Attachment V

NYISO DEMAND RESPONSE NET BENEFITS TEST

In compliance with Commission Order 745, the NYISO has developed a methodology for calculating the threshold price at which demand response resources are cost-effective.[1] The NYISO's methodology includes nine steps. These are described below.

Step 1: Retrieve the supply offers from the Reference Month

The first step in calculating the net benefit threshold is to retrieve the bids and offers that will be used to develop the supply curve for the Reference Month.[2] The NYISO compiles the Day-Ahead market offers of physical generators (including pumped storage supply offers), Day-Ahead market import offers net of export bids, and Day-Ahead market bilateral import and export bids (or schedules). The hours analyzed are the high load period hours HB13 through HB19 for all days of the Reference Month.

Virtual supply and demand offers will not be included in the determination of the supply curve. The generator supply offers used in the analysis are posted to nyiso.com on a masked basis with a three month lag.

Step 2: Adjust the supply offers for changes in resource availability

The NYISO then adjusts the supply offers by taking into account resource availability. Offers from any resources with a capacity of 20 megawatts or larger that have permanently retired from service 45 or more days prior to the posting date for the Monthly Net Benefit Offer Floor are removed from the supply stack. For purposes of this procedure, the NYISO will consider a resource to be "permanently retired" if the resource has retired or been mothballed after notification to the New York Public Service Commission.

The NYISO will not adjust the supply curve of the Study Month for new entrants. Because there is no offer history in the Reference Month, offers from new entrants would need to be forecasted in order to incorporate them into the supply curve of the Study Month. The NYISO does not believe it is appropriate to use offer history from the most recent offers of a new entrant as a proxy or forecast of offers for the Study Month because the NYISO will be unable to account for any seasonal differences in offer patterns and to do so has the potential to lead to anomalous outcomes. In addition, including such offer data in the supply curve may compromise to confidentiality of the offers of a new entrant, because offer price data is not made public for 90 days after the offers are made.

To avoid undue complexity in developing the average supply curve on a monthly basis, the following types of adjustments will not be made:

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[1] Demand Response Compensation in Organized Wholesale Energy Markets, Docket No. RM10-17-000; 134 FERC ¶ 61, 187 (March 15, 2011).
[2] Capitalized terms used in this document have the meanings given to them in the NYISO OATT and Services Tariff.

- The Reference Month supply offers of resources that are expected to be out for some or all of the Study Month as result of planned outages or ongoing forced outages will not be removed from the supply stack.

- The supply offers of resources whose capacities have been increased since the Reference Month will not be adjusted for such increases.

- The supply offers of resources whose capacities have been permanently reduced since the Reference Month will not be adjusted for such decreases.

- The supply offers of resources whose capacities have been derated as of the posting date for the Monthly Net Benefit Offer Floor will not be adjusted for such decreases.

Step 3: Combine the offers to create hourly supply curves

Having compiled the generation offers described in step 1 for each relevant hour in the Reference Month and made the adjustments contemplated in step 2, the NYISO creates the supply curve for existing capacity in each hour by determining the amount of supply net of exports available from all suppliers in the Reference Month at each price level. Each hourly supply curve consists of a set of pairs of offer price and offer quantity: $\{P, MW\}$.

The supply curve is intended to measure the supply available to meet New York demand and therefore is net of supply supporting exports at each price level. The supply curve is adjusted for exports by subtracting from the supply available the amount of exports that would be economic to schedule at their offer prices or less (e.g. subtracting the total amount of MW exported at price levels below offer prices); and then adding back into the New York supply curve at the point on the supply curve at which they become uneconomic and would no longer be scheduled (e.g. adding back MW that were exported at the price just above the export bid price).

At this point in the process, the NYISO has roughly 210 hourly supply curves for a given Study Month. The NYISO will proceed to analyze the portion of the hourly supply curves that falls in the range between $5 and $350 per megawatt hour.

