

NYISO's Compliance Filing to Order 745: Demand Response Compensation in Organized Wholesale Energy Markets

(Docket RM10-17-000)

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Topics

- ◆ **Net Benefits Test**
 - *Creating the average supply curve*
 - *Updating the average supply curve of the reference month for current conditions*
- ◆ **Price Threshold Offer Floor Calculation**
- ◆ **Monthly Timeline**
- ◆ **Measurement and Verification**
- ◆ **Cost Allocation**
- ◆ **Implementation**
- ◆ **Next Steps**

Net Benefits Test

- ◆ **Order 745 prescribes a smoothed supply curve to determine the price above which demand response is cost-effective**
- ◆ **The Order is very specific on many aspects of the Net Benefits Test, but does not address congestion or locational aspects**
- ◆ **The NYISO proposes a single supply curve and a single monthly price threshold**

Step 1: Compile Supply for the Reference Month

- ◆ **Using 2010 data, obtain hourly supply curves for each day of the month for HB 13 through HB19 using:**
 - *Day-Ahead generators' offers including pumped storage,*
 - *Import bids,*
 - *Import bilateral bids,*
 - *Export bids,*
 - *Export bilateral bids*

- ◆ **Limit to HB 13 through HB 19 because they are high load hours**

Step 2a: Update Changes to Supply for Retirements

- ◆ **Minimum size for exclusions: 20 MW**
- ◆ ***Exclude plant if retired at least one-and-half months before publishing the Price Threshold Offer Floor:***
 - ***Retirements that occur before the 1st of the month that precedes the publishing month***
 - ***Example: Retirement before 9/1 , size: 25 MW***
 - **10/15 Net Benefits Test and Price Threshold calculations for November will exclude the retired plant from the average supply curve**
 - ***Example: Retirement on or after 9/1, size: 25 MW***
 - **10/15 Net Benefits Test and Price Threshold calculations for November will not exclude the retired plant**

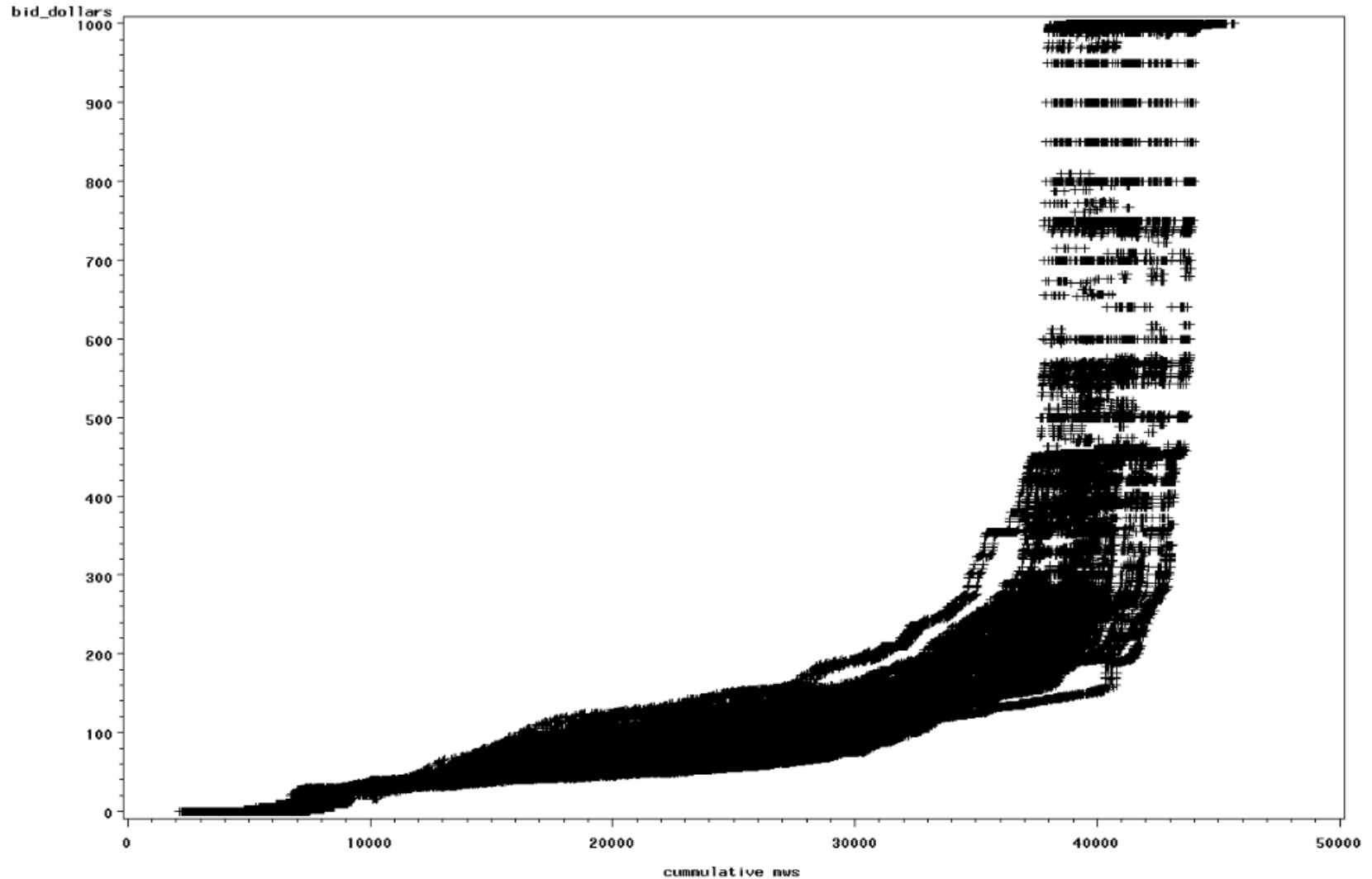
Step 2b: Update Changes to Supply for New Entrants

- ◆ **New entrants will not be included until the next year's offers are used for reference**
 - *Offers from new entrants would need to be forecast for the study month*
 - **Using previous month's data risks confidentiality of offers from new entrants**
 - *New entrants may test for 4-6 months, with offers that may not be representative of long-term offers*

