Net Benefit Test Methodology – FERC Order 745

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Market Information Working Group

December 6, 2018, Rensselaer, NY.

Agenda

- Background
- Net Benefit Test Methodology
- Results summary
- Challenges with the current Methodology
- Proposed revision to the Methodology

Background

Date	Discussion points and links to materials
March 15, 2011	FERC issued Order 745
August 19, 2011	NYISO initial compliance filing
May 16, 2013	FERC order on NYISO initial compliance filing
June 17, 2013	NYISO filed request for rehearing and alternative requests for clarification and compliance waiver
August 14, 2013	NYISO's second compliance filing
January 30, 2017	FERC order on clarification, rehearing and compliance*
October 15, 2018	First offer floor published to be effective for November, 2018.

*NYISO's proposed tariff revisions to comply with Order 745 are now accepted

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Demand Response Net Benefit Test

- Net Benefit Test (NBT) determines the cost-effectiveness of dispatching a demand response resource.
- Dispatching demand response is cost-effective when the benefits to customers from dispatching demand response exceed the payments to the demand response providers.
- NBT determines the price at which, the benefits to spot market power purchasers from a reduction in the spot price of power would be greater than the payments to demand response providers.

(Delta LBMP x MWh consumed) > (LBMP NEW x DR)

Analysis Timeline

- The Net Benefit Test calculation is done monthly.
- The calculation in the current month is done for the next month using data from the previous year for the corresponding month.

e.g.,

Analysis Month/Publishing Month	Study Month/Effective Month	Reference Month
November, 2018	December, 2018	December, 2017

- The calculated threshold LBMP or the offer floor for the study month is posted on the NYISO website by the 15 of the analysis month.

Net Benefit Test Methodology

Step 1: Compile Supply Offers for the Reference Month

- **Retrieve DAM hourly offers using reference month data for:**
  - Generator offers including pumped storage
  - Import offers
  - Import bilateral offers
  - Export offers
  - Export bilateral offers
- **The hours analyzed are peak load hours (HB13-HB19) for weekdays of the reference month.**

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Step 2: Update Supply Offers for Changes in Resource Availability

- Resources with a capacity of 20 MW or more, that are mothballed, IIFO or retired for more than 45 days prior to the posting date are removed from the stack.

  - *Example 1: Retirement before 10/01 , size: 21 MW*

    11/15 Net Benefits Test and Threshold LBMP calculations for December will exclude the retired plant from the average supply curve

  - *Example 2: Retirement on or after 10/01 , size: 21 MW*

    11/15 Net Benefits Test and Threshold LBMP calculations for December will not exclude the retired plant from the average supply curve

To review other exceptions, please refer to TB245.

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Step 3: Combine the Hourly Adjusted Offers to Create Hourly Supply Curves

- Hourly supply offers are arranged in ascending order to form hourly supply curves.
- Hourly supply curves consist of the capacity net of exports available at each price level: {p, MW}.
- Only the offers in the range between $5 to $350 MWh are used for this analysis.

Step 4: Adjust Offers for Changes in Fuel Prices

- Offers are normalized using daily Transco Z6 NY spot prices so that all hours are at a uniform fuel cost basis.
- Deflating the supply offers by the gas price yields:

Implied Heat Rate=Offer Price/Gas Price

Step 5: Create an Average Supply Curve

- An average supply curve for the study month is calculated by horizontally averaging the hourly supply curves.

Step 6: Smooth the Average Supply Curve

- Smooth the average supply curve using a numerical method.
- The following polynomial equation is used for this purpose:

