

White Paper on PPA Auction Design Issues

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Introduction

This white paper covers key issues for designing an auction for power purchase arrangements (PPAs). It was developed by Charles River Associates (CRA) and Market Design, Inc. (MDI), and reviewed by other members of the Independent Assessment Team (IAT) and the Alberta Department of Energy (ADOE). The purpose of this document is to develop a statement of the objectives, the design considerations, and the proposed design in order to motivate and facilitate comments from, and discussions with, interested parties.

This white paper is not intended to include a complete analysis of the issues or final conclusions. Nor does it lay out the specific auction rules and implementation plan that will be needed to take the next steps beyond basic auction design issues. We will continue to formulate the PPA auction design based on the ongoing dialog that we expect and look forward to with interested parties.

1. Issues in Auction Design for Power Purchase Arrangements (PPAs)

Experience shows that auction design matters. Design failures can result in distorted values, lost revenues, inefficient outcomes, other unsatisfied goals, and regulatory and public criticism. The rules of the auction must be complete, consistent, and without loopholes.

This section outlines the major objectives and several issues for auctioning PPAs (sometimes referred to as bidding transfer contracts or entitlements). A review of the requirements of the auction of PPAs in Alberta suggests the following guidelines.

1.1. PPA Auction Design Objectives

If carefully designed, the auction can address multiple objectives. We understand the main objectives in auctioning PPAs to be the following.

1.1.1. Establish Market Values

The auction process should result in payments for the PPAs that reflect the true market values of the PPAs. These are prices at which arms-length buyers and sellers are willing to transact. Related to this is the notion of economic efficiency. Efficiency is established when PPAs are owned by those who value them the most. Under normal conditions, providing for the establishment of market values leads to efficient outcomes.

1.1.2. Maximize Auction Proceeds

The auction process should maximize the proceeds into the balancing pool to maximize the benefit to consumers of transitioning from legislated hedges to the bid-transfer model.

[Question for ADOE: If there is a tradeoff between the objectives of efficiency and auction revenue maximization, are we to assume auction revenue maximization dominates? At a conceptual level, there are those who would argue that efficiency is at least as beneficial as revenue maximization for consumers in the long run.]

1.1.3. Mitigate Market Power

The auction process should mitigate market power and promote competition in Alberta. This will result in better price signals to electricity markets leading to market-driven decisions with regard to investment in new capacity in the Province.

1.1.4. Transparency

Bids for PPAs should be elicited in an open and transparent process that assures all participants of equal treatment. Such a transparent process encourages participation by reducing bidders' uncertainty and simplifies regulatory oversight.

1.2. The Winner's Curse

The *winner's curse* refers to the observation that the winning bidder in an auction is often the firm that has the most over-optimistic estimate of the value of the item being sold. Winning the bidding, in this sense, conveys the bad news to the winner that everyone else estimated the PPA's value to be less. Sophisticated bidders account for this effect by reducing their bids. The best auction designs increase the prices paid for PPAs by mitigating the impact of the winner's curse. The effect of the winner's curse can be reduced by minimizing those uncertainties in the value of the PPAs that are common among the bidders. Some auction designs are much better in this respect.

1.3. Transparency

The rules in transparent auctions are both objective and stated in complete form in advance. In the PPA auction, the auctioneer will fully describe in advance the contractual PPAs being auctioned, the rights and obligations of bidders, the qualification and eligibility requirements for participating in the auction, the bidding process and other rules for participating in the auction, and the terms of transferring the PPAs to the winning bidders. Also in a transparent auction, the process of bidding provides a public record of the competition among competing buyers, a record that is open to inspection at each step of the auction process. Thus, a transparent auction provides for a natural auditing capability with which it can be confirmed that the auction rules were followed and no bidder was advantaged or disadvantaged under the rules and administration of the auction. In a competitive, transparent auction, bidders have strong incentives to bid up to their own valuations of the PPAs. Bidders win solely because they are willing to pay more for

the PPAs than any other bidder, and participants' commitments to their bids are made credible by the substantial penalties that bidders face in the event of default.

1.4. Need for Clear Definition of Assets Being Auctioned

One of the first and necessary conditions for ensuring a successful auction is that the items being sold be well defined. It must be clear and unambiguous to bidders what it is they are bidding on. Moreover, the rights and obligations for each item being sold must be the same for all bidders. If there is uncertainty as to what the bidder is offering to purchase, or if bidders have different understandings as to the assets and liabilities that they would be acquiring, it is extremely difficult for bidders to value the items and it is extremely difficult for the auctioneer to determine which bids best satisfy the objectives of the auction (e.g., establish market values, maximize the value of the PPAs, and ensure that bidders participate on an equal, nondiscriminatory basis). Related to this, the auction process must allow bidders a consistent means to express their economic valuations and preferences for the items being sold. And there must be a way for the auctioneer to compare these expressed commitments that is predictable for bidders, regulators, and the public.

Given that one of the objectives of the PPA auction is to establish market values for the PPAs, it is imperative that the PPAs be determined and defined so that the valuations placed on the rights and obligations of the parties involved reflect market values and market allocation of risks. Thus, more than just providing clear, unambiguous, consistent definitions of the PPAs being sold, a successful PPA auction process requires PPAs that accurately capture the efficient allocation of rights, obligations, and risks among the parties involved in the PPA contracts.

It is the IAT's responsibility to ensure that the bid items in the PPA auction are well-defined PPAs, sold individually and/or as bundles of PPAs.

1.5. PPA Substitutes, Complements, and Bundling

The extent to which bidders consider PPAs to be substitutes and/or complements for one another is an important consideration in determining the appropriate auction design. The particular collection of PPAs that a bidder desires depends on the bidder's unique characteristics as well as the relative and absolute values associated with the PPAs. The best auction designs give each bidder the flexibility to assemble its desired collection of PPAs as information about prices improves through the bidding process. A bidder is able to adjust its position as prices change, thereby ending up with its preferred winnings in response to the market-determined prices.

