PointCarbon

Issues in the international carbon market, 2008-2012 and beyond

A study by

Point Carbon Advisory Services

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About Point Carbon

Point Carbon is the leading provider of independent analysis, forecasting, market intelligence and news for the power, gas and carbon emissions markets. Point Carbon has offices in Oslo (HQ), London, Kiev, Tokyo and Washington D.C.

The competencies of our staff include international and regional climate policy; mathematical and economic modelling; forecasting methodologies; methods for expert evaluation and energy industries analysis.

The in-depth knowledge of power, gas and CO_2 emissions market dynamics positions Point Carbon as the primary supplier of analysis on price-driving fundamentals for European energy and environmental markets.

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Executive Summary

In this study, Point Carbon examines the price patters in the various carbon markets established under the Kyoto Protocol and the routes to market available to companies with exposure to carbon price risk.

There is not one single price in the global carbon markets, but many. The reason for this is that the tradable instruments each have different risks and usability which has led to a fragmented price. In addition to this, there has been a large price and volume volatility, especially in the EU emissions trading scheme, while transparency of the market has been low in the CDM and JI market.

The CDM awards carbon credits, known as certified emissions reductions (CERs), to projects that reduce greenhouse gas emissions in developing countries. Those credits can be used by governments to meet their targets under the Kyoto Protocol.

Trades in CERs are described as the primary market, being the initial transaction between the project developer and the buyer. Often the transaction is agreed in a forward trade before the CERs are issued to the project developer. Currently the price range for CERs in the primary market is €6 to €17 per tonne of carbon dioxide (tCO_2). The range is set by several factors from project-specific and host-country risk to the creditworthiness of the counterparties and particular contractual issues. Ultimately, the CDM market as a whole responds to demand for credits.

The secondary market covers the resale of CERs once they have been issued to the project developer. Much of the project-related risk is therefore removed and these low-risk credits appeal to participants in the EU ETS. Such CERs tend to be sold at a price benchmarked to the EU emissions trading scheme, but at a discount, currently around €16 per tonne of carbon dioxide equivalent (tCO2e).

In the second phase of the EU emissions trading scheme, running from 2008 to 2012, the market is short about 1 gigatonnes of CO2 which will be covered primarily with imports of the Kyoto Protocol's project credits, CERs and ERUs, as relatively cheaper abatement measures can be found outside the EU. There is a limited quota of credit imports into the EU ETS, but it is set at a high level and allows for more credit imports than required to cover the aggregate short position. Some swapping of EUAs against CERs and ERUs will be necessary to utilise the credit import capacity more fully, which helps explain the price difference between CERs and EUAs.

The EU ETS experiences volatility on a daily basis. The effect of the volatility is felt in the pricing of secondary CERs, but the bulk of the CDM market, the primary market, does not respond to the EU emissions trading scheme on a daily basis.

However, there is double causality between the Kyoto Protocol project markets (CDM & JI) and the EU emissions trading scheme, where the price of one affects the other and vice versa. Project credit supply is one of the main factors behind the EU allowance price, while the

CER/ERU price in turn is affected by demand from the businesses in the EU emissions trading scheme.

Other than companies in the EU ETS, sources of demand for CERs include private and public sector carbon funds, aggregators and intermediaries, international financial institutions, the Japanese government, Japanese corporations and other participants in the international carbon market.

There are few price signals for the nascent market in governmental credits, AAUs. They are expected to come next year and in the form of a green investment scheme, where the seller undertakes to invest the proceeds in projects with environmental benefit. There are no reliable price signals yet regarding the AAU market and the period after 2012.

In response to the varied and size and needs of the participants in the global carbon market, a financial services sector has emerged to offer price risk management tools, with different structures to suit the target client, whether they be a minor emitter, major emitter or speculator.

Figure 1.1 summarises the price dynamics for various carbon credits under the different market mechanisms: EUAs, CER/ERUs and AAUs up to 2012 and beyond.

Figure 1.1 Price dynamics in the carbon markets

	Phase I 2005-2007	Phase II 2008-2012	Phase III? 2013-
EUAs	• Market is long • Low price • No quantitative restrictions on use of CERs • Incentives to bank CERs into Phase II	• Market is short • Forward price determined by CER/ERU supply and relative fuel prices for power generation • Quota limit allows for more credits that the aggregate short position, provided industrial sectors and the power sector swap EUAs and CERs. • Supply limitations are likely to be more relevant than restrictions due to the initial allocation of credits. • CERs might be banked forward again, once NAP 3 and post 2012 UNFCCC framework is in place.	• No supply/demand signals but ambitious political targets set. • Linking of trading schemes, with Kyoto project credits forming the price link, is a possible scenario. • Allocation process is likely to be further harmonized
CERs ERUs	• Forward CER prices reflect delivery risks and phase II allowance price in EU ETS	• Spot CERs will probably trade at a small discount to spot EUAs to reflect differences in usability • There is a two-way price causality between CERs and EUAs	• Price should be equal to marginal abatement cost. • US participation could boost demand
AAUs	• No AAU market	• Market is long • Limited private sector participation (except possibly in Japan) • Bilateral government-to-government trades expected • Supply from Russia and Ukraine will be important • Few price signals	• Price will be dependent on whether there is a market and how ambitious the commitments are made from the Annex-1 countries (including new ones) • Banking from Russia and Ukraine and US participation will have major impacts on supply and demand • Chinese and Indian participation unlikely but possible

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1. Introduction

The Kyoto Protocol introduced an international emissions trading system. The system has evolved into separate market fragments with different price ranges.

The most established market under the Kyoto Protocol is the Clean Development Mechanism, which rewards projects to reduce emissions in developing countries with project credits which can be sold to entities in developed countries. These credits, CERs, are priced according to a variety of factors including risk, contractual issues and the fundamentals of demand and supply.

The European Union created in 2005 a regional emissions trading scheme, known as the EU ETS. The credits in this scheme represent the highest price for carbon, currently at over €20 (NZ$40) per tonne of carbon dioxide. The EU ETS accepts project credits from certain types of projects. As European companies provide demand for CERs, there is a limited correlation between the two.