Step 3: Combine Supply Offers to Create Hourly Supply Curve

- ◆ **Supply offers for each hour are arranged in ascending order by price**

Hourly supply curves for December 2010



Step 4: Adjust Offers for Changes in Fuel Prices

- ◆ **Offers will be normalized using daily Transco Z-6 spot prices so that all hours are at a uniform fuel cost basis**
 - *Heat Rate = Offer Price / Z-6 Spot Gas Price*

Step 5: Create the Average Supply Curve

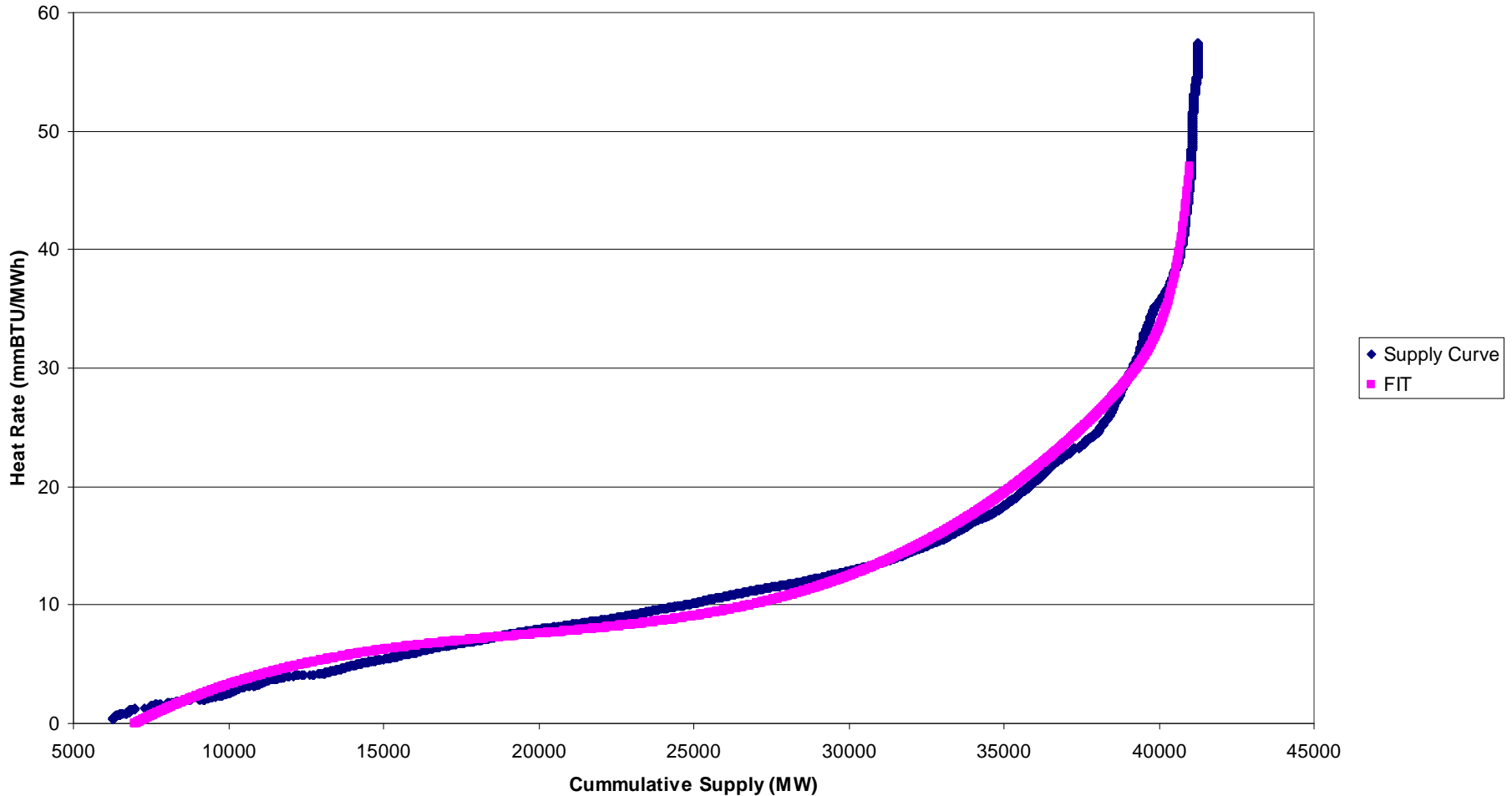
- ◆ **Average Supply Curve for a month (quantity offered at each heat rate level) will be created by horizontal averaging of the hourly supply curves**
 - *For a 30 day month: 7 hours x 30 days = 210 hourly supply curves*
 - *Divide each total MW offer quantity by 210*

Step 6: Smooth the Average Supply Curve

- ◆ **Fit a mathematical formula to the empirical supply curve**
 - *Heat Rate = $A + B * MW + C * MW^2 + D * MW^3 + \exp(E * MW + F)$*
 - *Constants A, B, C, D, E, and F are parameters that are estimated for each month*

