries, the European Commission has the right to veto national allocation plans and national decisions to opt-out some of their installations. However, many companies and industry sectors are concerned that distortions in competitiveness are bound to occur and the Commission will be relatively powerless to prevent this. In particular, most accession countries have large allowance surpluses compared with their 1990 emissions and there are concerns these will inevitably be used as industry subsidies.

In December 2003, the Japanese Government strongly attacked the European Commission's July proposal on linking JI and CDM projects to the EU-ETS, labelling it 'unacceptable, illogical and inconsistent with the spirit of Kyoto' (Point Carbon, 2003c). In contrast to the Commission's proposed limits on the use of project credits, Japan plans to reach its Kyoto target largely depending on the availability of such projects. Japan claimed that the EU's linking proposal will significantly restrict development of JI in the Central and Eastern European states. Many of these countries are to join the EU-ETS and the Commission wanted to make sure in its linking proposal that projects in these JI countries will not profit from double counting their emission reductions. Japan considered this argument unpersuasive because the EU had no counter-measures to avoid double counting between covered and uncovered facilities, and covered supply side facilities and uncovered demand side consumers. In response to a Commission suggestion that Japanese companies could profit by obtaining the EU allowances through private agreements with local firms, Japan stated that its companies develop JI projects not for profits but for complying with their own voluntary targets. It was crucial for them to acquire Kyoto compatible credits rather than EU local allowances.

5.3 Compliance issues arising from emissions trading

Each participant in the EU-ETS and any other trading scheme will constantly be assessing the costs of verifying emissions, of accounting for allowances, of purchasing any allowance shortfall and the risk of non-compliance. The level of penalty payments for the EU-ETS are very severe, especially after 2008, so this risk of non-compliance is likely to be seen as a major threat for some companies. If the buyers of credits are liable in the event that some credit certificates are not acceptable to the regulatory authority, or the contract with an allowance trader is not fulfilled, the prospect of legal action might also deter some participants. To minimise the threat of non-compliance, it would be expected that there will be a reasonable period (four months for EU-ETS) allowed for verification of annual emissions and then reconciliation/purchase of allowances. Staggering the reporting and compliance dates throughout the calendar year for different installations may help avoid a rush on verifier services and on allowance purchases. National authorities will be expected to issue clear, early messages on which types of credits will be acceptable for the reconciliation.

In some cases, companies may find that any savings from trading would be minimal and accept the alternative of an administratively easier emissions tax where it is available. Regulatory authorities are likely to set up an alternative tax to act as a cap on the market price because excessive spot market prices would be likely to discourage participation. There would be some administrative difficulties in switching between the trading scheme and a tax scheme because the tax would be applied to the fuel inputs before they reached a plant gate (as well as other non-fuel emissions).

Environmental groups sometimes raise a broader question of whether a compliance system can ensure environmental effectiveness. There is no doubt that some countries and companies will receive windfall credits for fortuitous timing of capital investments or production decreases or forest planting. Nevertheless, one of the key advantages of emissions trading is the certainty of the environmental outcome compared with regulation and/or taxation of emissions. By setting the overall cap on emissions for the compliance period and penalties for non-compliance, a regulatory authority can ensure there is genuine overall emissions reduction. The debate should be centred on what the level of that cap should be in balancing environmental goals and the costs of achieving them.

One compliance concern that is difficult to answer is the question of who will ultimately enforce the compliance. Assuming Kyoto enters into force, international reputation (and even the unspoken threat of trade sanctions) should prevent a non-complying country withdrawing from the Protocol in 2012. Similarly, the threat of European Commission action should deter EU-ETS countries from withdrawing from that scheme, but there may be some uncertainty as to how strictly enforcement will be applied in order to avoid direct confrontation.

5.4 Trading prices

5.4.1 Historical CO_2 trading prices

To date there exists no established carbon or greenhouse gas market, defined by a single commodity, a single contract type or a single set of buyers and sellers. The actual 'carbon market' is a loose collection of diverse transactions through which quantities of greenhouse gas emission reductions are traded. It is also clear from market participants that there is limited information on various issues surrounding the establishment of a market including prices as there is no recognised central clearinghouse for transactions. Therefore it is difficult to compare prices/quantities of sales of carbon credits. The types of contracts range from spot or forward or options to swaps with time frames of contracts varying from 10 to 14 years and some 50+ years.

In December 2003, the International Emissions Trading Association published a major study 'Greenhouse Gas Market 2003 – emerging but fragmented' that includes the views of all the major brokers and market participants (IETA, 2003). A summary of the main views and of historical trading prices is presented here.

In 2001, Natsource conservatively estimated that approximately 55 $MtCO_2$-e of emission reductions had changed hands in approximately 60 trades between 1996 and 2001 (Cogen and others, 2003). In December 2003 based on analysis by Natsource and others, the World Bank estimated that traded volume for 2002 was 30 $MtCO_2$-e and 70 $MtCO_2$-e in 2003 (Lecocq and Capoor, 2003b). Most of this was through project based transactions, intended for Kyoto Protocol compliance and 90 per cent was for World Bank client countries.

Emission reductions generated in locations or during periods that would disqualify them for international recognition as permits have traded for approximately 0.60–1.50 US$/$tCO_2$-e. Emission reductions that could potentially be converted into permits (through the Clean Development Mechanism or Joint Implementation) have traded for prices between 1.65–8.00 US$/$tCO_2$-e, with most occurring between 3–5 US$/$tCO_2$-e (Cogen and others, 2003). The World Bank Prototype Carbon Fund also summarised that prices for project based transactions in 2002 and 2003 had consolidated in the range 3–5 US$/$tCO_2$-e (Lecocq and Capoor, 2003a).

In the UK-ETS, the diversity of limitation types (absolute or rate based targets defined in units of energy or emissions) and of trading rules makes it a hybrid programme, unlike some programmes in which all participants face a uniform set of rules. Nevertheless, Natsource considered the UK-ETS to be the best indicator of permit or allowance trading prices instead of the emission reduction trading prices discussed above (Cogen and others, 2003). Natsource estimated that by September 2003 approximately 1.6 million UK allowances had changed hands in about 500 company-to-company trades. Prices rose from around 733 US$/$tCO_2$-e in August 2001 to a peak of approximately 20 US$/$tCO_2$-e in September 2002. Later in 2002 prices fell back to their earlier level and prices continued to decline to a September 2003 level of about 3 US$/$tCO_2$-e.

BP attributed these changes in UK allowance prices to basic supply/demand theory and the market structure design (Dutton and others, 2003). When the market first opened there were only a few participants with verified baselines, which reduced the number of issued allowances. This proved a constraint on supply and, with early demand, the allowance price rose steadily to the mid-year price peak. The price fell back rapidly as new supply came to the market. Despite active trading as first compliance dates loomed, the price slipped further in an over-supplied market.