Most of the other mechanisms have yet to evolve to a significant extent.

A new financial services industry has emerged to help companies manage the new risk associated with the greenhouse gases for which they are held responsible.

The New Zealand Emissions Trading Group commissioned this report to examine the relationships between the pricing in the two most significant markets, the EU ETS and the CDM, and the options and services available to companies seeking to manage their exposure to price risk in the international markets.

2. Price range in international emissions trading market

2.1. Introduction

There is no single price for carbon the world over. The international carbon market is in fact a system with different 'commodities', or types of carbon credits, that are linked to varying degrees. This section of the report explains how these different markets inter-relate.

2.2. What is the price of carbon?

The Kyoto Protocol was signed in 1997 and entered into force in 2005. Since then, several markets have emerged either directly from the Kyoto Protocol's flexible mechanisms, or as countries implement policies to meet their targets.

The Kyoto Protocol sets out three flexible mechanisms:

- Clean Development Mechanism – where tradable carbon credits are awarded to projects to reduce greenhouse gas emissions that are hosted in developing countries and that complete a formal approval process. These credits are known as Certified Emissions Reductions (CERs);
- Joint Implementation – where the credits are awarded to similar projects, only they are hosted in developed countries or those with economies in transition. These credits are known as Emission Reduction Units (ERUs);
- Emissions Trading – intended as a government-to-government market where the sovereign states can buy or sell credits they are issued as part of their cap under the Kyoto Protocol, known as Assigned Amount Units (AAUs).

The four flexible mechanisms have different currencies, being CERs, ERUs and AAUs. In addition, governments can log their emissions sinks from land use, land use change and forestry efforts as removal units RMUs, which are then convertible to AAUs. Also, the EU emissions scheme has its own currency, EUAs, which from 2008 are each shadowed by an AAU.

All of these currencies represent one tonne of CO_2, or equivalent where for example a project reduces the emissions of a different greenhouse gas. While they share this characteristic, they are not fully fungible and pricing depends on their use against targets, the risk inherent in their delivery to the final customer and many other contractual issues.

As a result, there is no single price for carbon. Each carbon commodity responds to different factors, but there are correlations between some of them. In the case of the market for ERUs is still in its infancy and firm pricing patterns have yet to emerge.

In the AAU market, no firm transaction involving AAUs has been concluded. A further complication is that only intergovernmental trading was foreseen in the case of AAUs, so there is no provision in the Kyoto Protocol and subsequent regulations to allow for private sector ownership of AAUs. It is not expressly outlawed, but unless a country provides for private sector ownership of AAUs there is disagreement over whether it can be permitted. This is primarily the case in the EU.

Japan, for example, does allow for private sector companies to submit AAUs against their national targets. It has resolved this issue by providing for private sector companies to own AAUs on the national registry. It is possible that this issue is overcome on a technical level as the various national registries and the over-arching UN registry, the international transaction log (ITL), become operational. In the meantime, the AAU market has not yet started. As a result there is no evidence of pricing in the AAU market.

This report focuses on what forms the price in the two main carbon market segments, the EU emissions trading scheme and the Clean Development Mechanism. This section sets out the price drivers in the EU ETS, then the price drivers in the Clean Development Mechanism, and finally the extent of the impact of EU ETS prices on the international carbon market.

Kyoto market supply and demand

The Kyoto Protocol sets caps for industrialised countries, expressed as an assigned amount of greenhouse gas emissions rights. For each tonne of CO_2 or equivalent, an assigned amount unit (AAU) is issued to that government.

Canada, New Zealand and the EU bloc are expected to generate demand of 3 to 4.5 billion tCO_2e, based on known or planned government budgets, EU ETS demand and expected demand from the private sector in Canada, Japan and New Zealand.

The total potential supply of AAUs is put at 7 billion tCO_2e, mostly from Russia, Ukraine and eastern Europe. However, most of the countries on the demand side have suggested they do not want to buy this 'hot air' but are willing to invest in projects that can be proven to reduce emissions.

Point Carbon expects supply of credits from the two project mechanisms, CDM and JI, to reach 2.5 billion tCO_2e by 2012. The volume from 'greened' AAUs is not known, although this simplified demand-side sum of suggests that there will be demand for 'green' AAUs.

These sums are based on official data and headline projections. They are subject to many factors that will change the demand-supply dynamic, notably evolving government policy and economic growth factors.

2.3. Pricing in the EU emissions trading scheme

In the European Union (EU), member governments and the European institutions in Brussels agreed to create a regional emissions trading scheme. It is mandatory and caps the carbon dioxide emissions of factories, power plants, refineries and offshore installations in all 27 member countries.

The EU ETS began with a trial phase running from 2005 to 2007, the second trading phase is to run from 2008 to 2012 in line with the Kyoto Protocol's commitment period.

In the context of the EU ETS, The two main areas of price formation in the EU ETS are:

- policy decisions, and
- fundamentals, being the energy complex (weather, energy and economic activity).

2.3.1. POLICY DECISIONS

Like other environmental markets, the EU ETS is created through political decisions and has to be framed in law. It must then be implemented through a series of regulatory decisions and operating guidelines, which could potentially have an impact on market price and developments.

As a result, the market responds to occasional price signals from issues such as the number of EUAs that are issued, the EU 'linking' directive which allows for the use of Kyoto credits in the EU scheme, rules on banking EUAs from one trading phase to the next as well as what happens when the Kyoto Protocol's first commitment period ends on 31 December 2012.

For example, as the scheme's watchdog, the European Commission must approve the decision by each government on how many EUAs that government can issue to its industry and energy companies. If the European Commission demands cuts to the government's original plans, the price history suggests that the market reacts to the prospect of supply being restricted beyond expectations and the price for EUAs will rise accordingly.

However, these political price signals occur only occasionally. On a daily basis, it is the broader energy complex that provides price drivers.

2.3.2. THE ENERGY COMPLEX

The power generation sector accounts for 60% of the emissions covered in the scheme. As a result it is the most important sector in the scheme and the relationship between the price of EUAs and the prices for oil, natural gas, coal, freight for coal and electricity itself has been established.

