STATE OF NEW HAMPSHIRE

BEFORE THE

PUBLIC UTILITIES COMMISSION

DE 14-238

Public Service Company of New Hampshire

Determination Regarding PSNH's Generation Assets

TESTIMONY

OF

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I. Witness identification

Q: Please state your name, title, and business address.

A: My name is Peter Cramton. I am a Professor of Economics at the University of Maryland. My business address is Economics Department, University of Maryland, College Park, MD 20742. My CV is contained in Appendix A.

Q: Please describe your work experience and educational background.

A: I am a Professor of Economics at the University of Maryland. Since 1983, I have conducted research on auction theory and practice. This research appears in the leading economics journals. The main focus is the design of auctions for many related items. Applications include spectrum auctions, electricity auctions, and treasury auctions.

On the practical side, I am Chairman of Market Design Inc., an economics consultancy founded in 1995, focusing on the design of auction markets. I am on the Board of Directors of the Electric Reliability Council of Texas. I have advised numerous governments on market design and I have advised several dozens of bidders in high-stake auction markets. Since 1997, I have advised ISO New England Inc. on electricity market design and was a lead designer of New England's Forward Capacity Market. I led the design of electricity and gas markets in Colombia, including the Firm Energy Market, the Forward Energy Market, and the Long-term Gas Market. Since 2001, I played a lead role in the design and implementation of electricity auctions in France and Belgium, gas auctions in Germany, and the world's first auction for greenhouse gas emissions held in the UK in 2002. I led the development of innovative auctions in new applications, such as auctions for airport slots, wind rights, diamonds, medical equipment, and Internet top-level domains. To date, my designs have been used to auction many tens of billions of dollars of assets. My CV provides many relevant papers and filings.

I received my B.S. in Engineering from Cornell University and my Ph.D. in Business from Stanford University.

II. Purpose and overview of testimony

Q: Can you summarize your testimony?

A: Yes. The purpose of my testimony is to provide a high level description of a sales process that best meets the objectives of the New Hampshire Public Utilities Commission (the Commission) in this docket. First, I describe the objectives of that sales process, based on my discussions with Non-Advocate Commission Staff (Commission Staff) and my review of relevant docket filings. These objectives include maximization of auction revenues, as well as a number of complementary secondary objectives—efficiency, simplicity, fairness, and transparency. Second, I propose a six-step sales process through which these objectives can be achieved. Third, I provide additional detail on the auction stage of the process. In particular, I describe how the auction works and explain why this design—which has been used with great success in a wide array of high-stakes auction settings—will meet the Commission's goals. Fourth, I present my conclusions.

Q: Please state your role in this matter.

A: I was asked by Commission Staff to develop an auction design that can be used in divesting the power plants currently owned by Public Service Company of New Hampshire (PSNH).

Q: How did you determine what auction design would be best suited to this setting?

A: In order to design a divestiture auction that would be appropriate for the PSNH power plants, I began with a review of descriptions of the plants to be included in the divestiture. Then I met with Commission Staff to better understand the economic setting in which the proposed divestiture would be taking place and reviewed the filings in the docket. I combined this knowledge of the plants and the economic setting with my expertise in auction theory and practice, which—as noted above—is focused on high-stakes auctions involving the sale of numerous related assets. Based on my thirty years of experience in this area, it is fair to say that I am one of the world's leading experts in the design and execution of such auctions.

Q: What were the key objectives in developing an auction design to sell the PSNH power plants?

A: Based on my consultations with Commission Staff, I ascertained that their main objective was to maximize total transaction value, while achieving key secondary objectives of efficiency, fairness, transparency, and simplicity. Hence, I sought a design for the PSNH divestiture auction that would achieve each of these objectives. Fortunately, all these goals are highly complementary.

Q: Can you explain each of the objectives?

A: Yes. *Maximizing total transaction value* involves obtaining the highest total revenue from buyers of the divested assets. Achieving this goal benefits New Hampshire rate payers because it contributes to the minimization of stranded costs.

Fairness means that all auction participants have equal opportunity. All potential bidders have access to the auction rules and qualified bidders have access to the same detailed information. Moreover, the auction rules do not inappropriately discriminate among parties.

Transparency means that the auction rules are clear and unambiguous. Bidders know how the rules translate bids into outcomes. With a transparent design, participants know why they won or lost and they understand why their payments are what they are. Participants are able—at least after the event—to confirm that the auction rules were followed.

Simplicity means that the auction is as simple as possible, but not simpler. A multi-plant auction is a complex setting; hence, it should not be surprising that some level of complexity is needed in an efficient design. Nonetheless, it is important that the auction be made as simple as possible to solve the economic problem of the setting. Simplicity is best measured in terms of the simplicity of participating in the auction. Are the needs of potential participants satisfied as simply as possible? Simpler designs let participants express preferences more simply and effectively. Simpler designs have straightforward incentives. Simpler designs also reduce participants' risks.