Shell offered a similar explanation (Campbell-Colquhoun, 2003), adding that many potential sellers did not want to take on the risk of non-delivery by selling forward allowances before they knew their position. When combined with traders trying to capture a profit by purchasing allowances while the market was bullish, there was competition on the buy side and only one or two companies were able to sell. The resulting price increase caused further competition amongst buyers and further reduced the incentive for sellers to make offers.

In the early stage of the UK-ETS development, it was considered likely that the voluntary nature of the scheme would keep prices below 8 US$/$tCO_2$-e (Blyth, 2002). This was because the voluntary entry route was likely to attract sellers to the market, as it favoured companies that had already made emissions reductions relative to the baseline period. Therefore the market would have an oversupply of allowances, forcing the market price to be low. A low price could limit the influence of the market on the way business operated, since investment decisions would be little altered by factoring in the price of CO_2. Thus the new greenhouse gas market would not stimulate much new investment in emissions abatement.

Point Carbon forecasted in September 2003 that 73 $MtCO_2$-e emissions would be transacted in different segments of the global market in 2003. The forecast was based on observed trends in carbon transactions registered in Point Carbon's proprietary Carbon Transaction Database (600 transactions since 1996), interviews with market actors, as well as their assessments of policy developments and their market impacts. Overall, the actual market development since their previous February forecast of the 2003 volume target (ranging 110–345 $MtCO_2$-e) led Point Carbon to scale down to a range of 50 to 138 (best estimate 73) $MtCO_2$-e. Table 2 shows the variety of emission reductions and allowances

Table 2 Point Carbon's Trading Forecast for 2003, as of September 2003

System	Trading volume, $MtCO_2$-e
UK-ETS	0.2
Denmark	0
NSW, Australia	1.7
USA	0.3
Canada	1.1
EU-ETS	1.0
AAUs	0.1
Dutch Erupt (JI)	8.6
Dutch Cerupt (CDM)	16.5
Prototype Carbon Fund	19.6
Other CDM	15
Other JI	2.5
Other	6.5
Total	73.1

traded. Estimates of volumes traded in the USA, Canada, the World Bank Prototype Carbon Fund and forward trades of Kyoto Protocol Assigned Amount Units were scaled down, while targets for the EU-ETS were adjusted upwards compared to the February forecast (Buen and others, 2003). Point Carbon believed the main reasons for lower trading than forecast to be uncertainty related to procedural aspects of the project based Kyoto mechanisms as well as uncertainty and risk stemming from Russia's Kyoto ratification.

As would be expected at this early stage, there have been few significant trades in the EU-ETS. Broker Evolution Markets announced two significant trades: one for 150,000 tonnes split between 2005, 2006 and 2007 at an average cost of 5.50–6.50 €/tCO_2-e, the other for 90,000 tonnes similarly split over the three years at an average cost of 9 €/tCO_2-e (in September 2003, €1 = US$1.14). Other information available was the first publicly announced trade between Nuon and Shell, which most likely was for 50,000 tonnes at 5.50 €/tCO_2-e, and various small scale test trades. Adding these together, Point Carbon estimated the total volume traded in the EU market as of September to be approximately 340,000 tonnes worth a total value of around €2.25 million (Buen and others, 2003). Point Carbon did not consider such speculative trades provided sufficient basis for predicting that prices under the EU-ETS will continue to increase or even stay at their present level.

Some further trades publicly announced in November and December were around the 12 €/tCO_2-e level. Some of these were low volume trades of 5000 tonnes or less (EF, 2003b) but one at the end of December was a major trade of 60,000 allowances at 12.40 €/tCO_2-e (Point Carbon, 2004a).

Early market reaction to allocation developments has served to demonstrate the critical nature of this stage in the establishment of an emissions trading scheme. By March 2004, falling prices (to about 10 €/tCO_2-e) and low market activity were attributed mainly to uncertainty surrounding draft national allocation plans and the expectation that a number of EU member states will be 'over-generous' in their allocations. Also the European Parliament voted in March to allow CDM credits to be used in the EU-ETS from 2005 and this added to suspicions that the market in 2005-07 may be over-supplied with allowances (Point Carbon, 2004c).

By the end of April 2004, prices had fallen below 7 €/tCO_2-e largely driven by the publication of a number of 'over-generous' NAPs compared to the targets set under the EU burden sharing agreement. Prices rose again on speculations that the European Commission will clamp down on the Italian proposal in particular. The Commission has stated it is concerned about weak NAPs and falling prices, especially if the price dips below €5. This signal from Brussels was considered to have some strange implications. On the one hand, many companies would now have an interest in keeping prices above €5, in order to avoid tightening of their NAPs. On the other hand, the companies which are facing strict NAPs have an interest in driving prices down below €5, in an attempt to tighten the NAPs of their competitors (Point Carbon, 2004d).

The tendency towards small trades (in the order of 1000 to 20,000 tonnes) was expected to continue as companies seek to gain experience in how to do business in this emerging market. Point Carbon considered the lack of activity in the Danish and UK schemes from March to September 2003 was evidence that there was limited ability for small and voluntary schemes to create an active emissions trading market. With regard to the Chicago Climate Exchange, another voluntary scheme, it was considered too early to pass judgements, although Point Carbon indicated they would be surprised if the transaction volume in this scheme turned out to be large (Buen and others, 2003).

In its view of the market in 2003, Natsource brokers have described Canadian and Japanese buyers as particularly active buyers during the mid to late 1990s (Cogen and others, 2003). Natsource considered these and other buyers were motivated by a variety of objectives including fulfilment of voluntary emissions reduction commitments, demonstration of environmental leadership, illustrating the practical benefits of emissions trading to inform public policy debates and learning by doing. In recent years, governmental and quasi-governmental entities such as the Netherlands Government and the World Bank's Prototype Carbon Fund have been the most active buyers. Together, these entities have purchased over 35 Mt of emission reductions over the past three years. Private sector entities continue to engage in emission reduction purchases, though less actively than in the past. In the late 1990s, many of the projects supplying emission reductions traded were located in Canada and the US. More recently, Latin America and Central and Eastern Europe have emerged as common locations for projects involved in trades. Projects involving renewable energy generation and landfill methane capture have been common sources of traded emission reductions.

In the 2003 review, Natsource also commented on the continuing fragmentation among early greenhouse gas trading programmes in the absence of a clear international trading system design (Cogen and others, 2003). For example, the UK and Danish programmes cover different gases and sectors and utilise a variety of allowance based and credit based approaches, posing barriers to trade between firms in these countries. They also differ from the EU-ETS coverage and in addition, EU officials have expressed reservations about linking the cap based EU-ETS with Canada's emerging rate based domestic trading system. Natsource concluded that greenhouse gas commodity markets around the world have a generally positive outlook even though significant uncertainties remain, because each new piece of guidance concerning trading rules further reduces barriers to more active trading.