While the initial supply in the EU ETS was a political/regulatory decision, demand for EUAs is set by emissions; as companies emit more than their limit, they must buy EUAs to cover their extra emissions.

In general, CO_2 emissions depend on a number of factors, such as weather data (temperature, rainfall, and wind speed), fuel prices and economic growth. Among these factors, weather has a double effect; firstly, cold weather increases energy consumption and corresponding CO_2 emissions through power and heat generation.

Secondly, rainfall and wind speeds will affect the share of power generated by non-emitting sources, which indicates greater use of fossil-fuelled power generation and thus emission levels rise. This is particularly important for countries and regions relying on hydropower and/or wind power to any significant extent.

In many countries, power generators are able to switch their overall fuel use from coal to gas and back, depending on which leaves them with a better return given current power prices. With the EU emissions trading scheme now in place, they must now also consider the cost of EUAs to cover the emissions associated with that fuel burn. Typically, burning coal to generate electricity results in the emission of twice as much carbon dioxide – approximately one tonne per Mega-Watt hour – than natural-gas fired power stations. The cleaner fuel faces a lower cost in buying EUAs to cover its emissions.

So, since the EU ETS was introduced, power generators are able to calculate each day whether they would be more profitable generating from coal plants (including the cost of emissions resulting from the generation), or natural gas. This decision determines the intra-day demand for EUAs and is the major price driver in the EU carbon market on a daily basis.

Figure 2.1 Price development of the headline contract in the EU emissions trading scheme (forward delivery of an allowance on 1 December 2008).

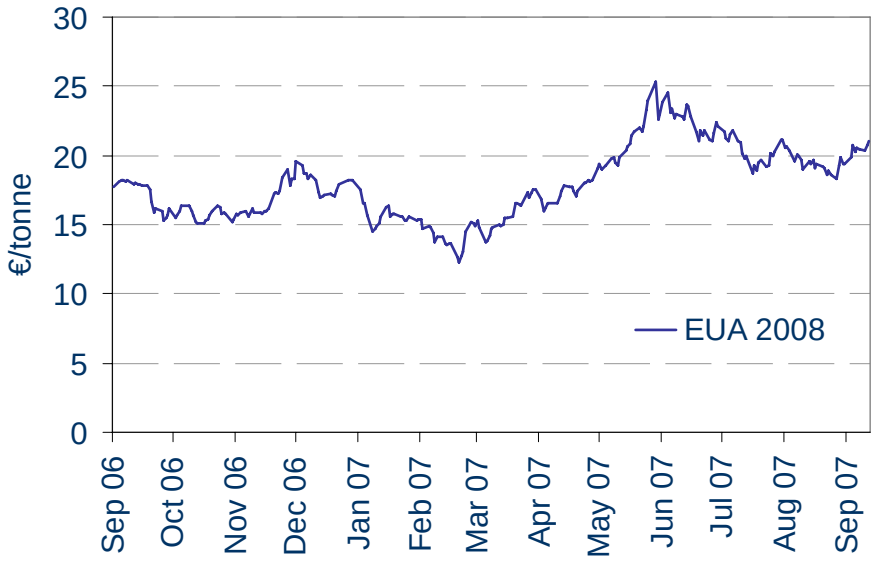
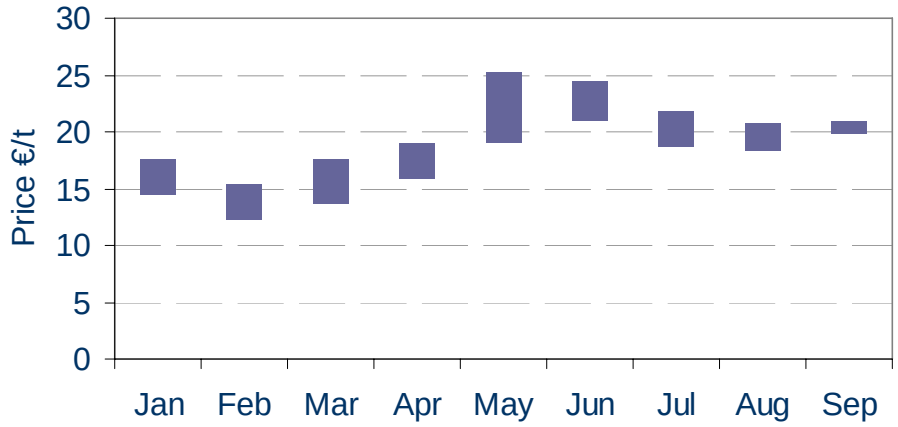


Figure 2.2 Monthly EUA 08 price range from Jan 07 to Sep 07



2.4. Pricing in the Clean Development Mechanism

The Clean Development Mechanism is a term that covers different market segments. The project approval process is regulated by a UN body, the CDM Executive Board and offshoot panels and committees. However, the commercial side has grown organically and is in a constant state of evolution.

Typically, participants in the market talk of two market segments, the primary market and the secondary market.

2.4.1. THE PRIMARY CER MARKET

The primary market refers to the initial transaction between the project developer and the investor. It is the transaction that carries the CER, the commodity in question, from the project in the developing country to the international market.

The contract to transfer ownership of a CER from seller to buyer is known as an Emissions Reduction Purchase Agreement (ERPA). As the initial CDM contract is much like project finance, ERPAs vary from case to case. Typically, however, the price agreed in most primary ERPAs is a function of the apportionment of the various risks inherent in generating a CER and delivering it to the buyer, as well as contractual issues.

The risks are grouped as follows:

- Performance risk (financial, technical, counterparty related)
- Registration and revision risk (project approval, baseline and methodology from the UN)
- Host country risk (general and carbon related).

Performance risk

The performance risk relates to how the project performs in relation to expectations:

- whether the developer will gain finance to build the plant;
- whether the plant will operate as foreseen in the project plans and the expected number of CERs are issued to it; and
- the creditworthiness of the counterparty.

