McCullough's Critique of the New York Electricity Market

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INTRODUCTION

Robert McCullough recently delivered short slide presentations that question the competitiveness of bidding in electricity markets coordinated by the New York ISO. [1] The views expressed in these slide presentations are premised on a simplified model of a power market that fails to account for important elements of any efficient electricity market. While high offer prices for electric power output can in some circumstances be a mechanism for the exercise of market power by suppliers, in real world electric systems requiring both power and operating reserves, supplied by a wide variety of generating resources including cogeneration resources, water limited hydro generation resources, conventional generating resources with environmental or other energy output limitations, and generating resources able to produce power in excess of their normal capacity by taking extraordinary costly measures, high offer prices for some capacity segments can also reflect the normal efficient operation of the electric power system. Consideration of the actual features of the New York market and the generating resources within it makes apparent that the McCullough critique does not identify competitive problems in the New York power market. Rather, examination of issues raised in the McCullough presentations indicates the importance of the market factors that Mr. McCullough did not consider.

MARKET DESIGN AND HIGH PRICE OFFERS

The McCullough critique expresses concerns regarding the quantity of supply offers in the New York ISO day-ahead market for power at prices above $900 per megawatt hour in February and March 2009. The underlying basis for concern is presumably that economic withholding of power from the market by submitting high offer prices for generating capacity can be a mechanism for the exercise of market power. While the potential for the exercise of market power through economic or physical withholding in electricity markets is an important public policy concern, high offer prices on small amounts of capacity near or even above an individual resource's normal upper operating limit do not necessarily signify either an intent or an ability to exercise market power in New York power markets. Evaluation of the potential for the exercise of market power

[1] Robert McCullough, "Do ISO Bidding Processes Result in Just and Reasonable Rates?" October 14, 2009 and "The Mysterious New York Market," October 15, 2009.

needs to consider the type of resources submitting high priced offers, the time of day, the day of the week, the time of year, and the amount of capacity offered at high prices. The fact that particular high offer prices were not subjected to mitigation may not signify that market power mitigation is ineffective in the New York power markets, but rather may signify that the high offer prices were reasonable and/or had no impact on market prices.

As background to an evaluation of Mr. McCullough's concerns regarding the high offer prices submitted on some segments of capacity in the New York ISO day-ahead market during February and March 2009, it is noteworthy that the highest zonal price in the New York ISO day-ahead market in any hour of February was $146 per megawatt hour and the highest price in any hour of March 2009 was $150 per megawatt hour. Moreover, over the entire period back to May 1, 2006 there were only 21 hours in which a zonal price exceeded $500 per megawatt hour in the New York ISO day-ahead market, all of which were during the summer of 2006 when fuel prices were much higher than today. Moreover, during 20 of these 21 hours, the only zone with a price of $500 or more per megawatt hour was the Long Island zone, in which virtually all the load is served by the Long Island Power Authority, which also controls the generation used to serve that load. Other than Long Island, the only instance of zonal prices as high as $500 per megawatt hour in the day-ahead market was during hour 16 (4-5 p.m.) on August 2, 2006 when the zonal price was $510 per megawatt hour in the Dunwoodie Zone and $503.55 per megawatt hour in the Millwood Zone.

Why are power prices so rarely high in New York power markets despite the high offer prices pointed out by Mr. McCullough? Part of the answer is that the New York power markets are designed to provide market participants considerable flexibility in using their offer prices to manage the operation of their generating resources so as to meet the reliability needs of the New York electric system, while providing checks on the exercise of market power by suppliers that at times may possess market power. While the New York ISO market design and market power mitigation framework are continuing to evolve both to improve performance and to accommodate changes in technology and government policy, the core design is performing well and does not need to be changed.

