

Western Climate Initiative



Markets Committee Task 6: Auction Design White Paper

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1. Introduction

The Western Climate Initiative (WCI) is a cooperative effort of seven U.S. states and four Canadian provinces that are collaborating to identify, evaluate, and implement policies to reduce greenhouse gas (GHG) emissions, including the design and implementation of a regional cap-and-trade program. Auctioning will strengthen the aim of the cap-and-trade program by establishing a price for carbon that will inform industry's investment decisions and promote abatement. The WCI Partner jurisdictions released *Design Recommendations for the WCI Regional Cap-and-Trade Program* in September 2008.¹ The program design recommends auctioning a portion of the emission allowances created under the program and coordinating a regional auction.

This white paper is the first step in developing recommendations for the design of the regionally coordinated auction, as called for in the WCI 2009 – 2010 work plan released February, 2009. It will inform decisions on auction design, including identifying design decisions to be made and assessing their inherent tradeoffs.

The remainder of this paper is organized as follows:

- Section 2 presents the draft auction Design Principles released by WCI in April 2009.
- Section 3 presents the parameters being examined to define the auction design.
- Section 4 summarizes the auction designs used in other programs.

2. Auction Design Principles

The auction design principles are guidelines that help inform decisions regarding the auction design to ensure that the auction maximizes environmental and economic benefits. They reflect a set of common principles developed to guide the overall WCI market design effort, including the auction. The principles were developed with input from WCI Partner jurisdictions and stakeholders at a meeting held on April 9th, 2009, in Seattle, Washington.

- ***Fairness:*** All market participants, including compliance entities, should have fair and equal access to allowance auctions.
- ***Efficiency:*** The market is designed to operate efficiently so that greenhouse gas emission reductions can be achieved at the least cost. An efficient market means that allowance and offset prices reflect supply and demand, and accurately reflect the value of allowances and offset credits to entities having compliance obligations. The auction design chosen should contribute to market efficiency.
- ***Effective Oversight:*** The design and oversight of the allowance auctions do not contribute to fraud, manipulation, and speculative excess.
- ***Transparency and Openness:*** Transparency in the design and the operation of the allowance auction builds and retains public confidence.

¹ The program design recommendations document *Design Recommendations for the WCI Regional Cap-and-Trade Program* is available at: <http://www.westernclimateinitiative.org/the-wci-cap-and-trade-program/design-recommendations>

- Reporting of relevant information to regulatory authorities and public disclosure of information has important benefits. It enables regulatory authorities to ensure effective oversight, compliance, and enforcement, all of which are necessary for market efficiency.
 - The release of information to the public can change the decisions of market participants, which in turn determine the prices of allowances and offset credits. Timely, accurate, coordinated and consistent release of market-relevant information allows all market participants to have equal access to public information.
 - The reporting and disclosure requirements for compliance verification and enforcement balance these benefits against the need for entities to protect certain sensitive information. The potential to disclose certain information that could be used to manipulate the market is also considered. This balancing is consistent with applicable law relating to the disclosure of information.
- *Administrative Simplicity and Cost:* The auction is designed to be as simple as possible for participants and administrators. Administrative costs and transaction costs are minimized for all parties, consistent with the need to provide effective oversight.
 - *Accountability:* All entities involved in the allowance and offset credit market, as regulators of the market or as participants, are accountable for their actions. The responsibility, authority, and capacity to conduct the necessary oversight and take appropriate action are fully defined for all agencies charged with compliance verification and enforcement.
 - *Conflicts of Interest:* Conflicts of interest between auction participants, monitors, and regulators are prevented.
 - *Compatibility with Other Markets:* Entities that participate in allowance auctions may also be participants in other markets, such as the secondary market where allowances are traded, or electricity wholesale markets. The auction design considers potential consequences of interactions between the operation of the auction and the operation of other markets and mitigates potential impacts.

3. Parameters

A large number of auction procedures are currently in use in various public sector auctions around the world. Auction operators generally select procedures based on the assessment of the characteristics of the expected participants, the nature and number of the items being sold, whether the auction will be repeated or whether the items will be actively sold on a secondary market, as well as other objectives the operator may have. The implication is that no procedure is optimal for all auctions.

Each auction procedure is defined by a set of design features or parameters. The WCI partners have identified ten parameters that must be set while accommodating the auction design principles set forth in Section 2 (Auction Design Principles) as well as the decisions contained in the WCI Design Document.

a. Auction Format

There are three main auction format elements to be considered: the number of rounds, the bid format and the pricing mechanism.

The auction operator will consider whether the expected auction participants have uniform access to market information, to evaluate possibilities for manipulation. Each bidder's private valuation of the item being auctioned would be the marginal cost to the bidder of one tonne of direct emission reduction from its operations.

If market information is available, either from previous auction results, trades on secondary markets, or studies evaluating the cost of direct abatement strategies for industry, then auction participants will be able to form good estimates of competitors' valuation of the allowances. Bidders will then worry less about the winner's curse (over bidding) and can increase their bids to be closer to their actual private value of an allowance.

Number of Rounds

Auctions may consist of one round of bidding or multiple rounds. Single round formats can be highly efficient even though bidders are known to shade their bids away from their actual private value and toward the expected auction closing price. Multiple round formats are used when the operator expects that bidders may not initially bid their private marginal values. Auction operators expect competition from multiple bidding rounds to result in a final bid equal to the highest private value among the bidders. The auction operator could specify the number of bidding rounds or alternatively, the auction could use a clock mechanism, where the initial auction price is chosen by the operator and price is then adjusted either upwards or downwards at fixed increments each round until the cumulative bid equals the number available.

Bid Format: Open or Sealed bid

The auction operator chooses between open and sealed bids by deciding whether there is benefit to having competitors see all the bids. The main benefit to open bids is that bidders can observe whether their bids are higher or lower than their competitors' bids. This tells them whether their private valuation of the item is shared by their competitors. This knowledge could prevent participants from reducing their bids to avoid the winner's curse. Of course, bid information is only of value if there are multiple rounds of bidding or if the auction is repeated.

The potential downside to open bidding is that bidders may collude to manipulate the auction price. To collude, bidders may signal their intentions and their identities through their bids. Bids can also be used in multi-unit auctions to retaliate against uncooperative bidders. Operators of multi-round auctions with open bidding could avoid some of these potential issues by specifying bid rules to limit signalling or by using a clock mechanism. Auction operators can avoid both problems by using a single round sealed bid format.

Pricing mechanism: Uniform price or pay as bid format

The operator of a multi-unit auction has two main options in the manner the clearing price will be set. First, the operator may specify a single winning price paid by all winners, known as a uniform price format. Alternatively, the operator may choose to have all winners pay their exact bid price, which is known as a pay as bid format.

In a uniform price format, there are two main design choices: first price and second price. Typically, in a multi-unit auction the auction price is set by awarding a unit to the highest bidder and working down the list of bids until the number of winners equals the number of units auctioned. At that point, the operator can set the auction price using the lowest winning bid (first price format), or by the highest losing bid (second price format.) One reason for choosing the second price format is to avoid having bidders worry about the winner's curse. This is less of an issue in multi-unit repeated auctions. The main risk in using the second-price format is that there may be a large difference between the first and second prices. Auction operators might be reluctant to sell items at a much lower price than the winners actually bid. This is unlikely to be a problem in emission allowance auctions where there are likely to be many bids clustered around the auction closing price. In this case, there will generally be either no difference or, at most, a very small difference between the last accepted bid and the first rejected bid.

Table 2 describes the objectives and highlights some tradeoffs for each of the design options.