Registration risk

Registration and revision risk relate to whether the project is registered as approved by the CDM Executive Board. The emissions reductions, which determine the number of CERs the project is issued, depend on what 'business as usual' scenario the CDM authorities decide is appropriate to judge the project (baseline risk). The project must be executed according to a 'methodology' which in turn must be approved by the CDM methodology panel.

Country risk

Once these challenges are overcome, there remains the investment climate in the country hosting the project. Consider the example of Thailand, which counts 70 projects in various stages of development[1]. In September 2006 the government was overthrown by the military, casting great uncertainty on all economic activity, including CDM projects. Since then, however, the host country approval of projects has continued and the country now has three projects that are registered as approved. They expect to be issued around 2.5 million CERs by 2012.

Point Carbon categorises ERPAs according to the risk that the seller assumes. This is expressed usually as a sanction on the seller if it fails to deliver as agreed (see box).

What happens if there is a project default, underperformance or wilful non-delivery?
ERPA category 1. Seller does its utmost to deliver a flexible or non-firm volume, while the buyer commits to buy if the seller delivers even if they turn out not to be eligible for CDM. No sanctions if non delivery.
ERPA category 2. Same as above but contract is only valid on a set of preconditions (CER contract). No sanctions if non delivery.
ERPA category 3. Seller commits to deliver a firm volume. Seller commits to replacing CERs if the contract's underlying project fail to deliver as planned.
ERPA_category 4. The seller guarantees to deliver a firm volume and the buyer guarantees to buy if the seller delivers. The seller must give compensation if the buyer does not receive the agreed amount of CERs.

Due to the low risk involved in categories 3 and 4, they overlap in their price ranges. The secondary CER transaction also falls somewhere in these price ranges.

[1] According to Point Carbon's project database and portfolio manager, the Carbon Project Manager, as at 14 September 2007.

Contractual issues

It is also noteworthy that each ERPA contract may have different provisions that affect the price. For example, where the buyer is willing to commit to upfront payment they will command a lower price than payment on delivery. Similarly, a higher price will be paid by one company seeking to be the preferred claimant if a project with several buyers under-performs. That company will pay more to be the first in line to receive CERs if there are not enough for the seller to meet all of its obligations.

Each CER in the primary market is therefore worth a different amount reflecting the risk profile of each individual project, depending on various factors, including:

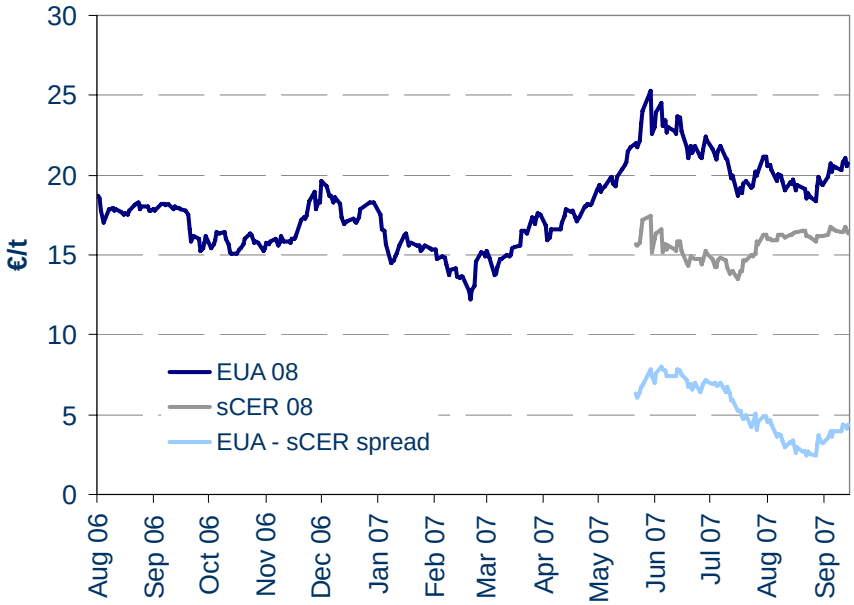
1. the risk inherent in each project, how that risk is apportioned between buyer and seller;
2. At what stage of development the project has reached when the ERPA is agreed;
3. the risk profile that project type, host country etc offer;
4. other contractual details of each individual ERPA, eg whether it covers the first 30% of the CERs to be generated or the last 30%.

2.4.2. THE SECONDARY CER MARKET

The secondary market refers to any further transaction after the primary transaction: the onward sale of the CER until eventually it is bought by the final consumer who will submit it to meet their target. Typically, the buyer in the secondary market (secondary CERs) carries much less risk as the CER is either already in existence, or its delivery is guaranteed in some way with replacement or compensation for non-delivery written into the contract. As a result, the buyer pays much more for the secondary CER.

The buyers for this more expensive, low-risk secondary CER tend to be European companies that face their specific target under the EU ETS. The secondary CER market has grown up as an offshoot of the EU emissions trading scheme and prices are often quoted as a percentage of the price of EUAs.

Figure 2.3 illustrates the recent price histories of the EUA and the secondary CER, and the spread between the two.



2.5. The effect of the EU emissions trading scheme on international carbon prices

The companies that face targets in the EU emissions trading scheme may use the European carbon commodity, EUAs, and that of the Kyoto Protocol's Clean Development Mechanism, CERs, to meet their compliance needs. The strong demand for CERs from European companies marks the interface between the EU emissions trading scheme and the global market.

As set out in this report, the weather and the energy markets determine to a great extent the price of carbon in the EU. Volatility on the energy markets or indeed abnormal weather events in turn create volatility in the EU carbon market. This is passed through to the secondary CER market.

However, there is little evidence in the carbon markets to date that the volatility is carried much further than that on a short time scale. The primary market constitutes the lion's share of the CDM, where European companies compete with European governments, Japanese entities and international financial institutions, all of whom have different price and contractual expectations and a different stimulus for being in the market. The primary market does not respond to short term price signals from the EU ETS.

Nevertheless, the EU emissions trading scheme does provide a constant, long-term source of demand for Kyoto credits such as the CERs from the CDM and eventually ERUs from JI. Over

the longer term, a greater shortfall in the EU market therefore implies demand for CERs and upward pressure on CER prices generally. It is reasonable to expect the supply of CERs to increase in response to such price signals, stabilising international prices.

