PointCarbon

Carbon Market Analyst

Special Issue - What determines the price of carbon? October 14 - 2004

TO THE POINT

Emissions trading is the key policy instrument for dealing with increasing greenhouse gas emission levels. Through the establishment of a market for trading of emission allowances companies in the EU must implement carbon management strategies, as their emissions will become either an asset or a liability. The emerging carbon market shows evidence of increasing activity levels and a number of new players will enter the market in the near future. What parameters must the players in the market consider when trying to assess the impact of future carbon prices?

There are a number of key factors that will influence the price of carbon in the 2005-2007 period, including: policy and regulatory issues; market fundamentals, including weather and production levels; together with technical indicators. Insight into these price drivers will inform a company's trading strategy, risk strategy and, ultimately, its investment decisions. This special issue of the Carbon Market Analyst provides a starting point for understanding the dynamics of emissions trading.

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Executive Summary

The use of emissions trading is to an increasing degree viewed as the preferred policy instrument to comply with emission reduction targets, including those set under the Kyoto Protocol as well as in regional and national targets for greenhouse gas (GHG) emissions reductions. Even though the emerging 'carbon' market is still in an early and embryonic stage, evidence of increasing activity levels and transactions of a range of new 'carbon products' (e.g., allowances and credits) suggest that this new kid on the block in commodities trading here to stay.

Point Carbon estimates that more than 100 million tons of carbon credits will be transacted in 2004 in the various carbon markets worldwide, compared to 37 million tons in 2003. The value of the carbon market is also expected to increase considerably from last year's €96 million to almost €360 million this year on the back of increasing investments in emission reduction projects (CDM projects) and increasing volumes traded in the EU Emissions Trading Scheme (ETS). Point Carbon expects some 8 million tonnes to be traded in the EU ETS in year 2004.

With companies throughout Europe preparing for the 'official launch' of the EU emissions trading system (EU ETS) on January 1st 2005, the key question facing market players is: What are the key factors that will determine the price of carbon in the first period of the EU ETS from 2005 to 2007?

This special issue of the Carbon Market Analyst addresses that question. In brief, the report argues that the way to forecast price and market developments is to monitor and assess three key drivers: i) policy and regulatory issues; ii) market fundamentals; and iii) technical indicators (market psychology). Insight into these price drivers will inform a company's trading strategy, risk strategy and, ultimately, its investment decisions.

Introduction

Carbon dioxide (CO_2) is the new kid on the block in commodity trading. The gas that makes up part of the atmosphere, that plants breathe in and we breathe out, is being bought and sold as if it were a barrel of oil or a tonne of coal.

There is, however, a fundamental difference between trading in CO_2 and more traditional commodities; what people are selling is a lack, an absence of the gas in question. Typical sellers will or expect to produce less than they are allowed, so they may sell that unused right to emit to someone who emits more than their allocated amount.

> What determines EU carbon prices from 2005 to 2007?

While companies in the UK and Denmark have already gained early experience from trading carbon under domestic emissions trading schemes, the first international market is being established in the European Union (EU), with the official start of the EU emissions trading scheme (ETS) of 1 January 2005. However, the market is already on its feet, with the first trade between Shell and Dutch energy company Nuon – on a forward basis, payment on delivery - conducted in February 2003. A number of trades have followed, and the total volumes traded in September 2004 exceeded 1 million tonnes.

Against that backdrop, the key question asked by market players, and the topic addressed in this special issue of the Carbon Market Analyst, is:

What are the factors that will determine the price of carbon in the first period of the EU ETS from 2005 to 2007?

The answer to that question will inform a company's trading strategy, risk strategy and, ultimately, its investment decisions. In brief, we argue that the way to forecast market developments and price trends is to monitor and assess the following three drivers:

i) Policy and regulatory issues;
ii) Market fundamentals; and
iii) Technical analysis

In monitoring and analysing market and price developments, one also has to understand how the drivers interact, which drivers carry more weight in the market, and last, but not least, to what extent and under what circumstances they may impact carbon prices.

Before examining the different price drivers and their potential impact on price developments in more detail, the next section aims to put the EU ETS in perspective by highlighting some experiences from other 'emissions markets', such as the US SO_2 allowance trading scheme and the UK ETS.

Prices and liquidity: Experiences from other emission markets

Even though the use of emissions trading as an instrument in environmental policy is largely unexplored territory in Europe, practical experience from SO_2 allowance trading in the U.S. suggests that it could be an effective instrument in ensuring cost-effective compliance with reduction targets. In fact, policymakers within the EU relied extensively on the design of the US SO_2 scheme when hammering out the rules and guidelines for the EU ETS. Hence, and although the US SO_2 and European carbon market are likely to differ in key respects, the US experience could provide important insights.

US SO_2 allowance market

Trading of SO_2 allowances in the U.S. has been running since 1995, structured in two phases. Phase I began in 1995, limited to emissions from the largest, highest-emitting power-generating facilities. Phase II, which commenced in 2000, tightened the annual limits on the large plants, and set restrictions on smaller, cleaner plants and all new plants. As of 2002, the program encompassed 3,208 electric generating units. Total emissions from the sources covered amounted to some 10.2 million tons in 2002 (almost 70 per cent of nationwide emissions), a reduction by more than 7 million tons from 1980 levels. By 2010, the program will lower the cap to 8.95 million tons of SO_2 emissions, a 50 percent reduction from 1980.

