



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

(Docket RM10-17-000)

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August 9, 2011

Topics

- ◆ **Net Benefits Test and Price Threshold Calculations**
- ◆ **Measurement and Verification**
- ◆ **Cost Allocation**
- ◆ **Implementation**
- ◆ **Next Steps**

Net Benefit Test and Price Threshold - Stakeholder Comments

- ◆ **Hours used to develop average supply curve**
 - *Expand supply curve to include all 24 hours of all days*
 - *Include all 24 hours of weekdays*
 - *Limit to hours HB 13 through HB 19 for weekdays only*
- ◆ **Elasticity should be calculated based on price not heat rate**
- ◆ **Price Thresholds seem significantly higher than other ISO/RTOs**
- ◆ **Why is NYISO only calculating one supply curve and one price threshold**
- ◆ **Gas Prices**
 - *Explain why 3-year basis adjustment is not a weighted average*
 - *Explain why change in gas price is being based on a fixed dollar amount instead of a percentage change*

Hours used to develop average supply curve

- ◆ **NYISO compared the supply curve based on the HB 13 through HB19, All Days, to supply curves based on:**
 - *All Days, All Hours*
 - *Weekdays, All Hours*
 - *HB 13 – HB19, weekdays only*
- ◆ **Findings:**
 - *Including or excluding weekends had little to no impact*
 - *Excluding non-peak load hours (HB0 – HB12, HB 20 – HB23) tends to result in somewhat higher heat rates (from 3% to 16% higher)*
 - **NYISO believes that portions of the non-peak supply curve are not representative, driven by bidding behavior specific to non-peak hours**
 - For example: bidding to stay on overnight, bidding to manage natural gas nominations, and hydro schedules
- ◆ **NYISO believes that using HB13 through HB19 for all days produces an appropriately representative supply curve on which to conduct the net benefits test.**

Elasticity should be calculated based on price not heat rate

- ◆ **NYISO chose to calculate the elasticity based on the estimated supply curve expressed in terms of heat rate, then convert the threshold point to a power price, based on the projected gas price**
- ◆ **This is mathematically equivalent to first converting the heat rate supply curve to a power price supply curve based on the projected gas price and then calculating the elasticity.**
- ◆ **See Supplemental Document: “Regarding the Order of steps 7 and 8 in the NYISO’s Net Benefit Test and Price Threshold Calculation” for full description of the mathematical equivalence.**

Price Thresholds are Significantly Higher Than Other ISO/RTOs

- ◆ **NYISO LBMPs are generally higher than other ISOs, resulting in higher heat rates and higher price thresholds**
 - *Comparison of LMPs for CAISO, PJM, ISO-NE shows NYISO average LMPs exceed others during the period of August 2010 and June 2011*
 - **CAISO average LMPs were 32% to 85 % of NYISO LMPs**
 - **PJM average LMPs were 57% to 99% of NYISO LMPs**
 - **ISO-NE average LMPs were 69% to 105 % of NYISO LMPs**

Comparison of NYISO LMPs to other ISOs/RTOs

On average, NYISO's LBMPs exceed nearly all average LMPs of CAISO, PJM, and ISO-NE

Price Threshold Comparison using Projected 2010 and 2011 Prices

Based on Prices for Hours 13 Through 19

Month	Threshold Price	NY Zone J	NY Zone F	NY Zone J + F Average LBMP	PJM West	PJM West As a % of NY Average LBMP	ISO NE Hub	ISO NE Hub as a % of NY Average LBMP	CAISO SP 15	CAISO SP 15 as a % of NY Average LBMP
Aug-10	\$ 68.56	\$ 93.07	\$ 63.68	\$ 78.37	\$ 71.20	90.84%	\$ 70.95	90.53%	\$ 42.55	54.29%
Sep-10	\$ 62.76	\$ 66.69	\$ 53.00	\$ 59.84	\$ 55.63	92.96%	\$ 56.44	94.31%	\$ 42.77	71.48%
Oct-10	\$ 53.92	\$ 47.56	\$ 40.33	\$ 43.95	\$ 41.03	93.37%	\$ 41.38	94.15%	\$ 37.42	85.14%
Nov-10	\$ 54.99	\$ 48.04	\$ 46.61	\$ 47.32	\$ 41.85	88.43%	\$ 49.94	105.53%	\$ 34.72	73.37%
Dec-10	\$ 72.72	\$ 105.71	\$ 90.38	\$ 98.04	\$ 60.67	61.88%	\$ 73.70	75.17%	\$ 33.46	34.12%
Jan-11	\$ 81.82	\$ 108.78	\$ 95.81	\$ 102.30	\$ 58.45	57.13%	\$ 79.61	77.83%	\$ 32.84	32.10%
Feb-11	\$ 63.18	\$ 87.25	\$ 75.45	\$ 81.35	\$ 44.33	54.49%	\$ 61.03	75.02%	\$ 31.11	38.25%
Mar-11	\$ 51.28	\$ 64.57	\$ 55.94	\$ 60.26	\$ 41.48	68.84%	\$ 49.50	82.14%	\$ 28.99	48.11%
Apr-11	\$ 53.13	\$ 70.44	\$ 46.09	\$ 58.27	\$ 45.57	78.20%	\$ 45.97	78.90%	\$ 34.17	58.64%
May-11	\$ 59.05	\$ 65.67	\$ 45.85	\$ 55.76	\$ 55.41	99.38%	\$ 47.45	85.09%	\$ 32.41	58.12%
Jun-11	\$ 61.01	\$ 105.60	\$ 48.71	\$ 77.15	\$ 74.47	96.52%	\$ 53.40	69.21%	\$ 41.85	54.25%
Averages	\$ 62.04	\$ 78.49	\$ 60.17	\$ 69.33	\$ 53.64	77.38%	\$ 57.21	82.53%	\$ 35.66	51.44%

Comparison of NYISO Price Thresholds to Other ISOs/RTOs

- ◆ **CAISO threshold prices in Order 745 filing:**
 - *On-Peak: \$46.59 - \$54.30*
 - *Off-Peak: \$46.30 – \$53.79*

- ◆ **PJM threshold prices in Order 745 filing:**
 - *\$34.07 – \$40.49*

- ◆ **ISO-NE threshold prices (June 2, 2011 presentation):**
 - *GE MAPS simulation results: \$36.70 –\$68.90*
 - *Average Offer Curves: \$35.50 – \$51.20*

- ◆ **NYISO threshold prices**
 - *\$51.28 - \$81.82*

NYISO Price Thresholds

Revised from July 18, 2011 to account for retirements that occurred between December 2009 through March 2011 in the Net Benefit Test and Price Threshold calculation