The primary CDM market is a multifarious, opaque market where contracts can take months to negotiate, where price discovery is a complicated and difficult process and volatility is therefore much reduced. The following table sets out prevailing prices in various market segments.

Figure 2.4 Comparison of prevailing market prices as at 17 September 2007, according to Point Carbon database of transactions in the EU emissions trading scheme and the Clean Development Mechanism.

Contract type	Price or price range (€/tCO_2e)	Price or price range (NZ$/$tCO_2e$)
EU allowance (EUA) for delivery on 1 December 2008	20.61	40.11
Secondary CER for delivery on 1 December 2008	16.35	31.82
Primary ERPA for CERs, category 1	6-8	11.68-15.57
Primary ERPA for CERs, category 2	8-14	15.57-27.25
Primary ERPA for CERs, category 3	14-16	27-25-31.14
Primary ERPA for CERs, category 4	15-17	29.19-33.09
Primary ERPA for ERUs	5-12	9.73-23.36

While the EU allowance and secondary CER markets are relatively dynamic (see figure 2.3), the prices in the primary CER and ERU markets have not shown much volatility over the years, but rather reflect how developed each individual project is. In the early years (2003 and 2004, for example) projects were at an early stage in the approval process, forward contracts were being signed at €4 per tonne of CO_2 equivalent (NZ$7/$tCO_2e$). Now some have been registered and emissions reductions have been validated and CERs issued, they can be acquired at over €16/tCO_2e (NZ$31/$tCO_2e$)

2.6. Summary

Like any emissions trading scheme, the main price drivers in the EU emissions trading scheme are political and regulatory decisions, and emissions levels which are determined by weather, the wider energy complex and economic growth. The EU market is particularly responsive to the energy complex due to the dominance of the power generation sector.

The Kyoto flexible mechanisms, notably the Clean Development Mechanism, provide carbon credits which European companies can use to comply with their targets. As a result, CDM

credits (CERs) with guaranteed delivery are traded at a rate discounted to the EU price and respond to volatility in the EU market.

However, the short term volatility does not impact the primary CDM market. Contracts are negotiated according to the apportioning of risk between buyer and seller, as well as the specifics of each contract. Price ranges there respond to demand signals from various sources including the EU emissions trading scheme, but on a longer time scale.

The market for ERUs, the carbon reduction project credit under the Joint Implementation mechanism, is expected to respond to some of the same price signals as the CDM market as it develops.

The market for AAUs has not yet started. Even when it does, it may be limited to government-to-government emissions trades in the EU, as there is still uncertainty over the private sector having legal ownership of the credit. It is possible that this hurdle is easily overcome when the various national and international registries are operational.

The surplus of AAUs held by economies in transition, particularly Russia and Ukraine, is enough to offset the targets set by the Kyoto Protocol on all other countries. The governments of many developed countries have indicated they are not willing to buy the surplus AAUs unless the host country invests the revenue in domestic projects that cut greenhouse gas emissions or have some other environmental benefit.

These so-called green investment schemes have yet to emerge in their final form. The first confirmed intergovernmental transaction is expected in 2008. The AAU market is expected to continue developing with occasional, large volume intergovernmental transactions, rather than a more liquid market with many private sector participants.

In the international carbon markets created by the Kyoto Protocol, the price range currently is €5 to €17 per tonne of carbon dioxide equivalent (NZ$10 to NZ$32/tCO_2e). The EU ETS, which is derived from the Kyoto Protocol, lifts the top end of the range to €21 (NZ$40/tCO2e).

Participants in the emissions markets have developed strategies and tools to manage the risk associated with their emissions in the complex emissions trading markets. A new area in financial services has evolved, offering companies exposed to the price of carbon with a range of carbon risk management tools to enable emitters to mitigate the risk and seek out opportunities in the carbon market. These price risk management tools are explained in the following section.

3. Price risk management tools

This section examines the price risk management tools and services available to mitigate the risk related to carbon price volatility. We first consider how the EU ETS has developed in size and in terms of the financial instruments available to participants, as an example of how other emissions trading schemes can be expected to evolve.

Secondly, we consider the relationship between the size of the participant and the transaction costs they face, including their ability to negotiate competitive prices.

3.1. EU ETS and Kyoto Flexibility Mechanisms

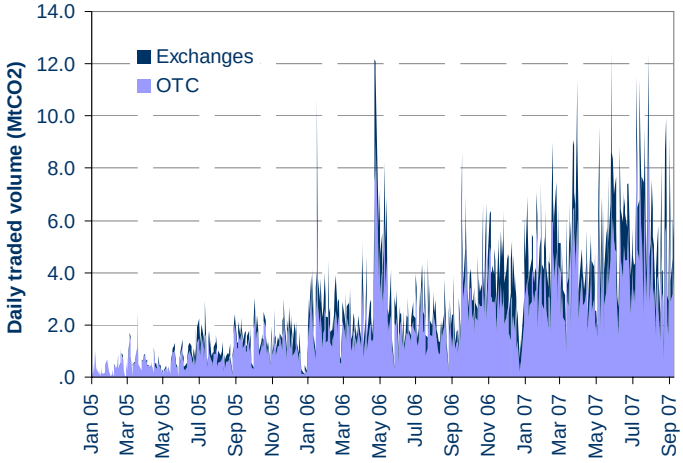
There has been considerable price volatility in the EU ETS market during Phase 1 (2005-7) with EUA prices reaching €31.6/t in April 06 and falling to €0.08/t in September 07. Whilst we don't expect prices to collapse in this way in Phase 2 (2008-12), due to the ability to bank EUAs into Phase 3, there are significant price risks that will need to be managed.

Development of EU carbon market

The European carbon market includes both spot and forward trading of allowances. The forward market includes contracts with monthly, quarterly and annual expiration (typically December expiration) for the final year of the first trading period (2005-2007), and contracts with annual expirations (typically December expiration) for the second trading period 2008-2012.