An important fact in understanding the design and performance of the electricity markets coordinated by the New York ISO is that the New York ISO is required by the New York Public Service Commission, the Northeast Power Coordinating Council,[2] and North American Electric Reliability Corporation[3] to maintain substantial amounts of operating reserves,[4] typically 1800 megawatts. The need to maintain operating reserves is an important element of the New York market, and of any other electric power system, that

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2 See NPCC.org

3 See NERC.com

4 Operating reserves are capacity that is available to be dispatched to meet energy load within a short-time frame. The New York ISO maintains several categories of operating reserves, 10 minute spinning reserves (which must be maintained on units that are on-line and synchronized to the grid and can be ramped up within 10 minutes), 10 minute non-spinning reserves (which also must be able to be ramped up within 10 minutes but can be maintained on off-line quick starting units) and 30 minute reserves (which must be able to be ramped up within thirty minutes and can be maintained on off-line units capable of starting and ramping up within that time frame or on on-line units).

is not considered in the simplified model of an electric system underlying the McCullough critique. The New York ISO markets and software are designed so that generation with high costs or limited availability can be used to provide these operating reserves, while lower cost generation is used to meet energy demand. Hence, capacity whose energy output is offered into the market at high prices is not necessarily withheld from the market but may be used to provide low (opportunity) cost supply in the reserve markets.

Moreover, while Mr. McCullough asserts that offer prices above $900 per megawatt hour are too high to possibly reflect energy cost considerations, this is not actually the case for some of the kinds of resources found in the New York market, or in many other electricity markets. There are sound reasons for such high bids on some portion of the capacity offered by many New York generating resources.

First, many generating units in New York have unfavorable operating characteristics at the extreme high end of their rated capacity. This is not something new. It was a characteristic of these same units when they were owned by regulated utilities and dispatched by the New York Power Pool prior to 1999. The extreme upper range of these units was referred to then as the "EDC high", reflecting the emergency dispatch capability of the units, not their normal operating range. The last few megawatts of the rated capacity of many of these old utility generating units were generally used to provide reserves rather than dispatched for energy under New York Power Pool operation because this is the most efficient use of this capacity, then as now. On some units special high cost actions must be taken to achieve the maximum output, while operating at maximum output materially increases the probability of operating problems on other units, so it is not desirable to operate at these output levels unless necessary for New York reliability, which is not the case when power prices are low. For capacity that is in excess of a resources' normal upper operating limit, therefore, offering that capacity at a high price is not an indication of an attempt to exercise market power through economic withholding, as the cost of using this capacity to supply energy can be very high and the capacity may be used to provide operating reserves.

Second, the resources dispatched by the New York ISO include hydro generation resources whose offer prices for very high output levels can reflect a variety of special costs associated with releasing water from their reservoir to generate the incremental power. Among these costs are the opportunity costs in the power market once the water in the reservoir is released and not available to generate power or to provide reserves. The release of the water to generate power outside the normal water release schedule may also adversely impact recreational and other non-power market uses of the water flow or the reservoir and, depending on the refill rate for the reservoir, these costs may persist for varying periods of time.

Third, some high offer prices for particular capacity segments may be submitted by co-generation facilities whose incremental output at high offer prices may be provided by shutting down portions of the host production process, or may entail operating the facilities generating power outside the normal operating hours for the host production

process. These decisions can have costs well above the basic gas conversion heat rate which is the only factor Mr. McCullough appears to consider in evaluating the reasonableness of the offer prices in the New York ISO day-ahead market. The gas cost times heat rate is one element of incremental costs for conventional gas fired generation, but it provides little if any insight into the cost of supplying incremental energy from such cogeneration facilities.

EXAMINING THE CRITIQUE

The actual number of megawatts of capacity offered at prices above $900 per megawatt hour during the hour on which Mr. McCullough apparently focuses (8 a.m. on Sunday February 1, 2009), was 779.7 megawatts on forty units. Of the capacity offered at prices of $900 per megawatt hour or above, 679.8 megawatts were offered by hydro generation or cogeneration resources which, as discussed above, have complex opportunity costs. The remaining 99.9 megawatts of high offer priced capacity on more conventional generating units was far below the New York ISO's reserve operating reserve requirements. Moreover, 120 megawatts of operating reserves and upward regulation were scheduled on the resources offering the 99.9 megawatts of high offer priced non-hydro and non-cogeneration capacity during the hour examined by Mr. McCullough. Hence, the bidding behavior is neither difficult to explain nor anomalous if the characteristics of the units offering supply at these high prices and the use of this capacity to provide operating reserves is taken into account, as it is by the NYISO and the independent market monitor in their assessment of competition and market performance.

