Environmental Economics Research Hub

Australian Government
Australian Research Council

Emissions Trading Expert & Policy Workshop
28 – 29 November 2007

Auctioning Greenhouse Gas Permits in Australia

Discussion Summary

Regina Betz

January 2008

Centre for Energy and Environmental Markets

Table of Contents

Acknowledgments

We are grateful to the research assistance of Oliver Sartor and Johanna Cludius. Financial support from the CERF funding for the Environmental Economics Research Hub of the Department of Environment Australia is gratefully acknowledged.

Executive Summary

This paper summarises the discussions and presentations at the workshops on "Auctioning Greenhouse Gas Emissions Permits" held in Sydney on the 28th and 29th of November with international participants from academic, political and industrial backgrounds. This is, however, not a consensus document which aims to reflect the views of all participants. It rather is a summary of the main presentations and lessons learnt and the conclusions drawn by the organisers.

The main objective of the workshops was to discuss the different design options for a greenhouse gas emissions permits auction with a special focus on the Australian context.

The presentations and discussions showed that for an auction of different vintages of greenhouse gas permits ***double-sided simultaneous ascending clock auctions (uniform price auctions) with intra-round and proxy bidding*** as special features are the preferred option. The reason for favorising this type of auction is: a) simplicity, since it asks bidders only to express the desired quantity at a given price b) a more competitive market structure in the long run, as simple auctions attract more bidders. Smaller bidders in particular might be encouraged to take part c) less vulnerability to manipulation, resulting from a more competitive market structure d) the opportunity for bidders to express their preferences among the different vintages, thus allowing them to buy their desired product mix e) a possible efficiency improvement of the secondary market , if this auction encourages smaller emitters to properly assess their marginal abatement costs in preparation for auction and therefore become more inclined to participate in secondary market trading after the auction.

With regard to auction frequency and timing it was generally agreed that ***quarterly auctions*** are a good frequency, which would a) help participants and the government to better manage price risk if the spot market is volatile, since more auctions over the course of the year would help even out this risk b) generate reliable revenue flows from auctions c) provide scarcity information and price signals, which is very important if only small volumes are traded on the secondary market d) guarantee a steady supply of permits, which can be especially important for new market entrants who may expect difficulty purchasing permits from competitors on the secondary market d) help participants to purchase permits in a manner that more accurately matches their demand profile e) make it more difficult for large buyers to "short squeeze" the market f) be less likely to impact volatility on the secondary market, since comparatively small amounts are supplied at each auction.

Since more complex auctions require significant management attention from businesses, it was suggested to have ***one large auction a year, involving several vintages***, that are auctioned at the same time and to which management can devote significant attention, followed by ***smaller quarterly auctions***, probably involving only one vintage. Early announcement of auctions was also favoured over announcements that don't allow time for potential participants to prepare their bidding strategy and compile necessary information (e.g. marginal abatement costs). The importance of early auctions and of auctions of future vintages (i.e. 'advance auctions') was also noted, since future GHG permit prices are required in due time in order to be able to make investment decisions. Therefore ***timing of auctions*** should be ***in line with decision making*** timeframes. These were considered to be around ***1-3 years***. Auctions further in advance would probably not generate a meaningful price signal, but instead be dominated by market speculators.

The ***auction reserve price*** (first round starting price) should not be set too low and be calculated based on a formula, which is given upfront, but does not risk manipulation.

A ***short settlement period*** (1 day) is important and company ratings as well as financial commitments should be collected in advance and be proportional to bidding amount.

It was discussed that ***auction revenues*** are best recycled outside the scheme, e.g. in the general budget in order to prevent rent seeking on the revenue spending.

Market monitoring was seen as important and comparing information of auction price with secondary market prices may be a way of discovering collusive behaviour.

Finally, the important role of ***laboratory experiments*** as well as ***field experiments*** was noted for the purposes of testing auction design in advance and training companies in order to make them more confident and comfortable with permit auctioning.

Introduction

All over the world, public support and political will are converging on the issue of the need for urgent action to curb greenhouse gas emissions. While experts agree that a host of policy instruments will be required to bring about the abatement measures needed to reach global reduction targets, emissions trading schemes (ETSs) are increasingly favoured by political leaders as a policy centrepiece for dealing with the problem. As this report is compiled, the EU is coming to the end of Phase I of its ETS with the second phase set to begin in 2008. In the United States action at state level has lead to the Regional Greenhouse Gas Initiative (RGGI), beginning in 2009, whereby 10 states have agreed to establish a market covering the carbon dioxide emissions (CO2) of the electricity sector in 2009. Other countries, such as New Zealand, Canada and now also Australia are at various stages of ETS implementation.

As the political momentum behind ETS has grown and experience from the European scheme been gained, a trend towards auctioning of permits is emerging in order to avoid rent-seeking costs and market efficiency losses resulting from the free allocation of permits. The wealth distribution issues involved in allocation of greenhouse gas (GHG) permits are a significant aspect of every ETS proposal for Australia. In fact, the auctioning of GHG permits in Australia has been predicted to generate annual revenues in the region of $10.5bn (≈ 1% of GDP) and be equivalent to 16-18% of overall company tax revenue[1].

It is in this context that, on the 28th - 29th of November 2007, the Centre for Energy and Environmental Markets (CEEM) of the University of New South Wales (UNSW) held a one-day expert workshop followed by a one-day public workshop on auctioning greenhouse gas permits. The workshops were jointly funded by the Economics Design Network (EDN), the Environmental Economics Research Hub (part of the Commonwealth Environmental Research Facilities programme, CERF) and the Centre for Applied Economics (CAER). The aim was to bring academics, industry stakeholders and policy makers together in order to discuss issues relating to GHG emissions trading schemes, in particular with respect to auctioning of permits and in view of an Australian ETS to be established in the near future. Key topics discussed were reasons for auctioning permits, optimising auction designs, timing and frequency of auctions, auctions as effective price discovery mechanisms, and lessons learnt from the EU, NZ and US schemes. This paper will give a summary of the discussions and topics presented on both days. It is not chronologically ordered, but rather arranged by content. For the agendas or presentations of the workshops please see the following webpages:
http://www.ceem.unsw.edu.au/content/28thworkshop.cfm?ss=1 and
http://www.ceem.unsw.edu.au/content/29thworkshop.cfm?ss=1

1. Auction types, suitability & the impact of revenue recycling

Already at the outset of the workshop, it became clear that, while the distributional aspect of permit allocation (and the wasteful rent-seeking behaviour it can induce, if done poorly) are well-known, the efficiency effects which different allocation methods may have in practice on the GHG permit market are not as frequently talked about. Auctioning can enhance market efficiency in a variety of ways (some of the listed arguments might relate or overlap). First, rather than allowing for large wealth redistributions to emitters under grandfathering, a successful auction efficiently allocates permits to highest value users. Second, auction revenues can be used to lower

[1] Source: Jack Pezzy presentation at CEEM 3rd Annual Conference and Dr. Iain Woods, Presentation at Garnaut Public Forum on the 31st of October see http://www.garnautreview.org.au/CA25734E0016A131/pages/public-forums-sub2.

distortionary taxes, thus, generating additional benefits (double dividend argument). Third, earnings can be used for the purpose of reducing long term abatement costs or compensating competitiveness losses. Fourth, auctioning can improve price discovery in the early stages of an ETS, when the secondary market is not functioning well yet, by bringing market participants in contact with each other. Fifth, some evidence suggests that auctioning can enhance the liquidity of the secondary market by a) leading to hedging activity just prior to the auction and b) encouraging smaller, more risk-averse emitters to discover their own marginal abatement costs, which in turn could lead to increased participation in the secondary market. Sixth, auctioning might increase management attention, because permits need to be acquired and will have immediate monetary impacts (in contrast to free allocation). Thus it might improve the efficiency of the scheme by augmenting information on emission and abatement options for companies. Finally, an efficient auction can help deliver price signals to guide efficient investment decisions about future abatement measures.