Two PPAs that are perfect *substitutes* for a bidder imply that the bidder is indifferent between one or the other. *PPAs in a group are substitutes for a bidder if raising the price of some PPAs would tend to make the bidder demand more of the others in the group.* Traditional auctions that

price and sell items independently often fail to maximize revenue, promote efficient assignments, or achieve other objectives when items are substitutes because bidders in the auction have to guess early in the auction process which items are likely to be relatively cheap. Among other attributes, this implies that the auction design should allow bidders to exercise arbitrage opportunities: as prices deviate between two PPAs that the bidder considers substitutes, the bidder should be able to bid on the lower priced PPA.

Two PPAs that are *complements* for a bidder imply that the value to the bidder of owning the two PPAs together is greater than the sum of the values of owning the PPAs if each were owned without the other. Thus, a bidder would bid more for the two PPAs if it knew that by winning one PPA it would also win the other PPA. *PPAs in a group are complements if raising the price of some would make the bidder demand less of the others in the group.* As discussed below, complementary PPAs can arise when there are synergies underlying the PPAs.

An important design issue for a PPA auction is establishing how the PPAs are specified in the bids. Three possibilities are individual PPA bids only (bids on bundles of PPAs are not allowed), specific bundles only (only those bundles that are pre-specified by the auctioneer are allowed), or all possible bundles (bidders can submit bids on any bundles they choose). The best approach depends on many factors including the type and extent of synergies among the PPAs, whether these synergies vary by bidder, the extent of competition, and market power issues.

For example, if no important synergies are anticipated and bidding competition is ample, then a simple auction for unbundled PPAs is best. However, synergies may be present that reflect economic or product marketing advantages for bidders or operational constraints. For example, synergies could arise from:

- Supply contracts, labor contracts, or other contractual relationships that cover multiple PPAs.
- Transportation capabilities affecting more than one PPA.
- Synergies across PPAs due to common fuel types, geographical location, or other sources.
- Administrative, operational, or other scale economies that are particular to a subset of the facilities.

Below we outline some of the arguments for and against different bundling alternatives. Some of these arguments apply to only certain auction formats.

1.5.1. Individual PPA Bidding

Arguments for individual PPA bidding include the following.

- Individual PPA bidding provides substantial flexibility for bidders. Bidders can assemble their own preferred collections of PPAs and switch among PPA bundles according to their own valuations and the relative bid prices on the PPAs. Thus, the bidding process itself can determine what bundles, if any, achieve the objectives of the auction.
- Individual PPA bidding is very conducive to a transparent process, particularly with respect to price determinations on PPAs and alternative bundles.
- Bidding on individual PPAs does not preclude smaller bidders that are interested in only a few, smaller PPAs.
- Individual PPA bidding can achieve the maximum possible auction revenue if competition is strong or there are many bidders favoring small PPAs.
- If economic efficiency is more of a goal than revenue maximization, then individual PPA bidding may be better than any bundled bidding, even if there are conditions (such as weak competition) that would otherwise suggest pre-specified bundles best achieve the objectives of the auction.
- Even if complementarities are strong among PPAs but these complementarities are similar across bidders, there is little need to allow bids on PPA bundles as the bidding will naturally form around the combinations of PPA and bidders will naturally compete on these combinations.
- Individual PPA bidding is perceived by bidders and regulators to be simpler than an auction with many possible, even overlapping bundles.

Arguments against individual PPA bidding include the following.

- Individual PPA bidding may impose higher transaction costs because there may be more parties involved in closing the transactions. This is particularly true if there is to be negotiation on the terms of the PPA or if special considerations are to be given to certain bidders (which we do not advocate at this time).
- Some PPAs may not sell under individual PPA bidding. For example, this may occur if a PPA is perceived to have negative value, if a minimum opening bid (discussed below) is set for the PPA that is too high, or if budget-constrained or eligibility-constrained bidders that have positive valuations for the PPA are able to maximize their net valuations on other PPAs.
- If competition for PPAs is weak, the auction proceeds may be reduced under individual PPA bidding. Bidders can assign the PPAs among themselves and not bid aggressively. Also, if the valuation of the bidder with the second highest valuation on a PPA is well

below that of the valuation of the highest valuation bidder, the latter bidder has little incentive to overbid substantially the second highest valuation bidder.

- In individual PPA bidding it is more difficult to express certain complementarities. Without bidding on PPA bundles, bidders can attempt to form their preferred bundles by bidding on the individual PPAs, but they are exposed to the risk that other bidders may outbid them on one of the PPAs in its bundle. This exposure problem is less important if the complementarities are weak or they are similar across bidders.

1.5.2. Specific PPA Bundles

Arguments for pre-specified bundling of PPAs include the following.

- If the complementarities among PPAs can be identified and are strong and vary by bidder, pre-specifying the bundles can facilitate determining market values, establishing an efficient assignment of PPAs, and maximizing auction revenue.
- Transaction costs may be lower with specific PPA bundling than with individual PPA bundling, as there may be fewer parties to execute the transactions.
- If competition is expected to be weak for some PPAs, then specific PPA bundling may increase prices bid for the PPAs.
- If one goal of the auction is to ensure that all PPAs are sold, and if it is anticipated that a PPA may have negative value in the auction on a stand alone basis, then bundling this PPA with other PPAs that have positive value may ensure that the less desirable PPA is assigned in the auction process. This presumes that negative bid prices for PPAs will not be entertained in the auction. **[Questions for the IAT and ADOE: Confirm that each PPA is expected to have positive value and confirm that (implicit or explicit) PPA reserve prices will be at least zero. Just in case, how important is it that all PPAs will be sold in the auction — regardless of (positive or negative) price? My understanding of the Act is that there is discretion, in effect, to reject any and all bids in the auction. Are the criteria clear for this action? If nothing else, reducing the uncertainty for bidders (and owners) ahead of time would be beneficial.]**

Arguments against pre-specified bundling of PPAs include the following.

- If the complementarities among PPAs are not identified appropriately, the auction may suffer in terms of achieving market values and efficiency, maximizing auction revenue, and benefiting from transparency.
- The pre-specified bundles may exclude small bidders or bidders preferring individual PPAs.

1.5.3. All Possible Bundles

Arguments for allowing bidders to specify their own bundles during the auction include the following.