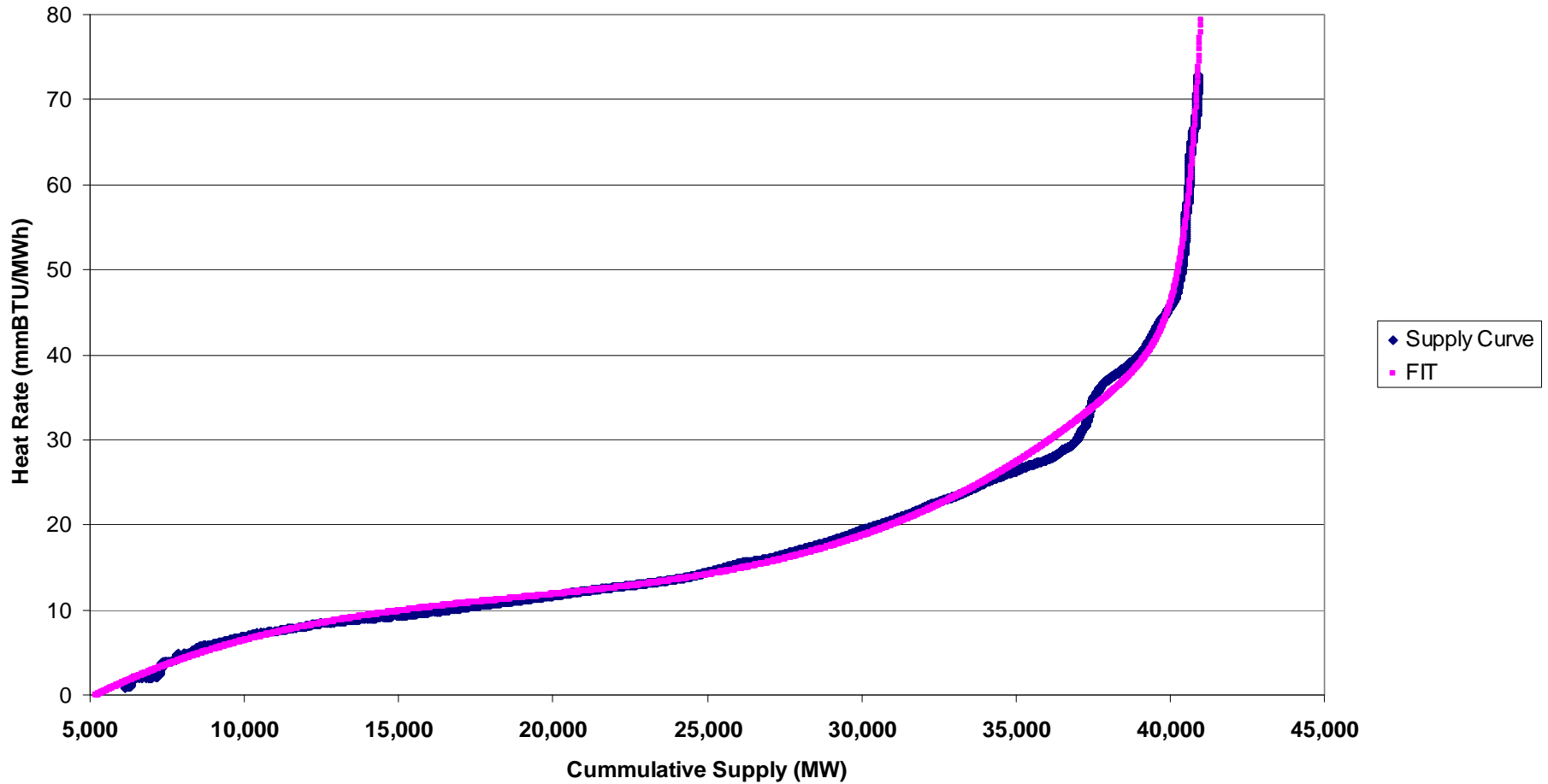
Smoothed Average Supply Curve

January 2010 Average Supply Curve and Smoothed Fit



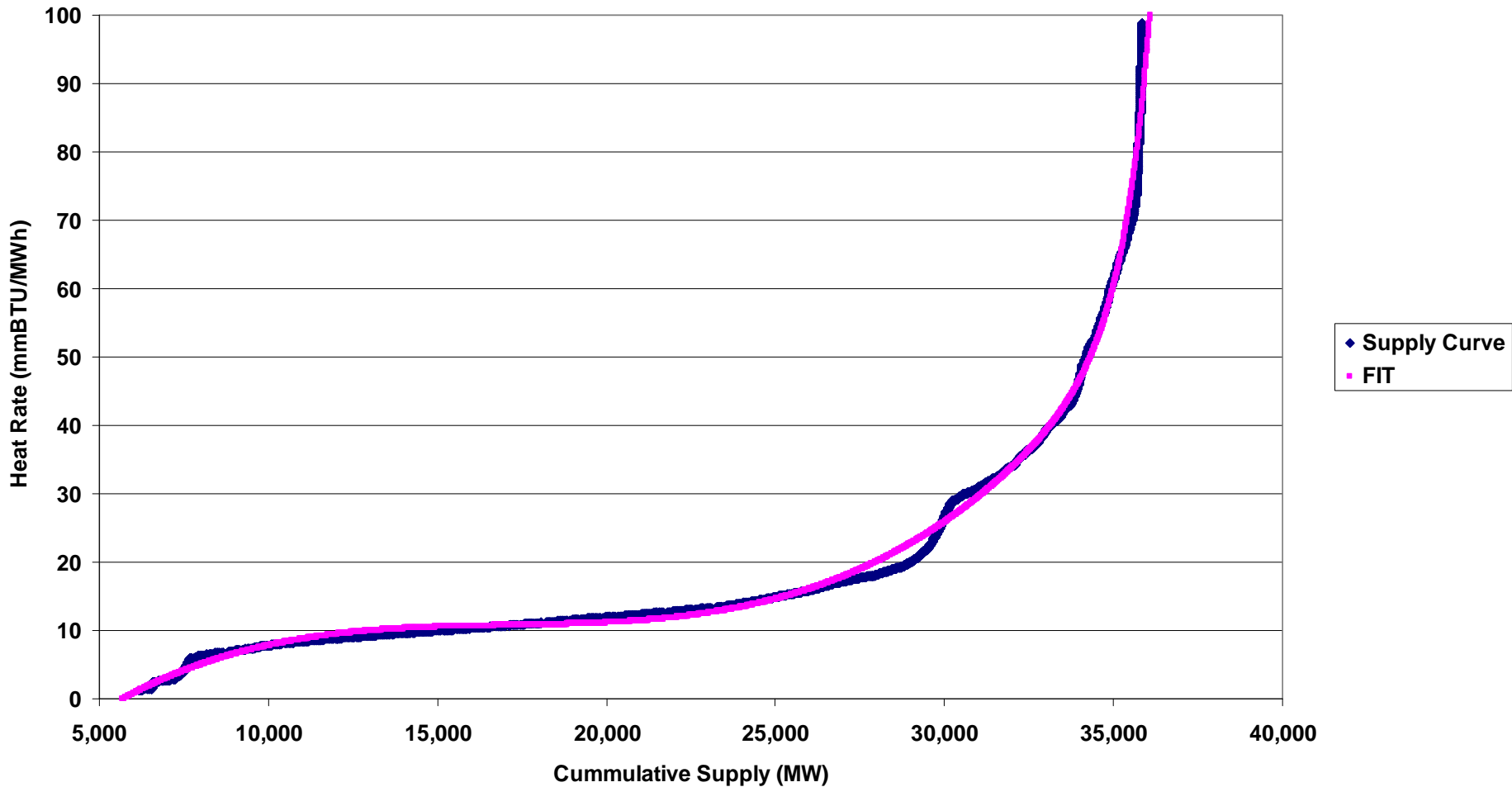
Smoothed Average Supply Curve

July 2010 Average Supply Curve and Smoothed Fit



Smoothed Average Supply Curve

October 2010 Average Supply Curve and Smoothed Fit



Step 7: Calculate Heat Rate Net Benefit Threshold

- ◆ **Smoothed supply curve estimated in step 6 is evaluated to identify heat rate meeting FERC’s criterion for net benefit threshold**