Table 2: Basic options for auction type²

Design Element	Objectives	Tradeoffs
Number of Rounds		
Multiple Rounds Open Bidding and Clock Formats	<ul style="list-style-type: none"> Bidders may adjust private valuation based on other bids 	<ul style="list-style-type: none"> Provides information on demand schedules during auction Small bidders can obtain market valuations from larger players and vice versa Manipulation is possible by signaling during bidding in open bid format, not in clock format Tests have shown clock auctions more prone to collusive outcomes
Single Round	<ul style="list-style-type: none"> Efficiently auction large number of items 	<ul style="list-style-type: none"> Bidders without good information on competitors' valuations may bid less than their private value to avoid winner's curse Presence of repeated auctions or active secondary market reduces the winner's curse phenomenon
Bidding Format		
Sealed Bid Bidders do not see other participants' bids before the auction closes	<ul style="list-style-type: none"> Limits manipulation by minimizing opportunities to signal Format simpler and more common to emission markets 	<ul style="list-style-type: none"> Reveals less information about bidders' demand schedules to other participants than open bids Less information is not a problem if there is an active secondary market (as is expected).
Open Bid Bidders see other participants' bids before the auction closes	<ul style="list-style-type: none"> Bidders learn and adjust to competitors' valuations of the item Smaller bidders are able to piggy-back off larger players when it comes to price discovery 	<ul style="list-style-type: none"> Potential for manipulation by signaling in multi-round auctions Potential for retaliation among bidders in repeated or multi-round auctions
Price Mechanism		
Pay-as-bid	<ul style="list-style-type: none"> Winning bidders pay their bid for item 	<ul style="list-style-type: none"> Bidders may learn that others paid much less for allowances Bidders will avoid overpaying by setting bids by the price they expect the auction to yield, rather than their own valuation of the item
Uniform Price	<ul style="list-style-type: none"> All allowances are sold at the lowest successful bid price (or the first rejected bid) 	<ul style="list-style-type: none"> Bidders may try to drive down marginal price to reduce their cost in a multiunit auction Conversely, bidders might bid high to ensure receipt of allowances with the knowledge they will pay lowest winning price Sellers may learn that buyers were willing to pay much more if successful bid amounts are released

² Refer to Section 4.0 – Other Jurisdictions for examples on how these basic options for auction type can be used in conjunction.

b. Reserve Price

It is the WCI jurisdictions' intent that the allowance auction design process will determine: the percentage of allowance budgets to be auctioned, the reserve price, the fraction of unsold allowances retired, and the fraction of unsold allowances retained by the individual WCI Partner jurisdictions.³

The WCI design calls for a minimum auction level of ten percent of the allowance budget in the first compliance period (2012-2014), increasing to twenty-five percent in 2020.⁴

There is also existing WCI policy on the use of reserve prices and unsold allowances. To manage the risk of setting the program cap too high, resulting in over allocation, the WCI design recommendations paper suggests the use of a reserve price. The WCI recommendations paper also suggests the application of a reserve price for at least five percent of allowances auctioned, but WCI jurisdictions are also considering maintaining a reserve price for all auctions.

If allowances remain unsold at the reserve price, the WCI design recommendations specify that a fraction of the unsold allowances will be retired. The remaining un-retired/unsold allowances may be auctioned at a later date or returned to the jurisdictions for other uses. Further, "[a]ny WCI Partner jurisdiction that does not participate fully in the auction with the reserve or minimum price will retire the same proportion of its allowance budget as those retired by the WCI Partner jurisdictions that participated in the auction."

The reserve price feature could be used in the WCI auction system to advance several objectives.

First, the reserve price could ensure allowances are not sold below the seller's opportunity cost. In private auctions the opportunity cost is typically the expected price at which a seller could sell the item in an alternative venue. The WCI Design Document does not consider direct sales of allowances, so no alternate sales venue exists. The opportunity cost could also be viewed as the value of the item in an alternative use, such as retiring them to benefit the environment.

Second, the reserve price could reduce the incentive for market manipulation by reducing the expected profits from colluding to lower the closing price.

Third, the reserve price would guard against low prices resulting from the cap being set too high. The failure to maintain a minimum price in the presence of low prices could discourage efforts by businesses to reduce their own emissions or create offset projects.

The WCI Design Recommendations indicate that at least five percent of each Partner's annual allowance budget should be auctioned with a reserve price feature. The stated purpose of the reserve price was to guard against over allocation. The Design Recommendations do not include a specific destination for the unsold allowances, only that the Partners should decide what fraction to retire and what fraction to return to the Partner jurisdictions for use in approved programs.

³ *Design Recommendations for the WCI Regional Cap-and-Trade Program*, September 2008
<http://www.westernclimateinitiative.org/the-wci-cap-and-trade-program/design-recommendations>

⁴ *Design Recommendations for the WCI Regional Cap-and-Trade Program*, September 2008

To apply a reserve price, the auction operator must decide which objective forms the basis in setting the reserve price, and which determines the method of calculating a reserve price. The operator must also determine when the reserve price will be released to bidders.

Setting the Reserve Price to Limit Price Decreases

Whether the objective is to limit the price depressing effects of over allocation or market manipulation, the auction operator would need an estimate of the expected auction clearing price. The expected clearing price could be estimated from secondary market activity or economic modeling. For example, RGGI applied economic modeling to forecast market prices prior to the first auction and the development of a secondary market for allowances. Generally, the auction operator uses the estimated variability to set the reserve price sufficiently below the expected price so that it does not interfere with normal variability.

Setting the Reserve Price Percentage

Currently RGGI has a fixed reserve price of \$1.86. However, RGGI rules specify that this be replaced with a reserve price based on market prices once sufficient data is available. Once this criterion is satisfied, RGGI has indicated it will set its reserve price at 80% of the expected auction closing price (See Table 3).

WCI could also consider setting a reserve price percentage to reflect the secondary market. The reserve price in the first WCI compliance period would be based on forecast and modeling data as WCI may not have sufficiently reliable price information from the secondary market. WCI could modify the reserve price after receiving secondary market data.

Setting the Reserve Price to Support Direct Reductions

The value of allowances allocated to set-aside programs also provides a method of setting a reserve price. Consider a set-aside used to support investment in new technologies. The reserve price could be set using an estimate of the cost of reductions provided by the new technologies supported by the set-aside, with the intent being to prevent over allocation from delaying investment in direct emission reductions. This approach could result in setting a reserve price high enough to interfere with the price discovery objective of the auction by setting a price higher than many potential bidders' private valuation.

Determining when to reveal the reserve price

If WCI commits to setting a reserve price, a decision must also be made on when to reveal the reserve price to participants: prior to the auction, during the auction, or after the auction.

The advantage of revealing the reserve price after the auction is to reduce market manipulation. If bidders intend to bid below their private values, they would run the risk of losing an allowance award if they drive the apparent market-clearing bid price below the (unknown) reserve price.

Revealing the reserve price prior to the auction reduces the bidders' need to balance the goal of purchasing an allowance below their private value with the risk of losing an allowance award by bidding below the reserve price. In a repeated auction sophisticated

bidders will likely derive a good estimate of the method WCI might use to set a reserve price so the unknown reserve price feature would lose its effectiveness over time.

One advantage of revealing the reserve price prior to the auction is transparency. Those with a private valuation for the item below the reserve price would not participate in the auction. Another advantage is fairness; all bidders would know the reserve price reducing possible advantage of those bidders who are able to accurately estimate the reserve price.