5.4.2 Transparency

In a review of project based transaction prices, the World Bank Prototype Carbon Fund (PCF) commented that any figures must be viewed with caution: 'Price information is notoriously hard to get.' (Lecocq and Capoor, 2003a). Compared with other buyers, the World Bank and the Dutch Government are in general more transparent about prices

paid. PCF considered this may skew the averages into a different trading price range from that of undisclosed transactions. PCF also noted that commodities are rarely comparable and that risk distribution, penalties, guarantees, and other features of each contract might go a long way towards explaining seemingly important price differences. For example, preliminary data analysis suggests that sellers who are willing to take on the Kyoto Protocol risk receive generally higher prices.

PricewaterhouseCoopers (PwC) also commented in its contribution to the IETA 2003 review that large institutional buyers of credits have dominated the early markets and this has consequently led to a somewhat biased view of the market (Segalen and Rajakaltio, 2003). The World Bank and the Dutch Government together accounted for over half of the volume of deals closed in 2002. PwC considered that these institutions have rightly benefited from their early mover status, (partial) taxpayer funding and the risk tolerant structure of the institutions. New markets seldom emerge without differences in the preparedness between companies on the supply and demand sides. One side may lack the capacity and understanding of the market to prevent it from starting to trade, or there may be regulatory uncertainties which impact one side more strongly than the other. Unevenly shared information often leads to biased markets. The unequal positions between buyers and sellers in a newly formed market can significantly restrict liquidity as speculative trade is hampered. PwC colourfully expressed this with 'enthusiastic dips into this new sea of opportunity have been regularly slammed by waves of uncertainty.'

There are clearly difficulties in balancing companies' right to privacy of their transaction information with the need for a degree of transparency to assist the development of an efficient emissions trading market. The IETA review and PCF's similar review (Lecocq and Capoor, 2003b) of the 2003 greenhouse gas market represent major steps in drawing together information from market participants and brokers. It is to be hoped that similar studies will receive the same degree of cooperation in the future.

5.4.3 Likely trading price range

The price of allowances will for the foreseeable future be dictated by the market that develops for trading EU-ETS allowances. The trading price range will be influenced by many factors including:

- the allocations made to all installations (in total and individually);
- the range of abatement opportunities and costs for individual installations;
- access to the Kyoto mechanisms, especially the likelihood that an emission reduction will be recognised by the EU as a credit (eg, if credits from a particular JI or CDM project are eligible to meet an installation's obligations. The EU linking directive is currently under discussion with the possibilities that JI or CDM project credits might be capped at a certain quantity or eligible from only renewable energy projects);
- cost of validation and potential certification of any credits;
- creditworthiness of any carbon credits;
- structure of the contract between trading parties, for example a spot versus a forward contract or a likely discount for payment up front rather than on delivery;
- potential additional environmental and social benefits for a company in the short or long term.

Point Carbon has examined CO_2 prices under different scenarios for international emissions trading in the Kyoto period 2008-12 (Buen and others, 2003). Perhaps contrary to what might be expected, model based simulations suggest that prices will not be significantly lower in a scenario where the EU-ETS (including EU candidates and Norway/Switzerland) operates in isolation from the Kyoto market (including Japan, Canada, Russia and New Zealand), than in a scenario where all developed countries take part in a scheme for international emissions trading. In simple terms, this is because demand from the group of current EU member states is almost balanced by potential supply of excess allowances from the EU candidates. Also, countries like Japan and Canada, which are likely to become large net buyers of Kyoto compliance units, will not pay too high a price to a large seller like Russia because domestic action in the buyer country becomes more cost effective with increasing prices.

For Point Carbon's 'most likely' scenario, international emissions trading among all developed countries less the US, Australia and Ukraine, the updated price estimate for 2010 is 9.90 US$/t$CO_2$-e, with low (25th percentile) and high (75th percentile) estimates of 5.00 and13.70 US$/t$CO_2$-e respectively. Using a discount rate of seven per cent per annum, the present carbon value is therefore 6.20 US$/t$CO_2$-e, with low and high estimates of 3.10 and 8.50 US$/t$CO_2$-e respectively (Buen and others, 2003). Point Carbon estimated that the greenhouse gas markets will be worth around US$10 billion by 2007.

Brokers CO_2-e commented in the IETA 2003 review that the market is becoming increasingly stratified. Early movers had no choice but to source Verified Emission Reductions (VERs) and hope to get them certified as CEM Certified Emission Reductions (CERs) later with many buyers expecting the seller to take that risk. Commercial buyers are almost exclusively contracting to take delivery of CERs (no payment if no certification or Kyoto entry into force). Prices for reductions in 2010 are around 5.50–6.50 US$/t$CO_2$-e per CER. On the other hand, the World Bank and government agencies are still contracting to take VERs with a strong conversion promise and will pay out even if the Kyoto Protocol does not enter into force. Prices for reductions in 2010 in this category are around US$3.00 to US$ 4.50 per VER/CER, though the preparedness for these agencies to pay a proportion of the price up-front increases the present value of these transactions. CO_2-e concluded that the implied pricing on Kyoto ratification risk is therefore around one dollar (Drummond, 2003).

CO_2-e explained that there was no market pricing for EU-ETS allowances for 2008-12 because the underlying variables (particularly national allocation plans) to any price forecast were so wide (Drummond, 2003). CO_2-e noted that the European Commission had released a price forecast of 26 €/t

for 2005-07, and 14 €/t for 2008-12. The price drop is attributed to the EU ruling that CDM or JI credits will only be able to be converted into EU allowances from 2008 onwards.

PricewaterhouseCoopers (PwC) has speculated that the global greenhouse gas market could be segregated into at least seven OECD emissions trading schemes by 2006 (Segalen and Rajakaltio, 2003). A developing country project could in the future be in a position to 'choose' its buyer between buyers in a US state scheme, a US voluntary scheme, a North American Free Trade Agreement (AFTA) scheme, a domestic Japanese scheme, the EU-ETS and Kyoto CDM or emissions trading mechanism. In this situation the credits should be able to claim a premium for their fungibility (interchangeability). However, today the situation is less diverse. Assuming guaranteed EU-ETS approval, the price could be around 9–10 €/tCO_2-e in the EU, 6 €/t the CDM market and 1 US$/t on the US voluntary/offset market.