Similarly, the total number of megawatts offered at prices above $750 per megawatt hours was only slightly higher in this hour, 905 megawatts on 47 resources and of this total, 759.1 megawatts was offered by hydro generation or cogeneration resources. Furthermore, the data Mr. McCullough cited also show that the amount of capacity offered at high prices is greatest in the middle of the night and lowest during the peak load hours, not the pattern that would result from attempts to exercise market power through economic withholding. Thus, there were 894 megawatts offered at prices of $900 per megawatt hour or more at 1 a.m. in the morning, 779.7 megawatts at 8.a.m. in the morning, and 746.3 megawatts between 5 p.m. and 8 p.m. on February 1.

While Mr. McCullough seems to imply that the day-ahead offer prices for power for the 8 a.m. hour on February 1, 2009 artificially raised prices in the day-ahead market, the zonal prices that actually resulted from these offer prices within the framework of the New York ISO market ranged from $36.17 per megawatt hour in the west to a high of $47.75 per megawatt hour on Long Island.

The energy offer prices of generation scheduled to provide operating reserves is not mitigated in the New York ISO day-ahead market, ensuring that energy limited resources can be scheduled to provide operating reserves, and can use high energy offer prices to

manage their energy limits. [5] This essential design feature draws on what should be one of the lessons from the western power crisis, that mitigating the offer prices of energy limited units so that they are dispatched for energy instead of providing operating reserves undermines reliability and ultimately raises consumer prices.

With this understanding of the New York market and the data, there is no support for the statement by Mr. McCullough that:

> "One of hundreds of Hockey Stick Bids per hour: Generator #285855750 adds a small increment to its bid curve at $999/MWh; Obviously, the odds that $999/MWh actually represents cost is very very low; The small increment is a loss to this generator since it seldom dispatches."

Without discussing the confidential specifics of this generator but understanding the design of the New York market and the diverse characteristics of the generation resources serving load within that market, the behavior in question is hardly irrational or anomalous on its face. First, if the capacity in question were scheduled to provide reserves, the generator would earning a margin on this capacity, $7 per megawatt for providing spinning reserve during hour beginning 8, on February 1, 2009, which would be a rational use of this capacity if it is not dispatched to generate energy. And if operating in this capacity segment at the very top of this unit's generating capability materially increases the likelihood of operating problems or requires extra-ordinary measures to achieve this output, then the offer prices would be rational.

Mr. McCullough makes a similar mistake when he concludes:

> "Economic theory assures us that all of these bidders are making a serious mistake: In the presence of perfect competition, no bidder should believe that his bidding strategy can affect prices.; If he systematically bids above his marginal cost, he will not be dispatched during many periods when the plant would be profitable."

Submitting high energy offer prices in the New York ISO day-ahead market does not forego revenues if the capacity is scheduled to provide operating reserves. Hence, entities submitting high offer prices are not necessarily mistakenly attempting to exercise market power, but are ensuring that capacity with unfavorable characteristics or high costs for generating energy is used to provide operating reserves during ordinary conditions and is only dispatched for energy during short periods when operating reserves are activated by the New York ISO.

Similarly, submitting high energy offer prices in the New York ISO day-ahead market for energy that a cogeneration facility uses to run a production process is not a mistake. On the contrary, one should expect that it would only be rational to interrupt such a production process when day-ahead power prices are quite high.

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[5] See New York ISO Technical Bulletin 67 dated May 20, 2004 "Automated Mitigation Procedures for the Day-Ahead Energy Market."

Mr. McCullough's general concern with "hockey stick" bids is misplaced. Hockey stick bids, in which very small megawatt quantities of power are offered at high prices, would set prices only when the system is extremely short of generation and in these circumstances a high energy price would be sending an appropriate signal for consumers to reduce power consumption. Because hockey stick bids entail offering only very small quantities of output at high prices, they generally do not raise market power concerns. Market power concerns would potentially arise if a market participant offered a large block of output only at high prices, rather than a megawatt or two or in some cases a fraction of a megawatt.