Step 4: Adjust offers for changes in fuel prices

Next, the NYISO adjusts the supply offers comprising the hourly supply curves for day-to-day differences in gas prices. The NYISO uses the daily spot Transco Z-6-NY natural gas prices for the Reference Month in this adjustment. The offer prices comprising each hourly supply curve are deflated by the spot Transco Z-6 NY natural gas price for the gas delivery day corresponding to the New York day-ahead market day. The NYISO then calculates an implied heat rate for each price quantity point on the hourly supply curve:

- Heat Rate = Offer Price / Gas Price

Step 5: Average the hourly curves to form a representative average supply curve for the Reference Month

The representative average supply curve, {*Heat Rate, MW*} is calculated by horizontally averaging across the deflated hourly supply curves for the Reference Month (from step 4) and for retired capacity (from step 2). The NYISO calculates the amount of supply offered on each supply curve, summing over the quantities offered at a given heat rate over all of the supply curves for the month, and then dividing that supply by the number of hourly supply curves included in the calculation.

Step 6: Smooth the curve using numerical methods

The NYISO next applies numerical methods to smooth the representative supply curve. The NYISO utilizes the following polynomial equation with exponential term:

$$[1] \qquad \text{Heat Rate} = A + B*MW + C*MW^2 + D*MW^3 + \exp^{(E*MW+F)}$$

Where: coefficients *A, B, C, D, E*, and *F* are parameters that are estimated for each month.

The NYISO estimates values for the parameters using a non-linear partial least squares methodology[3]. Because the representative supply curve consists of continuous offer curves that have been averaged, a sampling process is necessary to identify the price quantity points on this supply curve that will be used to estimate the parameters of the model.

NYISO posts to its web site the estimated parameters for the supply curve equation along with the Monthly Net Benefit Offer Floor for each Study Month.

Step 7: Find the point on the heat rate supply curve at which the benefit exceeds the costs

Order 745 describes the net benefits threshold as the point at which the net benefits from demand response exceed the payments to the demand response providers. The net benefit point is that point at which the estimated elasticity of supply rises from below 1 (inelastic) to above 1 (elastic) indicating the pecuniary benefits to spot market power purchasers from a reduction in the spot price of power would be less than the payments to demand response providers. The elasticity is defined as:

$$[2] \qquad \text{Elasticity} = \frac{\dfrac{Heat\ Rate}{MW}}{\dfrac{d(Heat\ Rate)}{d(MW)}}$$

Where: based on the specification of the supply curve in equation [1]:

$$[3] \qquad \frac{d(Heat\ Rate)}{d(MW)} = B + 2*C*MW + 3*D*MW^2 + E*\exp^{(E*MW+F)}$$

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[3] NYISO utilizes SAS software to estimate the monthly average supply curves.

and therefore:

$$[4] \qquad \text{Elasticity} = \frac{Heat\ Rate}{MW} * \frac{1}{B + 2*C*MW + 3*D*MW^2 + E*exp^{(E*MW+F)}}$$

The NYISO applies the values of the supply curve parameters (A, B, C, D and E) estimated in step 5 and computes the supply elasticity at each price and quantity along the estimated supply curve. The NYISO then determines the heat rate at which the elasticity falls below one and remains below one for higher heat rates. This heat rate will be used to determine the "heat rate" threshold.

Step 8: Calculate the net benefit threshold

The NYISO converts the heat rate threshold determined in step 7 to an LBMP value by multiplying the projected natural gas price[4] (GP) for the Study Month by the threshold heat rate from the Reference Month.

[5]   Threshold LBMP = Threshold Heat Rate * Projected Natural Gas Price

Where:

[6]   Projected Natural Gas = Henry Hub Futures Price + 3-year Basis

The NYISO utilizes a Henry Hub NYMEX Natural Gas Futures Price plus a constant three-year basis as the projected natural gas price for the Study Month. The NYISO collects the relevant gas price no later than the 11th of the month prior to the Study Month. The 3-year basis is a differential between the Henry Hub daily spot price and Transco Z6-NY daily spot price averaged over corresponding months of the three prior years.

Step 9: Calculate Monthly Net Benefit Offer Floor

The LBMP value calculated in Step 8 is the Monthly Net Benefit Offer Floor for the Study Month and is posted to the NYISO web site on the 15th of the month prior to the Study Month. If there is a material change in the forward natural gas price for the Study Month between the posting date and four (4) business days before the end of the month prior to the Study Month, the NYISO will recalculate the Monthly Net Benefit Offer Floor. For these purposes, the NYISO defines a material change as an increase or decrease of more than $0.75 per MMBtu in the Henry Hub forward price for the Study Month.

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[4] Projected Gas Price will be constant for each Study Month.