Table 1 highlights some key activity indicators for the period 1995-2002, showing for instance that the total number of transfers and market value increased considerably over the period. We have here distinguished between overall market activity, which includes re-allocations within organisations and intra-utility

Table 1: Knock your SO_x off: large reductions
Activity data for US SO_2 allowance trading 1995-2002

Year	Total number of allowances ($MtSO_2$)	Total transfer of allowances ($MtSO_2$)	Inter-company transfers ($MtSO_2$)	Total number of transfers	Inter-company transfers	Average market prize (USD/tSO_2)	Total market value (bn USD)	Market value inter-company transfer (bn USD)
1995	8,70	16,70	1,90	613	329	127,9	2,14	0,24
1996	11,70	8,20	4,40	1074	578	83,3	0,68	0,37
1997	13,50	15,20	7,90	1429	810	100,5	1,53	0,79
1998	15,00	13,50	9,50	1584	942	158,7	2,14	1,51
1999	16,60	18,70	6,20	2832	1743	195,8	3,66	1,21
2000	21,58	30,09	12,66	4690	2889	142,3	4,28	1,81
2001	19,92	22,24	12,60	4900	2330	185,3	4,12	2,33
2002	18,80	21,40	11,55	5700	3080	152,3	3,26	1,76

Source: US Environmental Protection Agency (www.epa.gov)

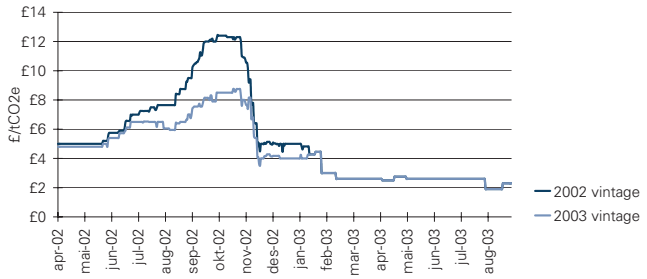
transfers, and transfers that involves economically distinct organisations (inter-company transfers). Serving as an indication of increasing market activity, the number and volume of inter-company transfers has increased almost tenfold since the start of the scheme. In comparison, total transfer of allowances increased by about 30 per cent. In order to estimate the financial value of the market, it is important to distinguish between transfer and trades. The former refers to allowances moving from one account to another – the 'physical market - while the latter – the financial market - includes financial instruments (forwards, futures, options). Estimates suggests that the financial size of the market is comparable to the physical, in which case the market value for inter-company trades stood at some 3,4 bn USD in year 2002.

UK ETS

The UK emissions trading scheme (ETS) officially came into operation on 2 April 2002, following the government incentive auction on 11–12 March 2002 when a total of 34 organisations entered as so-called 'direct participants'. The establishment of the scheme also provided an opportunity for about 6,000 companies under Climate Change Agreements (CCA), so-called 'unit participants', to enter the UK ETS. Through the incentive auction, direct participants volunteered to take on an absolute emissions reduction targets over the period 2002–2006 in return for a financial incentive. The Government made £215m (~€ 310m) available to encourage companies to join this scheme, which was allocated through a descending clock auction to companies bidding in an absolute cap or reduction in their greenhouse gas emissions against a 1998–2000 baseline. At the final clearing price of £53.37 per tonne of CO_2 equivalent emission reductions (tCO_2e), 34 companies bid in emission reductions totalling some 4 million tCO_2e by 2006. This is equivalent to a price of about £12.45/tCO_2e (~€ 18) after tax. Initially, the UK government intended to include projects from particular sectors within the UK. However, the project rules were put on ice when negotiations on the EU ETS started.

Following a period in which prices increased considerably from about £5 in May 2002 to more than £12 in October 2002, prices gradually dropped to a level of some £2–3/tCO_2e, and have been stable at this level since (see figure 1), with prices in 2004 staying between £3-3,5/tCO_2e. The early price increase was largely due to a combination of lack of sellers and unit participants entering the scheme to hedge against the risk of high prices and non-compliance with relative targets. Owing to a significant surplus of allowances from direct participants, and the fact that the next 'true-up' period for unit participants is not due until 2005, the demand for allowances has essentially vanished. This, in turn, caused a downward pressure on prices and market activity. With respect to trading volumes, Point Carbon has estimated that some 1,2 $MtCO_2e$ was traded between companies in the first year of the UK ETS (2002), only to decrease to a meagre 0,3 $MtCO_2e$ in year 2003.

Figure 1: Apathy in the UK?
Price developments for UK allowances (2002 and 2003 vintages)



Source: US Environmental Protection Agency (www.epa.gov)

EU ETS (2005-2007)