Moreover, auctioning can not only improve efficiency, but is also fairer and simpler than free allocation. This is because, unlike within so-called “beauty contest” systems of extensive lobbying for economic rents under a grandfathering scheme, auctions provide a clear set of rules, whereby the allocation of permits depends only on the bidding and thus the willingness to pay. The allocation of permits based on the result of the auction is therefore expected to be straightforward and not to lead to lengthy court decisions as free allocation in some EU countries did. However, to avoid lobbying spending of the revenue needs to be set well in advance.

In addition, auctioning also holds advantages over selling when the secondary market is not fully developed, as it makes for greater transparency and has the potential to lift participation rates.

Not only auctions as such, but also their specific design may have an effect on efficiency. For example, the potential for achieving windfall profits through collusive bidding behaviour at auctions affects the efficiency of the market, since an artificially low (or high) clearing price at the auction will distort signals about the marginal cost of abatement. This is a particularly grave problem when an emissions trading scheme lacks a deep and liquid secondary market, meaning that collusion at the auction cannot be “patched up” by the efficiency of later trading on the secondary market, where true preferences are revealed.

Even though auctioning might add complexity and transaction costs, these have to be compared to the transaction costs of free allocation and the transfer costs of achieving an efficient allocation in the secondary market, which might be higher than the transaction costs of the auctions, that could also lead to a more efficient distribution of permits as compared to free allocation.

In view of these issues there was unanimity of opinion across both the expert workshop and the roundtable discussion that 100% auctioning at competitive, transparent and fair auctions is the preferable method of allocating permits. This view is also supported by the argument that any amount of permits allocated for free is likely to provide an incentive for firms to engage in rent-seeking, Moreover, it mirrors results reported from auctions of other goods: the FCC auctions for spectrum in the US showed that the greatest costs in the allocation process emerged from non-market-based allocation elements. Given the lessons learnt from the European experience with grandfathering emissions permits in Phase I of the EU ETS, where large windfall profits were granted to emitters, and the amount of political will emerging behind the speedy introduction of an effective ETS in Australia, there was hope that an Australian ETS would opt for a large share of auctioning in its permit allocation. It was also concluded that compared to 100% auctioning, partial auctioning reduces the benefits of auctioning and renders the whole process more complex (since companies have to deal with both free allocation and auctioning rules).

1.1 Auction Criteria

The essential criteria for selecting auctions for GHG were listed as:

1. **Maximising efficiency.** This has two aspects: *allocational* efficiency (i.e. ensuring that resources are directed to those who value them most highly) and *informational* efficiency (i.e. timely price signals, revealing the true market value of GHG, which allows for efficient investment decisions). Allocational efficiency implies maximising participation, keeping transaction costs low, and minimising market distortions such as collusion used to achieve market power. Informational efficiency in the context of GHG auctions implies generating timely and reliable price signals, revealing individual marginal abatement cost curves, and, again, minimising distortions such as market power.
2. Generation of reliable **revenue** streams. Since GHG auction revenue is expected to be large and contribute a significant quantity of taxation revenue, the capacity of an auction to generate reliable revenue streams (which should go hand in hand with an efficiently run auction) is relevant. However, it was noted that maximising revenue is not a central goal of GHG auctions, but that an efficient auction usually also leads to high revenues. It was proposed that selling fewer permits would be an option to increase revenue.
3. **Additional issues relating to the above mentioned goals**: ensuring sufficient quantity of permits in an auction to attract small-bidders, minimising risk, ensuring comprehensibility, maximising transparency, adequate security provisions to prevent default risk, supplying technological and institutional infrastructure, minimising cash-flow impact (also to encourage smaller bidders), flexibility and adaptability of the auction design, so that future changes can be accommodated.

1.2 Auction Types

On the topic of alternative auction formats, one speaker provided a brief introduction to three prominent auction designs. These are the uniform price, pay-as-bid and Vickrey auctions. All of the three are auctions for multiple identical items as well as sealed bid auctions, where bidders simultaneously submit demand schedules. A bid usually consists of both the price and the respective quantity the bidder wishes to purchase at this price (a pair of price and quantity). After collecting the bids, they are ordered by their unit price and the items are awarded to the respective bidders, starting with the highest bid until demand equals supply. The auctions are differentiated by the price winning bidders pay.

In a ***uniform price*** auction, all winning bidders pay the same price for the product, which is either determined by the lowest successful or the highest rejected bid.

In the ***pay-as-bid*** auction winning bidders pay the prices each of them has offered.

At a ***Vickrey*** auction everyone who bids above the clearing price wins, but also pays the opportunity costs of each unit won at the auction. This means. for each unit won, the bidder pays the price of the next highest losing bid, had the bidder not bid for that unit. For example, if bidder n wins 2 units at auction and the next highest losing bids were $15 and $13 respectively, he pays $15 and $13 for each unit respectively. .

In the process of evaluating the different auction types with regard to revealing true marginal abatement costs and generation of revenue, it was highlighted that the different pricing rules affect bidding behaviour. For example demand reduction (also called “bid shading”) is a particular problem in uniform price auctions if few, large bidders dominate the auction. Thus it is only possible to determine which of the auction types performs best, if certain assumptions are adopted. The advantages and disadvantages of the different auction types were discussed in light of this precondition,

The downsides of the pay-as-bid auction are that it a) rewards those that can best guess the clearing price (usually larger bidders) and therefore often scares off smaller bidders and prevents them from entering the auction, b) encourages bidders not to reveal their true valuation of the good, but instead try to forecast the market clearing price and bid slightly above it c) can be difficult for participants to understand why larger participants pay less than the smaller ones who usually have less information to estimate equilibrium price and therefore are more likely to overbid. Thus, true highest valuers of a good may miss out, which leads to reduced efficiency. Moreover, this auction type might be more vulnerable to manipulation. This was illustrated by the US treasury auctions which were short-squeezed by the Salomon brothers in 1991.

Vickrey auctions encourage bidders to bid according to their real valuation of the good and therefore reveal information about true market value, which other formats are not as likely to achieve. It was noted that while the Vickrey auction works well in theory, in practice a) it does not work for two sided auctions since the budget might not balance, b) it can be difficult for participants to understand why different bidders pay different prices and why it gives discounts to larger participants, c) seller revenues can vary dramatically, d) it is vulnerable to collusion by losing bidders to drive up the price paid by competitors.[2]

Therefore, the uniform price auction appears to be the best auction type, since every bidder pays the same price (unlike the pay-as-bid) and it encourages small scale bidders to participate. By doing so, it leads to a more competitive market structure in the long run and is less vulnerable to manipulation. It was also suggested that this could benefit the efficiency of the secondary market by encouraging smaller emitters to properly assess their marginal abatement costs and therefore become more inclined to participate in secondary market trading after the auction.