- *Find the Heat Rate at which the elasticity falls below one and remains below one for higher heat rates*

- *Elasticity =*

$$\frac{\text{Heat Rate}}{MW} * \frac{1}{B + 2 * C * MW + 3 * D * MW^2 + E * \exp^{(E * MW + F)}}$$

Step 8: Calculate Net Benefit Threshold based on Projected Gas Price for Study Month

- ◆ **Net benefit threshold calculated in step 7 is in terms of a heat rate.**
- ◆ **Actual LBMP net benefit threshold will be calculated using projected natural gas price.**
 - *Net Benefit Threshold (in \$) = (Heat Rate Net Benefit Threshold) * (Projected Natural Gas Price)*
- ◆ **Projected Natural Gas price is a sum of:**
 - *Henry Hub Future price from the last trading day that is closest to the 4th business day before the posting date*
 - *Basis Adjustment = average difference between Z6 Spot price and Henry Hub Spot price in corresponding month of prior 3 years*

Step 9: Supplemental Adjustment for Changes in Fuel Prices after the Monthly Posting

- ◆ **Gas price (futures) value for the study month will be recalculated using the last trading day that is closest to the 4th business day prior to the first day of the month for which the price threshold applies (study month)**
- ◆ **If the recalculated gas price varies by more than +/- \$1 per mmBTU, the Price Threshold Offer Floor will be recalculated and posted**
 - *Notification of this update will be sent to the marketplace*
 - **NYISO website will be updated to reflect the revised Price Threshold Offer Floor**

2010 Price Thresholds using Projected 2010 Monthly Average Z-6 Spot Gas Prices

Reference Month	Heat Rate threshold, mmBTU	2010 LBMP threshold, \$/MWh
Jan-10	8.687	<u>\$76.89</u>
Feb-10	8.929	<u>\$73.39</u>
Mar-10	9.926	<u>\$65.14</u>
Apr-10	10.287	<u>\$53.79</u>
May-10	12.080	<u>\$53.37</u>
Jun-10	11.970	<u>\$57.11</u>
Jul-10	13.724	<u>\$73.57</u>
Aug-10	13.450	<u>\$64.96</u>
Sep-10	12.865	<u>\$59.49</u>
Oct-10	11.872	<u>\$50.94</u>
Nov-10	11.825	<u>\$49.97</u>
Dec-10	8.694	<u>\$59.07</u>

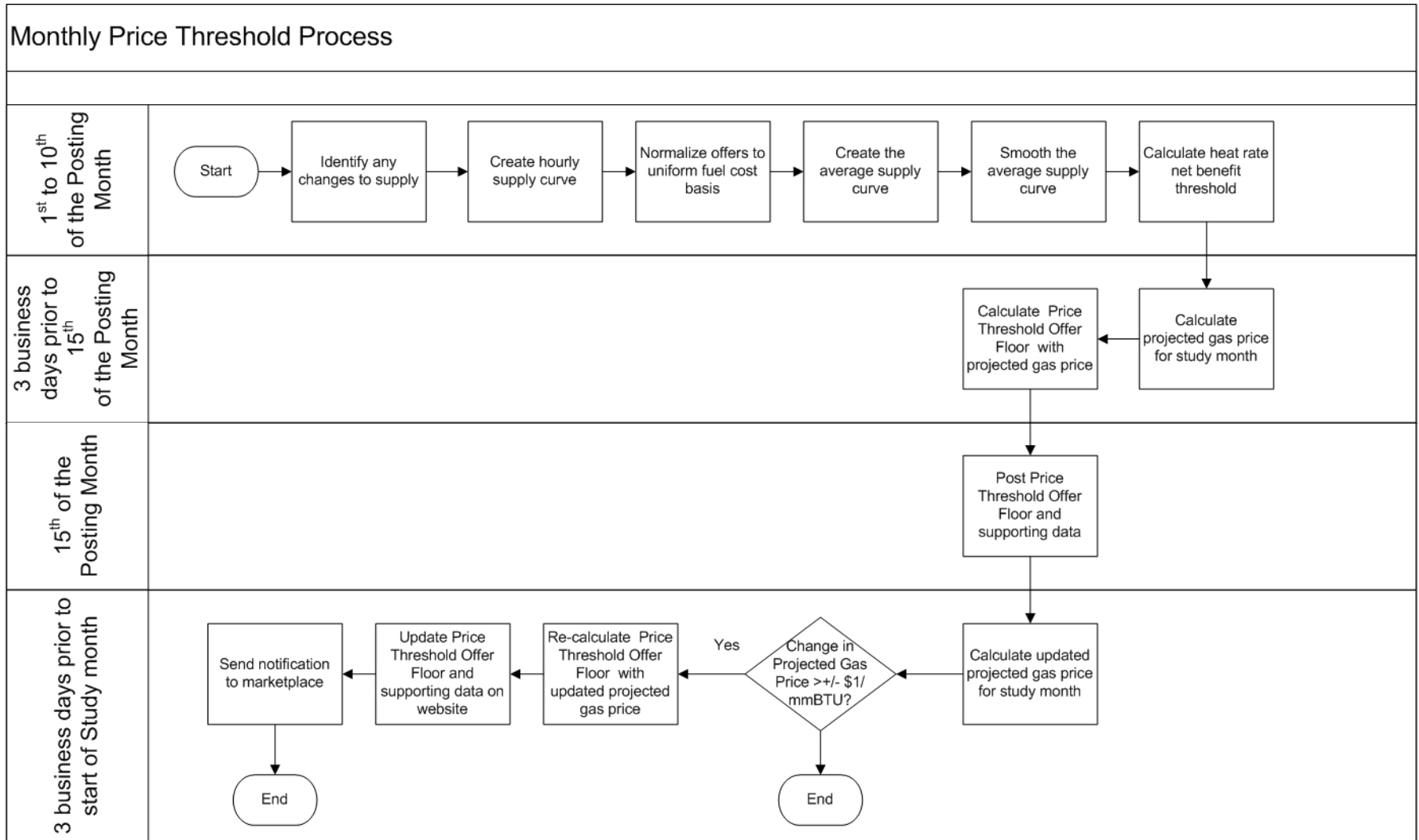
2011 Price Thresholds using Actual 2011 Monthly Average Z-6 Spot Gas Prices