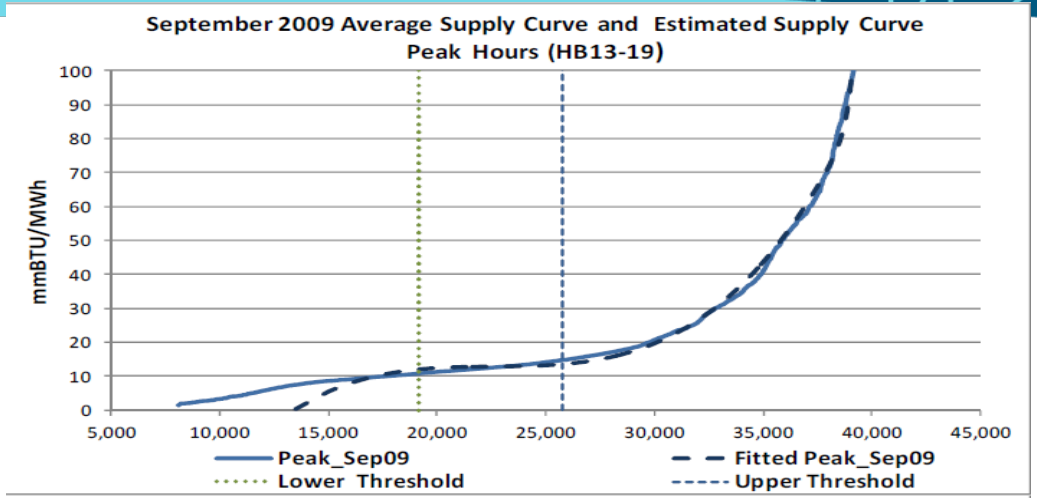
$$Heat\ Rate = A + B * MW + C * MW^2 + D * MW^3 + exp^{(E*MW+F)}$$

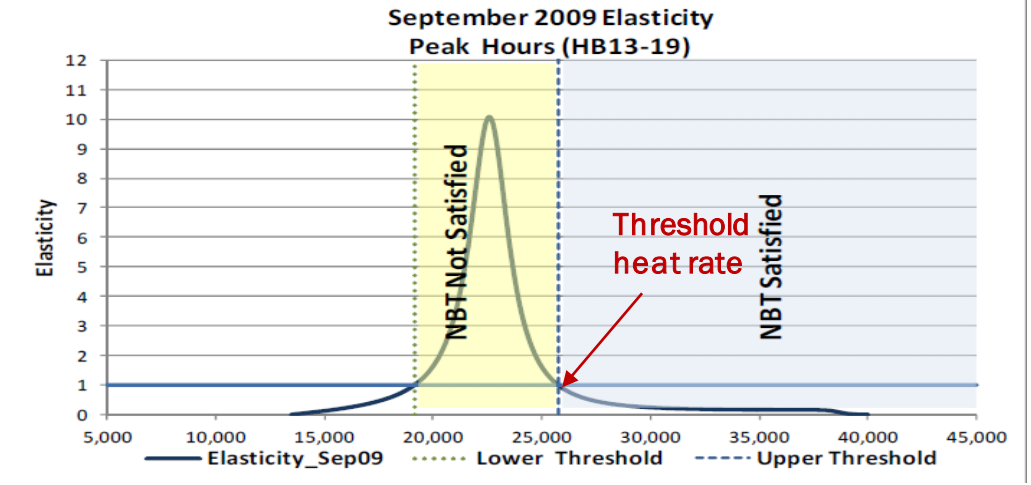
Where, coefficients A, B, C, D, E and F are estimated each month

Step 7: Identify Heat Rate Net Benefit Threshold

- Heat rate net benefit threshold is the point on the heat rate supply curve at which the benefit exceeds the costs.
- Threshold heat rate point on the heat rate supply curve is that point at which the estimated elasticity rises from below 1 to above 1 and then falls below 1 and remains below 1 for higher rates.
- The elasticity is defined as: $$elasticity = \frac{\frac{d(MW)}{MW}}{\frac{d(Heat\ Rate)}{Heat\ Rate}}$$
- Using the estimated model parameters, the elasticity is calculated as:

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





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Step 8: Calculate Net Benefit Threshold LBMP

- The Net Benefit Threshold LBMP is calculated as:

$$Threshold\ LBMP\ (\$) = Threshold\ Heat\ Rate\ * Projected\ Natural\ Gas\ Price$$

Where,

$$Projected\ Natural\ Gas\ Price: Henry\ Hub\ Future\ Price + 3 - year\ Basis$$

- The 3-year basis is the average difference between the Transco Z6 NY daily spot price and the Henry Hub daily spot price in the corresponding months of the three prior years.