1.3 Dynamic Implementation Features

At the expert workshop it was suggested that the uniform price auction (generally the preferred model in US markets) can be enhanced by implementing it along with dynamic elements. The greatest improvement can be achieved by including a clock, which makes the process easier for bidders, since they only need to bid the desired quantity at a fixed price. A special case (and common example) of this auction format is the ***ascending clock auction*** (***English auction)***. Over several rounds, an auctioneer announces a *current price* that he increases from one round to the next and the bidders indicate how many permits they are willing to acquire at the given price. Once a bidder reduces the number of permits in a particular round, he cannot increase the number of permits in a later round. The clock stops and the auction ends as soon as the total demand is no longer larger than the supply being auctioned. Then, the winning bidders pay either the price of the last round (if aggregate demand equals supply) or the price of the second last round (if aggregate demand is lower than supply). The advantages of this auction type are that the price is discovered slowly and bidders only need to state their quantity for each round, which simplifies the decision making.

A clock auction is also suited for auctioning multiple products at the same time and helps participants to attain the desired mix of products. This is important, if emission permits are differentiated products or only partially substitutable, e.g. if permits for different vintages are auctioned. In this situation, several clock auctions can be conducted simultaneously. However, clock auctions might run a higher risk of collusion[3].

[2] For more details on Vickrey Auction see: Asubel and Milgrom 2006, The Lovely but lonely Vickrey Auction, in Cramton, Shoham and Steinberg, Combinatorial Auctions, pp. 17-40.

[3] Under a clock auction the most likely collusive strategy is to reduce individual demand quantities by colluding to enter the exact quantity supplied at the auction in the first round, so that the clock stops at the lowest per unit price.

Various suggestions were made regarding the practical design of such ***simultaneous clock auctions*** for spot and forward vintages. This would allow buyers to express their preferences between present and future permit vintages at given prices for (or given price spreads between) both goods, thus aiding in revealing true valuations between different vintages. The auction format uses a separate clock for each vintage for sale. Bidders may shift demand from one clock to another. At the end of each round, a clock will tick forward if total demand for the respective vintage exceeds supply. Auction continues as long as at least one clock keeps ticking forward. There was concern, however, that demand shifts might exist in between simultaneous clocks (demand would shift to the clock showing the lowest price and this would stop those clocks in the next round, thus those clocks will be the clocks with the lowest price in the next round and demand would shift again) and that a multitude of clocks would add complexity as the number of vintages for sale increases, which might disadvantage smaller bidders.

Further implementation suggestions for the uniform price clock auction were:

First, ***inter-round bidding***, allowing bidders to secretly submit their desired quantities for all prices between the previous and present round prices. This would smooth out the ending and pricing rule by reducing the probability that more than one bidder is rationed.

Second, it was suggested that *during* a clock auction only excess demand should be ***reported as information***, not actual individual bid quantities. Revealing individual demand was considered to provide almost no additional value, but would only increase the risk for collusive behaviour and add complexity. After the auction only the clearing price should be made public and not the name of the successful bidders and their quantities, as such information could support effective and collusive coordination of strategies in future auctions, if they are held frequently.

Third, an '***activity rule***' to ensure the monotonicity of the clock (in other words, the number of units demanded needs to fall as the price rises with the clock). To achieve this, it is required that a) a bidder's total demand for all vintages may never increase from one round to the next; b) if a clock did not tick to the next price level from the previous to the current round (i.e. total demand for that particular vintage was lower than the supply of that vintage), any bidder, who submitted a demand bid for that vintage in the previous round, has to submit a bid for at least the same amount in the current round.

Fourth, ***proxy bidding,*** as a suitable way of minimising participation costs and giving bidders greater freedom (e.g. allowing for absence from the auction for a while). Proxy bidding allows bidders to submit a single demand curve to be used throughout the whole auction, rather than participating explicitly in each round.

Fifth, the auction ***reserve price*** (first round starting price) should be calculated based on a formula which is given upfront but does not risk manipulation.

Yet another implementation suggestion, also applicable to clock auctions, is the use of ***double-sided auctions***, meaning that sellers specify their supply schedules before the start of the auction. As the clock price increases, total supply will therefore increase as well. A design with this dynamic features several advantages. First, the gradual increase in supply as the clock rises reduces vulnerability to strategic demand reduction and collusion. Second, price signals are likely to be more reliable as both net buyers and net sellers participate in the auction, increasing the informational efficiency of the auction.

In summary, the proposed auction design is a double-sided simultaneous ascending clock auction (in case of different vintages are auctioned at the same time) with intra-round and proxy bidding as special features.

A similar auction design has already been used for auctioning other goods:

- EDF generation capacity (virtual power plants)
  - 24 quarterly auctions (Sep 2001 – present)
- Electrabel generation (virtual power plants)
  - 8 quarterly auctions (Dec 2003 – present)
- Ruhrgas gas release program
  - 5 annual auctions (2003 – present)
- Trinidad and Tobago spectrum auction
  - 1 auction (June 2005)
- Federal Aviation Administration airport slot auction
  - 1 demonstration auction (Feb 2005)
- GDF and Total gas release program
  - 4 auctions (Oct 2004)
- New Jersey basic generation service
  - 6 annual auctions (2002 – present)
- Texas electricity capacity
  - 16 quarterly auctions (Sep 2001 – present)
- Austrian gas release program
  - 3 annual auctions (2003 – present)
- Nuon generation capacity
  - 1 auction (September 2004)

1.4 Recycling Revenues

First best option would be to use the revenue of the auction to reduce other distortional taxes or to invest revenues in a way that reduces the long run cost of cutting emissions (e.g. in Research and Development of new technologies). However, if for political reasons the revenues need to be recycled to the emissions intensive industry for compensation, the following issues were discussed:

Returning auction revenue to bidders based on the quantity each bidder wins at auction has the undesirable effect of distorting incentives to bid according to individual marginal abatement costs. Therefore it was noted that if auction revenue is to be returned to emitters as compensation, this payment must be based on a mechanism that does not alter bidding behaviour at the auction.

One speaker gave an example of one auction revenue recycling proposal in the United Kingdom which would have been disastrous to auction success, since revenues were initially intended to be recycled in proportion to emissions. This would have had perverse consequences, because if revenues were to be recycled on the basis of future emissions, the auction would fail to determine the marginal cost of abatement, because as the auction price rises there would be no incentive for any bidder to drop out and choose to abate. Hence, the practical benefit of the auction in discovering the market value of greenhouse gas emissions and delivering permits to highest valuers of emissions would be lost.

Alternatively, if revenues were recycled on the basis of historic emissions, perverse incentives would be generated to artificially increase emissions prior to auction in order to gain windfall profits via revenue recycling. This would also threaten to encourage rent seeking behaviour and unnecessary administration costs for governments to pay for the extra monitoring required by this system.

A better rule for recycling revenues would be to assign revenue according to industry benchmarks, for instance.

1.5 Exposure to Price Risk at Auction

A further issue that arose during discussion was the price risk on the spot market during the auction itself, which participants in the auction are exposed to, since they would hold an open position. To address this problem, it was recommended that the auction process, from bid-submission to settlement, be performed as quickly as possible. The 2007 Irish auction for greenhouse permits was mentioned in this regard because of its extremely long settlement period of five days. One expert in US high-stakes auctions suggested that 'minutes' was a more appropriate time frame to be looked at.