				All Days HB13-19	
Study Month	Reference Month	Publishing Month	Projected Monthly Avg Natural Gas: 3-Yr Straight Avg	Heat Rate threshold, mmBTU	LBMP threshold, \$/MWh
Aug-10	Aug-09	10-Jul	\$4.83	14.195	\$ 68.56
Sep-10	Sep-09	10-Aug	\$4.62	13.593	\$ 62.76
Oct-10	Oct-09	10-Sep	\$4.29	12.566	\$ 53.92
Nov-10	Nov-09	10-Oct	\$4.23	13.014	\$ 54.99
Dec-10	Dec-09	Nov-10	\$6.80	10.696	\$ 72.72
Jan-11	Jan-10	Dec-10	\$8.11	10.086	\$ 81.82
Feb-11	Feb-10	Jan-11	\$6.25	10.113	\$ 63.18
Mar-11	Mar-10	Feb-11	\$4.70	10.918	\$ 51.28
Apr-11	Apr-10	Mar-11	\$4.47	11.891	\$ 53.13
May-11	May-10	Apr-11	\$4.58	12.881	\$ 59.05
Jun-11	Jun-10	May-11	\$4.78	12.770	\$ 61.01
Jul-11	Jul-10	Jun-11	\$5.31	14.156	\$ 75.11

A Single Supply Curve and Price Threshold

◆ Paragraph 79:

- *“ First we direct each RTO and ISO to undertake an analysis on a monthly basis, based on historical data and the RTO’s or ISO’s previous year’s supply curve, to identify a price threshold to estimate where customer net benefits, as defined herein, would occur.”*

◆ Footnote 161:

- *“The ISOs and RTOs are to select a representative supply curve for the study month, smooth the supply curve using numerical methods, and find the price/quantity pair above which a one megawatt reduction in quantity that is paid LMP would result in a larger percentage decrease in price than the corresponding percentage decrease in quantity (billing units). Beyond that point, a reduction in quantity everywhere along an upward sloping supply curve would be cost-effective.”*

◆ NYISO’s interpretation of these sections of the Order is a single supply curve and price threshold

Gas Prices for Calculating the Price Threshold - Basis Adjustment

- ◆ **Explain why the three-year basis adjustment is not a weighted average**
 - *NYISO analyzed the difference in using a weighted average and a straight average for the three-year basis adjustment*
 - *NYISO found that a weighted average that weighed more recent years more heavily was not a better predictor over the last 5 1/2 years*
 - *NYISO proposes to use a straight average for the three-year basis adjustment*

Gas Prices for Calculating the Price Threshold - Gas Price Threshold

- ◆ **Explain why the end of month change in gas price threshold is based on a fixed dollar threshold instead of a percentage change**
 - *The Price Threshold Offer Floor depends both on the fuel price and the heat rate.*
 - Therefore a significant change to the Price Threshold Offer Floor depends on the interaction between the fuel price and the heat rate.
 - *To meet FERC's requirement that "the supply curve analyses for all months should be updated and posted on the RTO website if a significant change to the composition or slope of the historic monthly curves occurs" (§81), the NYISO is proposing to use a threshold of $\pm\$1/\text{mmBTU}$ change in the gas price because it corresponds to a maximum change in the monthly Price Threshold Offer Floor of $\pm\$10.09/\text{MWh}$ to $\pm\$14.29/\text{MWh}$ (using the monthly heat rates calculated for August 2010-July 2011).*
 - The NYISO does not believe that a percentage change gas price threshold would be an appropriate threshold.



NYISO's Proposed Net Benefits Test and Price Threshold Offer Floor

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**

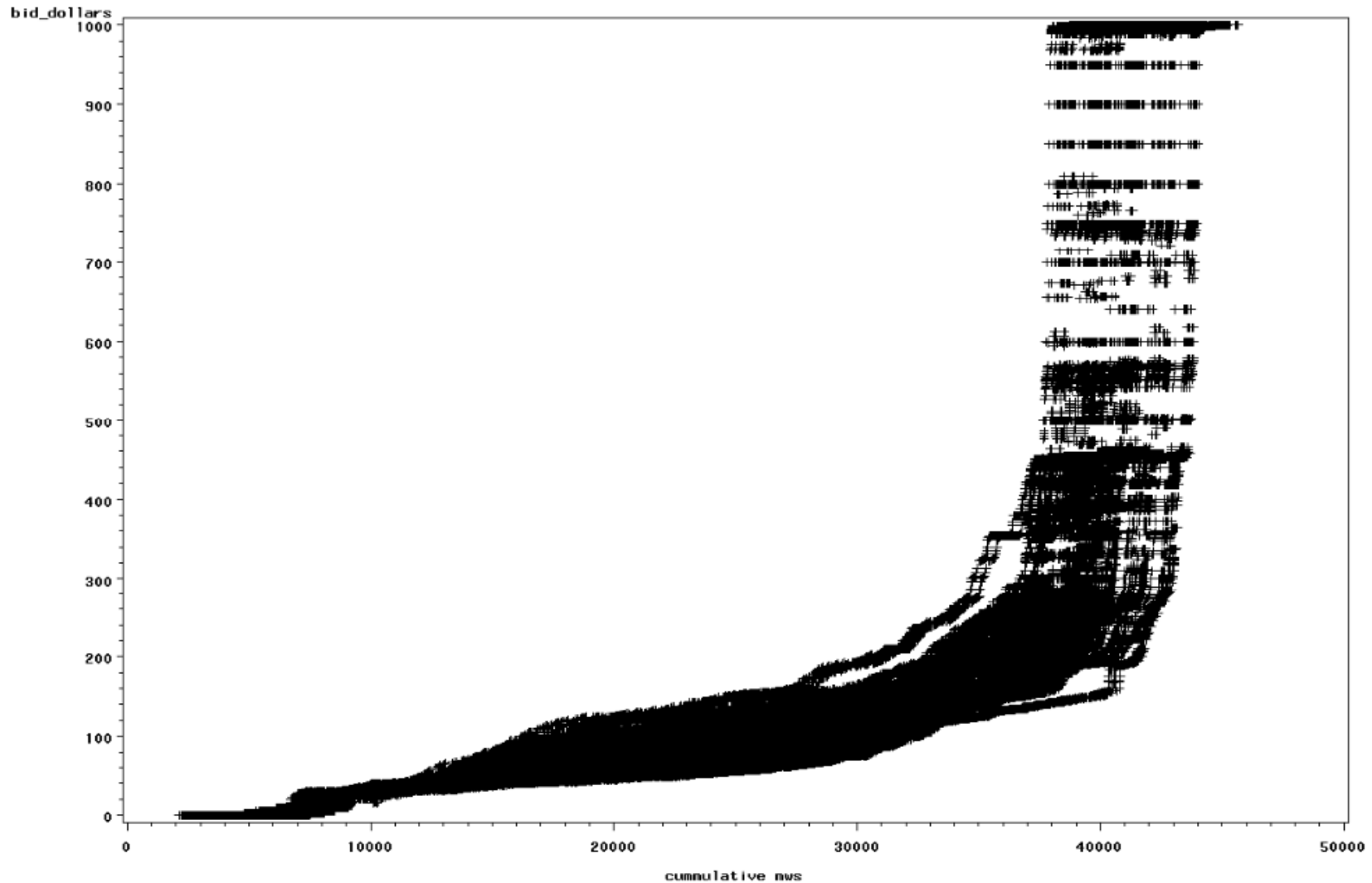
Step 2b: Update Changes to Supply for New Entrants