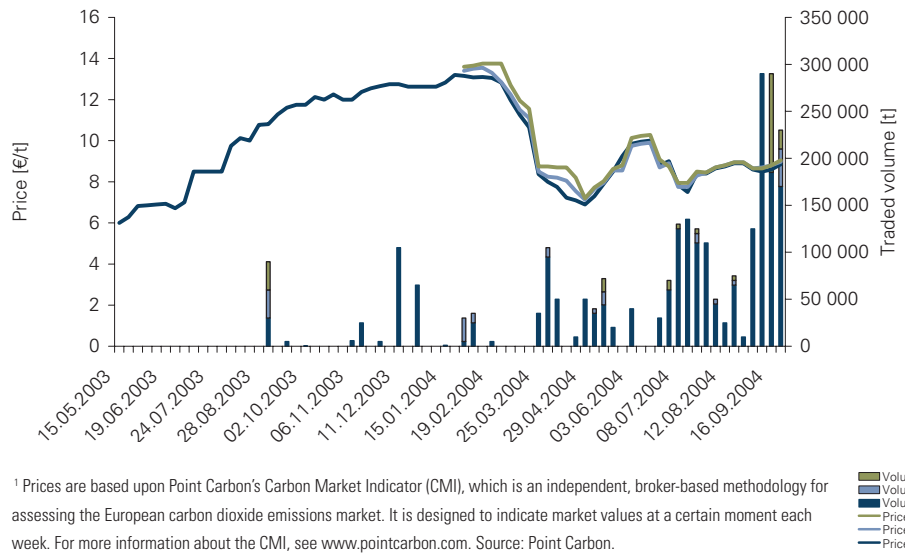
In comparison, the total amount of allowances to be allocated in the EU ETS will be in the order of 2.1 billion tonnes of CO_2 per year, about 50 times the total quantity of allowances available in the US SO_2 allowance trading market in year 2001. The most recent data suggest that the system will cover approximately 13,000 installations in EU25.

Point Carbon has estimated that traded volumes in the EU ETS totalled some 600,000 tCO_2 in year 2003, with prices increasing from about €5/tCO_2 in March/April to more than €13/tCO_2 towards yearend. Recently, prices have been hovering around the €8-9/t marker (see figure 2) . Most of the trades were on a forward basis with payment on delivery. Traded volumes have experienced a steady increase in year 2004, with traded volumes exceeding 1 million tonnes in September alone. For the year 2004 as a whole, Point Carbon expects that a total of 8 million tonnes will be traded (including the OTC and bilateral markets). This increase in trading activity has followed on the back of more clarity about framework conditions (including key policy decisions) and improved availability of information about key price determinants (to be discussed further in the next sections). The volatility in the market has been substantial, as illustrated in Figure 3.

> EU ETS will cover 2.1 bn tonnes of CO_2 per year from approximately 13,000 installations.

Needless to say, it is difficult to have a firm opinion about the transferability of the US and UK experiences to the EU ETS, for several reasons. On the one hand, one could argue that differences in legal frameworks between Member States (e.g., legal status of allowances) and tax-related issues pertaining to cross border-trade could impair market liquidity in the EU compared to the US. The fact that borrowing allowances from next year's allocation is allowed in the first period of the EU ETS (2005-2007) may also impede liquidity. On the other hand, the range of options for emissions abatement and the opportunities to earn credits through project-based mechanisms (CDM/JI) is much wider compared to the case of reducing SO_2 emissions, which could increase market depth and liquidity. One could also argue that liquidity should be higher than in the UK ETS, which has suffered strongly from structural deficiencies (over-supply) and a limited number of market players. Finally, weather is a factor that will cause fluctuations in emissions from the heat and power sector, for which the need

Figure 2: Volumes up: increasing activity
Price developments and volumes traded for EU allowances (2005-2007 vintages)

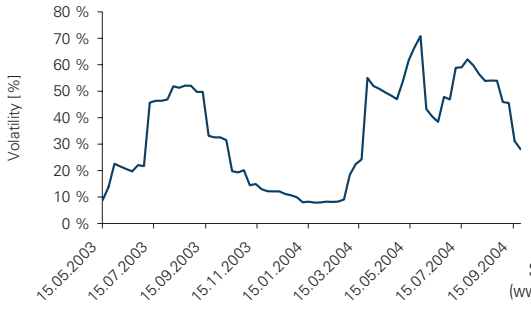


[1] Prices are based upon Point Carbon's Carbon Market Indicator (CMI), which is an independent, broker-based methodology for assessing the European carbon dioxide emissions market. It is designed to indicate market values at a certain moment each week. For more information about the CMI, see www.pointcarbon.com. Source: Point Carbon.

to hedge against short positions and opportunities for speculative trading could increase volatility and liquidity (more on this in the section on fundamentals).

Notwithstanding the above-mentioned caveats and prevailing uncertainties about the design of the EU ETS, one could draw upon the experience from the US SO_2 market and use for instance the ratio of transferred volumes between companies to the total volume of allowances ('turnover') as a proxy of liquidity for the EU ETS. Using the data shown in table 1, turnover for inter-company transfers increased from about 10 per cent in 1995, the first year of trading, to 70 per cent in 1999, after which it has stabilised at around 50 per cent. For the UK ETS, however, turnover in year 2002 was only around 2-3 per cent.

Figure 3: Ups and downs: huge variations in volatility



Source: Point Carbon (www.pointcarbon.com)

Using a market turnover based on the US SO_2 scheme of 50 per cent and a carbon price of €10/tCO_2, the financial value of the EU ETS would amount to € 10 billion per year (2 billion tCO_2 * 0.5 * € 10/tCO_2). This would make the EU ETS the largest environmental market in the world. Based upon the UK experience, however, the financial value would be in the order of € 0.5-0.6 billion per year.