Another solution might be to simply merge the spot and auction markets electronically, thus bringing all market participants together in the one market for GHG permits, which would mitigate the exposure to price risk at auction. However, the practical issues involved in implementing such a system (and setting up the institutional framework required for it) could not be discussed at sufficient length due to time constraints.

1.6 Frequency and Timing of Auctions:

It was generally agreed that the more frequently auctions take place, the better. There are several reasons for this. First, since spot market price fluctuations expose individual auction participants to price risk, more auctions over the course of the year would help even out this risk. This is also relevant with respect to generating reliable revenue flows from auctions. Second, regular auctions can help to provide scarcity information and price signals to the secondary market, if it is not trading high volumes of permits. Third, regular auctions are a way of guaranteeing a steady supply of permits, which can be especially important for new market entrants who may expect difficulty purchasing permits from competitors on the secondary market. This also helps participants to purchase permits in a manner that more accurately matches their demand profile. It also makes it more difficult for large buyers to "short squeeze" the market. Fourth, since smaller amounts will be supplied at each auction, each auction will have less potential to have a volatile price impact on the secondary market.

Some disadvantages of more frequent auctioning are that, a) auctions with very little supply might not attract enough bidders and thus the price signal effect of the auction is diminished, b) more frequent auctions will also increase the administration costs for both auctioneer and participants.

As the number of auctions per year increases, administrative costs, a weakened price signal effect and a diminishing number of participants begin to become a more significant issue. For this reason it was generally agreed that the frequency one should aim for are ***quarterly auctions***. It was also observed, however, that large and complex auctions require significant management attention from businesses and a lot of auctions can consequently impose an unwanted burden on management time. Hence, ,it was suggested to hold one large auction a year, involving several vintages auctioned at the same time, to which management can devote significant attention. This auction could then be followed by smaller quarterly auctions, probably involving only one vintage.

Furthermore, early announcement of auctions was favoured over announcements that don't allow time for potential participants to prepare their bidding strategy and compile necessary information (e.g. marginal abatement costs).

The importance of ***early auctions*** (well before the start of the scheme) and auctions of future vintages ('***advance auctions'***) was also noted, since future GHG permit prices are required in due time in order to make investment decisions. On the question of how far in advance such auctions should take place (i.e. the question of an "optimal time period"), it was suggested that, since electricity market companies generally don't plan more than 1-3 years ahead for the purposes of making pricing decisions, auctions further in advance probably wouldn't generate any meaningful price signal, but would instead be dominated by market speculators. Some industries, however, may require a longer time for preparation.

Another issue of auction timing and ***quantity to be released per auction*** are the competing demand profiles of different permit users. Some emitters will prefer a “front-loaded” auction schedule. These are likely to be emitters selling output on forward contracts who wish to hedge the price risk of GHG by buying permits early. Emitters selling products close to the time of production will prefer a uniform distribution across auctions in order to avoid open positions on GHG by buying permits close to their production time. Installations, that are less concerned about GHG price uncertainty, will have a preference for “back-loaded” auctions These are, for example, small companies which want to engage as little as possible in the trading of permits, because of a small amount of emissions relative to turnover. Such installations might decide to buy permits only a single time and close to the compliance point, when they already know how many they need. Matthes and Neuhoff (2007) have suggested that, since the weighting across these different groups is unknown, a uniform distribution is the best approach.

1.7 Auctioning and Impacts on Secondary Market: Effects on Liquidity & Price

To begin with, the definition of liquidity of the secondary market was given as the “ability to convert emission permits into cash through sale or to purchase additional permits when market participants desire to do so. The market allows large transactions without a substantial change in market price.” Liquidity is therefore not equivalent to the volume traded in the secondary market!

Despite fears that the price risk involved in auctioning would cause the secondary market to dry up around the time of the auction, the US T-bond market presents evidence that auctions can have a positive impact on liquidity. This is put down to increased hedging activity in order to protect against the price risk presented by the auction. Moreover, auctioning permits may well induce greater liquidity if smaller participants are brought into the process of valuing marginal abatement costs – something which did not occur in the first phase of the EU ETS, as smaller participants received free permits and, being more risk averse, held them despite profitable opportunities to trade in the secondary market. In general, paying for permits, rather than receiving them via grandfathering, encourages hedging activity which in turn stimulates activity in the secondary market.

One interesting outcome of experimental work conducted by Charlie Holt et al at the University of Virginia demonstrated that the relationship between spot and auction price can be used to provide evidence of collusion (see discussion of RGGI experiments in section 3).

2. Auctioning GHG Permits – Lessons Learnt from Previous Auctions and Trends in Proposals for Future Auctions

As a homogeneous good, GHG permits do not come encumbered with the same complexities for the auctioneer as goods on some other markets, such as electricity for instance, which, with its timing and location issues, renders auctioning of such a differentiated product more complex. It was commented that auctions for GHG permits have a lot in common with auctions for financial securities, since they are also issued for different periods and traded actively on a secondary market. However, the following examples are based on experiences in the area of auctions related to the environment.

2.1 SO_2 & NO_x Auctions in the US

Experience gained from auctions for SO_2 and NO_x in the US, as well as auctions in the EU ETS, was another topic in the discussions. The **SO_2 market auctions** began in 1993 for a compliance period beginning in 1995. They were conducted with annual spot and advance auctions (with approximately a 50-50 share between each product). Advance auctions were held in 1993 (1995 and 2000 vintages), 1994 (1995 and 2000, 2001 vintages), and annually from 1995 until today (spot and 7 year advance vintages). The share of auctioning vs. free allocation was only 2.8% and revenues were recycled back proportionally to contribution of permits (de facto 100% free allocation, with a mandatory selling part of 2.8%). In these auctions, early auctioning was found to be important for signalling price and was more accurate in providing this information than early bilateral trades or studies. However, the auction only proved important in the first years after establishing the market, because it delivered an early price signal and facilitated private selling. Afterwards, the secondary market dominated and the auction was influenced by the secondary market rather than the other way around. The graph below tracks the relationship between spot & forward auction prices and the secondary spot market price:

The graph shows that spot auctions closely follow the secondary market. It is also evident that advance auctioning was only effective in predicting the future market price before the regulatory change, which caused the spot market price to jump. This is an important lesson for policy-making, as it demonstrates the impact that regulatory shocks can have on the effectiveness of advance price signals.

The auction design has been heavily criticised. The auctions are two-sided auctions, in which the lowest ask price is matched with the highest bid price, the second lowest ask with the second highest bid price, etc. until the market clears. In such a design, however, no incentive exists to bid or to ask one's marginal abatement cost, causing participants to not collectively reveal the information required for the market to determine the true price of SO_2 emission permits. Effective auction design includes efficient price discovery as a key criteria, since this is required to provide accurate price signals in order to achieve least cost abatement. However, as mentioned above, the auctions played a relatively minor role later on in the market and therefore the bad auction design did not have a great impact on the efficiency of the market.

(Source: Evans and Peck 2007)

The **NO_x market in Virginia** started in June 2004 with an initial allocation of 5% to be auctioned. In these auctions spot and one-year advance vintages were sold (2004 and 2005 vintages). Sequential ascending clock auctions were used instead of simultaneous clock auctions because of their relative simplicity and because they were in line with the time constraints affecting the preparation of the auction. However, the only information bidders were given was, if the clock was still running and the price and time for the next round. Thus, this auction format was - ignoring bid increments- similar to a static uniform price auction, given that the auctioneer only indicated whether total demand exceeds supply or not.[4] The result was that significant revenue was raised (the main goal of the auction), the auction clearing price proved to be 5-7% above the spot market for that day and the expected price decrease on the secondary market flowing from the additional supply failed to occur. The auction was successful despite quick implementation (a matter of weeks!). Furthermore, administrative costs were limited to US$200,000.