- ◆ **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

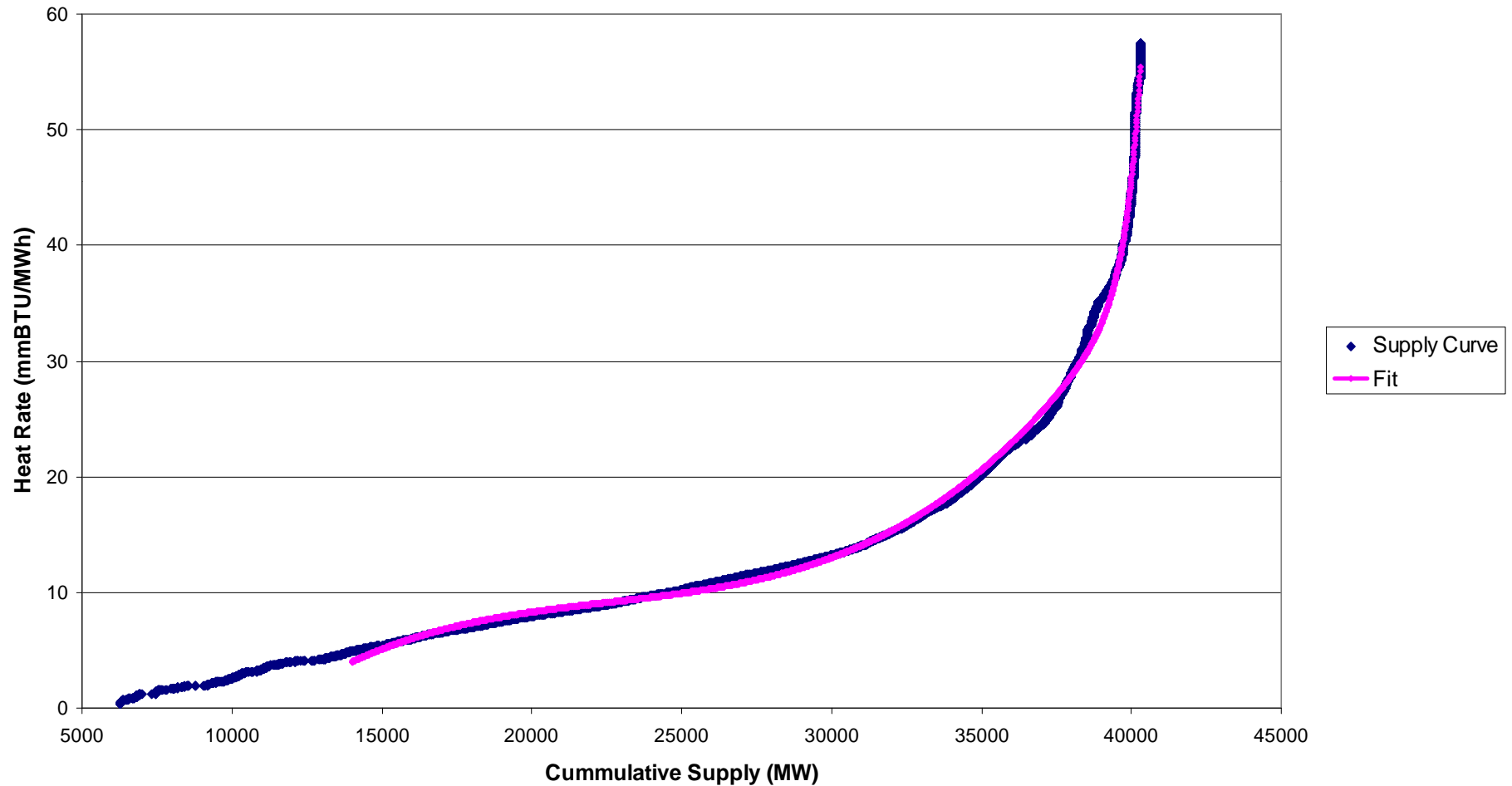
- ◆ **Average Supply Curve for a month (quantity offered at each heat rate level) will be created by horizontal averaging of the hourly supply curves**
 - *For a 30 day month: 7 hours x 30 days = 210 hourly supply curves*
 - *Divide each total MW offer quantity by 210*