PwC believed that increasingly from 2004 large sellers will start shaping the greenhouse gas markets. The market will be initially driven by demand from the EU-ETS but it will be increasingly influenced by other emerging schemes in which credits can be used. This will not only apply to the credit markets but also to the EU allowance market. PwC considered that Eastern European sellers, in particular, will see the early benefits of a seller's market, provided their opportunity is not diminished by their 'hot air' eligibility. 'Hot air' is the term for the largely fortuitous credits that have arisen from the emissions reduction associated with large scale industry closures in mainly Eastern European countries since 1990.

PwC concluded the developments with the EU-ETS and in the CDM executive board will start pushing buyers to the market and open more clear opportunities for sellers of credits. As a result the market will shift from public buyers to corporate buyers, from a buyer's market to a seller's market, and from one-off reductions to packaged and tailored streams of compliance tools and offsets. Consequently, companies with a large international asset base from which to produce emission reduction credits will begin to see their role on the market grow substantially (Segalen and Rajakaltio, 2003).

A useful indication of future price range came from the Annual General Forum of IETA in October (Point Carbon, 2003b). 116 participants from companies and organisations involved in the emerging greenhouse gas market responded to a request to guess the closing price for 1 tCO_2-e on 31 December 2010. The guesses ranged from 1 to 100 US$/t$CO_2$-e with a median (mid-guess) of US$10.50 and a mean (average) of US$14.30. Price expectations were lower than previous years' surveys. In 2002, the results were 12.20 and 14.90 US$/t$CO_2$-e for median and mean respectively and in 2001, 10.75 and 18.70 US$/t$CO_2$-e.

5.5 Economic impacts

Many studies have been conducted on the potential cost savings due to international emissions trading for greenhouse gases within the Kyoto Protocol (UNEP/UNCTAD, 2002). The studies differ in terms of:

- the emissions covered (ranging from energy related CO_2 only to all greenhouse gases);
- the coverage of sinks (no sinks to maximum allowable sinks);
- the projected emissions in the absence of emissions abatement policies;
- the scale of CDM activity (none to all reductions from developing countries);
- transaction costs for project based mechanisms (0-30%);
- the structure and assumptions of the model employed and particularly;
- whether the USA would ratify the Kyoto Protocol.

For studies assuming US ratification, estimated savings vary widely for different regions. When emissions trading is limited to developed countries with Kyoto commitments, the USA achieves the smallest savings (average 46%, ranging from 30% to 76%), Japan the largest savings (average 64%, ranging from 21% to 93%), and the Europe and Canada region and Australia and New Zealand region both about 55%. Including developing countries in the trading gives larger savings because more low cost abatement opportunities are available. Fewer studies assume that the USA does not ratify. Since demand for allowances falls while supply is the same, prices fall significantly and savings are much smaller (although larger in percentage terms). Emissions trading simulations, where individuals represent participants, show that they do not always achieve the least cost result. Some researchers show 97% of potential cost savings are achieved, others 82% and others as low as 45% for some simulations (UNEP/UNCTAD, 2002).

5.6 Technology development

There is little doubt that placing a value on the emissions of CO_2 and other gases will encourage fuel switching and the development of more efficient technologies. The challenge for the coal industry is to ensure that new clean coal technologies will be eligible for any incentive payments to reduce emissions. Investment in coal efficiency improvements and sequestration technologies will make an important contribution in the transition to a sustainable energy future.

Clean coal technology plays a prominent role in the US federal greenhouse gas policy. The most significant of these clean coal research and development initiatives is the 'Future Gen' project (Braine and Francis, 2003). This US$1 billion, 250 MW demonstration plant (with 80% funding from the federal government) is planned to be completed by 2008. Future Gen will be designed to produce both power and hydrogen while sequestering 90% of CO_2 emissions underground. The 2003 budget includes a sizeable investment of US$62 million for CO_2 sequestration.

6 Implications for the coal industry

The major impact of climate change policies will be the increased prices faced by users of fossil fuels (particularly coal). The direct cost impact of a simple carbon tax on different fuels in various countries is illustrated below.

Other indirect costs will impact on the operations of coal users and producers in ways that can not be adequately simulated in this study:

- all fuel users will need to manage the risk of their CO_2 emissions cost as they face the price variations and transaction costs associated with emissions trading;
- indirect transport fuel and electricity price increases will have an impact on coal mining practices, particularly in relation to the economics of overburden removal for opencast mines;
- increased shipping and road/rail transport costs will contribute to increased prices;
- there may be an indirect investment impact on the selection of technology for electricity generation;
- coal price increases could possibly influence the types of coals utilised, although based on lower heating values, the average bituminous coal emits only 1.5% less CO_2 than the average sub-bituminous coal (94.7 tonnes CO_2 per net terajoule of input energy (tCO_2/TJ) for an average bituminous coal, 96.2 tCO_2/TJ for a subbituminous coal and 101.3 tCO_2/TJ for a lignite (IPCC, 1996));
- some coal users will require their coal supply contracts include the cost of emission reduction credits or allowances appropriate for their emissions compliance.

The challenge for the coal industry will be to ensure that governments provide energy users with sufficient flexibility to achieve abatement by cost effective means (such as emissions trading) rather than by direct regulation. This will then allow clean coal technologies and other solutions to be evaluated in terms of cost effectiveness rather than be dependent on potential regulatory bias against coal utilisation.

6.1 Energy price impacts

Table 3 demonstrates the range of potential price impacts of a 10 US$/$tCO_2$ emissions tax for coal users in various countries and compares these with the impacts on other fuels. The purpose of these comparative figures is to demonstrate the major differences in impact among some countries and among the different fuels from a direct emissions tax. The 10 US$/t tax level was chosen as a round number rather than a prediction of future prices. No attempt is made to assess any extra indirect increases from mining, processing and transport emissions. Also, no assessment is made of the political likelihood of each of the countries adopting such a tax.

The main conclusion from this simple comparison is that coal would remain the most competitively priced industrial fuel in the five countries where coal currently has the lowest price. Coal users in countries with the lowest coal prices would have the largest proportional cost increases (up to 82% for Canada). German coal users, with the highest coal prices of these six countries, should experience the lowest proportional impact (an increase of 16%). At the other extreme, petrol prices would face relatively small increases (2-5%) because they generally include high processing and taxation costs. Industrial gas and light fuel oil would face intermediate cost increases (ranging from 4% to 21% and 9% to 13% respectively).

As explained in the notes to the table, the cost impacts on electricity prices are highly speculative, depending on the relationship of thermal generation costs to the average and marginal wholesale prices. These figures represent the maximum impact from 100% conventional coal fired generation. On that basis, Japanese industrial electricity users would be affected the least (up to 7% price increase) and Canadian industry would face the largest impacts (up to 31% price increase).