2.2 Auctions in the EU ETS

So far only two EU member states – Hungary and Ireland – have conducted GHG permit auctions, although Phase II of the EU ETS (beginning in 2008) is expected to feature some increase in auctioning by member states (around 4 % of total permits). Due to limited transparency it is uncertain what conclusions or recommendations can be drawn from the Hungarian auction. This is different for the Irish case. The **Irish government**, planned two auctions in 2006 in order to spread risk – auctioning 250kt and 963kt respectively. They used a sealed bid uniform price auction with a non-disclosed reserve price. Bidders could submit a demand schedule with up to 5 mutually exclusive bids. A lot size of 500 EUAs was set to attract small emitters. Pre-qualification requirements were a valid account in a registry and submission of a €3000 deposit. There was no advance auctioning of future vintages.

The Irish auctions proved successful although it was decided that a 5 day settlement period was far too long as it exposed participants to unnecessary price risk on the spot market. The €3000

[4] This auction format is different to the suggested one (See section 1), in which the total actual demand is proposed to be published at the end of each round. This reveals more information than the policy of advising only whether demand exceeds supply and participants are in a better position to estimate the final price of the auction before it actually closes. This could result in heavily shaded bids, since it guides bidders in terms of optimal bid shading, but the additional information could also improve the efficiency of the auction.

deposit was also considered too low given bid sizes and it was concluded that a €15000 deposit would have been more appropriate in preventing default risk.

It was commented in one presentation that the small number and insignificant budget-share (0.12%) of auctioning during the first phase of the EU ETS somewhat limits the drawing of wider inferences about auction design from the EU's experience. The main practical lessons learnt from the Irish and Hungarian auctions are a requirement for significantly shorter settlement periods, and alterations to the deposit system (The deposit was either too low to create financial incentives or too high, which reduced the number small participants. It should rather be proportional to bidding amount). In the case of the Hungarian auction the importance of greater transparency was recognised.

It was also reported that auctioning at a share of 4% of allowances in the **second phase of the EU ETS** its currently expected (see table below). Auctioning will therefore continue to play a minor role. Significant windfall profits will once again prevail in the second phase. Some countries, like Germany, might sell into the market during the first years rather than auction. Furthermore, auction details are not yet decided in EU countries for the second phase, although a trend towards greater harmonisation is likely. It was noted too that, given the large windfall profits enjoyed by firms under free allocation of permits, a political decision towards having a much greater share of auctioning is becoming significantly more feasible, meaning that auctioning is likely to play a more dominant role in the third phase (e.g. 100% for the electricity sector).

	Phase I				**Phase II**	
Auction budget in Million EUAs p.a.	Auction share proposed	Auction share actual	Auction budget proposed	Auction budget actual	Auction share (%)	Auction budget
Austria	0.00%	0.00%	0	0	1.22%	0.40
Belgium (Flanders)	0.00%	0.00%	0	0	0.30%	0.18
Denmark	5.00%	0.00%	1.68	0	0.00%	0
Hungary	2.50%	2.50%	2.34	2.34	5.00%	1.49
Germany	0.00%	0.00%	0	0	9.00%	40.00
Ireland	0.75%+NER	1.81%	0.167	0.404	0.50%	0.11
Lithuania	1.50%	0.00%	0.1838	0	2.79%	0.46
Netherlands	0.00%	0.00%	0	0	4.00%	3.70
Poland	0.00%	0.00%	0	0	1.00%	2.64
UK	0.00%	0.00%	0	0	7.00%	17.23
EU 27	**0.19%**	**0.12%**	**4.37874**	**2.7515**	**3.4%**	**66.2**

Italy and Luxembourg have cancelled their auctioning share in the revised version of their NAP.

Share of auctioning in the EU ETS

2.3 Auctioning in the Regional Greenhouse Gas Initiative (US)[5]

RGGI is a "cap and trade" scheme for Carbon dioxide emissions of electricity generators in 10 US states and is set to start in 2009, with advance auctions held in 2008. The scheme is unique to date for GHG markets in a way that the states have agreed to auction at least 25 % of initial permits, with six states, such as New York and Massachusetts, announcing plans to auction 100% of permits. It is expected that RGGI will become the precursor to a national US ETS.

At present it is proposed for the first auction to be held one year before the start of the scheme (i.e. in 2008). It has been recommended that future permits be made available four years in advance, with additional issuing three, two and one year in advance respectively. The reasoning behind auctioning of permit vintages four years in advance is that auctioning future vintages will assist generators in their planning for future investments.

It has also been recommended that the auctions be held quarterly, because of the benefits of periodic price discovery and because this frequency enhances liquidity without interfering with the performance of a secondary market.

The scheme proposal looks as follows:

Figure 4. Recommended auction schedule

Auction date		Vintage							
Year	Qtr	09	10	11	12	13	14	15	16
2008	Aug	1/4	1/6	1/6					
	Nov	1/4	1/6		1/8	Steady State:			
2009	Feb	1/8	1/6			4 forward + 4 spot			
	May	1/8		1/6		each vintage			
	Aug	1/8			1/8				
	Nov	1/8				1/8			
2010	Feb		1/8	1/6					
	May		1/8		1/8				
	Aug		1/8			1/8			
	Nov		1/8				1/8		
2011	Feb			1/8	1/8				
	May			1/8		1/8			
	Aug			1/8			1/8		
	Nov			1/8				1/8	
2012	Feb				1/8	1/8			
	May				1/8		1/8		
	Aug				1/8			1/8	
	Nov				1/8				1/8

	Share
Spot	50%
Forward	50%
1 year ahead	1/8
2 years ahead	1/8
3 years ahead	1/8
4 years ahead	1/8

(Source: Cramton, 2007)

2.4 Australian Proposal

The Australian proposal, which was developed in 2007 for the National Emissions Trading Taskforce (NETT), the group established by the State and Territory Governments, is as follows (Evans and Peck 2007):

- ascending clock auction with iterative sealed-bidding in multiple rounds,
- uniform pricing,
- aggregate demand revealed in each round,

[5] See also "*Economic Experiments of Auction Design for RGGI*" below.

- simultaneous auctions of different vintages whenever applicable,
- double auction (sellers can submit selling orders in advance),
- intra-round bidding,
- proxy bids to accommodate small participants, and
- an internet auction platform.

With respect to ***timing***, the first auction is proposed to take place before the start of the scheme, but after the first monitoring period in order to ensure that necessary information is available. A last auction of one vintage within the reconciliation period is proposed, because the final allocation of permits to trade-exposed energy-intensive industry is only revealed at that stage and such an auction would give companies with an unforeseeable shortage the chance to buy. It has been recommended that future permits should be made available three years in advance of their vintage to help establish a future market and assist decisions on future investments (a 3 year lead time for investments is seen as appropriate). The Prime Minister's Task Group Report of May 2007 recommends "A small number of future-dated permits, beyond 2020, would also be periodically auctioned in order to promote the establishment of liquid forward markets." However, the likelihood of generating pure speculator participation in auctions of such future-dated permits is a concern, because in that case these auctions are likely to lead to unreliable price signals.

