Reinforcing carbon markets under uncertainty:

the role of reserve price auctions and other options

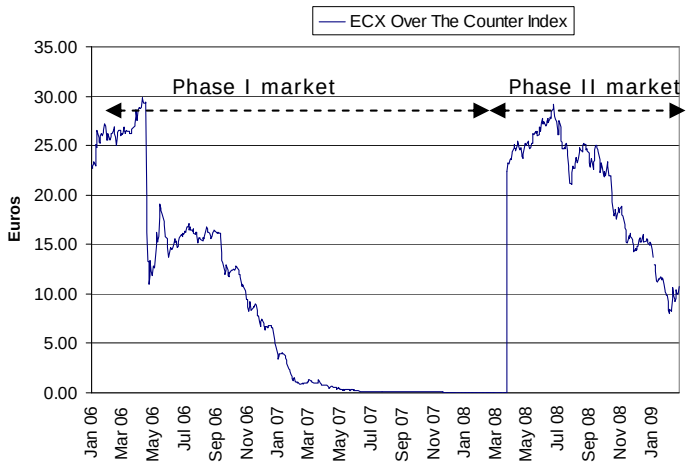
Michael Grubb, 4 March 09

Volatile carbon prices undermine the effectiveness of emissions trading in delivering multiple environmental policy objectives; a sustained price collapse would do further damage. This note analyses sources of price volatility and the risk of further price falls, explains why it is a problem that governments legitimately can and should tackle, and outlines options that could be sensibly used to underpin prices and investor confidence, including reserve price auctions. It argues that emission trading systems at present are incomplete, and that making them more robust through such measures is logical, feasible, highly desirable and now urgent.

The pattern of carbon prices

Emissions trading schemes have seen a pattern of high prices followed by dramatic declines, including in recent months. In the EU ETS, the trend of Phase I prices is now well known: a year of higher-than expected prices, followed by sharp decline after verification reports revealed a substantial surplus, with further decline towards virtually zero by the end of 2007. Phase II sustained a substantial price during 2008, its first operational year, before a sharp fall during the first two months of 2009 (see Chart 1 below). The US RGGI scheme, only a couple of months into its operation, is also trading at very low price levels reflecting growing perception of surplus.

Chart 1: Evolution of carbon prices



Source: European Climate Exchange Historical Data

These patterns echo the earlier experience in the UK's own pilot emissions trading scheme, in which incentives were paid to the companies offering the most significant cutbacks. Despite this, trading prices collapsed after about a year's operation as it became clear that the targets were being easily met and, indeed surpassed.

The collapse of the UK ETS and EU ETS Phase I can be reasonably apportioned to excessive allocations combined with greater than expected industrial response to the existence of a real price incentive. The factors that have halved Phase II EU ETS prices contain some of the same elements, but are more complex, and the final outcome remains uncertain as explained below.

Why are carbon markets so vulnerable to this boom-and-bust pattern?

Several reasons can be suggested for this 'boom and bust' pattern, which can be broadly grouped into two main categories:

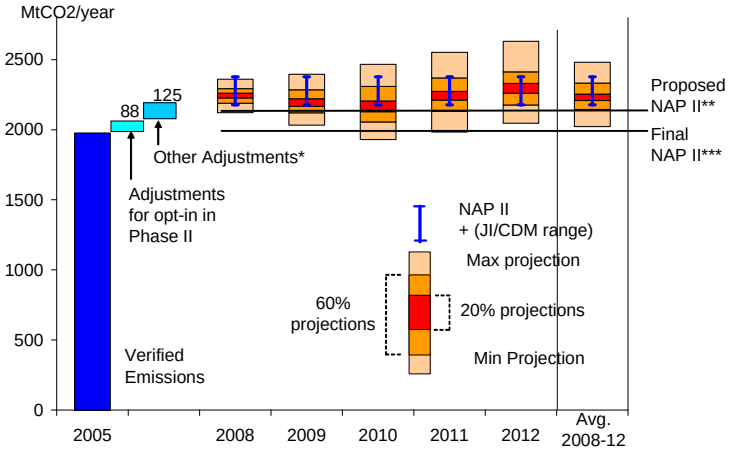
- *Small cutbacks relative to intrinsic uncertainties generate highly uncertain demand*. The potential demand for allowances and credits[1] is set by the gap between the initial allocation and the projected emissions. However, allocation cutbacks have been modest relative to projected emissions, due to fears about the costs of steep reductions. This makes the real scale of demand very uncertain – it is driven by the gap between two big numbers, one of which is quite uncertain. This is illustrated in Chart 2, which compares the cutbacks imposed in the final allocations for Phase II of the EU ETS (ie. *after* the Commission's interventions cut almost 10% from the originally proposed allocations) against projections of emissions modelled with uncertainty about fuel prices and GDP growth. The huge variation in the gap depending upon economic circumstances is clearly a recipe for highly uncertain prices.
- *Intrinsic bias arising from asymmetric information combined with lobbying, risk aversion and market interests drives the boom and bust pattern.* The original allocations are influenced by intense lobbying pressures between industry and government, with asymmetric information about