Efficiency is the most basic objective for economists. An auction design is efficient if it yields outcomes that maximize gains from trade—the plants are awarded to the companies that value them the most. An efficient auction encourages participation, especially by high-valuing buyers as they can be more confident that their participation will be rewarded with success.

To a large extent, these four secondary objectives are complementary. The auction designer can choose a design that gets high marks with respect to each objective. That will be true of the auction design that I propose here. The benefit of such a design is that it motivates bidder participation, and this supports the primary objective of maximizing transaction value.

III. Outline of proposed auction design

Q: Please outline the steps of the sales process for the PSNH plants.

A: The sales process for the PSNH plants proceeds in six steps:

Step 1: Distribute offering memorandum and qualify bidders.

Step 2: Allow qualified bidders to conduct initial due diligence and submit indicative bids.

Step 3: Standardize asset packages and contracts for use in a simultaneous ascending clock auction.

Step 4: Allow qualified bidders from step 2 to conduct further due diligence and participate in auction.

Step 5: Conduct auction.

Step 6: Commission reviews and accepts winning bids, followed by contract signing and settlement.

Q: Can you discuss these steps in greater detail?

A: Yes. The process begins with the solicitation stage, consisting of steps 1 and 2. First, PSNH begins the sales process by issuing an offering memorandum to a wide array of potential bidders. The offering memorandum provides detailed information on the plants being sold, including their operational, environment and financial history. It also provides a timetable for the sale and pro forma versions of the purchase and sales agreement and other contracts that will govern the plant's operation after it has been sold. Firms that are interested in submitting bids must provide proof of their ability to complete the transaction, such as information about their credit ratings or net worth. This threshold qualification requirement is intended to screen out unsuitable bidders while not imposing significant costs on more robust buyers whose participation in the auction will help maximize total transaction value. Second, the qualified bidders are invited to conduct initial due diligence on the plants by means of an electronic data room and to submit non-binding price-only bids for each individual plant that they would like to purchase. Bidders can also indicate their preferred packages of plants and indicate the premium that they would be willing to offer—over and above the sum of the prices of the individual plants—for the opportunity to obtain the package of plants.

The auction stage consists of Steps 3-6. In Step 3, PSNH standardizes the asset packages and distributes transaction documents for the assets that will subsequently be auctioned in Step 5. Thus, at the beginning of the round, we distribute the current version of the purchase and sale agreements—and potentially other key agreements governing the post-sale operation of the assets—and provide all qualified bidders with an opportunity to mark up the terms of the contract(s). The Auction Team—which includes designated staff from the Commission as well as from PSNH—will be charged with determining which contract revisions are ultimately accepted and will redistribute the revised purchase and sale contract(s) to all qualified bidders. Thus, for any given asset, no bidder will face different contract terms than the others. In Step 4, the bidders are invited to conduct further due diligence on the plants. In order to assist bidders in this process, the electronic data room will be expanded to include additional information, including data and documents that are produced to respond to individual bidders' questions. In addition, bidders will have the opportunity to tour the plants and have access to plant managers. They will also have to provide auction-related security as a protection against default. In Step 5, the qualified bidders are invited to participate in the auction itself. The list of qualified bidders is publicly disclosed before the auction begins. There are two reasons for this. The first is transparency. However, the more important reason is so that bidders have sufficient information to obey the anti-collusion rule, which requires that no bidder on the qualified bidder list engage in any communication with any other bidder on the list about any matter relevant to bidding strategy. Moreover, bidders are obligated to immediately report any violation of the anti-collusion rule to the regulator as soon as they become aware of the violating. In order to participate in the auction, bidders must agree that all of their bids will be binding and that they will sign the purchase and sale agreement and other relevant contracts if they win any plants. Finally, as noted above, in Step 6, the Commission reviews the winning bids and, assuming these are accepted, all contracts associated with the sale are signed and the transaction is completed. The Commission review happens as quickly as possible. Typically, this is about two weeks.

Q: Can you explain how bidding proceeds in the ascending clock auction?

A: Yes. The ascending clock auction, unlike a standard sealed-bid auction, proceeds in a number of rounds. In addition, all assets are offered for sale simultaneously, rather than one at a time. In round 0, the auctioneer announces starting prices for the various assets that are for sale (in this case, individual power plants or—potentially—pre-specified groups of power plants). Bidders indicate the assets they wish to buy at the starting price. The auctioneer determines the aggregate demand for each asset by counting the number of bidders wishing to buy the asset at its starting price. Assets for which there is no bidder interest (demand = 0) will go unsold. Assets with a demand of 1, will be awarded to the single bidder indicating interest at the starting price. For the remaining assets, the auction announces higher round 1 prices. Bidders respond with continue, for the assets they are willing to buy at the round 1 prices. For each asset that a bidder does not wish to continue, the bidder gives an exit bid, the highest price the bidder is willing to pay for the asset, which is a number between the price from prior round and the current price for the asset. This process continues until the demand falls to 1 for each asset. Each asset is sold to the bidder with the highest exit bid for the asset or for the final bidding round amount.