The risk of revealing the reserve price prior to the auction is that it may influence bid schedules, reduce clearing prices for the allowances, and reveal to bidders the potential scope of for manipulation. This may occur if the reserve price is viewed by participants as providing a target for manipulation. This concern is more important if a high reserve price reduces the number of bidders. As long as there many participants in the auction, then it is unlikely that the reserve price would serve as a focal point for bidding because there would be big profits to be made from bidding closer to the expected market value of the allowances. The presence of a secondary market is a much more compelling focal point for competitive traders.

In the long term, the question of releasing the reserve price prior to auction may be moot in the case of a repeated, multi-unit auction (such as WCI is considering). Revealing the reserve price after each auction would inform participants of the method used to set the reserve price. This allows the participants to accurately forecast the reserve price for the next auctions.

Table 3 provides a summary of the reserve price rules in the UK ETS, RGGI, and the planned Australian Carbon Pollution Reduction Scheme. All three trading schemes apply a reserve price, but differ in their decision to make the reserve price known to participants prior to the auction.

Table 3: Reserve price rules applied or planned in other trading programs

Trading Program	Reserve Price Rule
UK – EU ETS	Reserve price is based on the secondary market price in the most liquid EUA market and not made available to participants.
RGGI	Reserve price will be set at 80% of the expected auction closing price, and made available to participants before the auction.
Australia – Carbon Pollution Reduction Scheme	Reserve price will be set at some level below the expected market price and made available to participants prior to the auction.

c. Unsold Allowances

If the WCI does not receive bids above the reserve price for the number of allowances offered at each auction then WCI must have a procedure for reallocating the unsold allowances. The Design Recommendations direct that partners will retire a fraction (effectively tightening the cap) of the unsold allowances which would help prevent chronic

oversupply of allowances. The remaining fraction of unsold allowances would be retained by the partner jurisdiction for distribution in future compliance periods consistent with WCI Partner direction. The uses may include auctioning, set-asides or allocations. This section reviews two potential options for unsold allowances, and compares each option to immediate retirement.

Carry Forward to Next Auction

Carrying unsold allowances forward to a future auction is administratively simple and maintains a greater potential supply of allowances than immediate retirement. The risk, however, is that a significant amount of allowances could be carried forward over multiple auctions. If the initial oversupply was large enough, and WCI decided not to retire unsold allowances, several auctions may result in unsold allowances before the surplus is cleared. This may exaggerate the effect of an initial over allocation, compared to a policy of immediate retirement. This result could give the impression that the cap was set too high, not just initially, but over the entire period during which the reserve price resulted in unsold allowances.

Contingent Set-Aside Release Option

Unsold allowances could be used in a set-aside reserve to be released for auction at a predetermined release price. This approach lowers the risk of a glut of allowances building up as is possible under the carry-forward model, and provides some relief from temporary price spikes. The number of allowances in the contingency set-aside account would be known to all parties through the transparency of the allowance tracking system. The availability of a set-aside reserve, to be released during periods of high prices would have the benefit of moderating reactive bidding behavior of those speculating on future shortages.

To implement the measure, partner jurisdictions would have to agree on a release price mechanism as well as the proportion of unsold allowances to be used for the contingent set-aside reserve.

d. Vintages

Vintage refers to the year during or after which the allowance in question may be used for compliance purposes. Typically, in an emissions trading scheme, the regulator can issue allowances for compliance in the current or any future compliance period, although it is possible that allowances can be made available without temporal restrictions. That is, the regulator may sell or issue any vintage. Alternatively, an emissions trading scheme can forego the concept of vintages altogether. Selling allowances without vintages has the distinct advantage of significantly lowering administrative and the transaction costs associated with compliance.

There are several reasons to consider issuing future vintages. First, if current-year allowances could be used for compliance in future years then they would likely be valued more highly (effectively increasing the price). Issuing future vintages could increase the liquidity of the market and so ease the price pressure on current compliance vintages. In so doing the regulator decreases the chance of a spike in price in the early years that could trigger calls for the abandonment of the program. Second, future vintages are useful to businesses as a hedge against future compliance liabilities. However, a well functioning carbon market should see the development of instruments that allow them to do this.

Third, issuing future vintages contributes to the long-term viability of the program by creating an interest in program continuation. (If the program is superseded by U.S. and/or Canadian federal programs, the existing allowances may be recognized by that program as is proposed in the American Clean Energy and Security Act of 2009). Fourth, vintages may be part of borrowing mechanisms in trading systems, though this feature is not yet part of the WCI.

One disadvantage with respect to auctioning future vintages is the ability of liable entities to purchase them. To address working capital constraints from liable entities, the Australian government has agreed to provide deferred payment arrangements which allow entities to make final payment and take receipt of permits over an extended time period after the conclusion of the auction.

Notwithstanding the benefits of selling future vintages, the decision to sell them is independent of the actual design of the auction and will be considered by Partner jurisdictions a later date. We assume that vintages exist for the purposes of this section.

Other vintage questions to be considered by Partner jurisdictions are:
How far in advance and how often should allowances be sold and how should their sale relate to the auction of current-period allowances?

Simultaneous or consecutive auctions

Different vintages can be auctioned either simultaneously or consecutively. If a multiple-round auction format is chosen, simultaneous auctions of different vintages can be complicated for bidders to follow. However, it affords the bidders the ability to use information from one vintage auction to inform its decisions on participation in another, thus increasing the efficiency of the auction. It is expected that with clear instructions and adequate training simultaneous auctions will become less complicated for bidders to follow. While consecutive auctions are easier for participants to follow, they do not allow participants the opportunity to execute a plan to minimize costs by substituting certain vintages for others (recall that, with banking, allowances of current or past vintages are interchangeable).

If the auction format is a sealed bid, the complexity of the auction process decreases. While firms may face some challenge in determining what to include in the sealed bid for each auction, the execution of the auction itself is straightforward and is the responsibility of the auctioneer.

e. Lot Size

Lot size refers to the number of allowances bundled together as an auction unit. In the development of an auction design, Partner jurisdictions must consider how many allowances will be offered as a unit for purchase.

Smaller lot sizes allow for more flexibility bidding strategies by allowing bidders to define their offer curves over more price levels than for large lot sizes. Entities that want to participate in the allowance auction, but have relatively small operating budgets may benefit from the flexibility that comes with lower gross pricing resulting from smaller lot sizes.

One consideration in determining the lot size is the emission profiles of compliance entities. By understanding the compliance obligations of participants in the cap and trade program, the number of auctions per compliance period and the lot size can be coordinated to ensure

that participants have the opportunity to obtain the necessary allowances to meet their obligation. For example, if there are four auctions per year over a three year compliance period and a lot size of 1,000 - an entity needing 25,000 allowances could spread its purchases over all 12 auctions. If the lot size were larger, perhaps 10,000 allowances or more, the entity would need to purchase three lots and will have an opportunity to do this over a maximum of three auctions. This would be less of a problem if allowances were available on the secondary market in smaller lots.

Another consideration in determining lot size is future plans to reduce the compliance threshold. If the threshold drops to 10,000 tonnes, then the smallest emitters (those with 10,000 allowance obligations) would be more dramatically impacted by a larger lot size. A 10,000 or 5,000 allowance lot size would allow these smaller entities only one or two opportunities to purchase allowances at auction.

WCI Partner jurisdictions should further consider sizes of contracts likely to be traded on private exchanges for compatibility with auction lot sizes. Matching lot sizes to those normally traded in the secondary market could enhance the development of the secondary market and reduce friction overall.

Table 4 highlights the lot sizes of RGGI, the UK ETS and the Carbon Pollution Reduction Scheme.