[1] Respectively, emission allowances confer a "right to emit" as under the EU ETS and "credits" represent officially verified emission savings from projects outside the scope of the capped sectors, but which can be used to offset the emission obligations of capped sectors

the real emission prospects and potential for cutbacks.

- But industry players themselves also fall victims to bias. The natural tendency (and interests) of industrial companies to optimism about their growth prospects combines with a clear incentive for the carbon market business itself to optimism about carbon prices, since its income ultimately depends upon significant prices. These combine to leave individual emitting companies believing the overall market is short even when their own position is long. At some point inevitably the truth comes home to roost and a sharp fall ensues.

Chart 2: Projected CO_2 emissions versus cap for €20/tCO_2 price



* See original source (Neuhoff et al, 2006, *Emission projections 2008-2012 versus NAPs II*)
** Includes opt-ins and extensions
*** Includes opt-ins and extensions. Values are estimated for the final caps for Italy, Estonia Finland, Hungary, Portugal and Denmark, taken from http://www.eprg.group.cam.ac.uk/naps/. Cyprus Romania and Bulgaria are excluded.
Note: The Chart shows modeling projections of emissions made in 2006 with ranges of economic growth and fuel prices and a carbon price of €20/tCO2. The combination of conditions that led to minimum emissions (bottom of the blocks, relative to final National Allocation Plans (NAPII) implies virtually no need for external credits (the blue bars). Economic prospects now look to fall outside the range considered even in this study.

Some of these features are of course intrinsic to other markets, particularly those with long investment timescales. There is however at least one feature that makes carbon markets subject to a unique degree of volatility. In any normal market, price influences both supply and demand: oil price falls, for example, are accompanied by cutbacks in oil production. However, the current design and presumption of emission trading systems is that allowances are fixed for a given period; and even the volume of emission credits from offset projects is virtually fixed once they have entered the pipeline.[2]

As a result, we have created an almost unique market structure in which supply is almost completely fixed in the face of very uncertain demand that is also subject to large bias errors in both setting and market perception. Small wonder, then, that the market is prone to boom and bust patterns.

EU ETS Phase II: "A perfect storm"

The European Commission did its best to contain such problems by imposing significant cutbacks in Phase II – cutbacks that were as big as politically conceivable at the time - and also by adopting provisions to bank allowances forward (which in theory should give greater stability). Our own analysis at the time concluded that the chances of the market being long overall were negligible.[3]

However, circumstances have conspired to drive reality outside the range of what seemed plausible just 30 months ago:

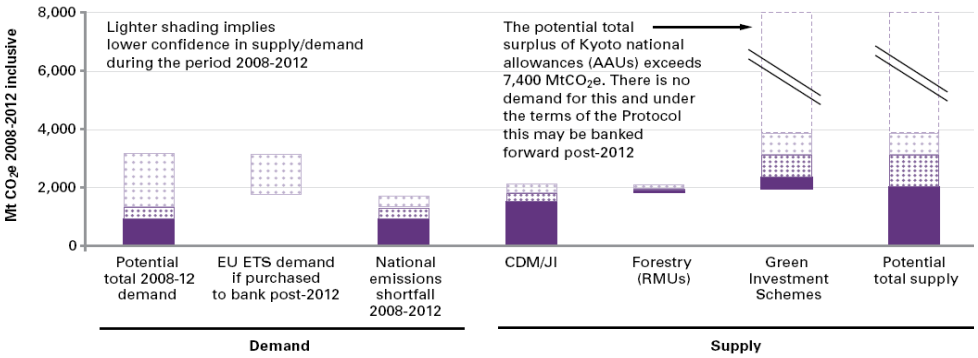
- The extraordinarily high energy prices up to mid 2008 drove a surge of investment in energy efficiency across the EU economies
- This and the emerging credit crunch depressed economic growth already in 2008; and
- Rapid growth of CDM projects has led to much greater supply than originally anticipated.[4]
- The high energy prices in 2008 also helped to drive up carbon prices and both factors contributed to emissions abatement in EU ETS sectors; preliminary evidence suggests that again this response has been bigger than expected.