Reference Month	Heat Rate threshold, mmBTU	2011 LBMP threshold, \$/MWh
Jan-10	8.687	\$81.91
Feb-10	8.929	\$57.23
Mar-10	9.926	\$48.44
Apr-10	10.287	\$47.32
May-10	12.080	\$55.45
Jun-10	11.970	\$59.52

2011 Price Thresholds using Projected 2011 Natural Gas Prices Based on 3-year Average

Reference Month	Heat Rate threshold, mmBTU	LMP threshold	Difference from Actual 2011 Monthly Average Spot Gas Prices
Jan-10	8.687	<u>\$70.43</u>	<u>\$11.48</u>
Feb-10	8.929	<u>\$55.84</u>	<u>\$1.39</u>
Mar-10	9.926	<u>\$46.40</u>	<u>\$2.04</u>
Apr-10	10.287	<u>\$45.96</u>	<u>\$1.36</u>
May-10	12.080	<u>\$55.38</u>	<u>\$0.06</u>
Jun-10	11.970	<u>\$57.18</u>	<u>\$2.34</u>
Jul-10	13.724	<u>\$72.77</u>	-

Monthly Timeline



Price Threshold Offer Floor

- ◆ **Calculated monthly and posted by the 15th of the month prior to the month for which it is effective**
- ◆ **NYISO Proposal: Monthly price threshold will become the DADRP Offer Floor and utilize existing offer validation rules**
 - *As currently implemented for DADRP, offers below the DADRP Offer Floor (monthly price threshold) will not validate in MIS*
- ◆ **Monthly Price Threshold Offer Floor will apply to all zones**

Cost Allocation

- ◆ **Current DADRP cost allocation method:**
 - *Each Zone (or set of Zones) are allocated the cost of the DADRP based upon its load ratio share on a daily basis using real-time metered daily load data and the static probability:*
 - (i) that no constraints existed;
 - (ii) that this Zone(s) was upstream of a constraint and curtailment occurred upstream; and
 - (iii) that this Zone(s) was downstream of a constraint and curtailment occurred downstream.
 - *For the purposes of DADRP cost allocation, four composite zones are used:*
 - West of Central-East (Zones A,B,C,D,E,);
 - East Upstate Excluding NYC and LI (Zones F,G,H,I);
 - New York City (Zone J); and
 - Long Island (Zone K).

Cost Allocation - continued

- ◆ **NYISO will keep the same cost allocation method for DADRP**
 - *Calculations described in Attachment R*
- ◆ **No change to interfaces are necessary**
 - *Central-East*
 - *Sprainbrook-Dunwoodie*
 - *Con Edison-Long Island*
- ◆ **Adjustments to coefficients are being finalized**

Measurement and Verification

- ◆ **NYISO is required to describe its Measurement and Verification (M&V) protocols and either:**
 - *Explain how existing protocols will ensure validity of reported reductions; or*
 - *Propose M&V protocol changes.*
- ◆ **NYISO analyzed current DADRP baseline and an alternative that reduced “look-back” and complicated exclusion rules**
 - *Used the same interval data provided for recent SCR baseline analysis*
 - *Tested current CBL and alternative with five schedules of increasing frequency*
 - *Calculated the Absolute Mean Error and Mean Error of the current CBL and the alternative*
- ◆ **Objective was to determine whether increased frequency degraded the integrity of the CBL**

Analysis Approach

- ◆ **Six schedule scenarios were created**

Scenario	Schedule frequency	Total Annual Hours Scheduled
1	No DADRP schedule	0
2	2 scheduled days per month	91
3	3 scheduled days every 2 weeks	268
4	4 scheduled days every 2 weeks	365
5	5 scheduled days every 2 weeks	457
6	6 scheduled days every 2 weeks	546

Analysis Approach - 2

- ◆ **Eight schedules, based on historical DADRP schedules, were randomly assigned**

Schedule	Schedule Time(s)	Scheduled Hours
1	HB 10 through HB 14	4
2	HB 15 through HB 19	5
3	HB 21 through HB 22	2
4	HB 13 through HB 18	6
5	HB 19	1
6	HB 7 through HB 9	3
7	HB 3 through HB 5	3
8	HB 13 through HB 16	4

- ◆ **Distribution of schedules over weekday types and schedule times was evaluated after random assignment to check for any bias by weekday type or scheduled hours**

Analysis Approach - 3

- ◆ **All 229 resources were processed through models for current CBL for DADRP and alternative**
 - *Current CBL for DADRP was not processed through Scenario 1 because the current CBL needs a schedule to begin the 10-day selection process*
- ◆ **One benefit to using the data from the SCR baseline analysis was that 2008 had no reliability events**
- ◆ **One drawback to using the data from the SCR baseline analysis was that only 69 resources had a full year's worth of data, the remainder had only data for the Summer Capability Period**
 - *This resulted in reducing the number of hours scheduled to only the summer months of May through October for all resources*

Alternative CBL

- ◆ **Called “10-Day CBL” for analysis**
 - *10-day CBL for weekday schedules*
- ◆ **Objectives**
 - *To maintain “look-back” days that are contemporary to the schedule for which the CBL is being created*
 - *To simplify exclusion rules by having a value for each of the 10 most recent days*
- ◆ **Structure of the 10-Day CBL**
 - *Uses only the previous 10 weekdays that were not holidays*
 - *Substitutes the CBL of the hour as proxy for any hour with a schedule*

How to Calculate the 10 Day CBL

- ◆ **Use previous 10 business days of actual load data for that hour**
- ◆ **Identify which hours need to be replaced with CBL values as a result of being scheduled**
- ◆ **Substitute a previous 10-Day CBL calculation for any scheduled hour**
- ◆ **Rank the data, take the highest five hours and compute the average**
- ◆ **Use the value as the 10-Day CBL for that hour.**