Bankers UBS Warburg forecast power wholesale prices could rise by 63% across Europe following the start of emissions trading in Europe (Platts, 2003). UBS considered that it could result in a windfall for utilities as wholesale prices rise. Taxation could mitigate gains for some companies as some governments might use the permit allocation process as a tool of energy policy or taxation. The utilities likely to benefit the most would be UK's Scottish & Southern Energy, Spain's Iberdrola and Germany's E.on.

Analysts at Citigroup released a tentative study of the likely costs on German energy giants RWE and E.on once allowances have been allocated (Platts, 2003). RWE has more exposure than E.on because of its greater reliance on fossil fuel production. Citigroup envisaged that RWE could be targeted to cut emissions by 15 Mt by 2012. Were allowances to be set on this basis from the outset in 2005, and if RWE decided to maintain its production from its fossil fuel plant, the additional cost burden might be in the region of €150 million assuming an allowance price of 10 €/t. A recent energy summit had agreed that utility and energy intensive industries should cut annual emissions by 45 Mt by 2012 and that additional free allowances would be granted to new power stations replacing decommissioned nuclear plants.

An International Energy Agency report concluded that coal fired power plants could keep their competitive advantage in the EU if the price of CO_2 remained 'relatively low' below 9 €/tCO_2-e (IEA, 2003). The report stressed that this figure was sensitive to changes in the underlying assumptions, which include low gas prices, an increase in coal costs, an average 55% net efficiency rate for combined cycle gas turbines (CCGT) starting in 2010 and 40% for coal fired plants. The report also concluded that it would not be economic for a company to replace its existing coal fired capacity with a modern CCGT plant until the CO_2 price reached 23 €/t. It added that CO_2 prices would have to be in the range 30–200 €/tCO_2 for renewable technologies to become competitive. The report suggested that if the CO_2

Table 3 Relative cost impacts of an emissions tax on international industrial energy prices (US$)

	Coal, $/GJ	Gas, $/GJ	Regular petrol, $/GJ	Light fuel oil, $/GJ	Electricity, ¢/kWh
Australia + 10 $/tCO$_2$ Increase (%)	1.3 2.3 72	2.7 3.3 21	18.5 19.2 4	NA	4.3 5.2 22
Canada + 10 $/tCO$_2$ Increase (%)	1.2 2.1 82	3.4 4.0 16	17.7 18.4 4	6.3 7.1 12	3.0 3.9 31
Germany + 10 $/tCO$_2$ Increase (%)	6.0 6.9 16	5.5 6.0 10	37.6 38.3 2	8.7 9.4 9	5.2 6.2 18
Japan + 10 $/tCO$_2$ Increase (%)	1.7 2.6 56	12.8 13.4 4	32.3 33.0 2	7.2 8.0 11	13.5 14.5 7
UK + 10 $/tCO$_2$ Increase (%)	2.5 3.5 37	3.3 3.9 17	41.8 42.5 2	8.0 8.8 10	5.1 6.0 18
USA + 10 $/tCO$_2$ Increase (%)	1.5 2.4 64	4.5 5.1 12	14.7 15.4 5	6.1 6.9 13	4.8 5.7 19

This compilation (NZMED, 2003) is based on the International Energy Agency's Energy Prices and Taxes, First Quarter 2003
Care is needed in interpreting the information as some data relate to different years
NA = not available
CO_2 emission factors are from IPCC (1996); bituminous coal assumed
Cost impacts on electricity prices are highly speculative, depending on the relationship of thermal generation costs to the average and marginal wholesale prices. These figures represent the maximum impact from 100% conventional bituminous coal fired generation at 37% net efficiency

price was 20 €/t, wholesale electricity prices in Europe would increase by 21% but cautioned that many factors influence the way cost increases affect power prices.

6.2 Fuel switching

In view of the sort of price impacts demonstrated above, many coal users are likely to investigate a full or partial switch to lower carbon fuels such as natural gas or 'no carbon' fuels such as wood waste. Combustion of wood waste would not be taxed on the basis of its CO_2 emissions because the CO_2 absorption by a growing tree and eventual combustion of its wood products is considered a relatively short term cycle that does not contribute to climate change. CO_2 emissions associated with wood waste utilisation where trees are not replanted are considered as land use changes rather than combustion emissions for inventory purposes. Major barriers to fuel switching will be the availability of a low cost alternative fuel and the capital cost of converting existing equipment or installing new technology.

In the long term, fuel switching may have a significant impact on supply of all fuels. For example, Russia could decide to build more coal fired power capacity to free up more gas for sale to Europe.

6.3 Coal trade

With some fuel switching occurring at least in the medium term, reduced demand may lead to a general lowering of coal prices. Coal producers in developed countries with emissions taxes would face higher mining and transport costs coupled with methane emission costs for some of them. This would give a competitive advantage to coal producers in non-Kyoto countries. However, all coal producers and traders will face new challenges when some of their customers in Kyoto countries demand that allowances or credits be provided with their supplied coal. This could mean that coal producers and traders will have to build some experience in purchasing or trading allowances or employ brokers on their behalf. The boxed examples show two possible situations of how coal users and suppliers might develop this experience.

6.4 Opportunities for coal suppliers

Despite the significant price impacts on coal arising from emissions taxes and trading schemes, some coal suppliers have already seen the opportunities to package their coal supply contracts with emission reduction credits of various types. It is yet to be determined how well these moves will be

supported by coal buyers in different countries and what premium on coal prices will be the result.

6.5 Tax treatment

The tax treatment of allowances was considered in the New Zealand government's discussion paper on technical design issues for a domestic emissions trading scheme (NZMFE, 1998). Normal tax rules would apply for both income tax and value added tax purposes. The timing and valuation of any deductions or income would depend on the purpose for which the allowances were acquired. Any expenditure would be treated as revenue rather than capital for tax purposes. For traders intending to resell at a profit, allowances would represent trading stock. Value added tax would be charged on allowances and recovered by industries as an input tax credit. The cost of the value added tax would ultimately be borne by the consumer of the final goods and services.

6.6 Banking credit rating

Global ratings agency Standard & Poor's has said that European energy companies should already be preparing for the economic effects of the EU-ETS. S&P noted that the scheme would have a significant impact on the sector's credit quality when it comes into force in 2005. Complying with the new regulations would increase costs for the sector and S&P have already begun to review the likely effects of the increased focus on emissions trading in Europe, particularly on the profitability and cash flow generation of utilities and energy trading companies (Platts, 2003).

6.7 Trusting the market

Hundreds and perhaps thousands of companies face the prospect of trading in the greenhouse gas markets in the next few years. With accounting scandals having had the effect of denting confidence in the share market, these companies may have significant concerns about the trust they will need to place in the relatively new greenhouse gas markets. Some may find the following statements from the Emissions Marketing Association President reassuring (EMA, 2003). The EMA consists of more than 250 members from 150 companies worldwide and its goal is to promote market based trading solutions for environmental control.