With respect to ***frequency***, the current Australian proposal states that auctions should be held quarterly in order to minimise transaction costs, enable both price and quantity risk management and assist the government in generating higher revenues, if prices are volatile. During the discussion concern was expressed about the potentially prohibitive complexity for smaller bidders of holding simultaneous auctions for four separate vintages. Therefore, it was recommended to intensively test the auction design experimentally in order to ensure that the rules are simple and comprehensible.

Figure 5.3: Timing, frequency and distribution of permits across auctions

Auction date Year	Qtr	Financial Year of Emission Permit Vintage 10/11	11/12	12/13	13/14	15/16	16/17	17/18	18/19
2009	Aug								
	Nov	20%							
2010	Feb								
	May	20%	20%		20%				
	Aug	15%							
	Nov	15%							
2011	Feb	15%							
	May	15%	20%	20%		20%	4 products available at auction		
	Aug	s_i	15%						
	Nov		15%						
2012	Feb		15%						
	May		15%	20%	20%		20%		
	Aug		s_i	15%					
	Nov			15%					
2013	Feb			15%					
after review	May			15%		20%		20%	
	Aug			s_i	15%				
	Nov				15%				
2014	Feb				15%				
after review	May				15%		20%		20%
	Aug				s_i	15%			
						etc			

(Source: Evans and Peck 2007)
Note: This plan is slightly front-loaded with the 20% advance auctions.

Comparing proposals for GHG auctions, there appears to be a trend towards at least quarterly auctions and towards advance auctions, typically not to be held more than 3 to 4 years prior to vintage year. It also emerges that the number of auctions of one vintage depends on total auction share and that there is an equal or slightly front-loaded distribution across auctions.

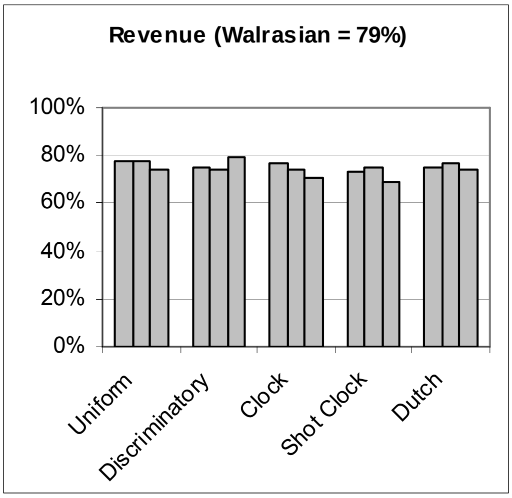
3. Economic Experiments on Auction Design for RGGI

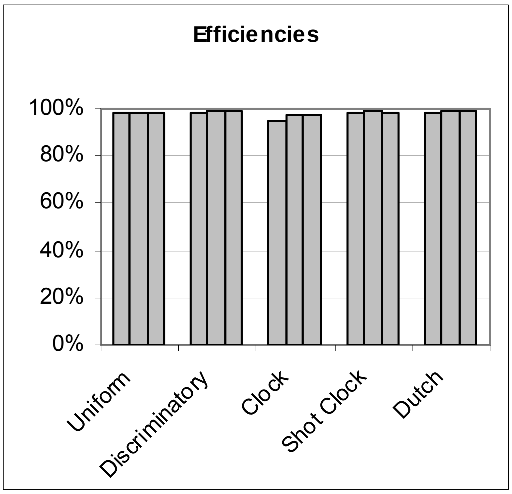
A presentation by Charlie Holt of Virginia University reported findings from his team's laboratory experiments. The teams' goal was to test various auction design proposals for the RGGI scheme in order to choose and then stress-test a recommended auction design. Over 1 000 auctions were conducted using more than 1000 student subjects. While a number of different auction designs were tested, three designs emerged as contenders for recommendation; these were a) sealed bid discriminatory auction, b) sealed bid uniform price auction, and c) ascending clock auction.

In Phase I of the experiments, 12 students participated in each auction. 6 subjects were allocated as high users and 6 as low users. Each subject also received a randomly generated cost-structure over 8 separate auctions, under which profit (= output – costs – permit costs) was to be maximised. 90 permits were demanded and only 60 supplied. In this phase there was no banking of permits, no spot markets, no shifts in costs, and no chat-room (to provide possibilities for collusion). The results were evaluated on the basis of three parameters:

1. **Revenue**, as a percentage of maximum bid value in a discriminatory auction.
2. **Walrasian revenue**, that would be obtained if people bid their values in a uniform price auction (Supply = Demand), expressed as a percentage of the maximum in (1).
3. **Efficiency**: maximum efficiency would allocate units to the highest value users; actual efficiency is a percentage of this maximum.

Using these parameters the following results were obtained in Phase I of the experiments:





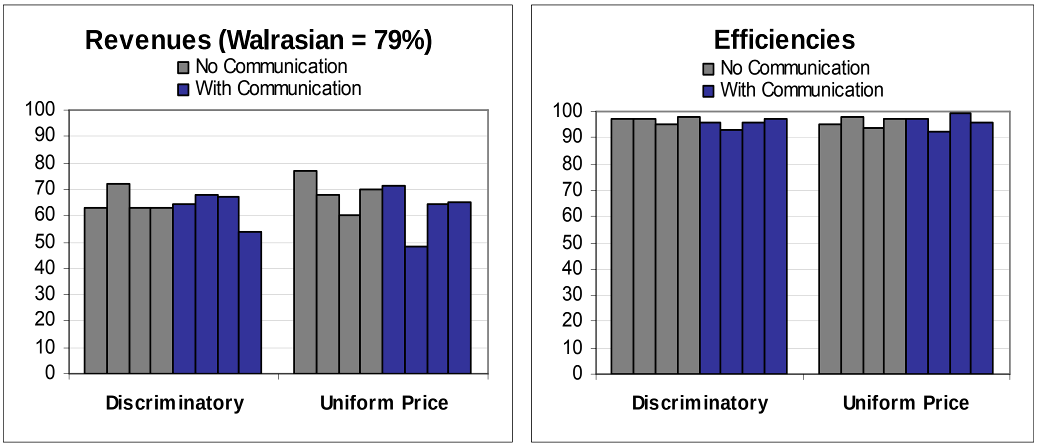
(Source: C. Holt, Expert Workshop Presentation, November 2007)

As revenue was very close to Walrasian levels across the range of auction formats, no clear winner emerged in Phase I of the experiment. In a second step. the experiment was altered in Phase I so as to narrow the difference between costs across bidders, which, based on experiments for the NO_x auction design, was expected to lead to the clock format outperforming the discriminatory price auction. However, this result did not eventuate.

In Phase II of the experiment, various stress tests were imposed on the auctions. First, the environment was made more complex by adding spot markets, partial grandfathering etc. Second. a chat room was added for the purpose of testing collusive behaviour. Third, a loose cap was set without spot markets, and finally, unexpected demand shifts were added without the presence of a spot market to check price discovery ability of the different auction formats.