Table 4: Lot Sizes

Trading Program	Lot Size
RGGI	1,000
UK ETS	1,000 in the competitive portion, maximum bid of 10,000 allowances in the non-competitive portion. ⁵
Australia: Carbon Pollution Reduction Scheme	To be determined - set low enough to allow participation by some emitters with less than the 25,000 tonne threshold ⁶ .

f. Timing and Frequency of Auctions

The frequency of allowance auctions requires a balance between administrative complexity and flexibility for participants. First, increased frequency can aid in developing liquid forward markets and by providing a stabilized spot market through continuous new supply. In addition, frequent auctions can offer participants a regular price signal from which to inform their decisions. Second, increased frequency is useful if the regulator wants to require a smaller capital commitment for each auction and address cash flow shortages for potential bidders. If auctions are infrequent, emitters that wish to acquire allowances in the primary market need to buy larger proportions of their requirements each time. This would require larger, less frequent outlays which could be a problem for small firms. This was a particular concern in the design of the Australian Carbon Pollution Reduction Scheme.⁷ As

⁵ If the non-competitive portion is over-subscribed, priority is given to bids of lower than 1,000 allowances, which is the standard minimum lot size on the secondary market. Remainder are allocated on a pro rata basis

⁶ The current general threshold for triggering a liability under the Carbon Pollution Reduction Scheme is 25,000 tonnes of CO₂e. This is complicated by the fact that some entities will be liable for their emissions below 25,000 tonne threshold. Lot size is likely to be set low enough to participate at the auction.

⁷ Carbon Pollution Reduction Scheme: Australia's Low Pollution Future
<http://www.climatechange.gov.au/publications/cprs/white-paper/cprs-whitepaper.aspx>

a result, Australia is considering monthly auctions. Third, increased frequency allows bidders to adjust their strategies over time as they gain experience with the process. Of course, holding more auctions is easier when there are a large number of allowances to auction. Fourth, increased frequency has the advantage of making market manipulation difficult, that is, it is more difficult to coordinate, and organize manipulative behavior.

However, auctions are costly endeavors and each one implies additional administrative costs for bidders and sellers alike. There are also scheduling constraints on the number of auctions that can be executed each year. For example, RGGI holds auctions quarterly, but each one has a 60-day lead time. Using the same approach for a monthly auction could be potentially confusing and could create perpetual overlap.

Conversely, offering frequent auctions may serve to keep secondary market prices consistent with the demand schedule revealed during the auction process

The WCI Partner jurisdictions may also consider holding auctions in advance of or after the compliance period. Compliance entities may prefer to purchase allowances once their emissions for the compliance period are known. An auction held after the end of the compliance period but before the reconciliation of emissions and allowances⁸ may be beneficial to firms that do not wish to hold allowances for a significant period of time. It could provide a means of addressing compliance needs (other than the secondary market) for firms with emissions in excess of planned allowances, especially if there is an immature and potentially illiquid secondary market.

Another issue for some businesses is assured opportunity, which is access to or ownership of allowances to sign long-term contracts. Assured opportunity is generally necessary to secure new project financing. This is a common issue in the electricity generation industry.

Another timing concern is the perceived need to have some allowances available (e.g., by auction) before the compliance period for which they are issued. An early allowance auction allows businesses to manage risk by securing allowances before producing emissions, and establishes an early price signal to facilitate secondary market activity.

g. Participant Access

A decision regarding which entities may be permitted to, and which entities may be restricted in purchasing allowances is in part related to the design of the overall program as opposed to the auction itself. Most carbon schemes allow non-restrictive access meaning that any entity that can hold an allowance can participate in the auction. However, it is possible to make it more restrictive by dividing access along compliance/non-compliance entity lines.

There are two types of participant access restriction: (1) restricting those who may be permitted to purchase allowances at an auction and (2) restricting access to the auction mechanism itself.

Auction Participation

⁸ Commonly called true up, where emitters exceeding the established thresholds are required to relinquish a sum of allowances and credits equal to their emissions of CO₂e.

One option for making the auction more restrictive is restricted participation. Restricted participation would allow only compliance entities to participate in the auction, as opposed to allowing any entity that can hold allowances to participate. Advocates of restricted participation in the auction tend to believe that the auction price will be more influenced by a larger number of auction participants rather than the overall demand in the markets. Therefore, they suggest that allowing more auction participants might increase allowance demand and drive the price up, whereas limiting auction participation could address concerns of increasing allowance prices (from speculating, non-compliance entities).

Conversely, advocates of unrestricted participation in the auction site several competing views. First, if the desired if a desired outcome from the auction of allowances is an indication of market value for the auctioned good, full market participation in the auction should be pursued in the design. Non-compliance entities can provide a service to the market by reducing price volatility. For example, they could prop up demand for allowances when it would otherwise fall due to broader macroeconomic factors, and release those allowances back into the market when demand rises.

Restricted participation is not typical of other schemes. This may be due in part to the perception that allowing non-compliance entities to participate in the auction can increase market liquidity, and in part because it is difficult to determine who is and who is not a compliance entity.

Auction Access

Notwithstanding the potential restriction on the acquisition of allowances via auction participation limitations, it is possible to restrict access in another way. Regulators can require entities interested in obtaining allowances to submit bids via a smaller group of pre-arranged intermediaries that deal directly with the government in the auction. Where the number of potential participants is large, the administrative burden associated with vetting financial assurance and checking for evidence of money laundering can be significant. In the UK, bidders must either apply to become intermediaries or bid through intermediaries (i.e., have intermediaries act as their proxies at the auction). Importantly, the intermediary approach also shifts the risks associated with non-payment to the intermediaries.

The intermediary approach is not common, possibly due to stakeholder concerns about the revelation of their business strategy to the intermediaries, especially where intermediaries are (potential) competitors. Control of sensitive business information is an important issue to many firms. Furthermore, the use of intermediaries creates a new set of issues for the regulator to monitor, i.e., supervision of the intermediaries.

In addition, the intermediary approach reduces competition at the auction, which may hamper the price discovery of the auction process. Such a strategy should only be used if there is strong evidence that the administrative savings would be large.

Non-Competitive Bids/Uniform-price auctions

A non-competitive bid is where bidders submit a request for a fixed number of allowances prior to the auction, agreeing to pay the auction clearing price. For the auction to be equitable, all potential bidders must believe they have a legitimate opportunity to obtain allowances. Some entities, in particular small emitters, may not be able to afford the number of allowances that are in the minimum lot size. The UK has taken a direct approach to this issue. Under some of the UK's EU ETS auctions, a maximum of 30

percent⁹ of the allowances available are reserved for non-competitive bids. These non-competitive bidders pay the eventual auction clearing price for the number of allowances they wish to purchase.

There is a precedent for this approach in electricity markets. Non-competitive bids are used in some electricity markets by generators that need to be dispatched (i.e., will be generating electricity regardless) and are not price-responsive. The objective is to allow extremely risk-averse compliance entities, especially those without activity in commodity markets, the ability to obtain allowances without quantity risk or risk of overbidding. Setting a quantitative limit on the amount of allowances set aside for the non-competitive bids requires a method of allocating participation if the non-competitive bids are oversubscribed.

The designers of the Australian Carbon Pollution Reduction Scheme decided that a non-competitive bid mechanism was not necessary to protect small or risk-averse bidders. It was judged that an ascending clock auction format would reduce the information asymmetry between large and small bidders, to the extent that one exists.

The non-competitive bid approach used in the UK was used for the first time in the second phase of the EU ETS and based on stakeholder feedback as well as information from the first phase of the auction.¹⁰ Given the current limited information about compliance entities in the WCI, stakeholder input will likely be the most effective approach to understanding auction participation limitations for compliance entities.

Consignment

Allowance holders may also wish to sell allowances using the auction platform designed for primary market distribution.