'Executive accountability exists in the emissions field and EMA has a strong policy statement of ethics applicable to all members… covers general obligations to uphold laws, codes and regulations, obligations to the public and obligation to professionalism… Emissions trading is a privilege. It allows for environmental goals to be achieved faster and with less disruption to consumers than more draconian command-and-control approaches. But if the emissions trading industry does not maintain high standards of ethical operation, emissions trading will not be expanded or may be taken away. This makes ethics every emissions trader's business.'

6.8 First steps

Companies facing their first steps towards managing their greenhouse gas emissions may find the following advice from PricewaterhouseCoopers (PwC) useful (Segalen and

A 2010 view of how two coal users are coping with emissions trading

A large coal user (5 Mt coal annually) is situated in an Annex B country* that has had a national emissions trading scheme in place since 2005. Its regulatory authority allocates free allowances for 90% of an installation's 2000 emissions and since this company's output has grown since 2000, the free allowances cover 70% of its current annual CO_2 emissions. The company employed its own trading personnel from 2005-07 to purchase allowances when market prices were low and bank them for redemption in future years.

In 2008 the company decided to focus on its core business and entered a five year contract with a broker to supply the required allowances at a price annually set in relation to the previous year's average spot market price. The broker carries most of the market fluctuation risk and so charges that into the annually fixed price using a contractually agreed formula. The company continues to purchase its coal from a number of countries on annual contracts because it has found no advantage in longer term contracts. It has found that coal prices fluctuate significantly because reduced coal demand has generally lowered international prices. However, countering this trend, coal suppliers from Annex B countries have experienced higher mining and transport costs coupled with methane emission costs for some of them.

A medium coal user (100,000 tonnes coal annually) is situated in an Annex B country that has had an incentives scheme and carbon tax in place since 2005. From 2008 its regulatory authority chose to auction all of its allowances and use the revenue to provide substantial capital incentives for further emission reduction projects. The company was one of many to receive funds for a major equipment upgrade increasing its efficiency and helping it to remain internationally competitive.

To demonstrate corporate citizenship, the company paid a premium on its coal supply from 2005-07 by purchasing from a supplier that had attached 'Verified Emission Reductions' certificates (or 'green credits'). The regulatory authority indicated that from 2008 these would not be acceptable for compliance within its jurisdiction because of the risk to the country's Assigned Amount Unit (AAU) management. From 2008, the company has been in a three year contract with a coal supplier as a result of a tender that specified the coal must carry AAU certificates or equivalent. The total cost is still less than the carbon tax alternative. The coal supplier (from an Annex B country) employs its own trading personnel and has found that the profits from buying allowances at low market prices have offset the increased costs from emissions charges on its mining and transport operations.

* An Annex B country is a developed country that has ratified the Kyoto Protocol and accepted its legally binding commitment to limit net greenhouse gas emissions to a level (commonly about 95%) relative to its 1990 base year emissions or purchase Assigned Amount Units (or other units for Kyoto compliance) for any shortfall.

Rajakaltio, 2003). PwC considers the cornerstone of any corporate wide assessment of greenhouse gas assets is data management including site information, operational data, local management practices and data collection responsibilities. In PwC's experience, the quality of data collection in climate change projects is seldom even close to the standards set by financial or operational reporting. Only after the 'homework' on a company's own assets (including the internal marginal abatement cost) has been done properly should a potential buyer or seller start to approach the market with a long term buying or selling strategy.

The Greenhouse Gas Protocol is a freely available emissions accounting tool that has been adopted as a basis for several companies around the world to account for their emissions (WBCSD/WRI, 2003). The protocol has been deployed by trading schemes in the UK, the EU and the Chicago Climate Exchange.

7 Conclusions

This report has summarised the current status of emissions trading and the implications for coal producers, traders and users. Emissions trading is one of the flexible mechanisms within the Kyoto Protocol and the European Union will launch an Emission Trading Scheme (EU-ETS) in January 2005. The EU-ETS and other emissions trading schemes internationally will impact on the operation of the coal industry, arguably reducing the costs of complying with greenhouse gas emission reduction policies.

Emissions trading is a key instrument in the drive to reduce greenhouse gas emissions. In practical terms, emission trading should ensure that emission reduction takes place where the cost of the reduction is lowest and is particularly suited to the emissions of greenhouse gases, which have the same effect wherever they are emitted. This allows governments to regulate the amount of emissions produced in aggregate by setting the overall cap for the scheme but gives companies the flexibility of determining how and where the emissions reductions will be achieved. There are two main types of emissions trading systems: baseline and credit and cap and trade.

In the baseline and credit system, a baseline emission profile is projected in terms of emissions growth or technological change. The implementation of a specific project would create an alternative projection generating credits when emissions are below the baseline. Consequently, the credits can be traded with companies that exceed their baseline. However, without a binding cap on emissions the regulatory authority must provide an incentive for trading to occur. Such an incentive could be created by recognising early abatement action in awarding credits for participation in a scheme such as a voluntary agreement. Baseline and credit systems often have the problem of an oversupply of credit sellers and not enough buyers.

A cap and trade system has the main feature that the total supply of emission allowances is capped. When the supply is plentiful, the allowance trading price will be low and when allowances are scarce, their price will be high. Initially, allocation of allowances can occur by free allocation, auctioning or a combination of both. Free allocation is based on a set of criteria, the most common being a level of historical emissions over an agreed period. In auctioning, a regulatory authority sells the allowances by various methods of auction or tender. Most regulatory systems are of this type.

The most useful non-greenhouse gas example of emissions trading has been the US sulphur dioxide allowance trading system introduced in 1995 to reduce acid rain. The introduction of this cap and trade programme had the objective of capping total SO_2 emissions from electric utilities at less than half their total emissions in 1980. The result was to stimulate industry into finding innovative and cost effective ways of reducing emissions. The system is claimed to have low transaction costs for participants once the expensive monitoring systems were installed and low administration costs for government. The cost of using this system is estimated to be approximately US$1 billion (45%) less than equivalent, efficient regulations. The experience gained is influencing the development of other SO_2, NOx and possibly mercury emissions trading schemes.

There have been a number of useful lessons learned from pilot greenhouse gas trading schemes conducted in Canada, Denmark, the UK, some US states and by private companies such as BP, Shell and the Chicago Climate Exchange. The UK experience has had the most significant impact in terms of the number of installations involved and the volume of trading since its inception in April 2002 as a voluntary scheme (UK-ETS) that covers a broad range of sectors. The UK Government described the objectives of the scheme as achieving a significant amount of absolute emission reductions at a reasonable cost, enabling business to gain practical experience of emissions trading ahead of a European and international system, and helping the City of London establish itself as a global centre for emissions trading.