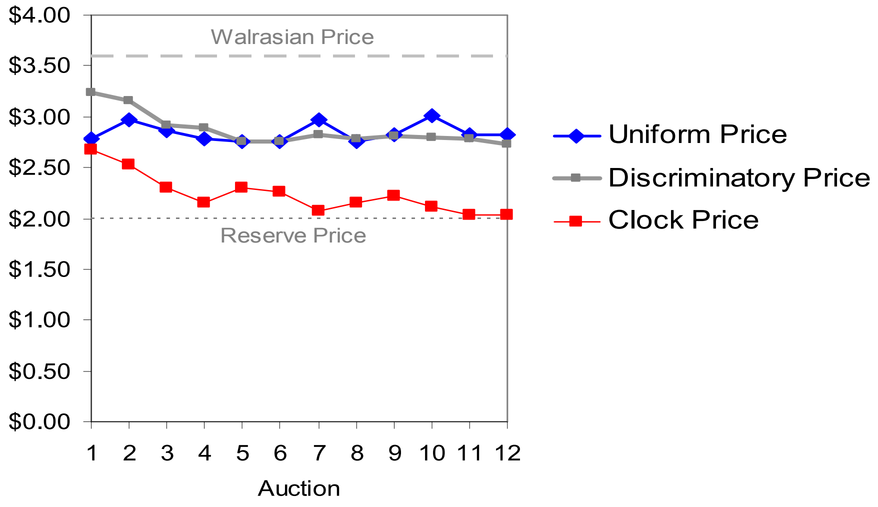
In the first stage of Phase II no clear difference emerged in either the revenue or efficiency performance between the discriminatory and uniform price auctions and spot prices tracked auction prices. Adding partial grandfathering also failed to have a significant effect on the way spot prices tracked auction prices.

For the purpose of testing collusion the group size was reduced to 6 subjects and a chat room added. The success of collusive behaviour was marginal and generally dependent on individual group dynamics. (See graph below)



(Source: C. Holt, Expert Workshop Presentation, November 2007)

However, it is noteworthy that under collusive conditions, the clock auction appeared to perform significantly worse than the other two:



This was put down to the fact that the decision rule in a clock auction is simpler, since the bidder only has to decide on quantity to bid at the prevailing price. Hence, collusive decision making also becomes easier.

The chat room treatment also revealed that subjects were capable of devising intelligent ***collusive behaviour strategies***. For instance, one comment in the chat room was: "so why doesn't everyone bid exactly the same amount that we ended last round with, since we keep getting the same clearing price".

One interesting result was the relationship between the spot market and spot auction prices in the experiments allowing participants to collude under the clock auction. The results are presented in the graph below:

(Source: C. Holt, Expert Workshop Presentation, November 2007)

The graph shows that where the price was kept artificially low at the clock auction through collusion, the participants would turn to the secondary spot market to trade, which would clear at higher prices. Since the spot market price should match the auction price on average, a practical consequence of this is that significantly higher prices in the spot market might be evidence of collusion at auction and could be used to monitor collusive behaviour.

It was noted that, although the experiment design mirrored many of the likely key features of the proposed RGGI auctions, some important elements could not be replicated. For instance, the real auctions will probably involve a much greater number of bidders, brokers etc. and major asymmetries between energy market participants, antitrust penalties, supply elements, and the potential for hoarding attempts (to raise price on the electricity market) will exist.

The third part of Phase II of the experiments attempted to stress-test a scenario with a loose cap on emissions. Since ***loose caps*** are a likely outcome given the political pressure when introducing such an instrument (as EU ETS first phase). The effect of loose caps is a relevant issue. This part of the experiment, it was explained, was also motivated by Vernon Smith's early T-bill auction experiments, where a uniform price auction did better in a setting with more prizes (the rationale for this being that there is less risk with a loose cap, and risk drives bids up in a discriminatory auction). The organizers of the experiment therefore expected the clock and uniform price auctions to raise more revenue with a loose cap than the discriminatory price auction. The results, however, did not confirm this prediction.

The fourth and final stage of Phase II of these laboratory experiments aimed at testing how the auctions coped with a ***sudden demand shift*** in the market. This was tested using a series of auctions in which groups were again split into 6 high emitters and 6 low emitters. Just prior to the fourth auction, the low emitters would receive an average reduction in costs, leading to a demand spike for permits. It was anticipated that the continuous and multi-round auctions would track the shift in the efficient Walrasian price more closely. As expected, it was discovered that the discriminatory auctions tracked the Walrasian prediction poorly. On average, the continuous auctions performed worse than the discrete round auctions . The uniform price (with discrete rounds) and clock auctions, as predicted, were found to have tracked the price shift more successfully.

It was reported that, on the basis of these findings, the ultimate ***recommendation for RGGI*** auctions was a sealed-bid uniform price auction. Since 3 treatments were conducted in which the clock was anticipated to outperform other formats (i.e. elastic demand, loose cap, and the price discovery (unanticipated demand shift)), but did not do so, it was decided to recommend the sealed bid-uniform price format. The reasoning behind this decision was that this format provides simple sealed bid implementation, is highly transparent, and performed well in the experiments. It exhibited better price discovery than the discriminatory auction and was more resistant to explicit collusion than the clock. However, it produced less revenue than discriminatory auctions in a loose cap design and could cause “lock-in” for needed permits (which is also true for the clock).

It was added, however, that the experiments did neither fully address ***hoarding issues***, nor issues of simultaneous bidding for different vintages. Indeed, it was acknowledged that the clock auction is a simple and efficient solution for the purposes of simultaneous auctioning of different vintages, a key issue at the workshop. This is because the clock gives the opportunity to switch demand between different vintages, whereas the sealed bid auction allows to only make a one-off decision about preference, without knowing the price difference between the vintages.

Another point discussed in this context was the issue of ***strategic bidding*** when significant asymmetries between market participants exist. For instance, in the electricity market, a large nuclear plant might have an incentive to hoard GHG permits in order to drive up the price of electricity production for its competitors and thereby gain a greater market share. Under the RGGI scheme, this problem was tackled by the transparency of the system, combined with the fact that permits are valid over a compliance period lasting a number of years, which makes such a strategy highly costly to execute and easy to detect. What appears to be a more realistic concern is what happens if a large nuclear plant is intended for sale. In this scenario there is a chance to drive up the carbon price in the short term in order to make the nuclear plant more attractive to a potential buyer. Such concerns highlight the need for effective market monitoring. Fortunately, in Australia’s case, no participant controls more than 12% of the market for electricity generation, which makes for a more competitive market.

4. Experiments versus controlled field experiments

A key factor in establishing an efficient and effective ETS is testing auction and market outcomes experimentally prior to implementation. That is why, following the presentation of the outcomes of the RGGI auction experiments, one speaker gave a presentation on the usefulness of “controlled field experiments”. These experiments are specifically designed to reflect “true-to-reality” scenarios (which come with field experiments, natural experiments and case studies), while also maintaining the extra level of control of a more stylised laboratory-experiment. For the purpose of illustration a discussion on the practical example conducted by the Fraunhofer Institute and the University of Karlsruhe was offered. The subject of this experiment were the effects of the proposed EU ETS on GHG emitters in the German state of Baden-Württemberg.