While the focus throughout most of this paper has been on WCI Partner jurisdictions as sellers of allowances, this need not be the case. Other allowance holders may wish to sell allowances, and some of those may wish to do so without participating in the secondary market. In cases such as this, it is possible that the regulatory entity could sell the other parties' allowances on a consignment basis. This type of transaction is sometimes called a double-sided auction. The EPA offers this service as part of the auction of SO₂ allowances in the Acid Rain Program (see below). A double-sided auction was also proposed for the Australian Carbon Pollution Reduction Scheme.

Generally, this approach is likely to be favored by allowance holders who lack the technical expertise to confidently participate in the secondary market. For these allowance holders, permitting the regulatory body to sell your excess allowances is an attractive option, and one that would likely minimize transaction costs.

Many current systems have not incorporated consignment selling as a design feature in their auctions. Soliciting stakeholder feedback could be useful at this point to better understand the interest in potential consignment opportunities and challenges.

⁹ This limit was chosen to strike the balance between the needs of smaller compliance buyers and ensuring that there is enough competition in the 'competitive' stage of the auction, which is what determines the clearing price. The percentage will be kept under review.

¹⁰ UK representative presentation to WCI Markets Task 6. January 9th, 2009

h. Financial Assurance

Many auction programs, including RGGI, require financial assurance to ensure participants are able to cover the value of their bids. Financial assurance usually consists of adequate bond ratings, letters of credit, or similar instruments of comparable quality. Other entities who are unable to meet financial qualifications levels may deposit cash in escrow to cover their bids. The RGGI Auction Platform automatically rejects any bid that violates a bidder's financial security limits. When financial disclosure tools are used, design experts suggest levying penalties against any party that is unable or unwilling to pay for its winning bid¹¹.

i. Information and Transparency

The collection of information related to auctions along with transparent use and publication of that information plays a central role in building confidence in market-based programs. In general, the greater the level of transparency and disclosure of information, the more trust stakeholders, compliance entities, and others place in the value and integrity of the auction program. However, public disclosure of confidential information that compromises business positions of auction participants diminishes confidence in the allowance market and may have negative consequences outside of the cap and trade program. Decisions regarding what information to collect and eventually publish must balance the interests of transparency and confidentiality.

Clear rules for auction participation and administration lead to greater transparency. The RGGI design team used the following guidance to assist in development of their auction rules: "... auction rules should be transparent and available to everyone who might want to participate. The rules should not discriminate against any potential qualified participants."¹²

In addition to transparent rules, transparency in the auction execution, monitoring and reporting of results further fosters confidence in each auction. To ensure transparency, experts who designed the auction for RGGI suggested that the auction clearing price and the identities of winning bidders be disclosed publicly after each auction. However, RGGI does not disclose the quantity of allowances purchased by each winning bidder to protect proprietary information and tacit collusion by bidders buying fixed shares of available allowances.

To balance the interests of transparency with proprietary or business confidential information, auction operators may also release aggregated information on trading activity to the public. This ensures transparency without compromising an entity's ability to do business. For example, RGGI's independent market monitor provides public information on the percent of purchases going to entities with compliance obligations. RGGI also provides sixty days advance notice before upcoming auctions.

The RGGI auction design team asserts that "the actual value bid by each auction participant..." and "information about losing bidders should not be disclosed."¹³ In this vein,

¹¹ Auction Design for Selling CO2 Emission Allowances Under the Regional Greenhouse Gas Initiative Final Report. October 26, 2007. page 41
http://www.rggi.org/docs/rggi_auction_final.pdf

¹² Auction Design for Selling CO2 Emission Allowances Under the Regional Greenhouse Gas Initiative Final Report. October 26, 2007. page 22

¹³ Auction Design for Selling CO2 Emission Allowances Under RGGI. Final Report. October 2007.
http://www.rggi.org/docs/rggi_auction_final.pdf

not that RGGI's auction results are posted as quickly as possible after the conclusion of an auction.

Partners may also wish to consider the adoption of beneficial ownership disclosure requirements. The RGGI auction rules require all applicants to disclose their direct and indirect corporate associations with other applicants and bidding associations, beneficial relationships to other persons and groups participating in the auction. Information on beneficial ownership is gathered via a thorough on-line application system for participants in the regional auctions and is used, in part, to ensure that participants comply with the 25% purchase limit described in "Preventing Market Manipulation" below. Beneficial Ownership information may be considered proprietary because it has the potential to reveal business strategies outside of the allowance auction and market. The decision to disclose this information publicly must be weighed against potential impacts to confidential business strategies.

j. Avoiding Market Manipulation

Manipulation occurs when market participants engage in activities with the intent to artificially raise or lower the price of allowances. Market manipulation occurs when multiple bidders coordinate their bidding in an attempt to lower the price they pay for allowances at auction.¹⁴ In an effort to deter market manipulation and other forms of broader market manipulation RGGI included the, use of: a single-round sealed-bid uniform-price auction, a limit on the size of purchases at a given auction, and an open and transparent auction program. Auction monitoring is another tool the regulator may use to deter market manipulation.

An open and transparent auction improves competition and limits opportunities for market manipulation. A percentage limit on the number of allowances a single entity may purchase in a single auction "... raises the cost of using the auction to corner the market without placing too stringent a restriction..." on what compliance entities can purchase.¹⁵ It is expected that WCI market participants will have small compliance obligations, relative to the total pool of available allowances, and that new entrants will have access to allowances and offsets through the secondary market. Therefore, setting a percentage limit will not impose an excessive burden on participating firms because WCI does not anticipate that any one entity will have that large a share of the WCI market. In addition, purchasers can access an auction periodically (e.g., quarterly) – which further reduces the inconvenience of a percentage limit. Such a limit can also be a means of protecting inexperienced participants from purchasing more allowances than they will need.

WCI can consider working in partnership with existing and interested agencies in the design of monitoring criteria to guide and regulate the allowance auction program. Existing market monitoring activities by federal and state agencies and provincial agencies could be examined by the WCI Partner jurisdictions to ensure that the appropriate criteria are used for detecting market manipulation and for sharing information regarding the performance of the allowance market and the auction. The Markets Oversight task group is charged with consideration of secondary market monitoring; there may be room for coordination of monitoring for both aspects of WCI program operation through a common market monitor. In addition, auction design elements may be incorporated to reduce the possibility of broader market manipulation. For example, as a means of discouraging hoarding within

¹⁴ Auction Design for Selling CO2 Emission Allowances Under RGGI. Final Report. October 2007.

¹⁵ Auction Design for Selling CO2 Emission Allowances Under RGGI. Final Report. October 2007.

the allowance market, the regulator can set a single auction purchase limit for any applicant or associated applicants.

A number of entities may be able to provide auction oversight or monitoring assistance including¹⁶:

- Federal Energy Regulatory Commission (FERC)
- Commodity Futures Trading Commission (CFTC)
- Securities and Exchange Commission (SEC)
- The US Environmental Protection Agency (US EPA)
- The Independent System Operators
- Other market monitors hired by WCI

The RGGI auction design team explored coordination opportunities with all of these agencies and organizations. The CFTC currently exercises jurisdiction over derivatives in existing SO₂, NO_x, and CO₂ markets in the U.S., and parallel agencies in the European Union are doing the same for its emissions markets. In future GHG markets, the CFTC could expand its oversight to include new emissions derivatives markets.

RGGI contracted Potomac Economics as an independent market monitor to monitor auction activities and results. This group analyzes auction data including (but not limited to) the clearing price, total allowances sold, the quantity of each vintage sold, the range of prices bid, the number of entities with winning bids, and the percentage of allowances purchased by entities with a compliance obligation.