Some of the companies actively involved in the UK-ETS have assessed it as successful on the grounds that all participants have an incentive to innovate and invest in reducing the cost of complying with the targets. Since the UK-ETS was the first scheme of its kind, companies had limited experience in terms of managing a compliance position and were unwilling to take on targets with an associated risk of non-compliance. Companies therefore generally offered conservative volumes that could comfortably be achieved. In some cases the necessary reductions had been achieved before the start of the scheme and this has led to a major controversy over windfall credits. Shell concluded it was an ambitious piece of legislation that has allowed UK companies to gain experience and understand the business processes necessary for managing a position within an emissions trading scheme. Shell added that it could be classed as a success in that it did encourage a large amount of trading activity (Campbell-Colquhoun, 2003).

The European Union is establishing an EU Emissions Trading Scheme (EU-ETS) in up to 28 countries intended to begin on 1 January 2005 with a first phase from 2005-07 and then another phase from 2008-12. The first phase of the scheme will only cover emissions of CO_2 but individual member states will be able to incorporate other greenhouse gases from 2008. The EU-ETS will include power generation, oil refineries, offshore installations and other heavy industrial sectors in the first phase.

The EU collectively took on a target to reduce greenhouse gas emissions by 8% from 1990 levels by 2008-12. This 8% was then split in a 'burden sharing' arrangement around the EU member states. The EU will first set a total emission level for the 2005-07 phase and then negotiate with member countries to distribute, allocate or auction allowances up to

the set emission limit. Once the allowances have been allocated they would be freely tradeable. The number of allowances each company or installation with emissions will receive will be based on each member state's National Allocation Plan (NAP). Each member state government will be required to submit its NAP to the European Commission by 31 March 2004. In the 2005-07 phase of EU-ETS, at least 95% of these allowances must be allocated free of charge to installations. Individual governments will decide whether up to 5% of the allowances will be auctioned. 14,000-plus installations are expected to fall within the scheme.

To avoid penalty charges, these installations will have to surrender allowances equal to their emissions every year but they will be able to trade allowances to meet this obligation. Excess allowances for an installation in one year could be held for its own compliance in a later year during the first phase of the scheme regardless of the year in which they are allocated. Installations will be required to have their annual emissions verified by an independent accredited agency.

In November 2003, the European Commission claimed the majority of EU member states were on course to meet the deadline for allocating allowances. However, some industries were expressing frustration over what they saw as a chaotic process and they expected key deadlines to slip. Also in November, the European business trade association remained broadly supportive of the EU-ETS because of the potential to assist companies to meet commitments cost effectively. However, the group said it is crucial that the scheme be implemented in a consistent and timely fashion throughout the EU. In a December report, Deutsche Bank believed there was 'limited time available for solving massive problems in the initial allocation of credits' and consequently the planned 2005 launch date was at risk. The bank expected the greatest challenge to be in harmonising the various NAPs. Member states were reported to be keeping a close eye on each other's choice of allocation methodology because of the potential for market distortions. The European Commission was facing a difficult task in sifting the draft plans for overly generous allocations which could constitute illegal state aid.

In December 2003, commercial and energy law experts summarised the situation by saying the unprecedented timetable will make it extremely difficult for governments to implement the Directive in a timely and considered fashion. They believed the tight timetable may cause the incomplete or imperfect implementation of the legislation, which could create fertile ground for litigation challenging either the implementation or, more likely, the distribution of allowances in the highly political, technical and complex NAP process. These potential claims may delay the timing of the scheme (Hobley and others, 2003).

The future prospects for greenhouse gas emissions trading schemes will heavily depend on the future of the Kyoto Protocol. If the treaty does not enter into force or has limited participation, the future of the EU-ETS might also be in doubt because of the impacts on international competitiveness. It is possible that an alternative to Kyoto will be negotiated in the future that encourages wider participation by focusing on emission rates per unit output rather than the environmental certainty of an emissions cap. Its supporters claim it will maintain the international economic growth required for the major technology development to achieve significant abatement.

To date there exists no established carbon or greenhouse gas market, defined by a single commodity, a single contract type or a single set of buyers and sellers. It is also clear from market participants that there is limited information on various issues surrounding the establishment of a market including prices as there is no recognised central clearinghouse for transactions. Therefore it is difficult to compare prices/quantities of sales of carbon credits. Emission reductions generated in locations or during periods that would disqualify them for international recognition as permits have traded for approximately 0.60 to 1.50 US$/tCO$_2$-e. Emission reductions that could potentially be converted into permits (through the Clean Development Mechanism or Joint Implementation) have traded for prices between 1.65–8.00 US$/tCO$_2$-e, with most occurring between 3–5 US$/t (Cogen and others, 2003). The World Bank Prototype Carbon Fund also summarised that prices for project based transactions in 2002 and 2003 had consolidated in the range 3–5 US$/tCO$_2$-e (Lecocq and Capoor, 2003a).

Despite its limitations, brokers Natsource considered the UK-ETS to be the best indicator of permit or allowance trading prices instead of the emission reduction trading prices discussed above (Cogen and others, 2003). Natsource estimated that by September 2003 approximately 1.6 million UK allowances had changed hands in about 500 company-to-company trades. Prices rose from around 7 US$/tCO$_2$-e in August 2001 to a peak of approximately 20 US$/tCO$_2$-e in September 2002. Later in 2002 prices fell back to their earlier level and prices continued to decline to a September 2003 level of about 3 US$/tCO$_2$-e. BP attributed these changes in UK allowance prices to basic supply/demand theory and the market structure design (Dutton and others, 2003). When the market first opened there were only a few participants with verified baselines, which reduced the number of issued allowances. This proved a constraint on supply and, with early demand, the allowance price rose steadily to the mid-year price peak. The price fell back rapidly as new supply came to the market. Despite active trading as first compliance dates loomed, the price slipped further in an over-supplied market.

As would be expected at this early stage, there have been few significant trades in the EU-ETS. Early market reaction to allocation developments has served to demonstrate the critical nature of this stage in the establishment of an emissions trading scheme. Some trades publicly announced in November and December were around the 12 €/tCO$_2$-e level but by the end of April 2004 prices had nearly halved when it became clear that some governments were proposing generous national allocation plans that might lead to an over-supply of allowances. The tendency towards small trades (in the order of 1000 to 20,000 tonnes) was expected to continue as companies seek to gain experience in how to do business in this emerging market.