Calculating a 10-day CBL

Date	HB	Load	Exclude?	10 Day CBL
3/10/2010	12:00	223.6	N	223.6
3/11/2010	12:00	217.4	N	217.4
3/12/2010	12:00	210.8	N	210.8
3/13/2010	12:00	213.5	N	213.5
3/14/2010	12:00	204.0	N	204.0
3/15/2010	12:00	200.0	Y (Sat)	200.0
3/16/2010	12:00	204.9	Y (Sun)	202.9
3/17/2010	12:00	210.6	Y (sched)	210.6
3/18/2010	12:00	202.0	Y (sched)	202.0
3/19/2010	12:00	205.3	N	205.3
3/20/2010	12:00	201.8	N	202.5
3/21/2010	12:00	210.7	N	210.7
3/22/2010	12:00	204.6	Y (Sat)	204.6
3/23/2010	12:00	205.3	Y (Sun)	205.3
3/24/2010	12:00	204.0	N	204.0
3/25/2010	12:00	195.0	N	197.0
3/26/2010	12:00	191.2	Y (sched)	191.0
3/27/2010	12:00	190.5		10 Day CBL

To do this we use the previous 10 business days (scheduled or not) for the hour being calculated.

We want to calculate the value of the 10 Day CBL for this day and hour.

Exclude Weekends, Substitute CBL Values for Scheduled Hours

Date	HB	Load	Exclude?	10 Day CBL
3/10/2010	12:00	223.6	N	223.6
3/11/2010	12:00	217.4	N	217.4
3/12/2010	12:00	210.8	N	210.8
3/13/2010	12:00	213.5	N	213.5
3/14/2010	12:00	204.0	N	204.0
3/15/2010	12:00	200.0	Y (Sat)	200.0
3/16/2010	12:00	204.9	Y (Sun)	202.9
3/17/2010	12:00	210.6	Y (sched)	210.6
3/18/2010	12:00	202.0	Y (sched)	202.0
3/19/2010	12:00	205.3	N	205.3
3/20/2010	12:00	201.8	N	202.5
3/21/2010	12:00	210.7	N	210.7
3/22/2010	12:00	204.6	Y (Sat)	204.6
3/23/2010	12:00	205.3	Y (Sun)	205.3
3/24/2010	12:00	204.0	N	204.0
3/25/2010	12:00	195.0	N	197.0
3/26/2010	12:00	191.2	Y (sched)	191.0
3/27/2010	12:00	190.5		TBD

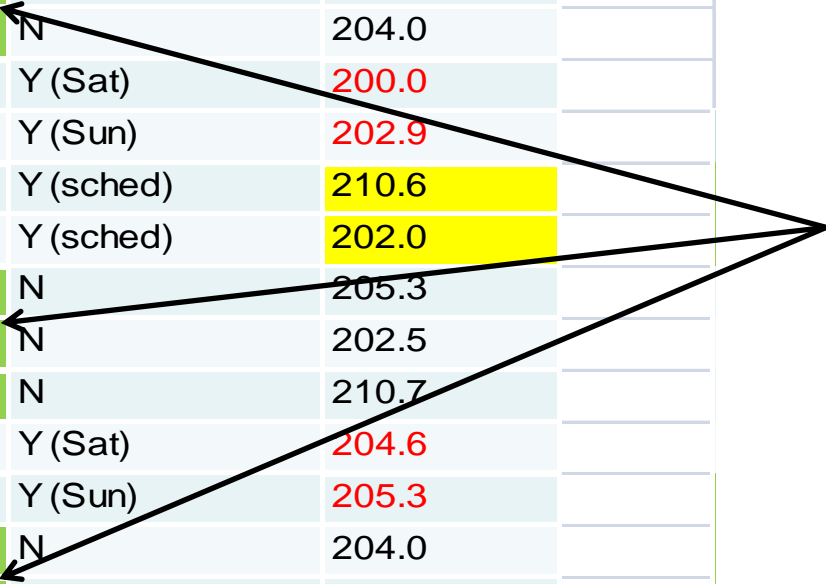
For weekday schedules, exclude all weekend intervals.

Substitute 10 Day CBL values that were previously calculated for intervals that were scheduled.

Use Actual Loads for Days with No Schedule

Date	HB	Load	Exclude?	10 Day CBL
3/10/2010	12:00	223.6	N	223.6
3/11/2010	12:00	217.4	N	217.4
3/12/2010	12:00	210.8	N	210.8
3/13/2010	12:00	213.5	N	213.5
3/14/2010	12:00	204.0	N	204.0
3/15/2010	12:00	200.0	Y (Sat)	200.0
3/16/2010	12:00	204.9	Y (Sun)	202.9
3/17/2010	12:00	210.6	Y (sched)	210.6
3/18/2010	12:00	202.0	Y (sched)	202.0
3/19/2010	12:00	205.3	N	205.3
3/20/2010	12:00	201.8	N	202.5
3/21/2010	12:00	210.7	N	210.7
3/22/2010	12:00	204.6	Y (Sat)	204.6
3/23/2010	12:00	205.3	Y (Sun)	205.3
3/24/2010	12:00	204.0	N	204.0
3/25/2010	12:00	195.0	N	197.0
3/26/2010	12:00	191.2	Y (sched)	191.0
3/27/2010	12:00	190.5		TBD

We use actual values where the day was not scheduled.