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*

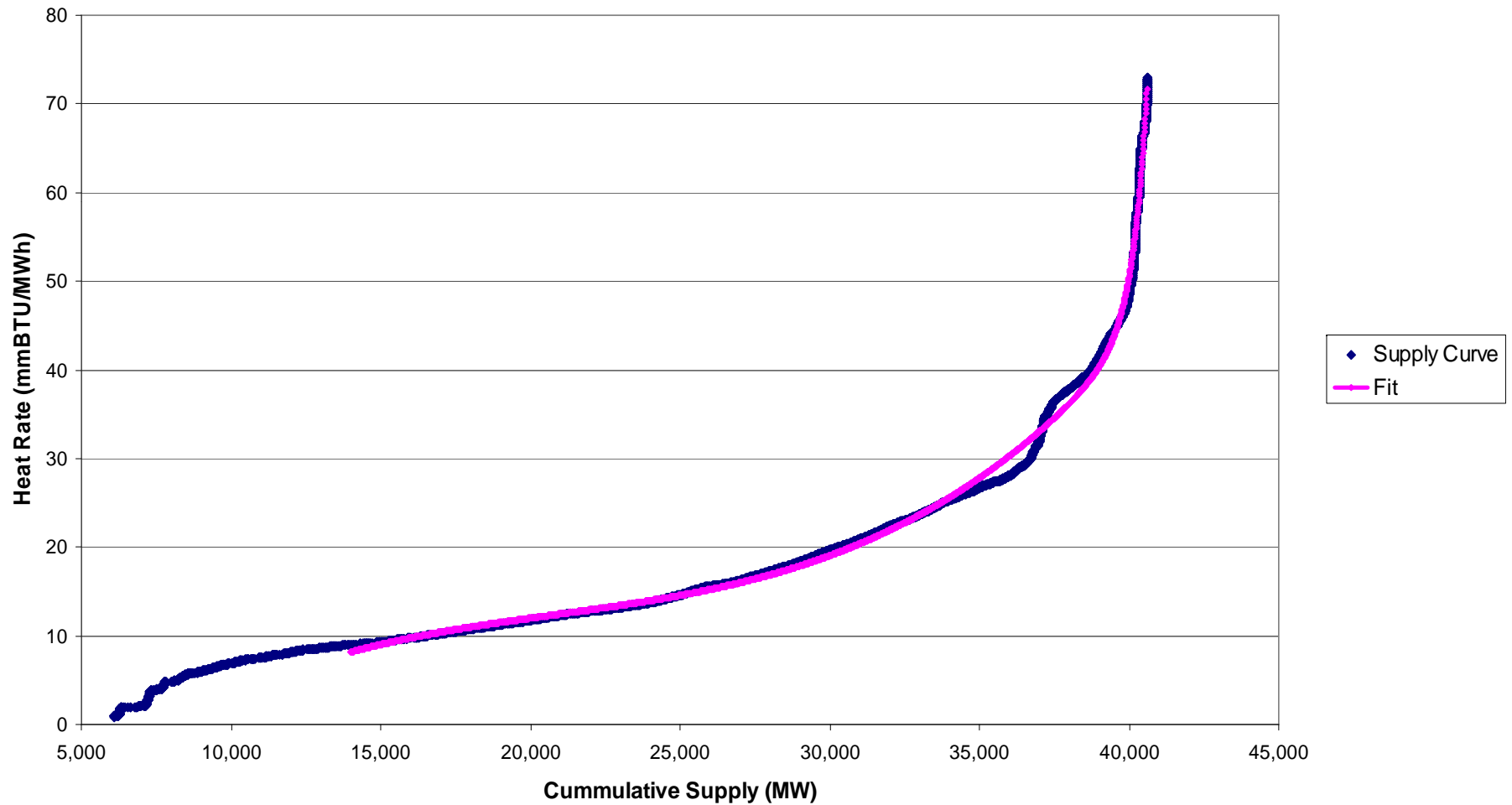
Smoothed Average Supply Curve

January 2010 Average Supply Curve and Smoothed Fit



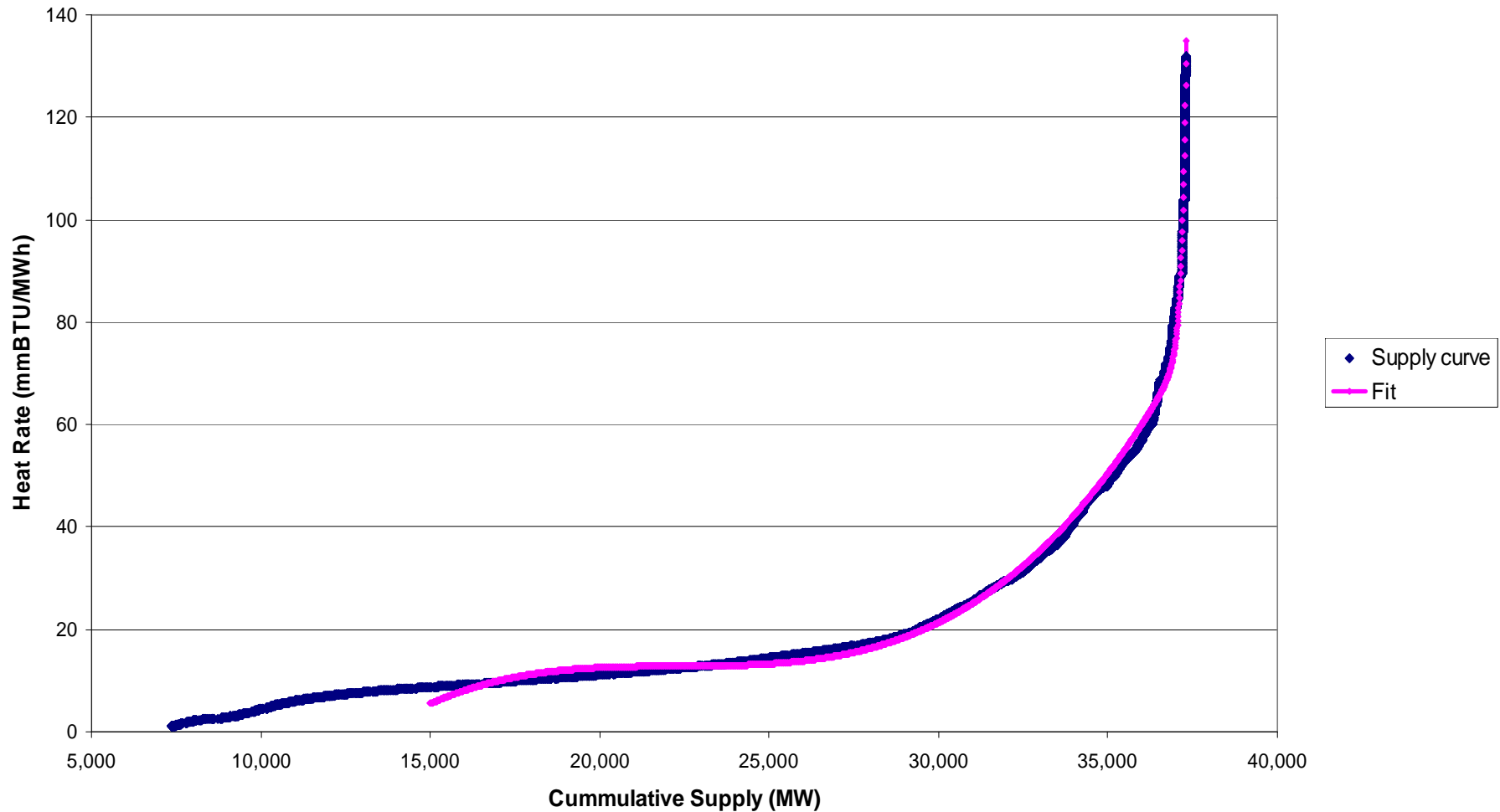
Smoothed Average Supply Curve

July 2010 Average Supply Curve and Smoothed Fit



Smoothed Average Supply Curve

November 2009 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 =*

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

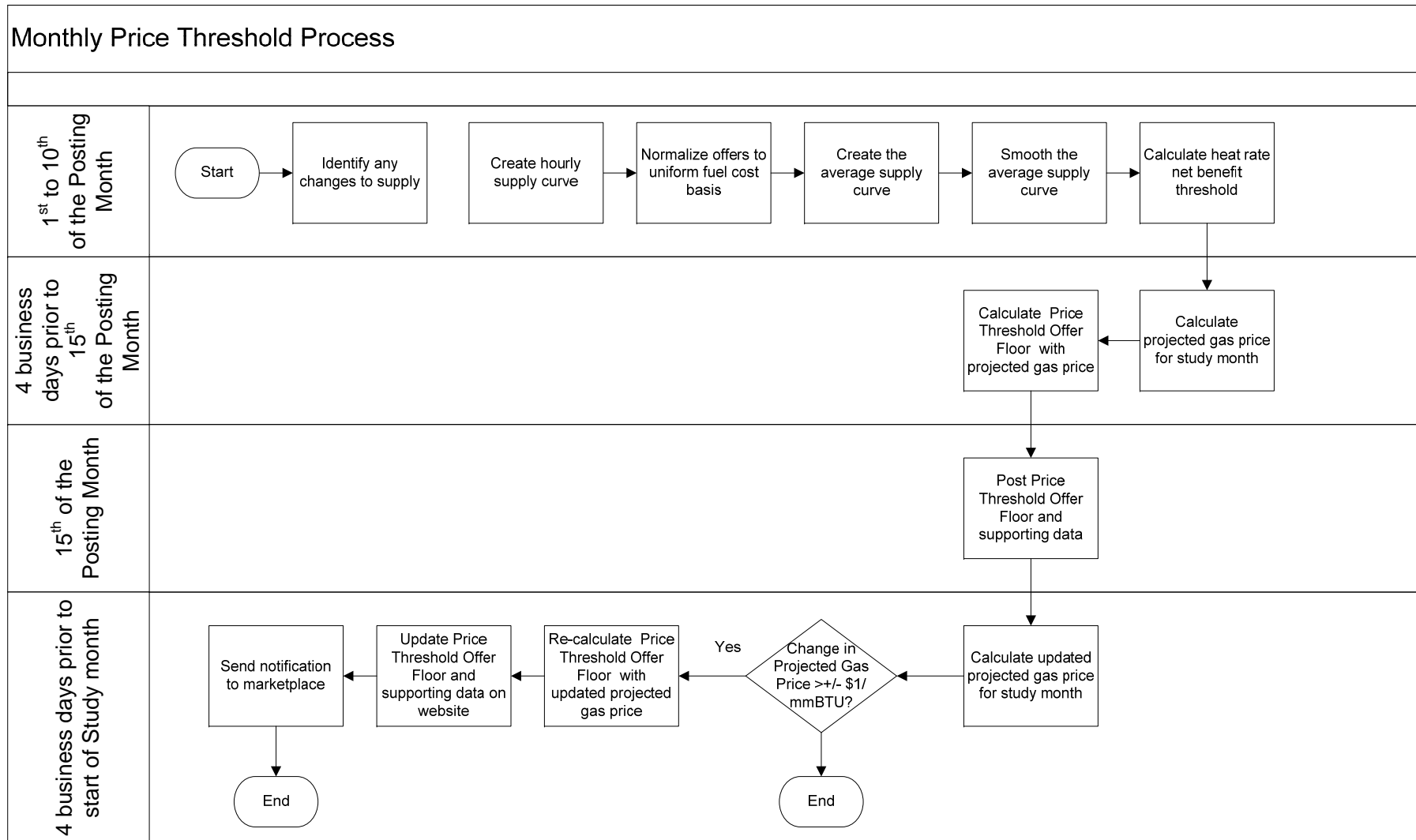
Step 8: Calculate Net Benefit Price Threshold based on Projected Gas Price for Study Month