Trading of EUAs is split between an over-the-counter (OTC) market and numerous exchanges. So far in 2007, exchanges have had around 30% of the market share, with the European Climate Exchange (ECX) taking over 80% of the exchange volume. Liquidity has increased significantly over the three years of trading. During the first 8 months of trading in 2007 an average of around 5,610,000 tCO2 traded each day, compared to 2,910,000 tCO_2 and 743,000 tCO_2 during the same time period in 2006 and 2005 respectively. Figure 3.1 shows the development of daily trading volumes from 2005 until September 2007.

Figure 3.1 Daily traded volume of EUAs ($MtCO_2$) from Jan 05 to Sep 07



One measure of the level of development of a traded market is comparison between the physical volume traded and the total physical demand (in this case, emissions). In 2006, this ratio for the EU ETS was around 0.5 (taking into account an estimate of the bilateral market size) and in 2007 YTD the ratio is around 0.9. Whilst this ratio is increasing every year, we note that in more developed markets such as the Nordic power and oil markets, this ratio is closer to 5.

Kyoto Flexibility Mechanisms

As mentioned above, the Clean Development Mechanism (CDM) and Joint Implementation (JI) market is split into a primary market, in which buyers invest in a particular project to receive the emission reduction credits, and a secondary market, in which buyers purchase credits (not associated to any particular project) from a seller with some guarantee of delivery (see section 2.4).

Several exchanges have now set up contracts that mirror the secondary CER market, for delivery in 2008 through to 2012. This has provided the CER market with more transparent price discovery and allows participants to simultaneously trade both EUAs and CERs on exchanges.

A large swap market has developed between these two credits. Any company in the EU ETS can import and use CERs to meet their target, as well as the usual EUAs. However, each government sets a limit on how many CERs can be used, typically 8% of the cap. This is an attractive option as CERs are cheaper than EUAs. For example, in the case where company A has more CERs than it can use within its limit, it may seek to swap its spare CERs for EUAs with company B that has not reached its CER limit. Company A gets to convert its unusable extra CERs for EUAs, on which there is no limit, while company B can still meet its target and benefits from the premium it charges for its efforts.

This deal structure is expected to extend to ERUs once the Joint Implementation mechanism, which is still in its early stages, has developed sufficiently. This market segment of CER-EUA

swaps is growing in stature and typifies the increasing sophistication with which companies in cap-and-trade emissions trading schemes manage their risk.

3.2. Derivative markets

Derivative markets include various forms of futures and option contracts where no physical exchange of commodities will take place and these assist market participants in managing price risks. Derivative contracts involve a financial settlement between the parties which is determined by the difference between the contract price and an agreed price index. As of yet, the derivatives market for emission allowances is not very well developed and these currently represent a very small portion of the market size. The instruments available include:

1. Futures: some of the allowance futures contracts can be considered as hybrids because a contract party can opt out of physical delivery and the contract effectively becomes a financial instrument;
2. Calendar spreads: these can be used to capitalise on the idea that the price of EU emissions allowances change in a specific way between two expiration dates. This allows traders to take advantage of the price differences over time between the contracts;
3. Options: the European Climate Exchange is the only exchange to offer option contracts on EUAs and Certified Emission Reductions (CERs) at present although other exchanges may follow suit as this market develops. Options are also carried out through the brokered OTC market;
4. Swaps: a large swap market has developed for EUAs and CERs. This allows companies to import large quantities of CER credits into the EU ETS and to swap these for EUAs in order to respect the limits on the use of credits for compliance (see 3.1).

3.3. Hedging through other markets

The introduction of a pan-European CO_2 price component into power prices has also led to stronger correlations between the various power markets. As well as this, CO_2 costs have also had an effect on the volatility of power prices. This is because both power and CO_2 prices react to some of the same fundamentals. For example, warm winters lead to lower power demand and hence fewer emissions, thus lower CO_2 prices. As a result, power prices will experience a double downturn effect directly and indirectly through the CO_2 pricing component. This means that an effective risk management strategy needs to consider the price risks in both CO_2 and power (and related fuels) markets. Many of the players in the carbon market have positions in power and fuels markets as well, and so will be able to use hedging tools in these markets to position themselves within a suitable risk perspective.

As explained in section 2.3, weather is another important short-term price driver of CO_2 as this not only influences energy demand but also the level of non-emitting renewable generation such as wind and hydropower. It is therefore possible to use weather derivatives as a tool in managing CO_2 price fluctuations.

3.4. Financial Institutions

Financial institutions play a significant role in the carbon market firstly by adding liquidity to the market through their speculative activities but also through the products they offer. As well as products traded on exchanges and through brokers, financial institutions (and to a lesser extent some of the largest utilities) offer their customers a wide range of services in relation to the carbon market. These include:

- Routes to market (either acting as a broker or trading on behalf of clients);
- Portfolio management (maximising the revenue of a carbon portfolio);
- Structured cross-commodity products (including EUAs, CERs, and other commodities – typically power and fuels);
- Insurance products (relating to the delivery risks inherent with CDM and JI projects).

3.5. Summary

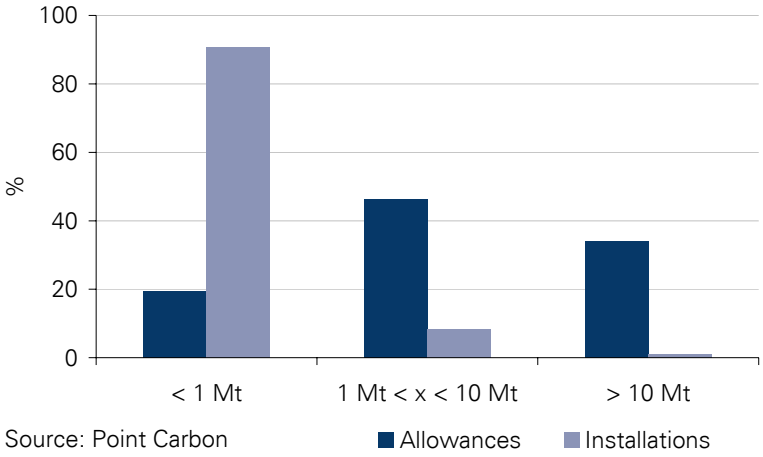
The carbon market is not yet as mature as many other more established commodity markets. However, in the case of the EU carbon market, there has been a 25-fold increase in the daily volumes transacted. There is a liquid spot and forward market both through brokers and on exchanges. Whilst the front years have most liquidity, it is possible to trade positions for the full time period of phase 2 (2008-12). The secondary CER market on the exchanges is also increasing in liquidity and this allows smaller players to access the CDM market without being exposed to the risks involved in the primary market. Finally, a number of financial products are developing, which is a sign of increased market maturity. These products should further increase the ability of participants to effectively manage their exposure to price fluctuations in the carbon market.