- Allowing bids on all possible bundles provides bidders with the maximum flexibility for expressing their preferences. This flexibility provides bidders the opportunity to submit contingent bids (a bid on PPA “A” is contingent on winning PPA “B”) to express their preferred collections of PPAs.
- If complementarities are complex enough — for example, there are strong complementarities and the complementarities differ substantially across bidders (leading to overlapping bundles) — then auction revenue may be maximized by allowing bids on all possible bundles.

Arguments against allowing bidders to specify their own bundles during the auction include the following.

- Large bidders and bidders wanting large bundles tend to be advantaged when all possible bundles are allowed. Known as the free-rider problem, two small bidders could each submit bids that together would displace a large-bundle bidder, but each small bidder has an incentive to wait for the other bidder to submit a bid that it can combine with.
- Combinatorial bidding involving several PPAs and many possible PPA bundles can require significant computational resources. Allowing bids on all possible bundles may not be feasible if the number of possible combinations precludes determining winning bids in a reasonable time frame, or makes it difficult to verify that the objectives of the auction have been achieved (market values, efficiency, maximum revenue). Also, there may be a loss in transparency if it is difficult for bidders to determine why their bids are not winning bids.
- An auction that allows all possible bundles is generally the most complex auction.

Our preliminary position is that individual PPA bidding best meets the objectives of the PPA auction. But we are open to considerations that there may be some PPAs that are better auctioned as bundles. We will continue to formulate our evaluation of the PPA auction design with respect to individual PPA bidding, specific PPA bundles, and flexible bundling as the underlying issues are resolved. In the remainder of this document, references to PPAs can be generalized to refer to bundles of PPAs, as appropriate, if it is later determined that bundled bids would best achieve the PPA auction objectives.

1.6. PPA Resale

Allowing resale of the auctioned PPAs is likely to increase the value to purchasers of the PPAs at the auction, to increase the purchase prices of PPAs at the auction, and to facilitate changes in ownership to those valuing the PPAs the most (potentially to the benefit of consumers). PPA resale is part of the IAT's determination of the PPAs but is linked closely to the PPA auction design.

We will leave the terms of PPA resale to PPA determination, but we note here some questions that might be addressed in such a determination because they will be important to bidders in the PPA auction. How can PPAs be re-sold after the auction? Can a PPA be split up and re-sold to several subsequent PPA holders? In time-period partitions? In MW partitions? How are post-auction restrictions on PPA ownership monitored and enforced (e.g., to mitigate market power)? Does the performance responsibility and liability remain wholly with the original PPA auction winner? What legal form would the resale take — outright change of ownership, or some other form of transfer or assignment?

1.7. PPA Term and Frequency of Auctions

It has been suggested that shorter time blocks than the base life or life extension periods should be auctioned rather than the full time periods. Additionally, that multiple auctions be held over time, with the auction for later time blocks taking place closer in time to when the time blocks will occur.

The argument suggests either that long time frames for PPAs are very risky and costly and therefore are unattractive to many bidders, or that long duration PPAs would be so costly as to exclude a significant number of serious bidders. By splitting up the PPAs into shorter time periods and auctioning these PPAs closer to their time of execution, uncertainty is reduced for bidders and the value of the PPAs to the bidders (given the duration) is higher. Moreover, more bidders would be capable of bidding on the PPAs.

However, at present we are not convinced these arguments offer a compelling reason to auction less than full term PPAs. First, there are several facilities with fairly short base lives under the PPAs. Second, there is little reason to believe the number of serious bidders would be reduced so much as to distort the outcome of the auction as a result of longer PPA terms. It is not obvious that credit-worthy smaller entities are unable to obtain financing on their own or in partnering with other smaller entities. In spectrum auctions, much of the technology is unproven and unknown, certainly more so than in electric power markets, and the time frames are comparable to the PPAs if not longer; yet smaller entities have been quite successful in obtaining financing and winning large blocks of spectrum without guaranteed returns. Some smaller entities join together for the purpose of participating in spectrum auctions. Third, if longer term

PPAs need to be discounted differently than shorter term contracts, then that is what should occur. Indeed, a primary objective of the PPA auction is to establish market values for the PPAs, including the market discounting of longer term PPAs.

Some serious bidders may be discouraged from participating or from participating as aggressively in the PPA auction unless they are assured of a minimum duration of the PPA contract. Also, allowing PPAs to be resold should provide the flexibility needed for those PPA holders who, for whatever reason, decide not to hold the PPA to term. In any case, the risk of longer time periods must be borne, regardless of whether full-term PPAs are auctioned in a single auction or “partial term” PPAs are auctioned in multiple steps over time. Auctioning only short term PPAs does not eliminate the risk. Taking into account the added administrative burden, contract and transactions costs, and possible system continuity and reliability issues associated with multiple time period contracts for each PPA suggests that letting the market determine value and assign risk efficiently is likely to be better than arbitrarily auctioning off partial term PPAs that are likely to be substitutes and/or complements with other period PPAs and previously auctioned PPAs. Precluding bidders from assembling their preferred aggregations of contractual rights and obligations under PPAs is a restriction that is likely to lead to sub-optimal auction outcomes. History shows us that sequential auctions of related items can lead to unintended outcomes and failure to accomplish auction objectives.

One important consideration is: What arrangement will be most attractive to potential purchasers and will best achieve the objectives of auctioning the PPAs? Our preliminary position is that base life PPAs (and life extension LEPPAs) will be defined in terms of the base life (and life extension) of the facilities and, as noted above, that the bid items in the PPA auction are well-defined PPAs, sold individually and/or as bundles of PPAs in a single, one-time auction. **[Question to ADOE: Are LEPPAs still on the table?]** At this time we see little compelling reason to split up the PPAs into smaller time blocks or to hold multiple auctions over time. But we will continue to formulate our evaluation of the PPA auction design as these issues are addressed.

1.8. Bidder Participation

To achieve the objectives of the PPA auction, the design should strive to:

- Encourage participation by serious bidders.
- Use bid deposits as a screen for serious interest and establishing initial eligibility to bid, but otherwise minimize the costs of participating in the auction.
- Release all relevant information in a useful and timely manner.

- Provide assurances to bidders of an above-board auction, where all are competing on an equal basis.