- ◆ **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*

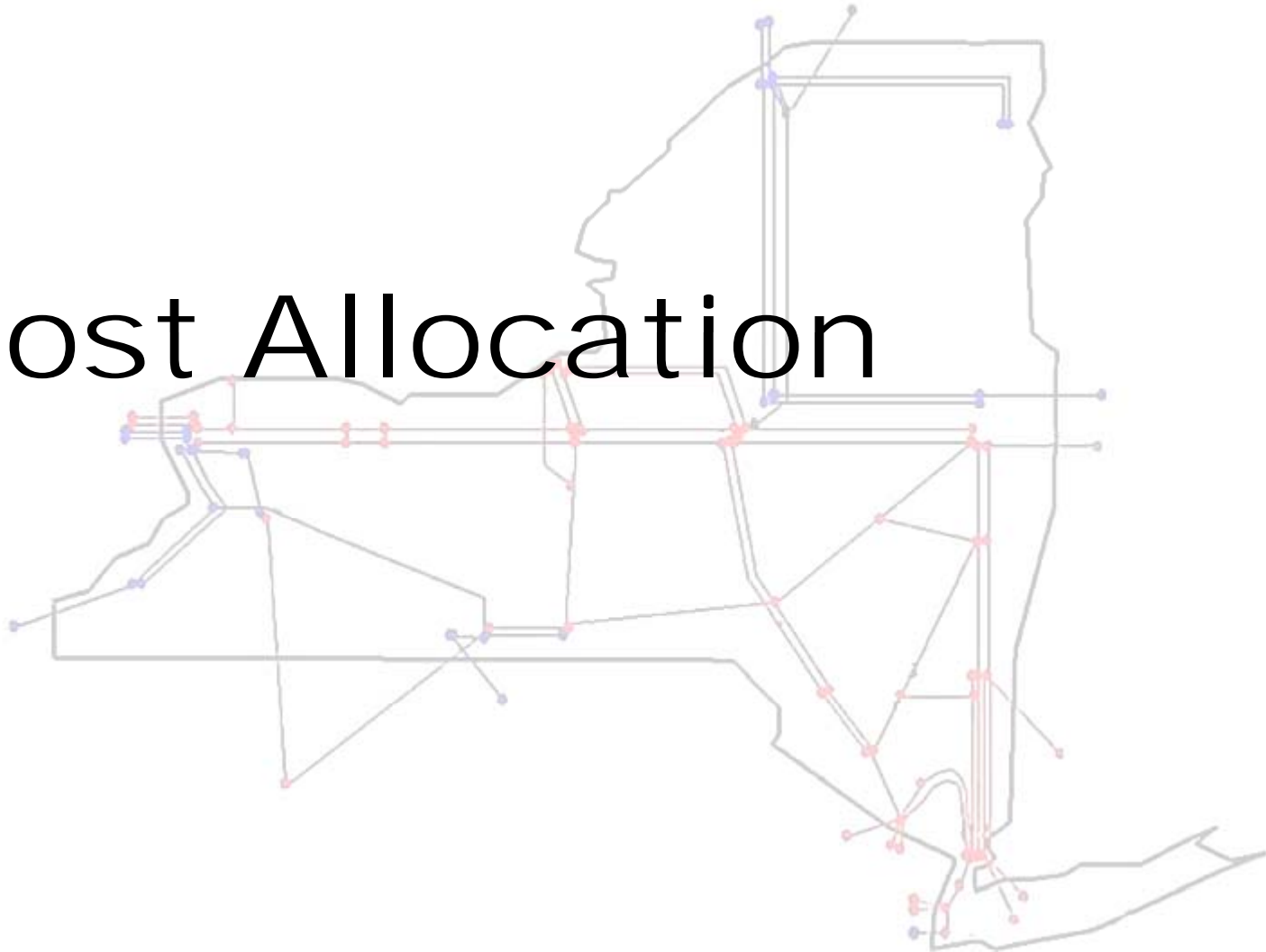
Monthly Timeline



Price Threshold Offer Floor

- ◆ **Calculated monthly and posted by the 15th of the month prior to the month for which it is effective. May be updated at the end of the month (see Step 9).**
- ◆ **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



Cost Allocation - Stakeholder Comments

- ◆ **Currently Attachment R does not address how costs should be allocated when multiple interfaces are constrained**
- ◆ **Cost allocation to the relevant market**
 - *Market participants with bilateral contracts should not be required to pay for demand response in day-ahead market*
- ◆ **Sub-zonal cost allocation**

Attachment R does not address constraints multiple interfaces

- ◆ **NYISO conducted additional analysis to determine whether additional coefficients were needed**
- ◆ **NYISO is proposing to modify Attachment R to add four coefficients to allocate costs for the percentage of time that multiple interfaces are constrained**
 - *a5 = fraction of time when Central East and Sprainbrook-Dunwoodie interfaces are constraining*
 - *a6 = fraction of time when Central East, Con Ed-Long Island and Y49/Y50 interfaces are constraining*
 - *a7 = fraction of time when Sprainbrook-Dunwoodie, Con Ed-Long Island and Y49/Y50 interfaces are constraining*
 - *a8 = fraction of time when Central East, Sprainbrook-Dunwoodie, Con Ed-Long Island and Y49/Y50 interfaces are constraining*

Cost Allocation to the Relevant Market

- ◆ **NYISO believes the beneficiaries of DADRP should pay for the costs of the program**
- ◆ **Since DADRP ultimately reduces actual load, all loads share in the benefits of the load reduction**
- ◆ **All load, whether Day Ahead scheduled, Real time scheduled, or bilaterally scheduled, is actually consumed in real time and therefore all load benefits from load reductions scheduled in the NYISO's DADRP.**
- ◆ **The impact DADRP has on local Real Time LBMPs is reflected directly in the NYISO Real Time price. Ultimately these DADRP impacts affect the NYISO Day Ahead and the bilateral market prices through the expectations of market participants and arbitrage between markets.**
- ◆ **Therefore, the NYISO believes it is appropriate to share the cost of DR among all load, be it bilaterally, Day Ahead or Real Time scheduled.**