4. Relationship between transaction costs and size of participants

Figure 4.1 below shows the relationship in the EU ETS between the number of installations compared to the size of installations in terms of their allocation. As can be seen, there is an uneven distribution of allowances with roughly 90% of the smaller installations (<1Mt/year allocation) accounting for only 20% of the total allocation volume.

This section examines the performance of small and large market participants in relation to their ability to execute transactions and their ability to achieve competitive price levels.

Figure 4.1. Size and number of installations in the EU ETS



Source: Point Carbon

4.1. Costs of trading in the carbon markets

The costs for companies in the EU ETS include annual administrative-based costs (e.g. application and permits, registry accounts, monitoring, verification and reporting) and transaction costs, which can be split into:

- Direct transaction costs – exchange membership, brokers fees, financial services etc;
- Indirect transaction costs – personnel to manage transactions and risk management, data/advisory services, financial reporting etc.

We note that the administrative costs of a trading scheme are effectively set by the legislators and that these costs can be controlled and set appropriately. In this section, we therefore focus on the transaction costs.

4.1.1. EXCHANGES

Cost of trading at exchanges is normally split between fixed annual costs and a variable cost element depending on the volume of transactions. The fixed element can be a combination of an application/set-up fee and an annual membership fee. The transaction cost is a combination of a trading fee and a clearing fee. Some exchanges add or waive delivery fees in forward contracts depending on physical transfer of the allowances. The table below provides a brief overview of the cost of trading at selected exchanges. We emphasise that the table does not accurately represent the detailed cost structures of each exchange as there e.g. may be optional fee schedules depending on the volume of transactions. Prices change regularly as well and detailed up-to-date price information can be acquired from the exchange websites.

Figure 4.2 Summary of trading fees at selected EU ETS exchanges (as at 12 September 2007)

Per 1000t CO_2[2]	ECX	NordPool	EEX
Application fee (one-off)	€500 – 2,500	0	€12,000
Annual fee	€2,500	€3,000	€5,000
Transaction fee	€2 – 2.5	€3[3]	€1-3
Clearing fee	€1.5[4]	€30[5]	€3

In addition to the fees, exchange members need to make available a certain amount of capital, known as a margin call, to cover the credit risks associated with their investments.

4.1.2. OVER-THE-COUNTER MARKET

The OTC market is less transparent than exchanges. There are numerous brokers operating in the emissions market but six of the most active brokers cover around 90% of the market. Rather than sign a contract for each trade, companies usually sign a master agreement with a counterparty and can then trade freely with that company through a broker, who has a list of companies that can trade with each other. It is mainly the large utilities and trading houses that have master agreements in place.

Smaller players, or companies that want to access OTC channels without a lengthy contract procedure either enter the market through trustees/financial institutions, who provide access to markets and credit lines, or it is possible to use OTC channels without signing master agreements by using clearing. This means that a deal is conducted through the OTC and cleared through a clearing house.

[2] Fees for forward/future contracts

[3] This includes trading and clearing fee together

[4] Requires a clearing membership at LCH Clearnet or agreement with a clearing member.

[5] Clearing fee for small clearing customer only

Brokers charge fees as a percentage of the volume traded but there is no transparency in the fee structure. There is a large discrepancy in fees based on the size of the customer and the number of different products traded. Fees are in the range of 0.5 to 2.5 euro cents/tonne and are often negotiable. Given the fact that the market is generally short and there is high demand for allowances, there are often lower fees offered to sellers.

4.1.3. KYOTO FLEXIBILITY MECHANISMS

Investing in projects

To receive credits from a project, investors need to be named as a project participant. Depending on the stake in the project this will involve investing a certain amount of capital (this amount is also dependent on the level of upfront cash required for the project). This means that investing directly in projects is often not possible for smaller players. There are also considerable risks, especially investing in projects at an early stage of development, so this means that the investing company should be able to absorb potential losses from defaulting/low-performing projects.

Purchasing on exchanges

Again, there is now a secondary market for issued CER credits, both over-the-counter on several exchanges. The fee structure for trading these products is similar to trading normal EUAs (see above). This market segment is more suitable for smaller players to participate in although the prices of issued credits are higher than for credit purchase agreements at earlier stages in the project pipeline.

Participating in funds

A large number of carbon credit funds are now in operation. These vary considerably in terms of target investors (public or private), cash-return or credit-return, type of credits etc. Many of the funds are open to investors of all sizes (i.e. the minimum investment amount is not too high) although there are some that require significant upfront investments, which would exclude many smaller players. Fees are either based on percentage fees or as fixed management fees (which may disadvantage smaller investments). It is possible, however, for smaller players to participate in funds through a financial intermediary, which may be catered more to smaller investment sums.

4.2. Other transaction routes

Investment banks (financial services) have been quick to move into the carbon markets and offer a wide range of services, particularly for smaller players. Naturally, there are fees involved but profit-sharing contract structures can be set up to ensure that the client receives part of the upside. This may be a better option than just using the financial institutions as brokers as financial institutions may be better placed to make trading decisions and have access to wider market segments. Fees and profit-sharing agreements are non-standardised and are negotiated on a case-by-case basis.

The experience of the EU emissions trading scheme and the Clean Development Mechanism demonstrates that financial institutions are quick to enter such new markets and offer solutions to smaller players. They benefit by aggregating demand in order to achieve economies of scale and/or by charging risk management fees to their clients.