These in turn suggest certain procedures related to qualifying bidders, including non-binding initial bids for screening and deposits for screening.

Concerns about possible market power and information advantages in the market for PPAs may recommend some limits on the ownership of PPAs, which may be implemented in the auction design. We must ask: What types of restrictions will need to be put on who can bid in the PPA auction and on who can win what? Will these restrictions be bidder specific? PPA specific? For example, should generation owners or their affiliates be allowed to bid in the PPA auction? What about foreign-owned firms? If there are limited restrictions on bidding, what limitations should there be on which PPAs certain bidders are allowed to bid on? Should they be based on ownership shares for geographical regions? What are the current restrictions in Alberta for ownership or control of generation?

We are inclined to allow all serious bidders to participate subject to restrictions to address any market power concerns. We will continue to formulate our evaluation of the PPA auction design with respect to bidder participation as these issues are addressed.

1.9. Bidder Qualification

Qualifying bidders for the PPA auction must ensure that only strong, committed bidders are allowed to bid in the auction — bidders that are capable with a high degree of certainty to close the PPA transaction and to carry out the terms of the PPA. The qualification process could usefully exclude obviously non-serious bidders, particularly those without the financial resources to acquire PPAs, in order to discourage bids that are merely speculative. However, at the same time, it is important that the qualification process avoids excluding desirable bidders. In any case, the criteria for qualifying bidders must be clearly spelled out and applied consistently across all potential bidders. All potential bidders must have an equal opportunity to demonstrate their capabilities for executing and performing under the terms of the PPAs.

1.9.1. Non-Binding Initial Bids for Screening

Initial bids are used often as a way to gauge bidder interest, particularly when large, “lumpy” assets (such as generating plants) are being sold. These initial bids are typically non-binding, since the bids are made before all the terms of the sales agreement are finalized and before extensive due diligence. These bids may be used to create a short-list of bidders, which limits the number of firms that must conduct costly due diligence, and thus motivates the short-listed bidders to conduct due diligence. Ideally, the bidders submit sincere initial bids, so that the right set of bidders is short-listed. There is at least some incentive for sincere bidding, since by

bidding sincerely a bidder with a low chance of winning a PPA can avoid the costly due diligence. However, there may also be an incentive to submit an inflated bid in an attempt to eliminate one or more serious bidders from the short list of bidders. Bidders have reported that coming up with an appropriate bid in the initial stage of asset sales is difficult at best and involves substantial guesswork about what other bidders are doing.

We recommend against the use of non-binding initial bids for screening in the PPA auction. Due diligence costs should not be significant in this PPA auction. Without such cost savings, there is no reason to have a short list of bidders. This would weaken competition, and hence reduce expected revenues and fail to establish market values.

It is better to forgo initial non-binding bids as screens and to let the bidders decide whether it is worthwhile participating. Some bidders may then decide to participate expecting that competition, and hence prices, will be weak. It is not necessary or helpful to take steps to exclude such bidders when others with stronger interest are present. These bidders can do low-cost due diligence and then bid sufficiently conservatively to avoid the winner's curse in a well designed auction. Their presence helps to ensure that there is sufficient competition in the auction.

1.9.2. Deposits for Screening

Bid deposits prior to the auction serve an important role to ensure first that bidders are able to pay for the PPAs they acquire and second that penalties for default in the auction can be collected. The ability to enforce collection of default penalties serves to make defaults (failure by a winning bidder to execute the PPA) much less likely. Bid deposits are refundable so long as the bidder abides by the auction rules and protocols.

In addition to screening, bid deposits typically are also used to establish a bidder's level of eligibility to bid in the auction. In the PPA auction, a bidder's eligibility will be related to the PPAs the bidder would like to win; for example, as measured by the maximum number of PPAs or the maximum capacity under PPAs it would like to purchase.

1.9.3. Security and Payment Terms

In addition to bid deposits used to screen bidders and to establish eligibility for bidders, it will be necessary to require bidders to satisfy other qualification requirements. The bidder will be required to describe its plans for financing its performance under the PPA, its experience in electric power markets, and other indications of commitment and ability to carry out the terms of the PPA. In addition to bid deposits, bidders may be required to post security assurances, bonds, letters of credit, or other financial indications assuring the bidders' commitment and performance capabilities. The design also will specify guidelines for the payment schedule auction winners will be required to follow.

We are interested in the viewpoints of interested parties as to the types and form of qualification instruments and documents bidders should be required to provide prior to the auction. The goal is to ensure execution of winning PPAs and the subsequent performance under PPAs, without imposing undue expense on serious bidders that would discourage their participation.

1.10. Collusion

Bidders in auctions tend to be quite imaginative in finding ways to reduce the bidding competition among themselves to keep auction prices low. There are three main keys to limiting collusion. The first is to encourage wide participation in the auction and to prevent bidders from forming bidding consortia except with strong economic justification. The second key element is the auction rules themselves. Various auction rules affect the ability of bidders to communicate and to “retaliate” against bidders who are bidding aggressively. The rules should prevent communication that does not contribute to the effectiveness of the auction. Also, there should be a clear reminder that all bidders are prohibited from cooperating, collaborating, discussing, or disclosing in any manner their bidding strategies or the substance of their bids, including the price, terms or conditions of their bids, or discussing or negotiating agreements with other participants in the auction until the auction has officially concluded. The third key element is antitrust law. Federal and provincial laws make interfering with or conspiring to affect prices in an auction a crime subject to both civil and criminal penalties. **[I assume these Federal and state laws in the U.S. have their counterparts in Canada and its provinces. Can someone verify this?]**

2. Auction Formats

The most common auction formats relevant for the PPA auction include a simultaneous ascending auction, a one-shot sealed tender, sequential auctions, and two-step sealed bid processes. These are summarized below.

2.1. Simultaneous Ascending Auction

In the simultaneous ascending auction, multiple PPAs are open for bidding at the same time, and remain open as long as there is some bidding on any of the PPAs. Bidding occurs in a sequence of rounds, with the results of each round announced to the bidders before the start of the next round. Bidding activity rules ensure that the auction proceeds at a reasonable pace. Other auction rules define the size of round-to-round bid increments, proportionate bonds or deposits posted to establish initial eligibility to bid, the penalties for bid withdrawals, provisions for waivers from the activity rules, the length of time for a bidding round, and so on.