Rank and Average

213.5
204.0
210.6
202.0
205.5
201.8
210.7
204.0
195.0
191.0

191.0
195.0
201.8
202.0
204.0
204.0
205.5
210.6
210.7
213.5

204.0
205.0
210.6
210.7
213.5

204.0
205.0
210.6
210.7
213.5
208.8

Get the 10 values



Rank them



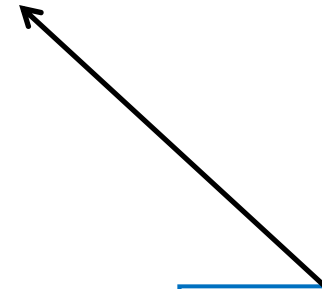
Take the highest five values



Calculate the Average

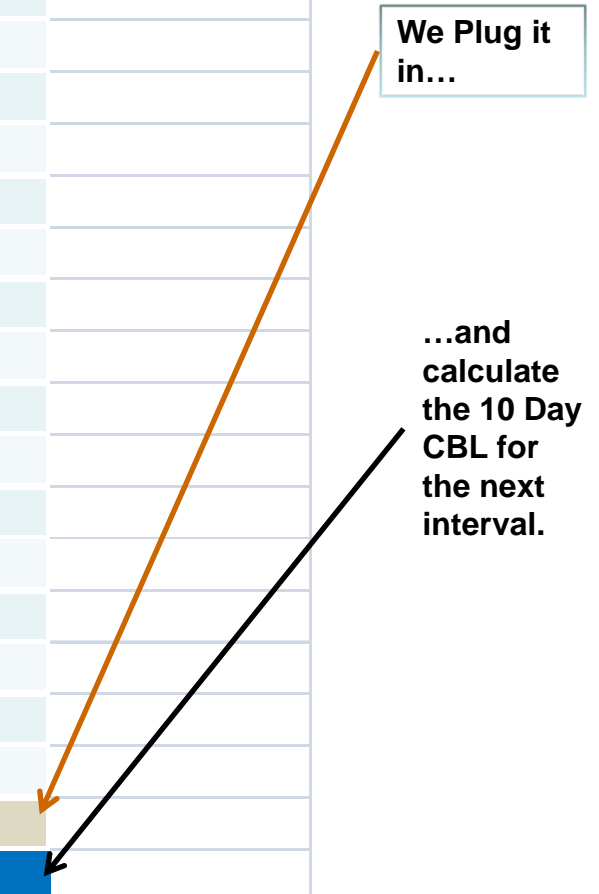


This is the 10 Day CBL for this hour of this day.



10-Day CBL Created for This Interval

3/10/2010	12:00	223.556	N	223.6	
3/11/2010	12:00	217.388	N	217.4	
3/12/2010	12:00	210.788	N	210.8	
3/13/2010	12:00	213.544	N	213.5	
3/14/2010	12:00	203.981	N	204.0	
3/15/2010	12:00	200.044	Y (Sat)	200.0	
3/16/2010	12:00	204.919	Y (Sun)	202.9	
3/17/2010	12:00	210.563	Y (sched)	210.6	
3/18/2010	12:00	202.013	Y (sched)	202.0	
3/19/2010	12:00	205.331	N	205.3	
3/20/2010	12:00	201.75	N	202.5	
3/21/2010	12:00	210.713	N	210.7	
3/22/2010	12:00	204.563	Y (Sat)	204.6	
3/23/2010	12:00	205.294	Y (Sun)	205.3	
3/24/2010	12:00	204.038	N	204.0	
3/25/2010	12:00	195.019	N	197.0	
3/26/2010	12:00	191.156	Y (sched)	191.0	
3/27/2010	12:00	190.538	Y (sched)	208.8	
3/28/2010	12:00	195.844		TBD	



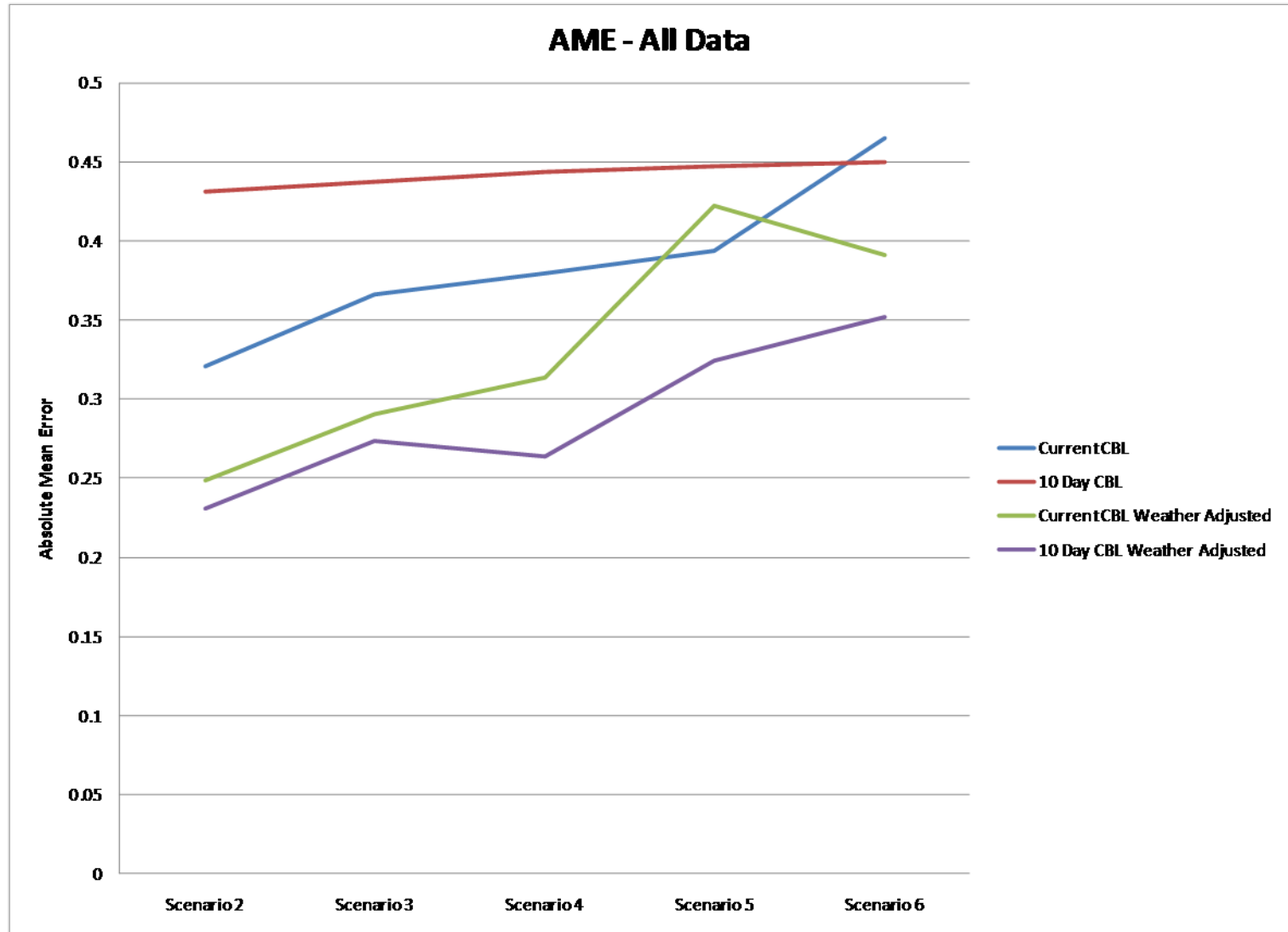
We Plug it in...