Policy and regulatory issues

Like other environmental markets, the 'carbon market' is created through political decisions and has to be framed in law. Hence, and similar to other commodity markets, such as the oil, gas and power markets, decisions concerning framework conditions and operating guidelines could potentially have a key impact on market and price developments. Anyone aiming to analyse and forecast market and price developments therefore needs to understand the role and potential impact of policy choices. For the carbon market in particular, this means that market participants need to monitor and assess issues such as the National Allocation Plans (NAPs), the "linking" directive, banking, as well as the future status of the Kyoto Protocol.

Reduction targets and the National Allocation Plans

Since robust information about the NAPs has in general been limited, market prices have not been affected much by fundamentals like CO_2 production trends or expected distance to targets. Once the NAPs have been submitted to Brussels, it is the role of the European Commission (EC) as watchdog to vet them and make sure the carbon market is set on a level playing field. The EC has warned governments that they must create scarcity (establish short positions) for the market to

Table 2: Differences in historical emissions and targets
Total greenhouse gas emissions ($MtCO_2e$) for base year and 2002; reduction targets for the period 2008-2012 according to the EU Burden Sharing Agreement (BSA) for EU15; and distance to BSA target in 2002.

	Base year (Mt CO_2e)	2002 ($MtCO_2e$)	Change baseyear to 2002 ($MtCO_2e$)	BSA (%)	BSA target ($MtCO_2e$)	Distance to BSA in 2002 ($MtCO_2e$)
Austria	78	85	7	-13,0 %	69,7	17,1
Belgium	146,8	150	3,2	-7,5%	135,8	14,2
Denmark	69	68	-1	-21,0 %	54,5	13,5
Finland	76,8	82	5,2	-0,0 %	76,8	5,2
France	564,7	554	-10,7	-0,0 %	564,7	-10,7
Germany	1253,3	1016	-237,3	-21,0 %	990,1	25,9
Greece	107	135	28	25,0 %	133,8	1,3
Ireland	53,4	69	15,6	13,0 %	60,3	8,7
Italy	508	554	46	-6,5 %	475,0	79
Luxembourg	12,7	11	-1,7	-28,0%	9,1	1,9
Netherlands	212,5	214	1,5	-6,0 %	199,8	14,3
Portugal	57,9	82	24,1	27,0%	73,5	8,5
Spain	286,8	400	113,2	15,0 %	329,8	70,2
Sweden	72,3	70	-2,3	4,0 %	75,2	-5,2
UK	746	635	-111	-12,5 %	652,8	-17,8
EU15	4245,5	4125	-120	-8 %	3905,6	219,4

Sources: Point Carbon (www.pointcarbon.com) and United Nations Framework Convention on Climate Change (www.unfccc.int).

work, but has also admitted that it does not have any legal basis to ensure overall scarcity. Hence, until final decisions about the caps are taken, which may take until yearend 2004, policy and regulatory issues will play a key role in price developments.

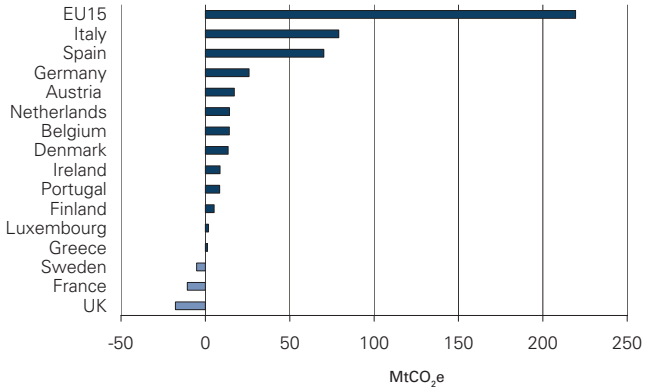
> The carbon market is created through political decisions

In order to illustrate how reduction targets to be set by the NAPs may affect the required reduction targets and relative positions of sectors and companies (long or short), one may use historical emissions data for EU Member States and compare with the targets set for each country under the Kyoto Protocol. Under the Kyoto Protocol, the EU as a whole committed itself to reduce greenhouse gas emissions by 8% compared to 1990 levels. This target was then distributed between Member States according to the so-called Burden Sharing Agreement (BSA), where different targets were set for each of the different Member States (EU15) as shown in Table 2.

Hence, Luxembourg, Germany and Denmark were assigned the most 'ambitious' targets, with reductions of 28, 21 and 21 per cent from 1990 levels, respectively. In comparison, countries like Spain Greece and Portugal were allowed to increase their emissions, due to expected economic growth, by 15, 25 and 27 per cent, respectively.

By comparing emission levels in years 1990 and 2002, the latter representing the latest official emissions inventory, one may then calculate the distance to targets for each Member State. As shown in Table 2 and Figure 3, only Sweden, France and the UK had already reached their targets in year 2002. In comparison, countries like Spain and Italy and emissions that stood some 70 and 79 million tonnes of CO_2 equivalent emissions ($MtCO_2e$) above their BSA target. Hence, if emission levels were to remain constant at the level of year 2002 in the period 2008-2012, Spain and Italy would have to reduce emissions by 70 and 79 $MtCO_2e$ or purchase allowances or emission reductions from the market. Moreover, emission levels in the Southern European Countries are expected to increase further in coming years, for which the distance to target will increase even more in the absence of additional policy instruments.

Figure 3: Unattainable targets?
Distance to targets under the EU Burden Sharing Agreement for each Member States in year 2002.