There are other products available for companies including lending part of an allocation to a financial institution to take advantage of differences in values of EUAs between years. In general, financial institutions, who are speculators in the market, are keen to get hold of physical volume and so offer competitive deal structures to participants that can offer this.

Some utilities, who are generally short, also offer bilateral deals with their customers to purchase credits as part of power-purchasing agreements.

4.3. Achieving competitive price levels

As with all commodity markets, larger companies will undoubtedly have larger staff numbers and potentially better analytical capability, which may help them achieve better prices in commercial transactions. However, the carbon market has developed and there is now several years of price history, which gives all participants better information on which to base future forecasts. There are also several data and analysis providers in the market, which give transparency to the market and improve price reporting. In general, as markets develop there is a narrowing of the knowledge-gap between the smaller and larger players.

In addition, the increase in the volumes traded at exchanges means that players of all sizes can see transacted prices at all periods in the trading day, and have access to these quoted market prices in exactly the same way as larger players.

4.4. Summary

Within the EU ETS, there are a large number of small players who only need to trade small volumes compared to some of the larger participants. Brokers' fees and exchange fees are set up in a way in which the average transaction costs will be higher if volumes are smaller. This is inevitable in any market.

However, the growth of the financial service sector within carbon markets presents many opportunities for smaller players to access the carbon markets indirectly, and to potentially benefit from these companies trading on their behalf. Smaller players hold physical carbon assets that are in high demand from the banks.

The main area in which smaller players may be disadvantaged is the ability to invest in CDM/JI/GIS projects directly (primary project market), as often this requires significant levels of upfront equity. However, it is possible to participate through funds directly or indirectly through a financial intermediary, or to trade in the secondary credit markets. This in turn involves some exposure to price volatility in the EU emissions trading scheme.

Finally, there is no real evidence of larger players being able to negotiate better prices in their deals as the carbon market has become a much more transparent market, especially with the development of exchanges for both EUAs and CERs.

5. Annex I – further reading

The following sources may be useful for further research into the international carbon markets:

www.unfccc.int – official website of the UN Framework Convention on Climate Change, including the Kyoto Protocol. There are resources on the protocol's flexible mechanisms and emissions trading, including pages dedicated to the Clean Development Mechanism and Joint Implementation pipelines. There are also the complete texts of decisions made at the Conference of the Parties to the UNFCCC.

www.ipcc.ch – Intergovernmental panel on climate change. The role of the IPCC is to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. It published its fourth assessment report on climate change in 2007.

http://ec.europa.eu/environment/climat/emission.htm – European Commission website on the EU emissions trading scheme, including beginner's guide, legislative texts, regulatory decisions and political statements.

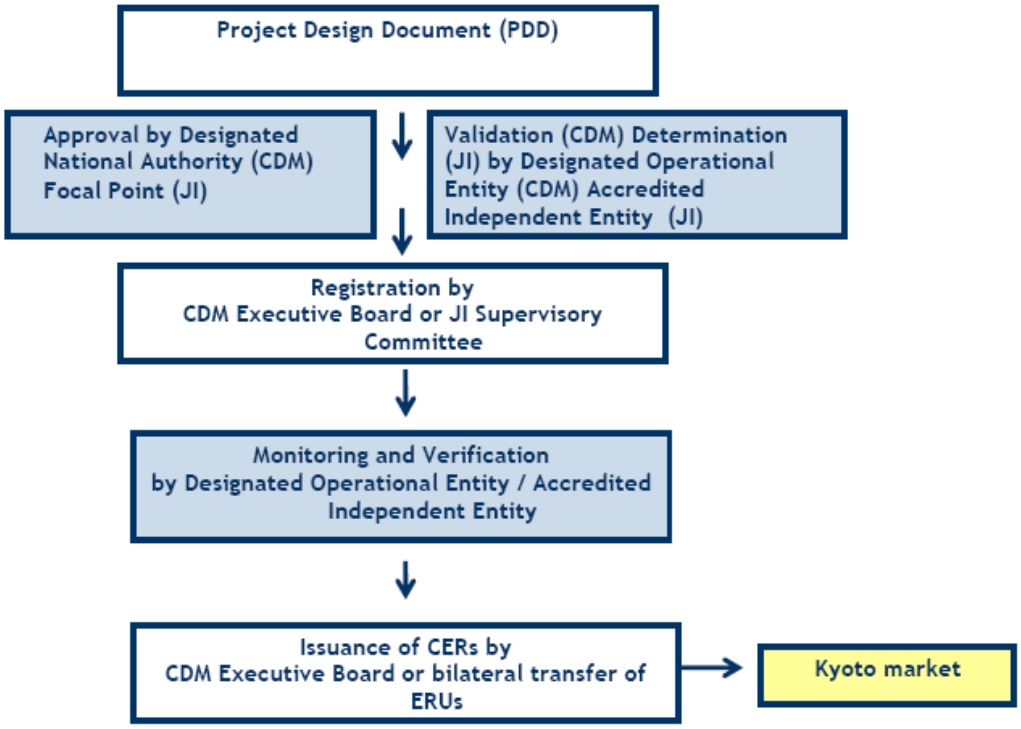
www.ieta.org – International Emissions Trading Association, industry association for the emissions trading industry. Members include most carbon credit brokers, exchanges, major emitters and service providers.

www.pointcarbon.com – Point Carbon website, including free research and news service. Analysis is available on a subscription basis. Advisory services offered including high-level strategy down to due diligence on investment transactions. Headline prices and news are available to all on the homepage.

http://carbonfinance.org/Router.cfm?Page=DocLib&ht=25621&dtype=25622&dl=0 – World Bank "state of the carbon markets" report 2007. Comprehensive review of the international carbon markets from the perspective of one its biggest participants.

6. Annex II – CDM project cycle

The following diagram is a simplification of the CDM project cycle. The complexity of the process may be off-putting, but various contract structures, intermediaries and service providers can help with the process of acquiring CERs, including full outsourcing of carbon price risk management. Once already issued, the CERs are available for acquisition without the complications of the project approval cycle.



7. Annex III – glossary of terms

A glossary of terms used in the emissions trading field are included in a separate document.