For Point Carbon's 'most likely' scenario, international

emissions trading among all developed countries less the US, Australia and Ukraine, the updated price estimate for 2010 is 9.90 US$/tCO$_2$-e, with low (25th percentile) and high (75th percentile) estimates of 5.00 and13.70 US$/tCO$_2$-e respectively. Using a discount rate of 7 per cent per annum, the present carbon value is then 6.20 US$/tCO$_2$-e, with low and high estimates of 3.10 and 8.50 US$/tCO$_2$-e respectively (Buen and others, 2003). Point Carbon estimates that the greenhouse gas markets will be worth around US$10 billion by 2007.

The major impact of climate change policies will be the increased prices faced by users of fossil fuels (particularly coal). The challenge for the coal industry will be to ensure that governments provide energy users with sufficient flexibility to achieve abatement by cost effective means (such as emissions trading) rather than by direct regulation. This will then allow clean coal technologies and other solutions to be evaluated in terms of cost effectiveness rather than be dependent on potential regulatory bias against coal utilisation.

The main conclusion from a simple comparison of price impacts of a 10 US$/tCO$_2$ emissions tax is that coal would remain the most competitively priced industrial fuel in five developed countries where coal currently has the lowest price. Coal users in countries with the lowest coal prices would have the largest cost increases (up to 82% for Canada). At the other extreme, petrol prices would face relatively small increases (2–5%) because they generally include high processing and taxation costs. Industrial gas and light fuel oil would face intermediate cost increases (ranging from 4% to 21% and 9% to 13% respectively).

Other indirect costs will impact on the operations of coal users and producers in ways that can not be adequately simulated in this study:

- all fuel users will need to manage the risk of their CO$_2$ emissions cost as they face the price variations and transaction costs associated with emissions trading;
- indirect transport fuel and electricity price increases will have an impact on coal mining practices, particularly in relation to the economics of overburden removal for opencast mines;
- increased shipping and road/rail transport costs will contribute to increased prices;
- there may be an indirect investment impact on the selection of technology for electricity generation;
- coal price increases could possibly influence the types of coals utilised, although based on lower heating values, the average bituminous coal emits only 1.5% less CO$_2$ than the average sub-bituminous coal;
- some coal users will require their coal supply contracts include the cost of emission reduction credits or allowances appropriate for their emissions compliance.

An International Energy Agency report concluded that coal fired power plants could keep their competitive advantage in the EU if the price of CO$_2$ remained ‘relatively low’ below 19 €/tCO$_2$-e (IEA, 2003). The report stressed that this figure was sensitive to changes in the underlying assumptions. The report also concluded that it would not be economic for a company to replace its existing coal fired capacity with a modern CCGT plant until the CO$_2$ price reached 23 €/t. The report suggested that if the CO$_2$ price was 20 €/t, wholesale electricity prices in Europe would increase by 21% but cautioned that many factors influence the way cost increases affect power prices.

In view of the sort of price impacts demonstrated above, many coal users are likely to investigate a full or partial switch to lower carbon fuels such as natural gas or ‘no carbon’ fuels such as wood waste. Major barriers to fuel switching will be the availability of a low cost alternative fuel and the capital cost of converting existing equipment or installing new technology. With some fuel switching occurring at least in the medium term, reduced demand may lead to a general lowering of coal prices. Coal producers in developed countries with emissions taxes would face higher mining and transport costs coupled with methane emission costs for some of them. This would give a competitive advantage to coal producers in non-Kyoto countries. However, all coal producers and traders will face new challenges when some of their customers in Kyoto countries demand that allowances or credits be provided with their supplied coal. This could mean that coal producers and traders will have to build some experience in purchasing or trading allowances or employ brokers on their behalf.

Despite the significant price impacts on coal arising from emissions taxes and trading schemes, some coal suppliers have already seen the opportunities to package their coal supply contracts with emission reduction credits of various types. It is yet to be determined how well these moves will be supported by coal buyers in different countries and what premium on coal prices will be the result.

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Links to useful websites

www.ieta.org The International Emissions Trading Association (IETA) is a non-profit organisation created in June 1999 to establish a functional international framework for trading greenhouse gas emission reductions. Its membership includes leading international companies from across the carbon trading cycle. IETA members seek to develop an emissions trading regime that results in real and verifiable greenhouse gas emission reductions while balancing economic efficiency with environmental integrity and social equity. Its objectives are set to achieve one of its key goals to be the premier voice for the business community on emissions trading. IETA's Trading Scheme Database (developed by Point Carbon) is a particularly useful summary of all known existing, planned, and proposed schemes for the trading of greenhouse gas emission allowances and reduction credits.

www.pointcarbon.com Point Carbon describes itself as the leading global provider of independent analysis, market intelligence and forecasting in the emerging carbon emission markets. Point Carbon offers standardised subscription based decision support tools to professional players in carbon markets, directly relating to these players' major financial decisions. In addition to its subscription based services, Point Carbon also provides consulting on selected topics. Its free online news service provides up to date information together with well archived earlier news stories.

www.natsource.com Natsource LLC is a provider of strategic advisory, brokerage, and asset and portfolio management services for energy related products in emissions permit, power, natural gas, coal, and weather hedging markets. Natsource describes itself as a pioneer in energy and environmental brokerage, assisting leading private firms and governments around the world in strategic management of energy and environmental risk. Natsource is headquartered in New York and has a global reach, with offices in many of the world's major financial centres.

www.prototypecarbonfund.org The Carbon Finance team of the World Bank manages the Prototype Carbon Fund (PCF) and other carbon funds on behalf of a number of private and public participants. These Funds are an opportunity for the World Bank to channel new public and private resources for development of clean infrastructure and poverty alleviation in its client countries. All funds purchase emission reductions from projects in transition economies and in developing countries. The pioneering companies and governments that have contributed to the funds also support the development of the greenhouse gas market and disseminate the lessons learned from their activities.

www.endsreport.com The ENDS journal contains detailed information on environmental issues in the UK and its assessments and reviews of the UK-ETS and the EU-ETS have been particularly valuable.

www.platts.com Platts provides information on a variety of energy sectors including coal. Its free online services have useful summaries of many emissions trading issues including developments on greenhouse gases, SO_2, NOx, particulates, mercury and other pollutants.

www.environmental-finance.com The monthly journal Environmental Finance is one of the best sources of reviews on all aspects of global emissions trading. Its free Online News is a good means of checking recent news.

www.defra.gov.uk The UK Government's Department of Environment, Food and Rural Affairs website contains a variety of useful documents explaining and assessing both the UK-ETS and the EU-ETS.

www.europa.eu.int/comm/environment/climat/ The EU climate change website may be useful to obtain the EU-ETS directive and guidance on the development of national allocation plans.

www.unfccc.int The UNFCCC website has a wide variety of information on climate change, the Kyoto Protocol and the Clean Development Mechanism, Joint Implementation and international emissions trading.