RGGI definition of principle to... "**Guard against collusion and/or market manipulation:** The allowance auction should be designed in a way that limits opportunities for bidders to actively or tacitly collude to keep prices low. To the extent possible, the auction also should limit opportunities for bidders to bid up the price of allowances above the competitive price, which we refer to as hoarding. Because collusion and hoarding are potential issues in the allowance market, and not just the auction, there may be a limit to the ability of an auction design to limit incentives for hoarding."¹⁷

¹⁶ Options for Limiting Market Manipulation, Washington State Department of Ecology. November 11, 2008. URL: http://www.ecy.wa.gov/climatechange/2008CTdocs/10102008_LimitingMarketManipulation.pdf

¹⁷ Auction Design for Selling CO₂ Emission Allowances Under RGGI. Final Report. October 2007 http://www.rggi.org/docs/rggi_auction_final.pdf

4. Other Jurisdictions

Introduction

Auctioning has long been touted as the best method to allocate allowances in an emissions trading scheme. There are now several examples of the use of auctions in new emissions trading schemes. These include:

- the Regional Greenhouse Gas Initiative (RGGI)
- United Kingdom Emissions Trading Scheme (UK ETS)
- Australia's Carbon Pollution Reduction Scheme
- the United States Environmental Protection Agency's SO₂ (Acid Rain Program) Auction
- Virginia's NO_x auction

The United States Treasury bill auction also provides an example of a well established auction.

Common Features

Most auctions evaluated share at least two criteria or values: fairness and allocative efficiency.

Fairness is important because: (1) the auction itself should not change the playing field for competing firms, (2) the perception of fairness is critical to the acceptance of the auction by all stakeholders: no one will embrace a process that is seen to give an unwarranted advantage to others.

Allocative efficiency is a measure of the degree to which the allowances go to the entities that value them most. Value can be expressed as the return that the firm can generate on the asset, and therefore what it is willing to pay to obtain it.

The auctions examined below also have common approaches to certain aspects of auction design. For example, all the examined auctions have a reserve price. This common adoption reflects a perceived value in establishing a reserve price as a way to create a credible auction and a deterrent to market manipulation.

Another characteristic that is common to all the auction designs reviewed is that they are open to all qualifying bidders. They are not restricted to compliance entities alone.

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is an initiative of ten northeastern states to cap GHG emissions from approximately 200 fossil fuel-fired electricity generation facilities with capacities greater than twenty-five megawatts. The ten states enacted the program with regulations based on a RGGI model rule, but functionally it is a regional compliance market. Each state must allocate at least twenty-five percent of its allowances by auction, although several have chosen to sell more. States may distribute the remaining allowances in a manner of their own choosing.

The overall cap is 188 million tons, with no entity forecast to demand more than 12 percent of available allowances.¹⁸ The first compliance period is 2009-2012; however, the first auctions were held in September and December 2008. The auctions were successful, with significant bidding activity leading to clearing prices (\$3.07 and \$3.32, respectively), well above the reserve price in both cases.¹⁹ Most allowances (>80%) were purchased by compliance entities but some non-compliance entities bought allowances as well.²⁰ Demand was high, as both auctions were at least 3.5 times oversubscribed and each saw approximately sixty bidders participating.²¹

Distinguishing Features:

Auction type

- single-round, uniform-price, sealed-bid auction

Advantage

- simple, transparent and provides good price discovery
- familiar to electricity generation companies
- single round restricts the amount of information that is revealed to competing firms that could be used to engage in market manipulation

Reserve price – what level?

- Reserve price set at \$1.86 for all auctions to date.

Vintages and lead time (when to sell each vintage)

- RGGI sells future vintages in advance of compliance periods.
- At all four auctions held in 2009 (March, June, September and December), the RGGI states sold 2012 allocation year allowances, the first year of the next compliance period.
- RGGI has committed to sell five percent of its allocation year 2012 allowances by the end of 2009.
- At the March 2010 auction RGGI will offer allocation year 2013 allowances.
- RGGI has committed to sell five percent of its allocation year 2013 allowances by the end of 2010.

Lot size

- The allowances are sold in lots of 1,000 (i.e., 1,000 tons)
- At the December 2009 auction, approximately 28,591 lots were available from the 2009 vintage, while 2,175 lots were available from the 2012 vintage.

Unsold allowances

- All allowances were sold in the first five auctions.
- 573,540 allocation year 2012 allowances were unsold at the December 2009 auction.
- There are State specific regulations on unsold allowances.

Timing and frequency of auctions

- All states are expected to sell at least a portion of their allowances in auctions held quarterly in each of year of the first compliance period.

¹⁸ <http://rggi.org/docs/Auction%203%20News%20Release%20MM%20Report.pdf>

¹⁹ http://www.rrgi.org/docs/Auction_3_Auction_Notice_News_Release.pdf

²⁰ <http://www.rrgi.org/docs/Auction%202%20Post%20Settlement%20Auction%20Report.pdf>

²¹ *ibid.*

- Allowances are made available for sale in an evenly distributed manner during the first control period.
- To prepare the market in advance of the launch of the initiative, RGGI sold some allowances at two advance auctions in September and December 2008.

Method of participant access

- Entities interested in obtaining allowances must be qualified to gain access to the auctions. Once qualification is complete, the applicants submit appropriate financial assurance, and then the registered entities or their agents participate in the online auction directly.

Financial assurance

- All participants in RGGI auctions must submit some form of financial assurance in advance of the auction.
- Depending on the financial sophistication and health of the prospective participant, the three following forms of assurance are accepted: a letter of credit from a US bank, cash, or a bond from a US bank.
- Without this assurance, qualified applications cannot participate in an auction.
- The auction platform is designed to reject bids that exceed a bidder's financial assurance amount

Information and transparency

- After each auction, RGGI releases the results along with an assessment of the auction proceedings, prepared by an independent market monitor.
- The total number of allowances sold and the clearing price are released along with the market monitor auction report. Once settlement is complete, RGGI states release additional details, including:
 - the pre-auction estimate of dispersion of demand for allowances;
 - the dispersion of actual bids;
 - the proportion of allowances purchased by type of bidder (compliance, environmental and other non-compliance);
 - amounts of allowances awarded to bidders (names not released), and
 - a summary of bid prices, showing the minimum, maximum, average and clearing price.

Monitoring

- As indicated above, RGGI has contracted a third party to observe the auctions and, in addition to the actual results, report on the degree to which the auction met RGGI's goals of transparency, effectiveness and, most importantly, any signs of market manipulation.
- In the six auctions already held, there was no sign of either market manipulation.

United Kingdom: European Union Emissions Trading System (EU ETS)

The United Kingdom participates in the EU Emissions Trading system which is one of the key policies introduced by the European Union to help it meet its Kyoto Protocol commitment to reduce emissions to 8 per cent below 1990 levels by 2012. The system covers emissions from electricity generation and the main energy-intensive industries. The EU ETS currently covers approximately 11,500 installations, which account for approximately 45 percent of

the EU27's CO₂ emissions (2.2 GtCO₂e). The EU ETS is currently in its second phase (2008-2012), which followed a three year pilot phase that ran from 2005 to 2007. Prior to the inception of the EU ETS, the UK ran a voluntary domestic emissions trading program from 2002 to 2006.

Before the start of EU ETS Phase II, each member state was required to submit to the European Commission a National Allocation Plan (NAP) in which it described how and to whom it would allocate allowances during the four years of the second trading period. Member states were allowed to auction up to 10% of their allowances each year.

The UK NAP provides for an allocation of 246 million allowances to covered sectors during each year of EU ETS Phase II. It has chosen to auction seven percent of these allowances, equal to 17 million allowances per year, or 85 million over the entirety of Phase II²² Allowances sold at auction are deducted from the nominal allocation to Large Electricity Producers. The auctions are open to any entity that holds an EU ETS Registry account.