In fact, because hockey stick bids entail offering only a few megawatts of output at high prices, they will often not set prices even when demand is extremely high, because the capacity with high offer prices will be used to provide reserves, rather than dispatched for energy. In part for this reason, the New York ISO market design does not rely on hockey stick bids to set prices at appropriate levels during reserve shortage but instead directly reflects reserve shortages in day-ahead and real-time energy prices. Thus, as observed above, the offer prices that apparently concern Mr. McCullough are almost certainly not intended to set prices at high levels during shortage conditions. A better explanation is that the bids simply reflect the opportunity costs and adverse performance impacts of operating to generate at these output levels on these resources.

Reserve shortages are very rarely present in the New York ISO day-ahead markets but do appear during real-time operation. Some of these reserves shortages are limited to shortages of 10-minute spinning reserves or perhaps 10-minute reserves during short periods, typically one or two intervals, when generation is ramp constrained and reserves are dispatched to meet load. Other instances of reserve shortages can be longer periods when the New York ISO is short of 30-minute reserves as well perhaps 10-minute reserves.

The empirical reality is that sustained high prices in the New York ISO real-time market arise during reserve shortages when they send an appropriate signal for demand response. There have been a total of 1705 dispatch intervals since May 2006 during which any zonal price outside Long Island exceeded $500 per megawatt hour. [6] Of these, 916 were intervals in which there were reserve or regulation shortages and prices were set in part by the shortfall values for reserves, rather than by the high offer prices of generating units. Of the remainder, 42 were intervals in which prices were set by the offer prices of

[6] A normal dispatch interval is five minutes long, so these 1705 intervals would total 143 hours and a few minutes based on the normal interval length, or about 6 high priced days over the more than three year period. Some of the high priced intervals are not of normal length because they arose during stressed system conditions when the real-time dispatch was being run more often than once every five minutes. High prices that were present only on Long Island were not included in the tabulation because their inclusion would have required much more effort to identify intervals impacted by Long Island reserve shortages over such a long historical period given the reserve pricing rules applicable to Long Island. A few high priced intervals impacted by software problems in which prices were corrected have also been excluded from the tabulation, because of the ambiguity in classifying the cause of the prices in such intervals.

demand resources in the New York ISO's emergency demand response program because there would have been a reserve shortage without the demand reduction provided by the demand response, and 180 were intervals in which prices were set by the penalty values for overloaded transmission constraints ($4000).

The remaining 567 intervals (about 47 hours of high prices based on 12 dispatch intervals per hour) were intervals in which prices were set by generator offer prices. These were virtually all sporadic intervals in which the system was ramp constrained due to sudden changes in system conditions, such as following implementation of a thunderstorm alert, and prices were set by high cost quick start gas turbines, rather than the offer prices at the extreme upper operating range of dispatchable resources.

Thus, high priced offers in the New York ISO market design accommodate the needs of New York reliability by providing a mechanism for suppliers to ensure that dispatchable capacity at the operating range of New York resources is scheduled to provide reserves rather than energy, yet these high offer prices virtually never impact either day-ahead or real-time prices in the New York market.

It is also appropriate when considering the impact of these high priced intervals on consumer costs to recognize that New York energy and reserves prices are in aggregate too low to support the level of generation needed to maintain the target level of reliability for New York. Generator energy and ancillary service margins are therefore supplemented by capacity market payments. These same costs of maintaining sufficient generation assets to provide the target level of reliability are borne by customers in other regions in their retail rates, which include, except in the case of consumers benefiting from government subsidized power, return of and on generation investment.

MARKET POWER MITIGATION

Mr. McCullough reliance on a simplified view of electricity markets and the New York ISO market design in particular also apparently lead him to conclude that the high offer prices he identifies indicate that the New York ISO market power mitigation design is not working, stating:

> "Is this working?
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> - The answer appears to be "no"
> - Since noneconomic bids are so pervasive, it is unlikely that the rules described by the ISO are mitigating 10% or more of total bids
> - Reading between the lines, it appears that application of the mitigation rules appears to be largely directed at New York City
> - In September, the ISO filed an emergency motion attempting to tighten up mitigation rules in NYC, citing non-economic bids"

Mr. McCullough's conclusions are again mistaken. First, the fact that a small number of megawatts at the upper operating range of a few dispatchable units within New York are offered at high prices has essentially no impact on market prices or efficiency because this capacity can be and is scheduled to provide operating reserves.