Sub-zonal Cost Allocation

- ◆ **While conceptually it can be done similarly to local DAMAP and local BPCG, a more complex cost allocation would be required than proposed for compliance with Order 745**
- ◆ **This may be evaluated as part of the Dynamic Net Benefits Study compliance filing in 2012**

NYISO's Cost Allocation Proposal

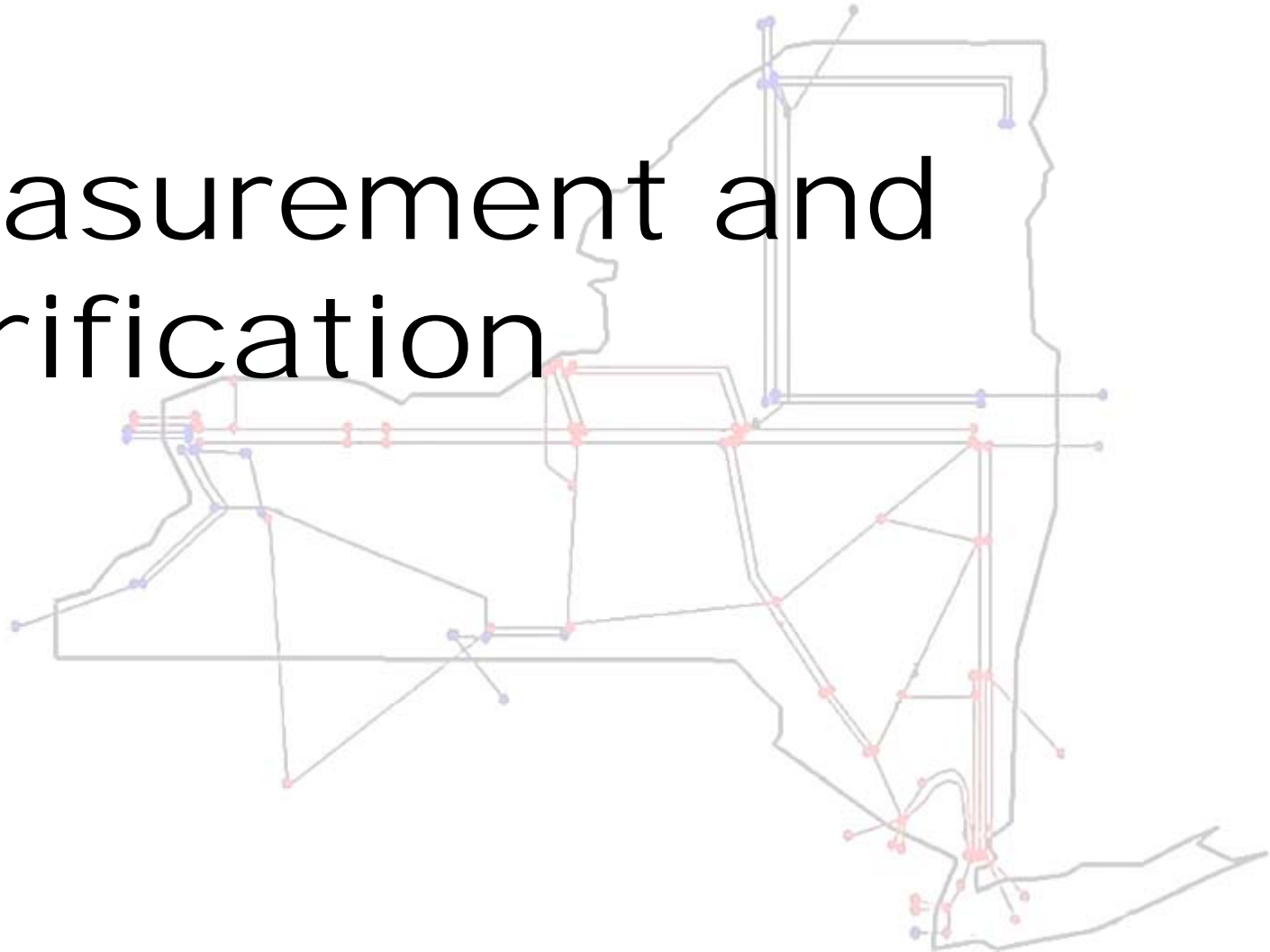
- ◆ **No change to interfaces are necessary**
 - *Central-East*
 - *Sprainbrook-Dunwoodie*
 - *Con Edison-Long Island*

- ◆ **Expand coefficients from four to eight to reflect cost allocation for multi-zone constraints**
 - *Modify Attachment R*

Cost Allocation Coefficients

Constraints	Coefficient	Current values	Proposed Coefficients using 2010 Data
No Constraint	a1	0.364	0.403
At Central East	a2	0.049	0.083
At Dunwoodie South	a3	0.036	0.184
At ConED - LIPA	a4	0.551	0.085
Central East and Con Ed	a5	-	0.042
Central East and LI	a6	-	0.096
Con Ed and LI	a7	-	0.053
Central East, Con Ed and LI	a8	-	0.055

Measurement and Verification



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

- ◆ **All 229 resources were processed through models for current CBL for DADRP and alternatives**
 - *Summer months only*
- ◆ **Two additional scenarios were added since July 18 to further test the robustness of the current CBL and the alternatives**
 - *Scenario 7 increased number of scheduled hours by 50%*
 - *Scenario 8 increased number of scheduled hours by an additional 25% over Scenario 7*
- ◆ **Two modifications to the 10-day CBL were analyzed to improve the accuracy of the CBL**
 - *A five-day average where the highest two values are eliminated*
 - *The median of the 10 ranked values*

Analysis Approach

- ◆ **Seven schedule scenarios were created**
 - *Scenario 1 was not used because Current CBL for DADRP needs a schedule to begin the 10-day selection process, thus a comparison cannot occur*

Scenario	Schedule frequency	Total Summer Hours Scheduled
1	No DADRP schedule	0
2	2 scheduled days per month	47
3	3 scheduled days every 2 weeks	133
4	4 scheduled days every 2 weeks	182
5	5 scheduled days every 2 weeks	235
6	6 scheduled days every 2 weeks	277
7	7 scheduled days every 2 weeks	425
8	8 scheduled days every 2 weeks	532

Analysis Approach -

- ◆ **New sets of scheduled intervals were introduced progressively**
- ◆ **Comparisons between scenarios utilized the values from the available intervals**

Scenario	2	3	4	5	6	7	8	Sum
2 thru 8	47	47	47	47	47	47	47	329
3 thru 8	0	86	86	86	86	86	86	516
4 thru 8	0	0	49	49	49	49	49	245
5 thru 8	0	0	0	53	53	53	53	212
6 thru 8	0	0	0	0	42	42	42	126
7 and 8	0	0	0	0	0	148	148	296
8	0	0	0	0	0	0	107	107
Total	47	133	182	235	277	425	532	1831