...and calculate the 10 Day CBL for the next interval.

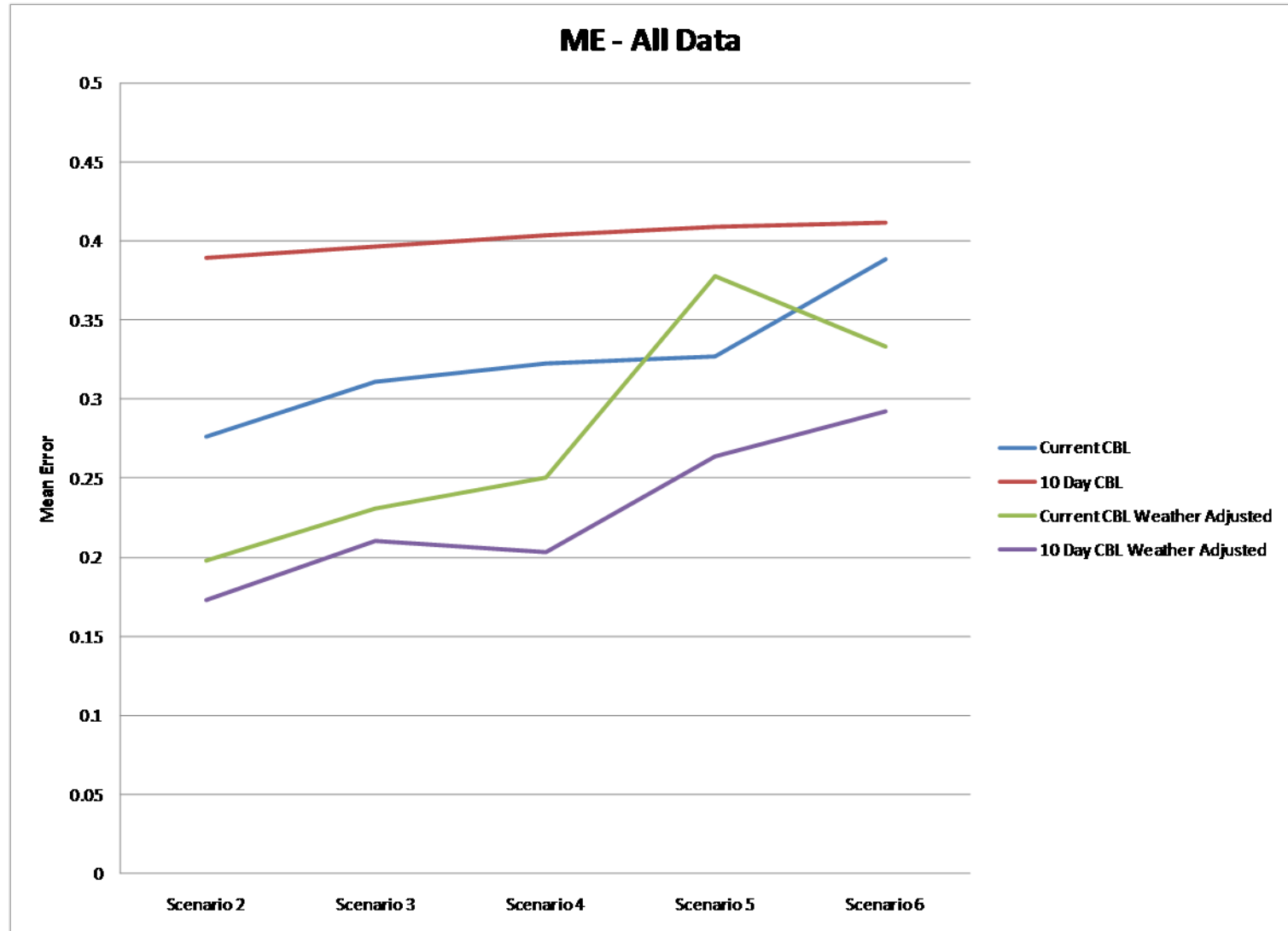
Results of CBL Analysis

- ◆ **Alternative 10-day CBL with in-day adjustment shows lowest Absolute Mean Error and Mean Error over all Scenarios**
 - *Best predictor and lowest bias*
- ◆ **Alternative 10-day CBL shows highest Absolute Mean Error and Mean Error over all Scenarios but shows no variability over time**
 - *Increases in frequency of schedule do not degrade the 10-day CBL*
- ◆ **Current DADRP CBL shows increases in both Absolute Mean Error and Mean Error as frequency of scheduled hours increases**

Average Mean Error



Mean Error



Conclusions from CBL Analysis

- ◆ **Frequency of scheduled hours in scenarios evaluated was not sufficient to conclusively determine which CBL would produce more accurate CBLs**
 - *However, 10-day CBL shows very little degradation over the scenarios evaluated*
 - *And, 10-day CBL with in-day adjustment produced lowest bias*
- ◆ **Additional analysis of 10-day CBL with some modifications may produce lower errors**

Implementation of Order 745 Compliance

- ◆ **The NYISO intends to request an extension for implementation of the changes to DADRP described in the July 22 compliance filing**
 - *Several systems will need to be modified to support the calculation of the Price Threshold Offer Floor*
 - *The length of the extension will be timed to not interfere with NYISO's Sarbanes-Oxley requirements.*
 - **A minimum of 120 days will be requested**

Next Steps

- ◆ **Compliance filing due date is July 22**
- ◆ **NYISO is requesting a two-week extension on the compliance filing to allow for stakeholder comments**
 - *July 22: NYISO makes tariff language available to stakeholders*
 - *July 27: Written comments due from stakeholders*
 - *Jul 28-August 4: NYISO reviews stakeholder comments and modifies tariff language as necessary*
 - *August 5: NYISO makes compliance filing on Order 745*

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and conducts reliability and resource planning for the state's bulk electricity system.



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