Sources: UNFCCC (www.unfccc.int) and Point Carbon (www.pointcarbon.com)

> Policy and regulatory issues will play a key role in price developments.

Links to project-based mechanisms

Another key policy issue that may affect market prices is the link between the EU ETS and the project-based, 'flexible mechanisms' established under the Kyoto Protocol. These mechanisms fall into two categories: Joint Implementation (JI), pertaining to investments in emission reduction projects in countries that have taken on a target under the Kyoto Protocol, and the Clean Development Mechanism (CDM), which applies to projects in developing countries.

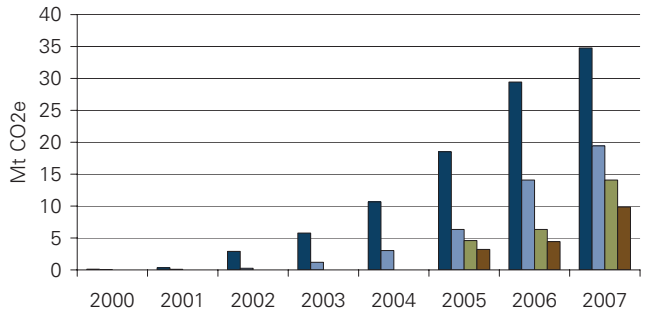
The motivation for establishing a link between project-based mechanisms and the EU ETS is essentially threefold. First, it will provide incentives for European companies to become more actively involved with the use of these mechanisms. Second, it would facilitate technology transfer to developing countries. Third, it would send a strong signal to countries that have not yet ratified the Kyoto Protocol that the EU is committed to the Kyoto Protocol.

In practice, a link would allow companies facing a cap under the EU ETS to invest in CDM projects or purchase emission credits (Certified Emissions Reductions – CERs) in the market and convert these into EU allowances (EUAs, the EU commodity), at parity. This could potentially boost the supply side of the EU ETS market, providing a bearish signal. Moreover, the price currently paid for emission reductions from CDM projects is lower than the price of EU allowances. The price paid for CDM/JI projects has this far been in the order of 4-6 USD/ tCO_2e, which by and large has been set by sizeable buyers like the Dutch procurement funds (CERUPT/ERUPT) and the World Bank Prototype Carbon Fund (PCF).

> Emission reductions from CDM projects are currently cheaper than EU allowances.

However, experience this far suggests that the supply of CDM credits could be hampered due to difficulties with host-country approval and prevailing uncertainties about operational procedures. That said, analysis by Point Carbon suggests that the emergence of so-called 'large-scale' CDM projects and new investment funds could increase supply, although total supply will probably be limited during the first phase of the EU ETS from 2005-2007 (see figure 4). Nevertheless, volumes are still small compared to the estimated 2 billion tCO_2 that will be allocated to companies covered by the scheme.

Figure 4: Increasing supply, but still small
Expected CER volumes towards 2007.



Source: Point Carbon (www.pointcarbon.com)

Banking and borrowing

Another issue facing governments is whether or not to allow companies to transfer or 'bank' any surplus allowances from phase one (2005-2007) into phase two (2008-2012) of the EU ETS.

If banking between phases is not allowed, prices towards the end of the first phase could be determined through a 'true-up' logic, for which fundamentals could potentially play a key role. For instance, if the market proves to be fundamentally short (long) allowances, the price during the 'true-up' period could increase (decrease). Conversely, if banking were allowed, prices would probably be affected by expectations of future prices and commitments. Even though one could argue that companies would foresee a possible shortage/surplus of allowances and embed this into their trading/hedging strategy, experiences from the US SO_2 market and the UK ETS market suggest that prices are in practice affected by 'true-up'.

> Borrowing could be seen as a relief-valve for companies.

Since companies will be issued allowances for the next calendar year two months prior to the

date when they are required to submit allowances to cover their emissions for the previous year, they may decide use allowances for the next year (borrow) for compliance. Allowing for borrowing could be seen as a relief-valve for companies, to the extent that extreme weather conditions could have a large impact on the balance for a single year. To the extent that borrowing is seen as an opportunity for deferring action into the future, it could have a negative impact on liquidity. However, since this raises serious issues in relation to exposure and risk management, it remains to be seen whether and the extent to which companies will explore this option.

What about Kyoto?

So far, uncertainties with respect to the status of the Kyoto Protocol in general, and Russian ratification in particular, has affected market expectations and prices, at least in the long term. However, the recent approval of Kyoto by the Russian cabinet has removed much of this uncertainty and the Protocol could now enter into force in 2005. Owing to the economic restructuring in the early 1990s, Point Carbon's estimates suggest that Russian emissions have decreased by some 30 per cent since 1990. Since Russia's target under the Kyoto Protocol is to stabilise emissions at the level of 1990, Russia has potentially vast volumes of allowances to sell into the market. Owing to the U.S. repudiation of the Kyoto Protocol, there will probably be a vast surplus of allowances in the Kyoto period 2008-2012, meaning that the market as a whole will be fundamentally long allowances. This, however, does not necessarily imply that prices will be low or even 'collapse'. Instead, it provides opportunities for Russia and other net sellers to affect prices by restricting supply or in other ways exercising market power. Analysis by Point Carbon suggests that Russia could earn up to 10 billion USD by restricting supply. Were Russia to develop a fully fledged trading strategy, involving both selling and buying of allowances, this number could be even higher.