Both features of the auction design — simultaneous bids and ascending bids — aid price maximization. Ascending bids let bidders see how their rivals value each PPA and which aggregations are likely to be most profitable. As the end of the auction is approached, each bidding firm knows whether it is likely to be able to construct its preferred aggregation, and roughly how much it will pay. With all PPAs open for bidding simultaneously, a bidder has flexibility to seek whatever PPA aggregation it wishes.

As well as facilitating PPA aggregation, the simultaneous ascending auction diminishes the winner's curse by allowing bidders to observe and respond to each other's bids. Also, simultaneous ascending bidding makes it likely that substitute PPAs will fetch similar prices, because, in practice, bidders will switch among the substitutes if their bid prices differ significantly, bidding up any lower priced PPAs and thereby exercising opportunities to arbitrage prices. In this way, market prices are established for each PPA.

2.2. One-Shot Sealed Bids and Sequential Auctions

A one-shot sealed tender and sequential sales of either the sealed tender or ascending bid varieties can be appropriate in some circumstances. One-shot sealed tenders and sequential sales are easy to administer, work reasonably well for selling certain kinds of items, and in some cases are appropriate if competition is limited.

However, sequential auctions and simultaneous sealed tenders may pose problems for bidders for PPAs. Both present the bidders with a large amount of risk and the prospect of regret, resulting in less aggressive bidding. In a sequential auction, the bidder must guess about PPA prices later in the sequence when deciding how much to bid for the early PPAs in the sequence. Later in the sequence, the bidders are likely to discover that they bid either too high or too low for the early PPAs. In a one-shot sealed-bid auction, the bidders must choose their bids for each PPA without knowing which other PPAs they are going to win, and without having any information about the strength of their competitors' interest in the PPAs.

2.3. Two-Step Sealed Bid Processes

Many electric power generation assets have been divested using a two-step sealed process. This process generally proceeds as follows.

- In the first step, the utility advertises the generating plants and qualifies bidders.
- A data room is made available to qualified bidders.
- Bidders submit indications of interest — non-binding initial bids.
- In the second step, the utility selects a short list of bidders and submits a request for proposals.

- The short listed bidders conduct due diligence.
- Final bids are submitted, with the potential for further negotiation or additional bidding.

As with one-shot sealed bids and sequential auctions, the two-step sealed bid process can be appropriate in limited circumstances. An advantage of the process is that it recognizes that some divestitures involve high due diligence costs, which can discourage serious bidders from participating. By limiting the second step to a short list of bidders, these bidders are more willing to incur the high costs of due diligence because their odds of winning are higher with fewer competing bidders.

However, other auction formats can also address the high costs of due diligence by limiting the bidding to certain bidders at some point in the process or through other means. In any case, the PPA auction is not expected to impose high due diligence costs.

Two-step sealed bid processes suffer from a lack of transparency. If transparency and the ability to verify that market values, efficiency, and maximum revenues have been achieved are not important objectives of the auction process, then two-step sealed bid processes may be a viable alternative for certain sale processes.

At one extreme implementation of the two-step process, bidders have only two opportunities to submit bids and only one opportunity to submit a binding bid. In this case, the process is much like the one-shot sealed bid auction and suffers the same shortcomings, including: bidders face a great deal of risk, are exposed to the winner's curse, and find it difficult to assemble their preferred PPA bundles.

To the extent bidders are encouraged to negotiate their bid prices, presumably in an attempt to establish an ascending auction process, the two-step process does not provide revealing, objective, contemporaneous information to bidders about other bidders' valuations. Because negotiation is anticipated, bidders will be conservative in their bidding. Much of the bidding activity and effort is incurred by the auctioneer rather than letting bidders observe directly the objective, committed valuations of the PPAs. Bidding is inefficient as bidders make guesses about the other bidders and bids, not knowing for sure what information the other bid amounts (as reported by the auctioneer) reveal and not knowing for sure what it can accomplish by alternative bid amounts. Moreover, its bidding strategy is complicated, as is the negotiation and price determination itself, if bidders desire alternative combinations of PPAs.

Furthermore, to the extent bidders are encouraged to essentially negotiate on the terms of the asset sale agreements, bidders are faced with the uncertainty of what they are bidding on. Such multidimensional bidding, while providing some flexibility, makes it difficult to determine who the winning the bidders should be, and makes it difficult for auditors to verify that the rules of the process were followed appropriately and that the objectives of the auction were achieved.

Finally, the lack of transparency in the two-step sealed bid process is problematic if an affiliate of the seller is allowed to bid in the process. It is difficult to assure other bidders and regulators that information will be made equally to all bidders and that no bidder is advantaged or disadvantaged if one of the bidders is also the seller.

2.4. Evaluating Auction Formats

The various auction formats above have been used in several industries including electric power markets. In weighing the advantages and disadvantages of the alternative auction formats, our preliminary assessment is that some form of the simultaneous ascending auction best meets the objectives of the PPA auction.

First, the PPA auction process should allow bidders to form their preferred aggregations of PPAs. It is very difficult for one-shot sealed bids, sequential auctions, and two-step processes to provide sufficient flexibility to bidders to accomplish this. Second, these auction formats generally do not address the winner's curse problem as well as alternative formats. There is little if any auditable contemporaneous price revelation of bids for related items, much less little if any opportunity for bidders to respond. Third, bidders are unlikely to bid as aggressively in a PPA auction in these less transparent formats, and the outcome is likely to be characterized by distorted market values, reduced auction revenues, inefficient outcomes, and different winning prices for similar PPAs. Moreover, regulators and the public generally prefer more transparency rather than less transparency. In short, there are many shortcomings with these alternative auction formats with respect to the objectives for the PPA auction.

Below, we describe how the simultaneous ascending auction design framework achieves market-determined PPA values and efficient assignments, revenue maximization, avoidance of market power, and transparency.