Some UK auctions will have two bidding stages: (1) a non-competitive element, aimed at smaller emitters who need to buy allowances for compliance purposes; and (2) a competitive element. Other auctions will only provide the competitive element. The first auction (competitive only) was held in November 2008 and was four times oversubscribed with a clearing price of €16.15.²³ The most recent auction of 4.4 million allowances on February 4, 2010 was almost seven times oversubscribed and cleared at €12.66.

A centralized EU-wide cap, which will decline annually, on emissions for Phase III (2013 onwards), will mean that there is more ambition, certainty and consistency across the EU. The number of allowances sold at auction will be greatly increased. In 2012, electricity generators in most EU countries will be required to purchase 100% of their allowances at auction, and free allocation to other non-trade-exposed EU ETS sectors will be gradually phased out by 2020. Overall across Europe, at least 60% of allowances will be auctioned by 2020, compared to around 3% in phase II.

Distinguishing Features:

Auction type

Competitive Portion

- Single round (static) uniform-price auction
- Chosen for simplicity and resulting cost effectiveness, but also because of limited incentives for market manipulation

Non-Competitive Portion (proposed)

- up to 30% of allowances available at any auction could be set aside for the non-competitive process²⁴
- bidders in this portion of the auction agree to pay the clearing price for any allowances received
- if oversubscribed, government will first fill the smallest orders, in preference of the smaller compliance entities
- stems from government concern that smaller compliance entities may otherwise have problems obtaining allowances in the auction and find it harder to access the secondary market.²⁵

²² <http://www.dmo.gov.uk/docs/ETS/etspr230209.pdf>

²³ <http://www.defra.gov.uk/environment/climatechange/trading/eu/operators/auctioning.htm>

²⁴ <http://www.defra.gov.uk/environment/climatechange/trading/eu/pdf/phase2-consultation.pdf>

²⁵ <http://www.defra.gov.uk/environment/climatechange/trading/eu/pdf/phase2-consultation.pdf>

Reserve price - what level?

- Used, but not announced in advance
- If the auction clearing price is less than the reserve price, the reserve price will be the price to be paid for each allowance at auction
- The reserve price is calculated based on the prevalent secondary market price at the time of the auction.²⁶
- Government announces whether the reserve price was triggered after the close of each auction.

Vintages and lead time (when to sell each vintage)

- There are no yearly vintages
- Phase II (2008-12) allowances can be used for compliance in phase III (2013 onwards)
- Plans for auctioning in phase III are still in development. The European Commission is expected to publish its proposals for the auctioning rules for phase III soon

Lot Size

- 1,000 in the competitive portion
- maximum bid of 10,000 allowances in the non-competitive portion. No minimum bid size

Unsold allowances

- Unsold allowances sold in future Phase II auctions

Timing and frequency of auctions

- Initially planned for quarterly auctions, but government maintains the option to increase frequency
- For example, the UK Debt Management Office has announced that there will be eight auctions in 2010.

Method of participant access

- In the competitive part of the auction, use of approved intermediaries that collect and submit bids on behalf of bidders is mandatory
- There are currently seven intermediaries also called Primary Participants. All seven intermediaries are investment banks but other organizations that meet the eligibility criteria can apply
- The UK Government believes that intermediaries can best carry out the critical role of implementing checks to guard against potential money laundering activities and providing assurance of the financial standing of bidders.

Financial assurance

- Handled through Primary Participants

Information and transparency

- limited information is released soon after the conclusion of each auction, including:
 - clearing price
 - total bids received
 - number of allowances allocated to competitive bids

Monitoring

- The Treasury contracts and independent third party to monitor the auction and report on its execution.

²⁶ ibid

- The monitor looks for signs of market manipulation, while observing the transparency of the process. The findings are published soon after the auction's conclusion.

Australia: Carbon Pollution Reduction Scheme

Australia proposes to launch the Carbon Pollution Reduction Scheme in July 2011. For the first year of the scheme (July 1 2011 to June 30 2012) there will be a fixed price operating, that is, permits will be available to liable entities for a fixed charge of \$10. This is intended to help companies transition to the scheme. These permits cannot be banked for future use and will be immediately surrendered. During the fixed price period there will be auctions of future vintage permits. Currently Australia intends to auction a portion of 2012-13, 2013-14, 2014-15 vintage permits in 2011-12.

Australia's Department of Climate Change released a White Paper explaining the Scheme details on December 15, 2008.

The aim of the auction is to have a fair, equitable process that aids price discovery. The proposed scheme shares many characteristics with other auction designs, in terms of the reserve price, openness to access and general philosophy. However, Australia will include two unique features: (1) double-sided auction, allowing those receiving allowances by administrative distribution to sell them in the auction (2) deferred payment, Australian authorities are considering a deferred payment option to help address cash flow concerns expressed by many compliance entities.

The Australian scheme will auction around 70 per cent of the permits, with the rest administratively allocated. With a smaller auction pool, settings such as the reserve price, the frequency of auctions and the auction schedule take on an added significance

Distinguishing Features:

Auction type

- Simultaneous ascending clock auctions used for multiple vintages (option to submit sealed proxy bid)

Benefits

- To further simplify the process for smaller entities, participants will be allowed to submit sealed proxy bids (bidders submit in advance their demand schedule for allowances at various price levels)
- Generates a uniform price for all winning bidders
- Market manipulation less of a concern in Australian scheme because there are many compliance entities with similarly-sized obligations

Reserve price - what level?

- Tool to increase efficiency and speed of auction not intended as a price floor
- Reserve price will be based on, but well below anticipated market price
- Goals are to limit benefits of market manipulation while increasing efficiency of the auction process²⁷
- Notify participants of the reserve price prior to auction

²⁷ Carbon Pollution Reduction Scheme: Australia's Low Pollution Future
<http://www.cramton.umd.edu/papers2005-2009/australia-carbon-pollution-reduction-scheme-chapter-9-auctions.pdf>

Vintages and lead time (when to sell each vintage)

- At least one of the monthly auctions (usually the first) will include the sale of allowances for the current year plus the three following compliance periods.
- This will help facilities plan production and foster the development of the secondary market
- Regulator acknowledges that this will increase the complexity of the auction operation but believes the benefits will outweigh the concerns

Bid restrictions – single entity parcel size

- Bidders will be restricted to 25% of allowances available for a given year at each auction
- Given 16 auctions per vintage, this means that a bidder may win a maximum of 1.6% of the allowances available for any one vintage at any particular auction.

Unsold allowances

- Details are being finalized

Lot Size

- Details currently being finalized

Timing and frequency of auctions

- Auctions will be held monthly
- The last auction of allowances for a given compliance period/year will occur after the year has ended but before the compliance reconciliation period, allowing compliance entities to purchase allowances after they know the actual emissions they need to address
- With the advance auctions, there are 16 scheduled opportunities for bidders to obtain allowances of each vintage

Method of participant access

- Direct access (no intermediaries)
- Subject to financial assurance, the auctions will be open to all
 - Limits market manipulation
 - Fosters development of a secondary market

Financial assurance

- Some form of financial guarantee will be required to participate in the auction
- Details to be confirmed

Information and transparency

- Auction results will be made public as soon as possible after the auction concludes
- In addition to the clearing price, the number of allowances demanded at each price will be published
- Individual bids will not be published

Monitoring

- Regulator will appoint an independent panel to review operation of the Scheme soon after its launch.
- Australian Securities and Investments Commission (ASIC) will have power to investigate and prosecute market manipulation; market will be subject to the same effective safeguards as the bond market.
- Additional rules will protect against individual entities manipulating auctions
- Banking and borrowing provisions intended to act as deterrents to market manipulation as well

- Further protection afforded by measures already contained in the Trade Practices Act.