The format of the auction for each asset is very much like that of an e-Bay auction. A key difference is that if a bidder in the divestiture auction decides to drop out of the bidding on a particular asset, it cannot re-enter the bidding at a later point. Because exit is irrevocable, bidders cannot wait for the last minute to enter their bids as they do in an e-Bay auction. As a result, the bidders can use information about other firms' bids to better assess the true value of the item being sold. As noted below, this enables firms to safely bid more aggressively.

Q: Can you provide a numerical example to further illustrate these concepts?

A: Yes. Consider an auction of two power plants. The auction manager uses the indicative bids from Step 2 together with other information to set the starting price for each plant. Suppose Asset A has a starting price of 50 million and Asset B has a starting price of 100 million. The auction manager invites the bidders on each asset to say whether they are in or out at these starting prices. Let us assume that only one bidder is willing to pay the starting price for asset A. In that case, that bidder wins Asset A at the starting price. Now consider Asset B.

Suppose that there are five bidders that are willing to pay the starting price of 100 million. In that case, the auction manager increases the price of Asset B to, say, 120 million. At that point, two bidders exit at prices between 100 and 120. Three remain. Since there is excess demand for the asset—more than one buyer wants to purchase the asset at the current price—the auction manager increases the price again to 140 million. Now another bidder exits at a price between 120 and 140 million. Two bidders remain. The auction manager continues to raise the price several more times. When the price is increased from 180 to 200 million, one of the two remaining bidders exits at, say 195 million. The other bidder continued at 200 million. At this point there is no excess demand. The high bidder wins Asset B at a price of 200 million.

Typically about four to six bidding rounds occur each day. At the end of the day, the auctioneer announces the schedule of rounds for the next day. The auctioneer can adjust the schedule during the day, but this typically only happens in exceptional circumstances, such as a technical issue that prevents bidders from entering bids at a particular time. The auction itself typically lasts between one day and two weeks.

Q: How will the auction deal with packaging of assets?

A: As noted above, bidders will be invited to submit proposed asset packages in the first phase of the auction. In particular, they will be asked to submit bids for the individual plants that they prefer and they will also have the opportunity to state the premium they would pay to obtain a specific package of assets. If *all* bidders would like to see the assets packaged in a particular way—e.g., they would like to see PSNH's hydro plants sold as a package due to operational or other synergies—then that package will be one of the assets offered in the auction. Continuing with this example, suppose that there are bidders who want the opportunity to bid on individual hydro plants. In that case, all of the hydro plants will be sold separately in the auction. Nonetheless, bidders who prefer the package of all hydro plants will still have an opportunity to assemble this asset grouping. With all assets open for bidding simultaneously, a bidder has the flexibility to seek whatever asset grouping it wishes, and can switch to a backup grouping if its first choice asset group becomes too expensive. Before the close of the auction, each bidding firms knows whether it is likely to be able to construct its preferred grouping and roughly how much that grouping is going to cost. This outcome discovery is a chief benefit of the simultaneous ascending clock auction as it allows bidders to better manage portfolio, budget, and other aggregate constraints.

Q: How is the simultaneous ascending clock auction implemented?

A: This auction design is easily implemented with existing software. The software determines bidder eligibility in each round and ensures that bids comply with the auction rules. Furthermore, the software manages the communication throughout the auction. Bidding is readily done over the Internet. Bidders only need an internet connection. Security is handled in standard ways.

IV. Use of the proposed auction design and its motivation

Q: Has this auction design been used in other electricity-related contexts?

A: Yes. The clock auction design that I describe has been used in the electric power industry both here and abroad for well over a decade. In 2000, the Canadian province of Alberta conducted an auction of power purchase agreements (PPAs) using the process described above. As discussed in a recent World Bank study, "the success of the auction was due to its openness, transparency, certainty, stability, and care taken to ensure that the auction design and rules were a good fit with the characteristics of the PPAs being traded. Eight of the twelve PPAs were sold, and the auction raised US$780 million." The ascending clock auction design has also been widely used in virtual power plant (VPP) divestitures in France, Belgium, the Netherlands, Denmark, Spain, Portugal, and Germany. VPP divestitures refer to auctions for the sale of electricity supply contracts that give the buyer the right to the output, or a share of the output, of a power plant. VPP auctions were first introduced in France in 2001 when Electricité de France was required by the European Commission to sell part of its generating capacity to potential entrants into the French market. The auctions continued for 12 years (each quarter of each year) without any significant rule changes. The same concept (and general auction design) has also been used in Belgium, the Netherlands, Denmark, Spain, Portugal, and Germany.[1]