A Cambridge Econometrics analysis covering some of these impacts, conducted in October 2008, concluded that net demand from EU ETS sectors would be negligible at a price of €20/tCO2 and that such prices could not be remotely sustained: given the supply of credits, significant prices could only be justified if companies kept or purchased allowances for use or sale post 2012 (banking). Also, in terms of the governmental 'Kyoto market' balance, other supply sources (land use and direct government supplies through Green Investment Schemes) are significant; yet they are largely overlooked in private EU ETS market analysis (since such credits are not eligible for EU ETS compliance) even though they serve governmental demand which would otherwise be competing for CDM/JI credits. The overall Carbon Trust/Climate Strategies analysis of the resulting supply/demand, indicated in Chart 3, underlines the scale of potential surplus in the overall system and led to our

[2] This is because the value of emission credits is generally ancillary to the primary revenue of selling the main product. It would be quite exceptional for a fall in emission credit prices to justify cutting back the actual production from a CDM-accredited project, for example.
[3] See Chart 2. As summarised in Carbon Trust, (2007) 'EU ETS Phase II: Prospects and Implications', www.carbontrust.co.uk.
[4] Despite downward revisions due to performance problems and recent sharp declines in project investment, our estimate of project credit delivery is 1800+/-200MtCO_2 – the great majority of this from projects already registered and operating

published prediction that prices would fall below €10/tCO2.

Chart 3: Supply and demand 2008-12



Note: The data on demand do not include Canada, which is a part to the Kyoto Protocol but not currently participating in the Mechanisms (see note 8), Canadian participation would add c. 500-600 $MtCO_2e$/yr of demand and so do much to restore a balance between demand and the supply of project-based emission reductions.

Source: Carbon Trust (2009), 'Global Carbon Mechanisms', www.carbontrust.co.uk

This analysis was conducted *before* the full scale of the economic downturn became apparent. The downturn drives additional factors:

- Overall industrial contraction directly reduces emissions
  It also weakens global energy demand, and hence energy, including gas, prices. Although over time this will reduce the pressure to increase energy efficiency, it has a nearer-term consequence of making switching from coal to gas in power generation cheaper; some projections now suggest that this might start occurring in summer months even without any carbon price incentive, further reducing emissions;
- The havoc wreaked by the credit crunch on the banking system has significantly weakened willingness to bank allowances for use post 2012. Cash strapped companies today, increasingly sceptical about the stability of financial markets, apply a very high discount to the possible value of holding on allowances for use after 2012.

Finally, the underlying economic factors increase the extent of surplus likely to be carried over to successor periods – thus reducing prospects for higher prices post 2012. The EU ETS Phase II is thus facing a "perfect storm" of circumstances that could drive prices extremely low for sustained periods.

Does it matter – and if so, why?

To some degree, this is a story of success: initial market concerns about the difficulty of meeting targets has driven high carbon prices that have contributed to greater-than-expected abatement. This is partly true but highly incomplete.

The current "orthodoxy" in governments is that once the quantity is set, it doesn't really matter how the market behaves – it will still deliver the set quantity target. This reflects a fundamental intellectual confusion about the nature of emissions trading systems.

It is not a natural market, connecting supply of a "natural" good to a private demand, but an instrument to achieve collective public goals. That is an absolutely fundamental difference, because it establishes that the instrument needs to be assessed against the goals it is intended to achieve.

Specifically, emissions trading is generally conceived as delivering four public policy goals around tackling climate change:

- Emission reductions over the period set, preferably as consistent as possible with long-term goals of deep emission reductions by mid Century;
- Incentives to drive low carbon investment and, preferably, innovation;
- Economic efficiency; and
- Investment into emission reduction projects in developing countries, to help increase global efficiency, to lessen the risks of 'carbon lock in' from carbon-intensive investments, and also to provide political glue to support engagement of developing countries in a global deal

In the orthodox theory, all four of these go together. However the real-world boom-and-bust pattern of current emission trading systems does not effectively deliver the second, third or fourth objective:

- Investment is already deterred by the uncertainties arising from the sequential nature of emission commitments, and the difficulties that business has understanding and predicting future government action; these naturally lead to a high discounting for political uncertainty. This will be greatly exacerbated if carbon prices collapse for an extended period, again;[5]
- High price volatility does not confer economic efficiency: this is obvious from a moment's reflection about the implied wide variation in operational mitigation decisions over time, as well as the inadequacy of mitigation investments.