2.4.1. Well-Informed Market Values

The simultaneous ascending auction is most likely to result in PPA prices that reflect their fundamental market values and avoid the pricing errors associated with the winner's curse and with guesses that bidders must make in most other auction designs. It avoids the winner's curse by allowing bidders to obtain information during the auction about other bidders' demands at the tentative prices. In addition, it allows bidders to observe and respond to prices as they emerge, which improves the accuracy of their forecasts and improves the efficiency of auction outcomes. Moreover, the rules of the simultaneous ascending auction ensure that similar prices are established for similar PPAs. Theoretically, any auction that establishes a uniform price for each type of PPA allows large buyers to exercise some market power, possibly undermining the efficiency of the auction outcome. However, within the class of standard auctions that do set a

uniform price, the simultaneous ascending auction maximizes efficiency by minimizing bidder error. As described above, it does this by minimizing the winner's curse and by avoiding the guesswork that is common in alternative auction formats.

2.4.2. Revenue Maximization

What the auction rules can affect is the ability of bidders to act collusively to reduce prices in the auction itself. Our preliminary rules outlined below are designed to avoid various pitfalls that have disrupted auctions in other countries and other applications. The specific rules that we propose below limit the bidders' ability to communicate, to retaliate in the auction against other bidders, and to form bidding consortia, thereby promoting higher, more competitive prices for the PPAs sold in the auction.

2.4.3. Mitigating Market Power

The main market power issue concerns concentration of control of electric power generation. The auction rules will specify any restrictions on which bidders can bid on which PPAs. The simultaneous ascending auction is very conducive to these types of restrictions while achieving the auction objectives because the complete rules are well-specified ahead of time eliminating this source of uncertainty for bidders, it provides bidders maximum flexibility (subject to these restrictions) to acquire their desired PPAs as prices are determined through the auction, and the bidding and auction outcome can be audited.

Because we expect there will be secondary market trading of PPAs, the PPA auction itself is limited to controlling initial market power. This is true of any auction design. Ongoing monitoring and Federal and provincial antitrust laws and regulations are required to enforce market power restrictions after the PPA auction.

2.4.4. Transparency

The simultaneous ascending auction is extremely transparent. Its rules are both objective and stated in advance. The PPAs will be fully described in advance of the PPA auction and the terms of the PPAs are specified prior to the auction. The process of bidding provides a public record of the competition among competing buyers, a record that is open to inspection at each round of the auction. As noted above, bidders win solely because they are willing to pay more for the PPAs than any other bidder.

Regulators and other interested parties will insist that the auction allow all bidders to compete on an equal basis. The open and transparent competition of a simultaneous ascending auction would address regulators' and bidders' concerns.

3. Preliminary Recommendation on Auction Rules

[This section begins discussing auction rules. Is this area of discussion appropriate for a white paper on auction design, or is it premature at this stage of the project?]

Given the auction design, the next step is to specify the auction rules to be used to implement the auction design. A proper set of rules is critical to ensure that the intended process and objectives of the auction design are realized. The rules must be comprehensive and ensure that all loopholes are eliminated; bidders have much at stake and will take advantage of any weakness or incompleteness in the rules. And yet the rules must also be straightforward and understandable by participants and they must ensure transparency.

We provide here some general, preliminary recommendations on the auction rules. The description of the rules here is not intended to be complete. The rules will be subject to further analysis and discussion with interested parties.

3.1. What is a Bid?

Prior to the auction the PPAs being auctioned will be specified. During the auction valid individual bids will be accepted for each PPA. Bids on bundles of PPAs may or may not be accepted depending on the outcome of our analysis of complementarities among PPAs. A bid for a PPA (or a bundle of PPAs) is a commitment from a bidder to pay that price if the bid is declared to be a winning bid for the PPA (or the bundle of PPAs). Subject to the activity rule and the bidder's eligibility restrictions, a bidder can submit no bids or one or more bids during each round in the auction.

3.2. Bid Submission Procedure

At the beginning of each round, each bidder is informed of its eligibility for submitting bids, the current price (standing high bid) for each PPA, the minimum bid requirement for each PPA, and any standing high bids it currently holds. In each round, each PPA has at most one standing high bid. The minimum bid requirement for each PPA is based on the minimum-bid increment as explained below. To prevent bidders from holding back and to encourage bidders to bid sincerely in the auction, an activity rule generally requires that a bidder's bidding activity in a round be sufficient in order to maintain its eligibility for the next round; this is explained in more detail below. The rounds continue until there are no new bids for any PPA. At auction closing,

each PPA is assigned to the bidder that holds the standing high (and now winning) bid for the PPA. Each winning bidder pays its winning bid amount for the PPA.

It is envisioned that bidders submit bids electronically to a secure Web site via the Internet, or telephonically if the submission of bids electronically is not feasible. (We assume the auction will be conducted with remote bidding, but available software can also accommodate local, on-site bidding.) Regardless of how a bid is transmitted, a bid submitted during the auction is a binding offer to purchase.

For each bidding round there are (a) a bid submission period, and (b) a period during which the round results are announced. In each round, bids must be submitted before the conclusion of the bid submission period. Bidders submitting bids electronically may print a hardcopy confirmation to their local printer after electronic bid submission. Telephone bidders will be required to provide a fax number to the bid operator and will receive an automatic fax-back confirmation of their bid submission. All auction announcements will be available from the secure Web site, including the schedule for bid submissions. The auctioneer will make further announcements if it decides to extend a period.

To submit bids during a round (i.e., during the bid submission period of a round), a bidder submitting bids electronically will be required to access the auction Web site, using a login code and confidential password. To place a bid telephonically, a bidder must call the bid operator during the bid submission period. The bid operator will request the login code, confidential password, bidder identification number, authorized bidder name, and fax number.

In submitting bids, bidders submit a price for each PPA for which they wish to submit a bid. A submitted bid is valid and accepted only if the bidder's eligibility restrictions are satisfied, as explained below. Each valid bid is time stamped upon submission to the auction computer system.

3.3. Minimum Opening Bids

The final auction rules may specify required minimum opening bids. A minimum opening bid can be justified if little competition is expected for a PPA. A minimum opening bid in this case ensures a minimum price paid for the PPA (consistent with the auction objective of maximizing revenue), as long as the minimum opening bid amount does not exceed bidders' maximum willingness to pay for the PPA. Minimum opening bids can also jump start the bidding in the auction.