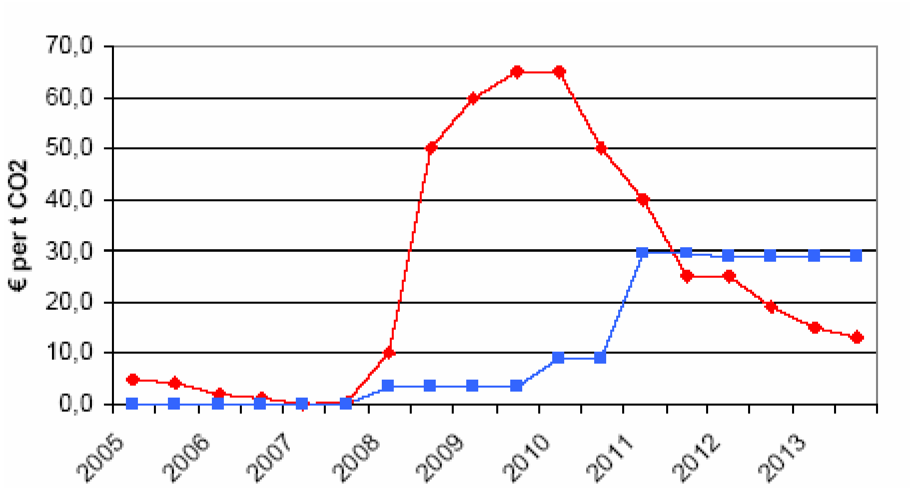
The experiments had two main goals. First, to prepare companies in Baden-Württemberg for the implementation of the EU ETS. (It was noted that the experiment proved highly useful for firms in making organisational preparations, identifying and evaluating abatement measures, discovering suitable emission management and trading strategies and giving indicators of prices for GHG permits.) Second, to provide useful feedback to policy makers, based on real data from real participants.

The experiment took place in 2002 and involved 15 different companies across a range of industries emitting carbon dioxide. The first stage consisted of companies gathering data on their own input, output, GHG emissions and abatement costs based on a given set of parameters (i.e. interest rate, energy and raw material prices, etc). This proved to be highly useful for the firms involved as an educative and information-gathering exercise. In total, the 15 companies discovered some 67 abatement measures – 21 of which were rational measures anyway (i.e. had an abatement cost less than zero) and discovered abatement potential well above the one required.

The trading simulation itself was designed to take place during three separate three year compliance periods (the starting year being 2005 - chosen to coincide with Phase I of the EU ETS). Allocation of permits took place at the beginning of the first year of each compliance period and a secondary market existed. In implementing the simulation, the participants spent three separate three hour periods trading, with each 3 hour simulation corresponding to one of the three successive compliance periods.

Banking was allowed between years within compliance periods, and from the second to the third compliance period, but not from the first to the second (this reflects EU ETS rules today). The emissions cap was initially set above business as usual levels for the first two years and then gradually tightened over the nine-year simulation period, only giving permits a value greater than zero after the first compliance period had ended (also reflecting the EU ETS).

One of the key results of the experiment is reproduced below:



(Source: Stefan Seifert Expert Workshop Presentation)

The red line represents the GHG price generated in the trading simulation, while the blue line represents the predicted market equilibrium based on the data. As can be seen in the graph, the actual realised price was much higher than the efficient equilibrium price in the middle phase and then dropped well below the predicted equilibrium price in the third period. The first bubble can be explained by the ban on banking permits of the first phase into the second phase. Therefore, excess permits at the end of the first phase lost all value. The reason for the increase in price in the second phase is that participants failed to sufficiently invest in rational abatement measures in the first compliance period (2005-07) when the cap was loose, leading to a run on permits in the second compliance period (2008-2010), since each measure needed a lead time before being effective in reducing emissions. Then, in the second period, with the high price of GHG, participants decided to invest heavily in future abatement measures, because given the higher price, a greater number of measures appeared rational. This, in turn, affected the price in the third period (2011-2013). As the high number of measures taken in the second period began to take effect and reduce emissions, the demand for permits fell sharply, leading to a market equilibrium price below the predicted equilibrium. However, this last effect might be due to the endgame effect in the experiment, which does not exist in reality, as the EU ETS is continuous.

These findings imply that, under the conditions imposed in the experiment, the market mechanism will perform poorly from an efficiency perspective, as an indicator of the future price of GHG, and as a driver of efficient investment in the future. Perhaps even more confounding than these initial findings was the fact that repeating the experiment with the same participants led to the same outcomes, despite the fact that participants had the opportunity to learn from the first experiment! Moreover, further control experiments with students produced the same results.

5. Further ETS Implementation Issues in Australia

For a 100% share of auctioning one of the central issues for Australia will be addressing carbon leakage. It was noted that it is important to address ***long-term carbon leakage*** of firm relocation, not potential short-term leakage, resulting directly from higher costs. Australian proposals today suggest free allocation to trade-exposed energy-intensive industries in order to prevent carbon leakage. However, an output-based free allocation, for example, does not provide incentives to reduce emissions by reducing output and might therefore be less efficient and have higher costs. That is why, the option of border tax adjustments or other measures which are outside of the ETS were preferred, thus that incentives for output reduction and thus for restructuring the economic behaviour within the country will prevail, but protects industry from export and import competition. Further work needs to be done with regard to practical implementation (e.g. revenue recycling) and since it involves issues of tariffs and trade protection, such problems will need to be negotiated internationally and might have WTO implication.

Financial market GHG price derivatives for hedging GHG price risk were also highlighted briefly and remain an issue worthy of greater attention in the future.

Another topic briefly discussed was the significant practical issues with linking ETS schemes, given the differences in units across schemes. The Australian proposals suggest annual permits (vintages) which are bankable, but no borrowing is possible. The EU scheme allocates permits annually (Phase I=2005-07, Phase II=2008-12, Phase III= 2013-2020) based on a national allocation plan for each phase. Those permits are valid within a phase (thus borrowing within a phase is possible) and bankable (i.e. transferable from one phase to the next) from Phase II onwards. Only from Phase I to Phase II banking was limited. The RGGI scheme will have annual bankable permits valid for three year compliance period (but extendable to 4 years if the price of GHG/tonne falls to $10 or less in 2005 dollars). Obviously, issues must be resolved as to how such differing units are to be recognised if, for instance, these two schemes were to link up.

Some additional questions yet to be answered were: Do we need each vintage in each auction? What is the additional information if each vintage is auctioned? Does it make sense to vary auction design depending on the share of auctioning (full, small share, double vs. one sided auctions)? Or with the time period in which permits are auctioned (early auctions different to later auctions)? What are the advantages and disadvantages of selling on the market instead of auctioning? What institutions are envisaged to be involved in the auction?

Further Reading

- Cramton, P.C and S. Kerr, 2002. Tradeable Carbon Permit Auctions: How and why to Auction not Grandfather, Energy Policy 30(4): 333-345.
- Holt, Charles; Shobe, William; Burtraw, Dallas; Palmer, Karen; Goeree, Jacob 2007. Auction Design for Selling CO2 Emission Permits Under the Regional Greenhouse Gas Initiative, Final Report, http://www.rggi.org/docs/rggi_auction_final.pdf viewed November 2007.
- Evans and Peck 2007, Further Definition of the Auction Proposals in the NETT Discussion Paper, Report prepared for the National Emissions Trading Taskforce, Sydney, http://www.cabinet.nsw.gov.au/greenhouse/emissionstrading/__data/assets/pdf_file/0015/8421/Auction_Design_Report.pdf, viewed October 2007.
- Matthes, Felix and Neuhoff; Karsten 2007: Auctioning in the European Union Emissins Trading Scheme, Report prepared for WWF, http://www.climate-strategies.org/item_list.php?item=document&id=124#124 viewed November 2007