[5] Propensity to invest and discount for political risk are inherently hard to measure. Anecdotal evidence suggests that relatively few companies are yet factoring in expectations of higher carbon prices into actual investment decisions.

- Some of the price variation follows the coal-gas switching price, but this just serves to underline that emissions trading may help to drive short-term emission reductions but is not reflecting longer term abatement investment costs which have to be an essential part of an efficient solution;
- A 'boom and bust' pattern does not provide a stable or predictable resource flow to developing countries, either directly or (as some propose) through channelling of auction revenues. Indeed over time it risks aggravating rather than improving engagement with developing countries, and discrediting market mechanisms.

Some recent contributions to the debate have suggested that it doesn't matter if emissions trading fails to support low carbon investment, since governments are applying other mechanisms (like renewable energy supports and CCS policies). This not only represents a pretty fundamental rewrite of the economic 'story', but on closer scrutiny is inadequate: the purpose of emissions trading is to offer *broad based,* and *levelised* incentives across operations and investment not confined to specific power generation technologies, but the wide set of options across industrial supply and demand investment. Indeed, carbon markets have been widely advocated as also providing a convergence goal to enable technology-specific supports to be phased out as technologies mature. If carbon markets are not playing that role, we have a problem.

Indeed, a price collapse sharpens concern that the first public policy goal itself is also not adequately delivered. The quantities set in trading schemes to date have clearly not been consistent with the strategic ambitions for mid-Century reductions. Low prices suggest that the reasons for this caution were, with the benefit of hindsight, misguided. If mechanisms can correct for this, they should be explored.

Thus, on all four counts: yes, price collapses absolutely matter. Governments created the system for public policy purposes, and if those purposes are not being delivered, urgent policy attention is fully justified.

Carbon taxation is not the answer

A large body of economic literature proposes that faced with uncertainty about the costs of a given emissions cutback, taxation is to be preferred. This literature has some relevant insights but as a guide to policy it overlooks several fundamental problems of taxation as an environmental instrument, and all evidence – as well as a key economic advantage of emissions trading systems:

Fundamental problems:

- Taxation combined the setting of a price with the transfer of large revenues from industry to government. By combining two very difficult things in one instrument it guarantees that the price will not be set at an appropriate level – it will rather be constrained by the politics of large-scale revenue transfers. Emissions trading has the huge advantage of separating these two factors through negotiations on the level of free allocation compared to auctioning and enabling an appropriate evolution over time.
- The 'additionality' of taxation is also very hard to establish, given widespread existing variation in underlying tax and subsidy regimes. It would be entirely possible for governments to introduce a carbon tax and offset this against changes in other tax structures, with the real effectiveness remaining opaque. Emissions trading focuses on the outcome – emission levels – and does reveal the real costs of cutting emissions.

Evidence

Carbon taxation was tried in Europe and consumed the politics of European climate policy for five years (1990-1995) before being finally abandoned. Several years more negotiations on harmonisation of energy excise taxes finally yielded an outcome that can most charitably be described as modest, with negligible impact on emissions.

Even where carbon taxes were strongly favoured and pursued, notably in the relatively homogenous and highly committed countries of Scandinavia in the early 1990s, the results indicate clearly the strong limitations of taxation in the real world and the impossibility of getting harmonised implementation given the established domestic processes and politics of taxation.[6]

Finally, emissions trading has some direct economic advantages that are rarely acknowledged in the literature. Although the *near term* incentive is not robust in the face of uncertainty, it can more effectively *frame strategic expectations* that emissions will be cut towards deep long term reductions. This is important for strategic positioning of companies.[7] And specifically for some technologies that appear crucial to long-term deep reductions (like carbon capture and storage (CCS)), it is important that companies believe carbon prices can respond to the cost of technologies – eg. rising to high levels under trading schemes if CCS proves to be more

[6] 'The taxes differ considerably regarding rates, tax base and exemptions .... nominal rates are currently the highest for Danish Households. Sweden and Norway have the highest rates for industry, however, Norway applies the high rate to offshore oil and gas .. all four countries have [differing] special arrangements for energy-intensive companies ...' (*Mikael Skou Anderson (2004), 'Vikings and Virtues: a decade of CO2 taxation', Climate Policy Vol.4(1):13-24)*

[7] The Carbon Trust report *Climate Change: a business revolution* (2008) found that in most sectors, a carbon price on its own is not likely to be the primary driver of the creation and destruction of economic value associated with the low carbon transition.

expensive than expected. Both the framing of long-term expectations and the 'upside' of price variations are thus important features of trading schemes that cannot be matched by taxes. And yet, the degree of price volatility and risk of collapse in trading schemes has been identified as a serious problem. The logic and evidence thus suggests the need to consider hybrid mechanisms.