The main disadvantage of minimum opening bids is that there is a risk that the minimum opening bid amounts could be set too high (above bidders' valuations for the PPAs), leaving some PPAs unsold in the auction. This defeats one of the objectives of the PPA auction which is to establish

market values for the PPAs. Thus, if it is decided that minimum opening bids are useful, they should be set conservatively low.

3.4. Active Bids

At the end of each round, all active bids are identified for the purpose of the activity rule. A bid is active if one of two conditions hold. First, the bid was the standing high bid for a PPA at the beginning of the round just ended. Second, the bid was submitted during the round just ended and it satisfied the requirements of a valid bid (i.e., it met or exceeded the minimum bid requirement for the PPA). All such bids are designated as active bids for the purpose of the activity rule and computing each bidder's activity as explained below.

3.5. Minimum-Bid Increments

In order for a bid submitted on a PPA to be considered valid, it must be at least as high as the minimum bid requirement for the PPA. The minimum bid requirement for a PPA in a round is the standing high bid amount for the PPA from the preceding round plus a minimum-bid increment. The minimum-bid increments will be specified in the final rules prior to the auction, and will likely take the form of a formula. Typically, the minimum bid increment for a PPA will be a percentage of the PPA's standing high bid amount or an absolute dollar amount, whichever is greater. Guidelines for these percentages and absolute dollar amounts will be specified prior to the auction. The percentages and absolute dollar amounts may change through the course of the auction — typically declining as bidding activity slows, excess demand nears zero, and final winning prices are approached. Final auction rules may allow the auctioneer to exercise some discretion with respect to implementing the minimum-bid increments. Bid increments that are too small slow the auction and the price discovery process (although in many implementations of the simultaneous ascending auction bidders have the opportunity to bid more than the minimum bid requirement). Bid increments that are too large risk foreclosing a winning bid on a PPA by the bidder valuing it the most.

3.6. Bid Withdrawals

Bids submitted during a round normally are considered binding offers to purchase. However, before the round closes, bidders can revise a mistaken bid made during the round or cancel it altogether. The auction software should accept the bidder's last valid bid in a round as that bidder's binding bid for the round. All earlier bids in the round are void.

An open question is whether a bid submitted in a round can be withdrawn by the bidder in a later round. A bid submitted in a round that is not declared a standing high bid for the round is considered for the purpose of computing the bidder's activity for the round, but is otherwise eliminated from the auction. Thus, bid withdrawals are relevant only for standing high bids.

One reason for allowing such withdrawals of standing high bids is if a bidder is attempting to win a certain combination of PPAs but is outbid on one or more of the PPAs, making the remaining PPAs in the combination less valuable to the bidder. The bidder can back out of a “failed aggregation” by withdrawing on its remaining standing high bids. Another reason for allowing bid withdrawals is to enable a bidder to remove a mistaken bid.

But there are disadvantages to allowing bid withdrawals of standing high bids. One is that it reduces the incentive for submitting serious, committed bids. Indeed, in some auction implementations, withdrawals can be used by bidders to send signals to other bidders in ways that are unproductive for the auction process. Without restrictions or disincentives for the use of withdrawals, bidders can employ strategies to game the bidding to their advantage.

Consequently, if bid withdrawals of standing high bids are allowed in the auction, serious and unambiguous withdrawal penalties should be part of the auction rules. Examples include a limit on the number of withdrawals a bidder can make during the auction and, even more effectively, a penalty payment paid by the bidder to cover the auction revenue lost as a result of its withdrawal. A standard measure of this penalty payment is the difference between the withdrawn bid amount and the final winning bid for the PPA (assuming the former exceeds the latter).

3.7. Eligibility, Activity, and Waivers

Activity is a measure of how many valid bids a bidder has submitted in a round and how many current active bids the bidder holds. Eligibility is a restriction (upper bound) on this activity.

In order to ensure that the auction closes within a reasonable period of time, the auctioneer will impose an activity rule. To prevent bidders from holding back in the PPA auction, the activity rule requires that bidders must maintain a minimum level of bidding activity in order to maintain its eligibility level.

The following explains (on a preliminary basis) the details of eligibility, the activity rule, and activity rule waivers.

3.7.1. The Point System Used to Measure Eligibility and Activity

A simple point system is used to measure a bidder’s eligibility and activity for each round of the PPA auction. Each PPA will be assigned an integer number of points (or activity weights). The points will be selected to be roughly proportional to the expected relative values of the PPAs.

3.7.2. Measuring a Bidder’s Activity

At the end of a round, a bidder’s activity is measured to be the sum of the points across all the bidder’s active bids (discussed above).

3.7.3. The Activity Rule

A bidder's overall activity in any round cannot exceed the bidder's eligibility for that round. The bidder's eligibility for the first round is established as described below. For each round after the first, the bidder's eligibility is equal to the bidder's activity for the preceding round divided by the activity rule ratio in effect for the round. The activity rule ratio is a positive number not to exceed one. It is specified in the final auction rules prior to the start of the auction. In the simplest example, the activity rule ratio is one, so that a bidder's eligibility for a round is the bidder's activity from the preceding round (in this extreme case, there is little reason to distinguish between activity and eligibility). As another example, the activity rule ratio starts off at 0.5 (50 percent) for the first rounds until bidding activity slows, then the activity rule ratio is increased, requiring bidders to submit more bids if they want to retain their eligibility level. The activity rule ratio approaches one (100 percent) as the auction nears close.

As a numerical example, assume the bidder has 10 points of eligibility entering a round. At the end of the round its activity for the round is determined to be 5 points. If the activity rule ratio in effect for the round is three-fourths (75 percent), its eligibility for the next round will be $5/(3/4) = 6.667$, or 6 points truncated to the nearest integer. Had the calculation yielded a number greater than 10 points, the bidder's eligibility would remain at 10 points because eligibility is not allowed to increase in the auction; it can only be maintained or reduced.

In submitting a bid a bidder is notified if his resulting activity (including the bidder's standing high bids entering the round) would be insufficient to maintain the bidder's eligibility level for the next round. The bidder can submit additional bids to achieve the minimum level of activity to maintain its eligibility level, the bidder can exercise an activity rule waiver (explained below), or the bidder can allow its eligibility to fall for the next round according to the activity rule ratio calculation.