> Russia could earn up to 10 bn USD by restricting supply of allowances.

The entry into force of the Kyoto Protocol will send a very strong bullish signal to the market. This is simply because the price currently paid for credits from CDM and JI projects includes a significant premium to adjust for the risk of the Protocol not entering into force. Entry into force in the near term could also increase the likelihood that Canada and Japan will establish a link to the EU ETS through so-called 'mutual recognition' of allowances (Art 25 in the ETS Directive). Since Japan and Canada are likely to be large net buyers of allowances and credits in the Kyoto period (2008-2012), this would in itself provide a bullish signal by bringing into the scheme companies having to cover a sizeable short position.

The role of fundamentals

Market fundamentals, similar to other markets, concern demand and supply. The supply of allowances - the right to emit one tonne of CO_2 – will be fixed by governments through the National Allocation Plans (NAPs). In brief, governments in Member States will first determine the total quantity of allowances to be allocated (the 'cap'), and then allocate the allowances to installations in energy intensive industries (e.g., production of iron and steel, building materials, pulp and paper) and the power and heat generation sectors. The demand for allowances is in turn a function of the level of CO_2 produced by the companies and installations covered by the scheme.

Estimating and forecasting CO_2 production

In order to monitor and forecast the demand side of the EU ETS, Point Carbon has developed a unique set of models that provide continuous updates and forecasts of CO_2 production for all sectors in each of the countries covered by the EU ETS. The models draw upon a wide variety of input data and structural information, including for instance detailed information about installations in the power and heat sectors (e.g., installed capacity (MW), efficiency, and availability).

In general, CO_2 production depends on a number of factors, such as weather data (temperature, rainfall, and wind speed), fuel prices, carbon prices and economic growth. Among these factors, weather has a double effect; firstly, cold weather increases energy consumption and so CO_2 emissions through power and heat generation. Secondly, rainfall and wind speeds will affect the share of power generated by non-emitting sources and thus emission levels. This is

of course particularly important for countries and regions relying on hydro- and/or wind power to any significant extent.

The impact of weather

Consider for instance the Nordic Power Exchange area. During dry years, CO_2 emissions tend to soar along with the price of power, with Norway and Sweden drawing power from the pool at higher levels and coal-fired generation in Denmark and Finland ramping up. The Danish emissions profile is thus a good litmus test for the impact of weather.

As shown in figure 5, annual emissions from power and heat generation in Denmark during the period 1990-2003 fluctuated from a low of about 24 $MtCO_2$ in 1990 to a high of 42 $MtCO_2$ in 1996, an exceptionally dry year, representing a swing of about 70% from the lowest to the highest level. According to the Danish NAP, the public power and heat sector will be allocated an average of 21.7 $MtCO_2$ annually in the first period 2005-2007. This is approximately 40% less than projected emissions for the period 2005-2007 and lower than any year during the 1990s. Hence, even under 'normal' circumstances, not to mention what could happen if for instance 2005 proves to be another dry year like 1996, Danish power and heat producers will have to cover a potentially significant short position through the market.

> Weather could become a key price driver.

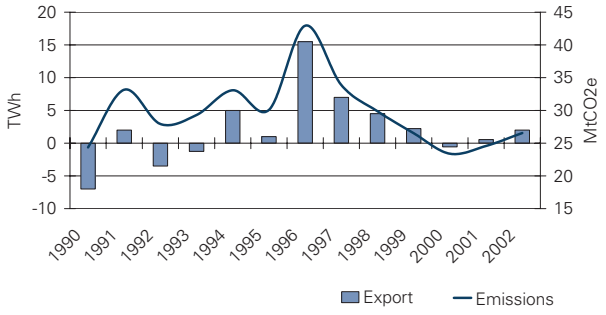
Hence, the message is clear – weather can cause a swing for power producers and flip their position vis-à-vis its cap from short to long and back during a season. Similar to what is the case in the power markets, weather could thus become a key price driver in the short term and possibly increase volatility. For instance, the combination of a cold winter and a warm summer could cause power consumption and emissions to soar, which would provide a clear bullish signal.

Emissions-to-Cap

Another key fundamental parameter, Emissions-to-Cap (E-t-C), is calculated by subtracting the cap from emissions. Since electricity demand and emissions vary throughout the course of a calendar year, one needs to distribute the annual cap in representative portions across the year to obtain a 'seasonally adjusted cap'. The emission profile and seasonally adjusted cap will differ between countries. For instance, demand and emissions are typically higher during the winter than the summer in Northern Europe, while demand also tends to peak during summertime on Southern Europe due to increased use of air conditioning. Calculating the E-t-C then provides an indication of whether the market as a whole, a country or a sector produces more or less than the cap for the period in question. For the market as a whole, a positive (negative) value for E-t-C means that the market is fundamentally short (long) allowances, suggesting a bullish (bearish) signal.