Multiple round clock auctions have also been used on a routine basis to procure default generation service—i.e., electricity suppliers for customers who are not served by a third party supplier. For example, in every year between 2002 and 2015, four New Jersey electric distribution companies (Public Service Electric & Gas, Jersey Central Power & Light Company, Atlantic City Electric Company, and Rockland Electric Company) have procured many billion dollars of electricity to supply their default generation service customers in an annual statewide auction process held in February.[2] The

[1]See e.g., Electricity Auctions: An Overview of Efficient Practices (World Bank Study by Maurer and Barroso www.ifc.org/wps/wcm/connect/8a92fa004aabaa73977bd79e0dc67fc6/Electricity+and+Demand+Side+Auctions.pdf?MOD=AJPERES. See also www.cramton.umd.edu/papers2005-2009/ausubel-cramton-virtual-power-plant-auctions.pdf

[2] See e.g. www.bgs-auction.com/bgs.auction.overview.asp

Pennsylvania utilities owned by FirstEnergy have followed a similar process since 2009. Likewise, various regional entities have used this auction format to procure forward capacity on an annual basis. For example, in every year since 2007, the New England ISO has used the clock auction format to procure billions of dollars' worth of forward capacity from hundreds of bidders.[3] Similar clock-format capacity auctions have been conducted by the Midwest ISO and by the Texas PUC. Further, this auction format has been used outside the electric power industry in a diverse array of high stakes applications, including the sale of spectrum for mobile telecommunications applications in numerous countries, the monthly sale of rough cut diamonds in Canada, and the sale of permits for greenhouse gas emissions in the U.K.[4]

Q: How does this auction satisfy the auction design goals that you discussed in the beginning?

A: The divestiture auction design described above maximizes revenues by curtailing bidders' tendency to bid very conservatively in order to avoid the "winner's curse." The winner's curse refers to the tendency for the winning bid in an auction to exceed the intrinsic value of the item purchased. Because of incomplete information, bidders can have a difficult time determining the item's intrinsic value. As a result, the largest overestimation of an item's value ends up winning the auction. In view of the winner's curse, rational participants in common value sealed bid auctions will bid less aggressively in order to avoid or at least minimize its effect. The ascending auction mitigates the winner's curse because the auction enables bidders to draw inferences about asset values from the demands of others.

As the auction progresses, bidders can use the developing pattern of prices as summary information about their rivals' assessments of factors that would affect the valuations of all bidders, such as—in this case—economic conditions affecting power prices in New Hampshire and ISO New England. This learning encourages more aggressive bidding and increases revenues. The reason that learning encourages more aggressive bidding is as follows. Each bidder's valuation of a property is necessarily imperfect. Part of this valuation may reflect the bidder's unique characteristics, but the larger part depends on factors that affect all bidders such as the economic conditions referred to above. As bidders learn more about one another's' valuations—which will necessarily reflect these common factors—the less they will reduce their bids in an attempt to avoid the winners curse.

In addition, this auction design is both fair and transparent. The rules are objective and stated in advance. The items being auctioned are fully described and the contract terms are specified in advance (except for price). The process of bidding provides a public record of the competition among competing buyers. Bidders win solely because they are willing to pay more for the assets than any other bidder. This bidding process is made credible by the substantial penalties that bidders face in the event of default.

Finally, the auction design meets the goals of simplicity and efficiency. Bidders no longer have to be overly concerned with the strategies of other bidders. They can simply bid based on their own

[3] See e.g. www.iso-ne.com/static-assets/documents/2015/02/fca9_initialresults_final_02042015.pdf
[4] See e.g. www.cramton.umd.edu/papers2010-2014/ausubel-cramton-medicare-clock-auction.pdf

valuations. As a result, the outcome discovery process is more reliable. All bidders have the option to continue as high as they want and no more. And all bidders have the benefit of the knowing the demand at the end of each round for each asset. The design further enhances efficiency by providing bidders with ample opportunity to construct their preferred groupings of plants—subject to any budget constraints they might face.

V. Conclusion

Q: Please summarize your conclusions.

A: In my view, the best way for the Commission to achieve its goal of maximizing the revenue from the auction—as well as the secondary and complementary objectives of fairness, transparency, simplicity, and efficiency—is to employ the six step sales process that I outlined above. The latter three steps of the process involve the use of a simultaneous ascending clock auction to allocate the assets to bidders who value them most highly. This auction format has been used with great success in numerous high stakes auctions including many electricity industry settings.

Q: Does this complete your testimony?

A: Yes it does.