The policy options

As indicated, a collapse of international carbon prices (through both the EU ETS and the global mechanisms) throughout 2009 could have serious consequences, both for individual companies and projects, and more broadly for confidence in the Mechanisms. When added to the experience of the EU ETS Phase 1, it may also seriously undermine the confidence of markets to place significant value on banking forward post 2012.

Response options depend upon which governments are willing to act, and how. At the international level the most obvious step would relate to Canada, which is not included in the estimates above because the Harper government has indicated that it does not intend to make use of the mechanisms.[8] Canadian participation would do much to restore the global supply-demand balance – and confidence, given the signal it would send in terms of the expected legal integrity of any future commitments - but such participation does not appear likely this year.

Post 2012 options

Early commitments by key countries to steeper cutbacks post-2012, in advance of a global agreement, would send the strongest and most consistent signals but only provide a partial solution, again because of the indirect nature of the linkage. A declaration by the new United States Administration of this nature could have a particularly powerful impact, both in terms of its scale and the political signals this would send.

The present focus of EU policy to protect its post-2012 package from excessive imports (by having a firm quantitative limit on imports) may help to sustain EU ETS prices and domestic action post 2012, but would largely isolate the EU system from the global mechanisms and this would further depress the international price.

An important variant on this would be for the EU to be more selective about the *type* of project credits it would allow; the volume could thus similarly be limited, but with a firmer focus on international project types that the EU wished to support.

Countries on the supply side of the global carbon market could also try and increase confidence in future prices, for example if some of the major transition economies were to consider voluntarily cancelling some, or all, of their surplus which would otherwise be banked.

However these are all rather indirect mechanisms in terms of current prices. Given the current inhibitions that deter private sector reliance on banking, there is a need to consider options that have an impact on the market balance in the *present* period (to 2012). The main options would appear to be as follows.

Demand side of the global market:

- Leading industrialised countries could retire emission units (or buy units specifically for retirement) without using them for compliance. However the direct cost this would imply, potentially on those countries already bearing the principal costs, makes it look politically very difficult at a time of recession, particularly given the apparent Canadian position of not complying with its existing commitments;
-A more politically palatable version of this is that governments could commit to bank some of their present Kyoto allowances post-2012 to increase demand in the present period; however this would add further to the level of post-2012 supply.

Supply side of the private sector market:

- China, as a dominant supplier of CDM credits (about 50% of the total), is already playing some role in price support through charges that it levies on CDM credit generation, notably from industrial gas projects. This is not an explicit policy of price support however; any attempt to turn it into one would imply a deliberate policy to restrict supply, with various ramifications including political instability.[9]
- A reserve price set on forthcoming auctions of EU ETS allowances (dominated by the UK[10] and Germany) could help to sustain EU ETS prices. If governments retired the unused allowances, this would tighten the EU ETS and increase overall private sector demand.

A global 'carbon bank' has also been postulated that could act on both supply and demand in an active way. This however would clearly be an extremely complex undertaking that would take many years to negotiate.

[8] This would place Canada apparently in a position of intent to violate international law if it cannot raise a Parliamentary majority to formally withdraw. The 'enforcement branch' of the Kyoto Protocol compliance system cannot formally act until compliance reports are assessed, in 2014. However, countries in difficulty can notify the 'facilitative branch' of the system and seek assistance.
[9] The obvious parallel would be with Saudi Arabian attempts to shore up the oil markets during the 1980s, which ended when its market share declined to a point at which it reversed policy in 1986 and global prices collapsed
[10] The first UK Phase II auction did in fact include a reserve price, but it was set explicitly in relation to recent spot prices, as an insurance against possible strategic behaviour of companies trying to undercut the trading market. It did not thus in any way play the role of a price floor.

Features of reserve price auctions

In terms of interventions that could support prices during the year of negotiating Copenhagen and weather the storms of the credit crunch, the option of auction reserve prices merits particular attention. It is an option that has been analysed in previous *Climate Strategies* research, most notably in Hepburn et al (2006) and Grubb and Neuhoff (2006),[11] and there are several reasons why it merits further attention now. It:

- Is predominantly in the hands of a few Member States, which are in principle committed to stronger action, it thus does not require lengthy and complex negotiations;
- Involves no ex-post intervention or changes of rules, it just needs specification of the terms upon which key governments would conduct their auctions during Phase II;
- Is thus also consistent with existing legal structures: nothing in the EU ETS Directive can reasonably be construed as preventing Member States from setting a reserve price;
- Addresses directly an underlying cause of the problem, namely the fixed supply in the face of highly uncertain demand.