US EPA: SO₂

The Acid Rain Program was created under the 1990 Clean Air Act Amendments to reduce the adverse effects of acid deposition through reductions in annual emissions of SO₂ and NO_x primarily from fossil-fuel burning electricity generation. The Act calls for SO₂ reductions from all sources of 10 million tons from 1980 emission levels, largely achieved through a cap and trade program which imposes a permanent emission cap on SO₂ emissions from electric generating units (EGUs) at power plants. The program initially affected about 2,500 EGUs (roughly 220 plants), but now encompasses around 560 coal fired plants plus gas fired and fuel oil plants.

This national program has two phases. All Phase I utilities were in the Midwest and on the east coast. Now, Phase II of the program covers the 48 continental states. Phase I auctions started in 1993, Phase II started in 2000. There is an opt-in program (voluntary entry into program), but only about only ten facilities chose to do this.

Auction type

- Single round, discriminatory price
- Regular auction: descending order (Congress specified descending order)
- EPA may sell other entities' allowances on a consignment basis

Auction Awards

- The auctions sell allowances on the basis of bid price, starting with the highest priced bid and continuing until all allowances have been sold or the number of bids is exhausted. EPA may not set a minimum price for allowances from the Auction Reserve.
- Allowances are sold from the Auction Reserve before allowances offered by private holders are sold. Offered allowances are sold in ascending order, starting with the allowances for which private holders have set the lowest minimum price requirements. Offered allowances are sold until the allowance supply is depleted, bids are used up, or the minimum price for the next set of offered allowances exceeds the purchase price of the next bid.

Reserve price - what level?

- No minimum price for auction

Vintages and lead time (when to sell each vintage)

- The SO₂ allowance auction consists of two parts:
 1. a spot allowance auction, in which allowances are sold that can be used in that same year for compliance purposes, and
 2. an advance auction for the sale of allowances that will become usable for compliance seven years after the transaction date, although they can be traded earlier.

Table: Allowances Offered at Auctions

Year of Auction	Spot Auction	Advance Auction*
1998	150,000	125,000
1999	150,000	125,000
2000 and after	125,000	125,000

* Not useable until seven years after purchase.

Lot Size

- Can purchase as little as 1 allowance. 1 allowance = 1 ton

Bid Restrictions

- Bidders must send sealed offers containing information on the number and type (spot or advance) of allowances desired and the purchase price to EPA, no later than three business days prior to the auctions. Each bid must also include a wire transfer, certified check, or letter of credit for the total bid cost.

Unsold allowances

- EPA returns proceeds and unsold allowances from the auctioning of reserve allowances on a pro rata basis to those units from which EPA originally withheld allowances to create the Auction Reserve.

Timing and frequency of auctions

- Once per year – usually the last Monday of March each year

Method of participant access

- The auction was initially meant to be for new entrants, but now it is open to any qualified bidder

Financial assurance

- Participants must complete a Letter of Credit, wire check, or certified check.

Information and transparency

- Philosophy is to share as much data as possible including raw hourly emissions data (limited by capacity and emissions monitoring is quarterly). Data is unit by unit.
- Allowance transactions: details available through on-line queries, allowing access to the allowance tracking database.

Monitoring

- Once per year, there is nothing in the rules that prevents someone from buying all of the allowances. Only 2.8% of allowances are sold via auction.
- It is apparent that market manipulation was not a significant concern; the auction was designed mainly for new entrants into program.

Virginia: NO_x

Under the EPA's NO_x State Implementation Plan (SIP) program to reduce smog in the eastern United States, Virginia received an annual 500,000 tonne cap. Most allowances were distributed free of charge to firms with historical rights to emit. About eight percent of 2004-2005 allowances (1,885 tons per year) were reserved for new sources and auctioned. Revenue for 2004 and 2005 vintages was \$10.5 million, 19% above target.

In the Virginia NO_x trading program, allowances are bankable, but there is a form of flow control. If over 10% of allowances surrendered during a given year are from a previous year, previous year allowances are worth only 50% of face value (i.e., vintages are not perfect substitutes for one another). There can be no borrowing against future issuance of allowances.

The primary goal of the commonwealth in the execution of the NO_x allowances auction was to maximize revenue. Simplicity was important, given regulators only had two months to design the auction from the time the decision was made to hold one. Transparency was also

Other Auction Types Considered

- Simultaneous (Combinatorial) Discriminatory Sealed Bid
 - Format: (P₀₄, Q₀₄; P₀₅, Q₀₅) P = Price willing to pay for *up to* Q the stated quantity. Gives the auctioneer some flexibility in awarding vintages.
 - Fairly simple and transparent.
 - Because auction is not iterative there is less chance for market manipulation between participants.
 - May be subject to the winners curse b/c of discriminatory pricing.
- Simultaneous (Combinatorial) Uniform-price English Clock (uniform)
 - Linked clocks auction off vintages simultaneously.
 - Good under elastic demand conditions
 - Involves complicated modifications to let the system handle substitutions of vintages efficiently.

a stated goal of the auction design.

Auction Type

Virginia employed two sequential English clock auctions for the 2004 and 2005 allowances. While their models indicated simultaneous English clock auctions would maximize revenue, the option was dismissed as too complicated given time constraints.

Auction Participation

- The auction attracted both regulated entities (energy companies) and brokerage houses

Frequency

- Only one auction each for vintages 2004 and 2005. The 2004 vintage allowances were sold in a morning auction, 2005 vintages in an afternoon auction.

Information Sharing

- Virginia Freedom of Information Act required that all bid information be released including the identities of winners and losers along with their bids.

US Treasury: Sale of Treasury Bills

The United States Treasury has a long experience auctioning Treasury Bills and other marketable securities. The auctions are open to individuals and institutional investors. To accommodate smaller, less sophisticated investors, the Treasury offers non-competitive access to the securities, but with a \$5 million limit on the value of securities that can be obtained in this manner. Prospective buyers can also bid through intermediaries such as brokers. The Treasury offers bills, notes, bonds and Treasury Inflation-Protected Securities (TIPS) at auction.

Distinguishing Features

Auction type

- Sealed bid, uniform price
- Competitive Bidders: submit as many bids as they want stating the quantity they are willing to buy at a given price.
- Non-Competitive Bidders – Place a bid stating the quantity they wish to buy. Pay either the clearing price or the quantity-weighted average of the winning competitive bids.

Auction Awards

- Accept all non-competitive bids
- Accept all bids from federal reserve bank
- Demand of highest price competitive bidders are met until supply is allocated

Bid Restrictions

- Competitive bidders: 35 percent of securities on offer (net long position)
- Non-Competitive bidders: \$1 million for bills and \$5 million for notes

Timing and frequency of auctions

Examples:

- All bills except 52 week bills and cash management bills are auctioned weekly.

Lot Size

- \$100.00

Method of participant access

- Both competitive and non-competitive (Usually 15-20%) bidders

Information and transparency

Through a press release available online the Treasury Department announces the following information:

- The amounts of accepted bids and the amount of securities awarded;
- The range of accepted yields or discount rates;
- The proration percentage;
- The interest rate for a note or bond;
- A breakdown of the amounts of noncompetitive and competitive bids accepted from, and awarded to, the public;
- The amounts of bids tendered and accepted from the Federal Reserve Banks for their own accounts;
- The bid-to-cover ratio; and
- Other information that the Department may decide to include.

Monitoring

- Penalty for non-compliance of the auction rules or failure to pay for issued securities.