Alternative CBLs

◆ Objectives

- *Reduce the likelihood of CBL degradation as a result of frequent schedules*
 - **Maintain “look-back” days that are contemporary to the schedule for which the CBL is being created**
- *Reduce the complexity of calculating CBL*
 - **Simplify exclusion rules by having a value for each of the 10 most recent days**

◆ Three Alternative CBLs were created for analysis

- *“CBL2” - 10-day CBL for weekday schedules where the top 5 ranked load hours are averaged (rank 1 = largest value)*
- *“CBL3” - 10-day CBL for weekday schedules where the load hours ranked 3-7 are averaged*
- *“CBL4” - 10-day CBL for weekday schedules where the load hours ranked 5-6 are averaged*

Calculating a 10-day CBL

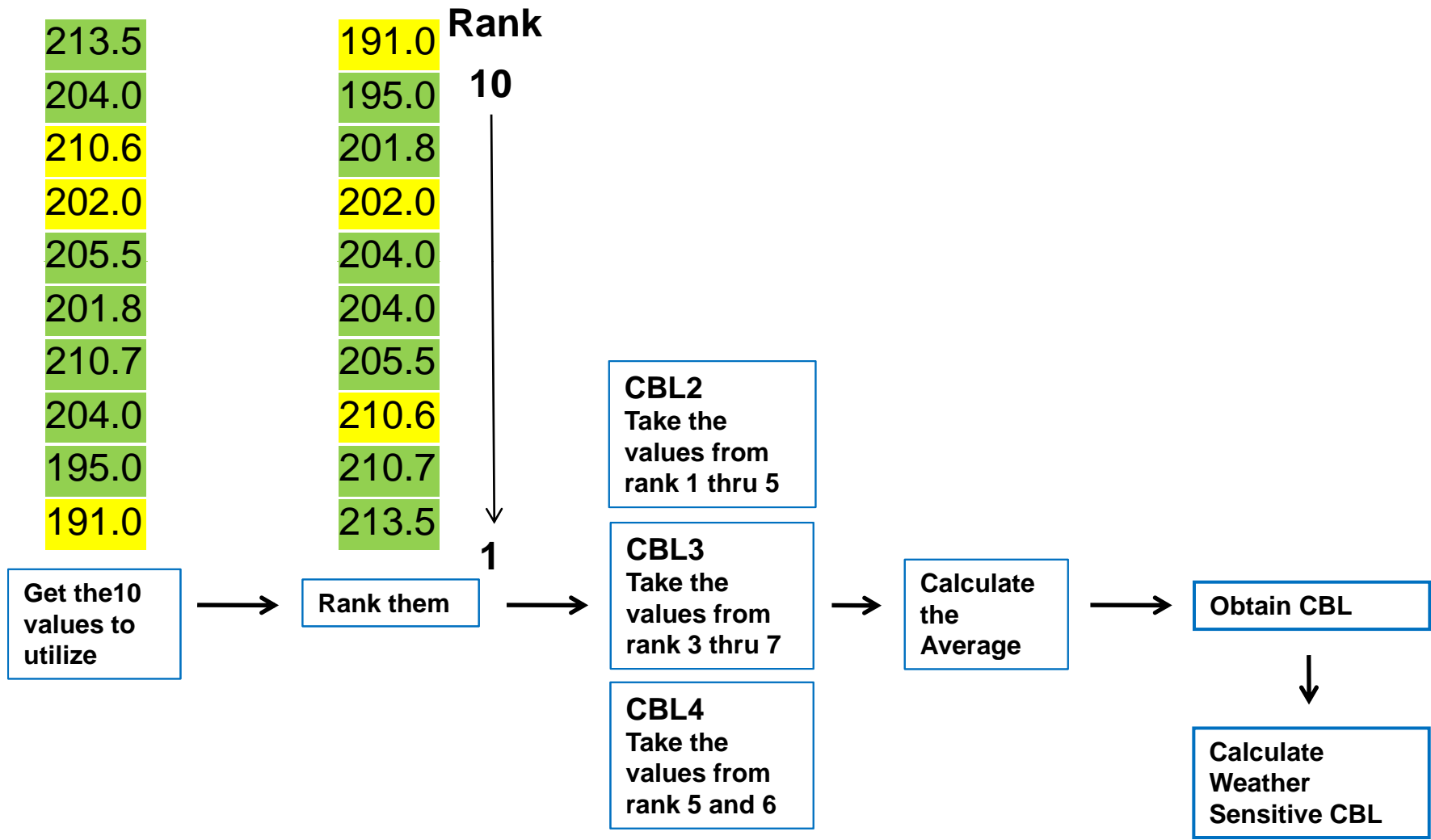
Date	HB	Load	Business day or Scheduled	CBL
3/10/2010	12:00	223.6	N	223.6
3/11/2010	12:00	217.4	N	217.4
3/12/2010	12:00	210.8	N	210.8
3/13/2010	12:00	213.5	N	213.5
3/14/2010	12:00	204.0	N	204.0
3/15/2010	12:00	200.0	Y (Sat)	200.0
3/16/2010	12:00	204.9	Y (Sun)	202.9
3/17/2010	12:00	190.1	Y (sched)	210.6
3/18/2010	12:00	190.4	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	180.2	Y (sched)	191.0
3/27/2010	12:00	190.5		10 Day CBL

Use the previous 10 business days (scheduled or not) for the hour being calculated.

Use Load values for hours without a schedule and CBL value for hours with schedule