The last point is strategically important. Reserve price auctions in effect set out rules in advance by which supply can adjust if prices fall to levels which make companies unwilling to pay the reserve price, Those additional allowances do not then enter the market. In this, reserve prices offer a simple yet fundamental way of increasing stability in carbon markets even in the face of large uncertainties. Moreover, they address the basic political concern that weak prices reflect targets that with hindsight turn out to be unjustifiably weak. In the face of genuine uncertainty, the system is reinforced by setting out clearly an automatic mechanism through which supply will be reduced if the target turns out to be much easier than expected. Reserve price auctions thus help the risk-averse political processes around target-setting cope with uncertainty.

This does not supplant the value of emissions trading as a system in which prices can respond to circumstances, but rather underpins expectations – and associated investments – in the face of wide uncertainty.

In practice, prices would tend to settle at some point above the reserve price, given the upside uncertainties.

Implementing reserve price auctions in EU ETS II

In EU ETS Phase II, the main contributions to auctions are:

- the volumes specifically reserved for auction in Phase II, dominated by Germany and the UK[12].
- the volumes that will not be utilised in New Entrant Reserves (greatly increased by the impact of the credit crunch in deterring new investment[13].

Given the sensitivity at the margin of the supply-demand balance, these volumes may indeed be sufficient to make a big difference, though a numerical analysis is beyond the scope of this note. However, there would ultimately need to be coordination. An initial cooperation between the UK and Germany could kick-start the process; some understanding over time would need to be reached regarding the treatment of auctions in other Member States, particularly as these accumulate allowances from unused New Entrant Reserves.

The revenue impacts for governments are uncertain at present and would require further analysis; they would also depend upon the nature and degree of coordination. However, it is entirely possible that the impacts would be positive, as indicated by brief consideration of the shape of supply-demand curves.[14] The present prospect is for governments auctioning full amounts at very low prices, well below €10/tCO2. Say the average was €5/tCO2, it is entirely possible that setting a coordinated reserve price at €15/tCO2, for example, would increase net revenues by trebling the price for half the total volume of sales.

To conclude, very low carbon prices could wreak much damage on the credibility of emissions trading and undermine the EU's attempts to forge a platform of leadership in the Copenhagen negotiations. Moreover, the historical pattern of 'boom and bust' points to the inherently volatile characteristic of emissions trading systems to date, and the potential benefits of building in a more robust design. There are various options that could be considered. Amongst these, reserve price auctions merit particular attention during 2009. They are not a panacea and should not replace debates on longer term strategy; but nor should serious options be ignored.

[11] C. Hepburn, M. Grubb, K. Neuhoff, F. Matthes and M. Tse (2006), 'Auctioning of EU ETS phase II allowances: how and why?', Climate Policy 4(1) 137-160 and M. Grubb and K. Neuhoff (2006), 'Allocation and competitiveness in the EU emissions trading scheme: policy overview', Climate Policy 4(1) 7-30

[12] In Phase II of the scheme countries are allowed to auction up to 10% of their allocations. The UK has committed to auction approximately 7% of its total, with it's first auction of 4 million EUA taking place in November 2008, with a further 25 million to follow in 2009. Germany will sell 40 million EUA per year (about 9% of its allocation) through exchanges in 2008 and 2009 with auctions starting in 2010. In addition Netherlands has committed to auctioning 4% of their allowance, and Hungary 5%. In total across the EU approximately 3% of total EUAs have been earmarked for auctioning. In Phase III of the scheme auctioning will increase, with no free allocation in the power sector and free allocation in other sectors reducing from 80% in 2013 to 30% in 2020 and eventually to zero in 2027.

[13] New Entrant Reserves (NERs) vary across the EU, for the UK, it is approximately 7% of their allowance, and for Germany it is 10%. Overall NERs are approximately 5.5% of the total EU allowance, although not all of this would be currently available for auctioning if unused. In total, assuming all NER's were available and unused, approximately a maximum of 8.5% of allowances could be available for auction in Phase II.

[14] See for example Carbon Trust (2008), *Cutting carbon in Europe: the 2020 package*, Chart 13