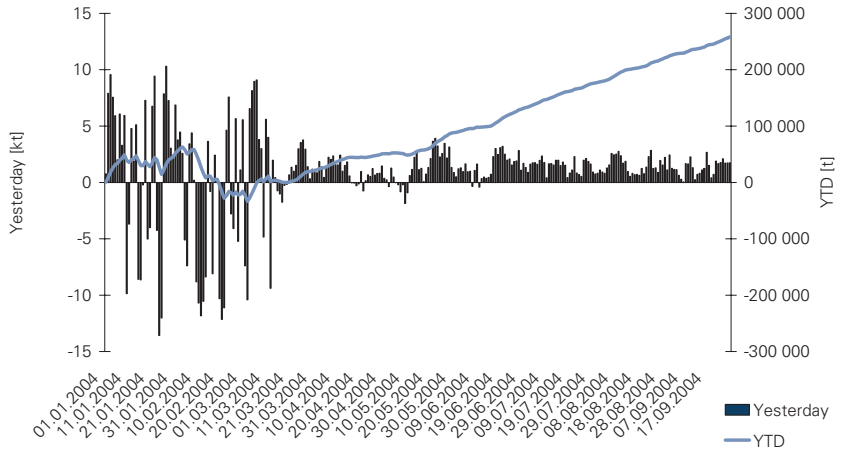
An illustrative example is shown in figure 6, using estimates of daily CO_2 production for the first three months of year 2004 and a (tentative) cap set at the level of emissions in year 2001 for the Danish power and heat sector. The figure first illustrates that E-t-C varies on a daily basis due to changes in for instance weather (as discussed above). Moreover, and interestingly, the accumulated E-t-C (year-to-date) has switched from positive to negative, to positive again, meaning that the relative position of the

Figure 5: Wet and dry spells: fluctuating emissions
Danish power exports (left axis – bars) and emissions from the power and heat sector (right axis – line)



Source: Point Carbon (www.pointcarbon.com) and Energistyrelsen (www.ens.dk)

Figure 6: Emissions vary on a daily basis
Emissions-to-Cap (E-t-C) yesterday (left axis) and year-to-date (right axis)



Source: Point Carbon (www.pointcarbon.com) and Energistyrelsen (www.ens.dk)

sector switched from short to long and then back again. To the extent that prices are affected by changes in fundamentals, the E-t-C provides strong buy (bullish) or sell (bearish) signals to the market.

Net Carbon Balance

As argued above, supply of credits from CDM projects (CERs) will also affect demand and supply. For that reason, Point Carbon has developed a tool to forecast the amount of CERs (supply) that is likely to be available in the market in the period 2005-2007. The impact of CER supply is then determined by another metric, the Net Carbon Balance, which is obtained by subtracting the supply of CERs from the E-t-C for the market as a whole.

The role of fuel switching

While the marginal CO_2 abatement cost might in the long run direct investment towards abatement projects, fuel switching from coal to gas for power and heat production is probably the single most important measure in the short term. This is firstly because the public power and heat sector is the largest in terms of emissions for most of the current Member States. As illustrated in Figure 7, public power and heat represent more than 70 per cent of total emissions covered by the EU ETS in Denmark, Ireland and Greece, and about 60 per cent in Germany and the UK, representing the two single largest emitters.

> There is considerable scope for switching from coal to natural gas in the EU.

Secondly, and even though burning any fossil fuel create CO_2 emissions, coal causes about two times that of natural gas per consumed unit. Figure 8 shows that solid fuels (hard coal, lignite) accounted for about 70 per cent of total CO_2 emissions from public heat and power stations in current Member States (less Luxembourg, EU14) in year 2001. The figure also shows that the share of emissions by fuel vary between countries, depending on factors like resource endowments, fuel prices and state subsidies/taxation. For instance, solid fuels accounted for almost 90 per cent of emissions from thermal power stations in Germany, but only about 26 per cent in Italy. In comparison, natural gas is an important fuel in countries like the Netherlands, Austria, Belgium and the UK.

There is a considerable scope for switching from coal to natural gas and other liquefied fuels in several Member States, most notably Germany and Spain. Hence, in order to forecast CO_2 emissions into the future, it is also important to monitor

developments in fuel prices and assess its potential impact on fuel switching.

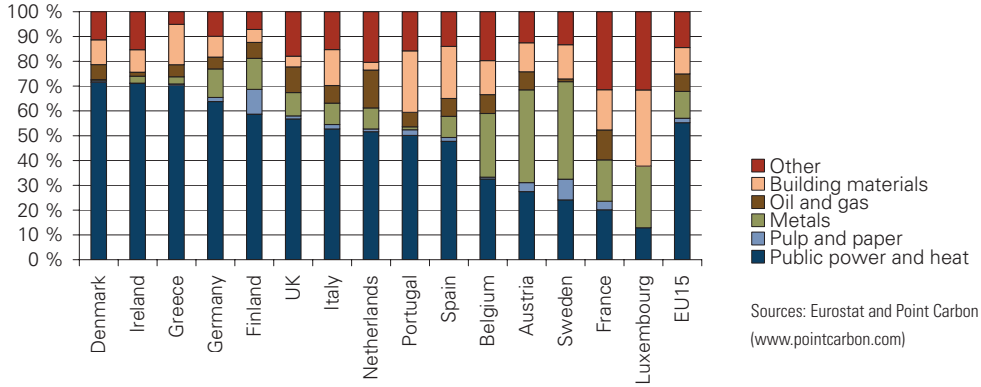
Technical analysis

Like other commodity markets, technical analysis can be used to assess historical price movements and forecast future price trends. In brief, this type of analysis focuses on the formation of charts and formulae to capture major and minor trends, identify buying/selling opportunities and assess the extent of trend reversals. In its simplest form, technical analysis assumes that market prices reflect all existing information, and that the knowledge available to market participants (traders, portfolio managers, analysts, market strategists) is already discounted in the price action.