3.7.4. Determining Initial Eligibility

At the start of the PPA auction, a bidder's eligibility level will be based on the bid deposit the bidder makes prior to the start of the auction and possibly on the financial qualifications and performance capabilities of the bidder. The complete methodology for determining a bidder's initial eligibility level will be specified in the final auction rules. Additional constraints on eligibility may be included in the auction rules to address market power issues.

3.7.5. Activity Rule Waivers

At the start of the PPA auction, each bidder may be granted a specified number of activity rule waivers (for example, five) to be used at its option during the auction. Waivers have two roles in the auction. The first is to ensure that a bidder does not suffer a loss of eligibility on account of a

mishap during the auction that prevents it from submitting a correct bid. The second is to allow it to shift activity from one PPA to another.

The waivers are used as follows. If, during a round, a bidder's activity is insufficient to maintain its eligibility level for the next round, the bidder may elect to exercise a waiver from the activity rule, provided that the bidder has any waivers remaining. The exercise of a waiver causes:

(a) the bidder's eligibility to remain at the same level for the next round despite its otherwise insufficient activity in the current round, and (b) the number of waivers remaining for the bidder to use in future rounds to be reduced by one. A bidder uses, at most, one activity waiver in a round. The use of a waiver prevents the auction from ending with the current round.

If, during a round, a bidder's activity is insufficient to maintain its eligibility level for the next round, and the bidder has at least one waiver remaining, the auction software by default will apply a waiver in order to maintain the bidder's eligibility level for the next round. The bidder will have the option to override this default application of the waiver, in which case the bidder's eligibility in the next round will be reduced accordingly, but the bidder will retain its number of waivers available for use in future rounds.

3.8. Reporting Round Results

At the end of each round, the auctioneer, from a secure Web site, will report the results of the PPA auction through the round just completed. For each PPA, the current standing high bid, the minimum bid requirement for the next round, and any bid withdrawals will be reported. Each bidder also will be informed of its own current active bids, its current eligibility, tentative withdrawal penalties, and the number of waivers remaining. Results can be obtained by fax in the event a bidder is unable to access the Internet.

An open question is whether to reveal additional information for each PPA such as the current standing high bidder and all bids submitted for the PPA, and whether to reveal information on all bidders such as all bids submitted, eligibility, and number of waivers remaining. The tradeoffs are as follows. Reporting all information to all bidders (and the public) provides full information to bidders that reduces the winner's curse problem and therefore encourages more aggressive bidding. Reporting all information also maximizes transparency and facilitates auditing the auction process. On the other hand, there are certain auction implementations that enable sophisticated bidders to game the auction process, including signaling other bidders in ways that are unproductive for the auction process. Allowing bidders to submit bid amounts with the full range of significant digits is an example of this.

Generally, an auction that is expected to be competitive supports full information reporting to take advantage of the benefits, while the disadvantages are likely to be less important. Our

preliminary assessment is that full reporting of information is likely to be warranted for the PPA auction but we are open to considerations for a range of information reporting.

3.9. Frequency of Rounds

The frequency of rounds is set by the auctioneer. The schedule for the first day of the auction will be included in the registration materials for bidders. The round schedule for the following day is announced by the end of the current day. The number of rounds per day during the auction is set at the discretion of the auctioneer, and typically increases in later rounds. For the PPA auction it is expected that several rounds per day can be run initially. Later in the auction, rounds may be even more frequent as necessary to bring the auction to a timely completion.

3.10. End of the PPA Auction

The PPA auction ends when a round closes with no new bids on any of the PPAs and with no exercise of a waiver. The winning bidder for each PPA will be the holder of the standing high bid as of the last round of the auction. The price charged to each winning bidder for each PPA will be the bidder's standing high bid amount for that PPA.

The winning bidders must execute and submit the required documents and payments (such as signed PPAs and down payments) to the auctioneer within, say, five business days of notification of winning status. Failure to do so constitutes default. Upon default, the auctioneer may reauction the PPA or otherwise determine the assignment of the PPA. A default penalty should also be assessed in this case. One possibility is that the penalty be the larger of 10 percent of the defaulted amount or 110 percent of the difference between the amount bid and the price at which the PPA is eventually resold.

3.11. Additional Auction Information

3.11.1. Group Bids

Our initial assessment is that there is little reason for groups to bid together for PPAs except in an attempt to suppress prices. For that reason, we suggest a prohibition on group bidding. The rule suggested below is more generous, allowing group bids if the parties register with the auctioneer.

Bidders may not act through a partnership, joint venture, limited liability partnership, limited liability company or other association, organization or group acting in concert with respect to the auction (a "Group Bidder") unless disclosed to the auctioneer in the relevant documents, together with the identities of and background information about each of the Group Bidder's

members. A Group Bidder must complete the relevant documents with respect to each of its members.

3.11.2. Modification of Rules, Auction Termination, and Disqualification

Here is a sample statement:

The auctioneer reserves the right to modify these auction rules at any time. Unless an oral modification is deemed acceptable to the auctioneer, only modifications made by the auctioneer in writing will bind the auctioneer and bidders. The auctioneer reserves the right to terminate the sale of the PPAs. The auctioneer also reserves the right not to proceed with a sale of PPAs if any regulatory authority imposes conditions that are materially detrimental to the auctioneer. The auctioneer reserves the right to reject any and all bids for the PPAs. Compliance with these rules is a condition to a bidder's participation in the auction. A bidder's failure to comply with these rules will be grounds for disqualification from participation in the auction. Determinations of compliance or noncompliance are within the auctioneer's sole discretion.

3.12. Post-Auction Negotiation

There is no reason to allow negotiations after the conclusion of the PPA auction. The more likely it is perceived by bidders before the auction that negotiation will be possible after the conclusion of the auction, the greater uncertainty and the less transparency there will be in the auction process and the less sincere and vigorous will be the bidding. The terms of the PPAs being auctioned will be defined clearly and comprehensively prior to the start of the auction. The number of PPAs being auctioned and the likely number of winning bidders also make it impractical to allow post-auction negotiation.