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

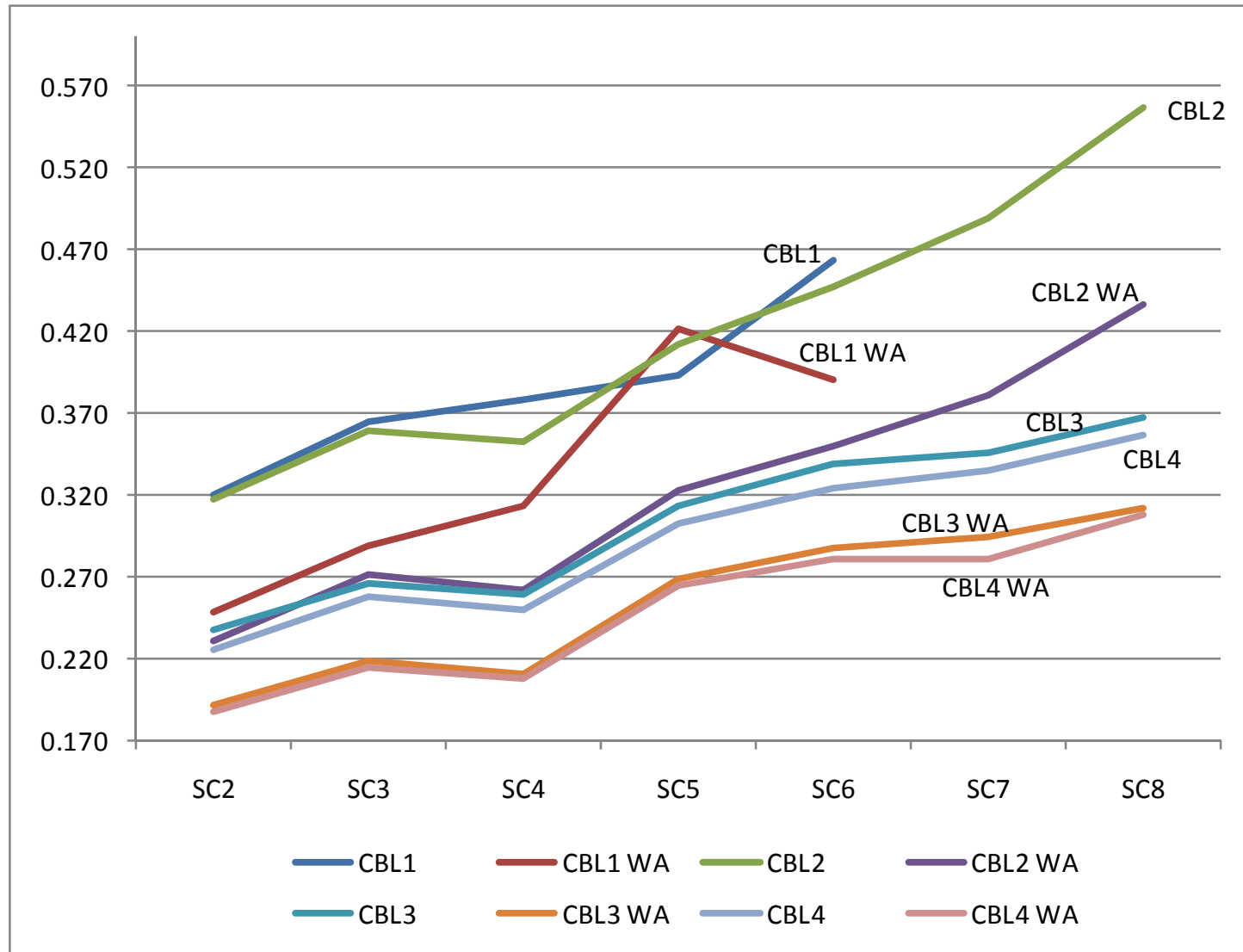
Rank and Average



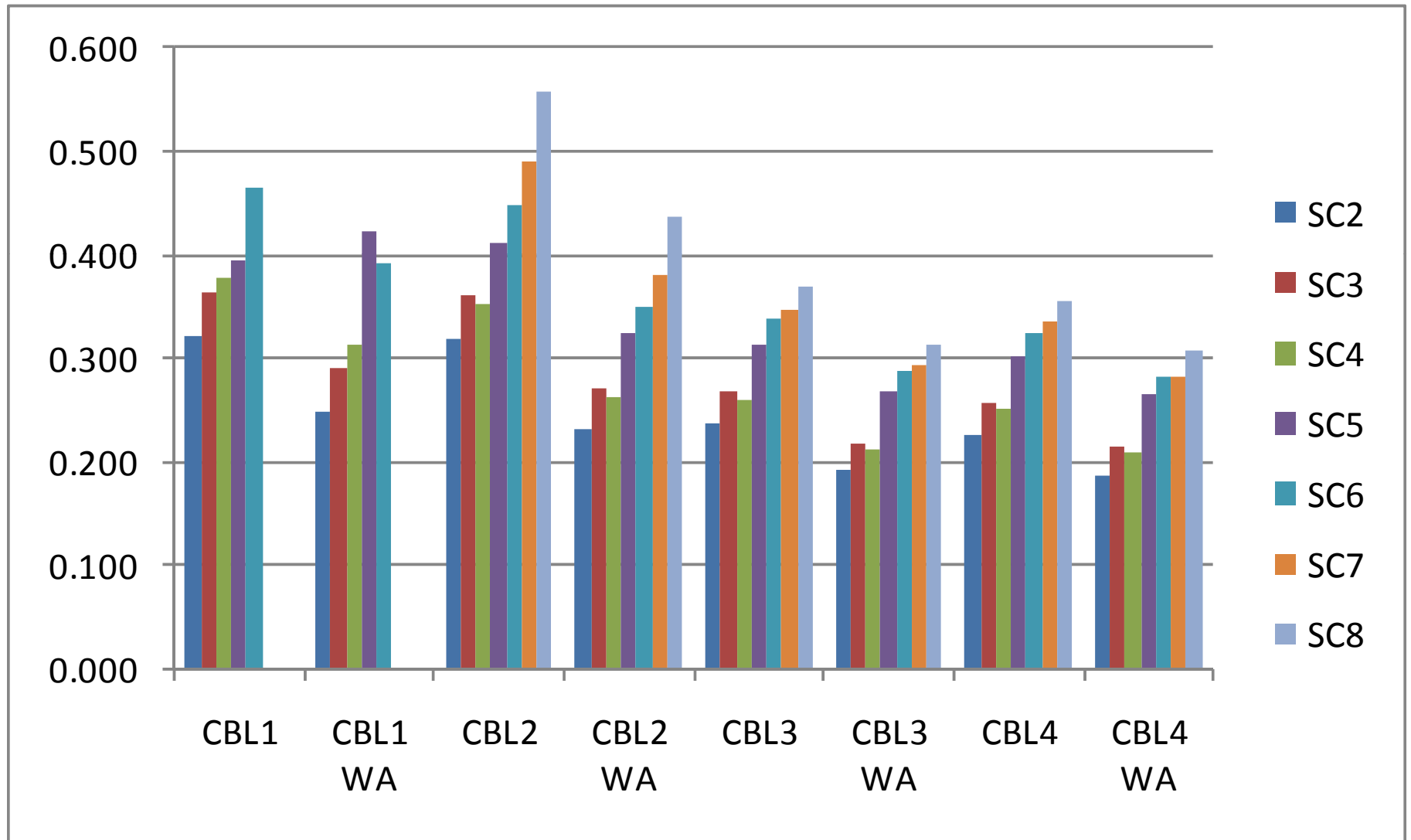
Results of CBL Analysis

- ◆ **Increased frequency degrades all 4 CBLs**
- ◆ **Current CBL (CBL1) could not be calculated for Scenario 7 or 8 due to the restrictive rules (exclusion days)**
 - ◆ Increased frequency resulted in no days in the summer available for a CBL to use with summer scheduled
- ◆ **The Weather Adjustment consistently outperformed the Base CBL**
- ◆ **CBL4 with a weather-adjustment had the least amount of errors for all scenarios and trended better with increased frequency of schedules**

Absolute Mean Error



Absolute Mean Error



Conclusion of CBL Analysis

- ◆ **Additional analysis of 10-day CBL with more scheduled hours to test robustness and modifications to average calculation produced a viable alternative to the current CBL for DADRP**
- ◆ **CBL4 WA (Weather Sensitive/in-day adjustment) will provide the best method for estimating a baseline for DADRP**
 - *Shows the lowest Absolute Mean Error over all scenarios*
 - *Degrades the least as frequency of scheduling increases*

Implementation of Order 745 Compliance

- ◆ **The NYISO intends to request an extension for implementation of the changes to DADRP contained in its 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

- ◆ **August 5: NYISO makes tariff language available to stakeholders in advance of the August 9 MIWG**
- ◆ **August 12: Written comments due from stakeholders by COB**
- ◆ **August 12 through 18: NYISO reviews stakeholder comments and modifies tariff language as necessary**
- ◆ **August 19: NYISO makes its 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.



www.nyiso.com