Among the more common indicators are support and resistance levels, representing points where a chart experiences recurring upward or downward pressure. A support level is usually the low point in any chart pattern, whereas a

Figure 7: Sector emissions vary from country to country

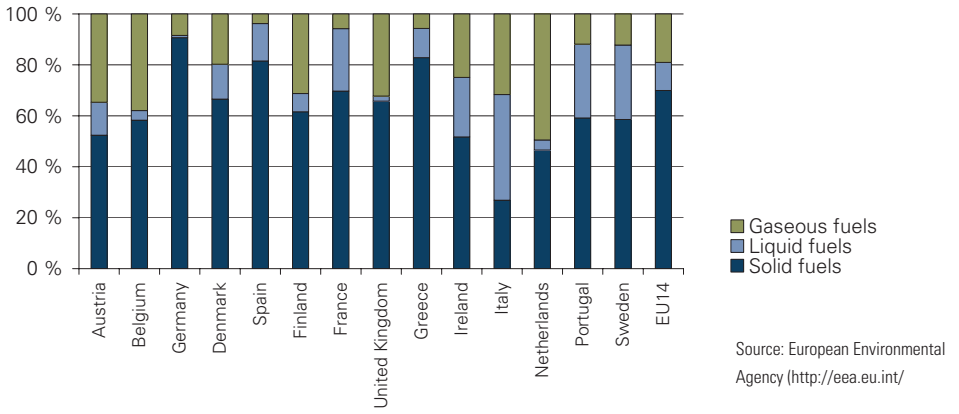
Share of emissions by sector covered by the EU ETS for EU 15 in year 2001



Sources: Eurostat and Point Carbon (www.pointcarbon.com)

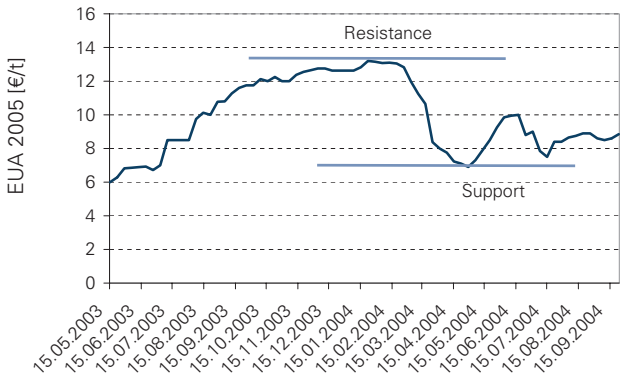
Figure 8: Solid fuels produce the lions' share of emissions

CO2 emissions from public heat and power generation in year 2001 by fuel



Source: European Environmental Agency (http://eea.eu.int/

Figure 9: Early signals are forming
Technical Analysis – support and resistance lines



Source: Point Carbon (www.pointcarbon.com)

Among the more common indicators are support and resistance levels, representing points where a chart experiences recurring upward or downward pressure. A support level is usually the low point in any chart pattern, whereas a resistance level is the high or the peak point of the pattern. These points are identified as support and resistance when they show a tendency to reappear. Once these levels are broken, they tend to become the opposite obstacle. Thus, in a rising market, a resistance level that is broken, could serve as a support for the upward trend, whereas in a falling market; once a support level is broken, it could turn into a resistance. It is usually best to buy/sell near support/resistance levels that are unlikely to be broken.

Looking at price developments in the EU market since spring 2003, the price peaked at the € 13 per tonne mark towards the year-end and early 2004, before bouncing off the € 7 per tonne mark in April 2004. This could be seen as an indication of an early formation of a support- and resistance line, as suggested in figure 9. However, since liquidity and the robustness of the underlying price data are limited, one should not put too much emphasis on results from technical analysis at this early stage of market development. When market activity and liquidity picks up, technical analysis will allow market players to assess price trends and be informed about market developments, similar to other commodity markets.

Concluding remarks

In brief, this CMA special issue paper has proposed and analysed three key drivers that are likely to have an impact on market prices in the EU Emissions Trading Scheme (ETS):

i) Policy and regulatory issues;
ii) Market fundamentals; and
iii) Technical indicators

Similar to what is the case with other environmental markets, decisions concerning policy and regulatory issues could potentially have a key impact on market and prices. For instance, policymakers will determine the total supply of allowances for the first period of the EU ETS from 2005-2007 through the National Allocation Plans (NAPs). And that is not even the end of it! Half way through the first phase, the whole process starts again – with negotiations for the new NAPs for the second period (2008-2012). Doubtlessly this will also trigger renewed worry over Russia's next move and the imminent Kyoto Commitment Period throwing up yet more questions. In the longer term, countries like the USA, Australia may decide to re-evaluate their stance in climate politics and enter into an agreement that would form the basis for a truly global emissions trading market.

Even though early movers in the EU emissions trading market have been operating in an environment dominated by political and regulatory risks, fundamentals will probably play an equally, if not more important role. Among the key fundamentals in this market is CO_2 production, which in turn is a function of parameters like weather, fuel prices and economic growth, Emissions-to-Cap (is the market/sector short or long allowances) and supply of credits from CDM projects.

Companies aiming to trade or hedge their risks actively in the carbon market needs to understand the role and potential impact of these key drivers, as well as the way(s) in which they might interact.

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A Point Carbon publication

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