Second, it mistaken to draw conclusions regarding the adequacy of market power mitigation by examining offer prices on a Sunday morning in February. Under the New York ISO conduct and impact test for market power mitigation, offer prices are only mitigated if the mitigation would actually impact market prices. Thus, the same offer price that might go unmitigated in March or February because the unit would not have been economic to use to meet load based on either the mitigated or unmitigated offer price, might be subjected to mitigation on a hot summer weekday.

Third, mitigation of offer prices is appropriately more focused on generation within New York City than upstate New York, because it is generation within New York City, particularly generation within load pockets within New York City, that sometimes faces limited competition, creating the opportunity for the exercise of market power. In the case of capacity elsewhere in the state, if the capacity is offered at high energy prices and low reserve prices, it will simply be scheduled to provide reserves in the day-ahead market and energy will be dispatched on other units with little impact on market prices.[7] This is not always on option within load pockets in New York City, which is why market power mitigation in New York is most likely to be applied to units located within New York City.

Fourth, the supply offered at prices of $900 per megawatt hour or more was not more than 10% of supply in the hour examined by Mr. McCullough (8 a.m. on February 1, 2009) but was actually less than 2.5%, and even less capacity was offered at such prices later in the day.

Fifth, the fact that the New York ISO market design and market power mitigation framework can accommodate generating resources with diverse characteristics, including cogeneration facilities and varying types of hydro generation is not an indication that the market design has failed or malfunctioned. Rather, the evidence is that the basic design is working as intended.

Sixth, Mr. McCullough also misunderstands and misstates the September New York ISO filing, which did not concern high offer prices in New York City, but instead concerned high offer prices by resources located in certain regions outside New York City in special circumstances in which a particular resource had to be committed to meet a local reliability criteria and thus that particular resource indeed possessed market power.

[7] While generators can submit offer prices for reserves in the New York ISO day-ahead market, all dispatchable generating capacity is used to provide reserves in real-time and the price of reserves is set by opportunity costs in the real-time energy market or reserves shortage values.

IMPLICATIONS FOR ELECTRICITY MARKET DESIGN

Mr. McCullough then asks: "If we are so smart why don't we understand these bids?"

The reason Mr. McCullough does not understand these bids may be his reliance on a simplified view of electricity markets that bears little resemblance to reality and the New York market design, the New York ISO market rules, the New York ISO pricing system, or to the reliability needs of electric transmission systems.

Mr. McCullough's observations regarding organized market are even less comprehensible than his comments regarding the New York market. In particular, he states that:

> "Against all probability the California Model has been copied across the US
> - Each of the states that has adopted the model has had similar problem;
> - As far as we have been able to determine, not one of the implementations has managed to create a market remotely similar to competitive markets;
> - Odd bidding patterns are the rule, rather than the exception
> - Although frequent press releases note how competitive the markets are, prices have continued to diverge from those outside of the California model states"

Mr. McCullough has the facts regarding the California electricity market design backwards. Rather than the California modeled being copied, in April 2009 the California ISO abandoned the old California market design and shifted to the PJM/New York ISO market model.

Mr. McCullough's opposition to ISO markets is particularly striking since outside an ISO administered market, none of the information he refers to regarding unit offer prices and availability would ever be publicly available. Vertically integrated utilities are not required to publicly post offer prices for capacity that is not dispatched to meet their load or even to show what capacity was available in excess of that needed to meet their load serving obligations. Mr. McCullough's apparent belief that odd bidding patterns are the exception outside organized markets is remarkable since there is no publicly available data to use in assessing offering behavior outside the organized markets.

CONCLUSION

Hockey stick offer curves, with small volumes of power offered at high prices, can be consistent with competitive behavior and efficient operations. The view that power should never be offered at high prices is based on a simplified model of electricity markets that ignores critical elements of real electricity systems. ISO market power mitigation rules and processes regularly distinguish between high offer prices that are

consistent with efficient operation of the electric system and those that would potentially permit the exercise of market power. The operational realities of the New York electricity market provide an illustration of some of the factors missing from the McCullough critique.

Endnotes

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