References

- **Technical Bulletin:**

http://www.nyiso.com/public/webdocs/markets_operations/documents/Technical_Bulletins/Technical_Bulletins/Technical_Bulletins/TB-245.pdf

- **Compliance Filing:**

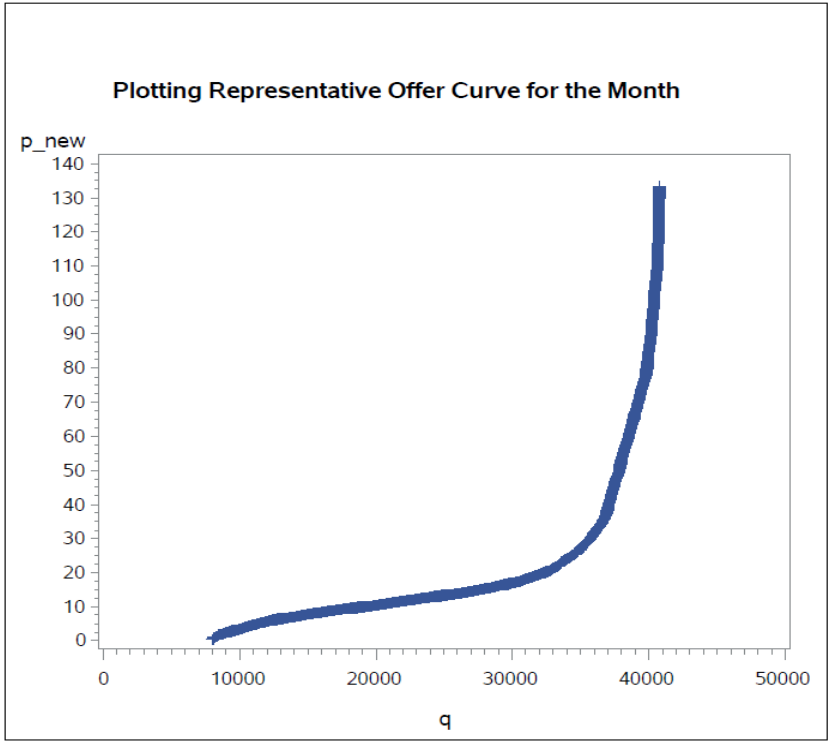
https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13328902

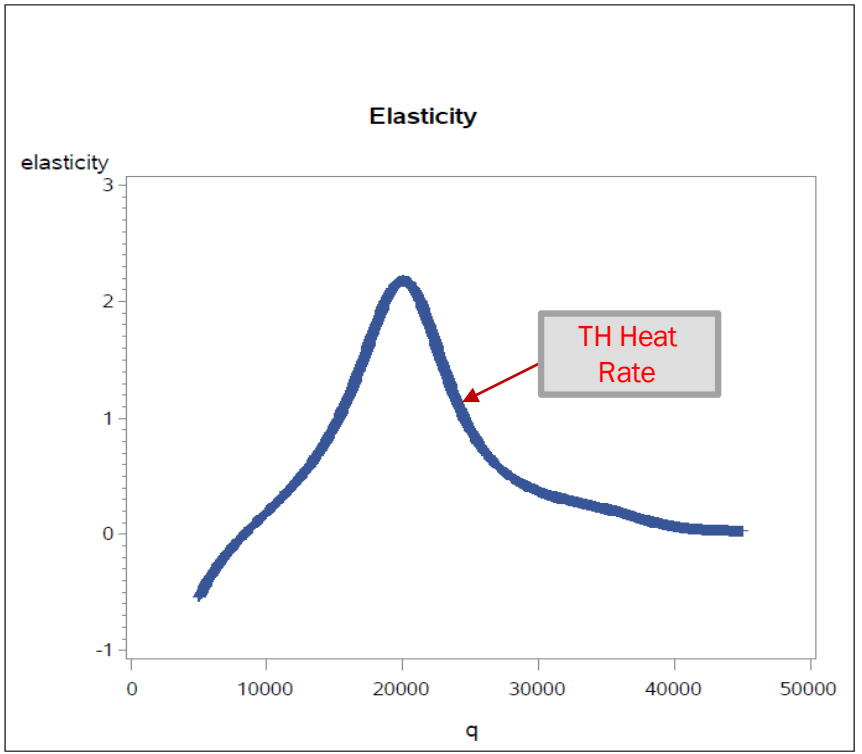
- **Previous Presentation:**

www.nyiso.com/public/webdocs/markets_operations/committees/bic_miwg/meeting_materials/2017-03-28/Order%20745%20Update_w_Appendix%20-%20MIWG%2020170328.pdf

Results Summary and Proposed Enhancement

December, 2018 Average Supply Curve





Study Month	Reference Month	Threshold Heat Rate	Future Price	3-Year Basis	Projected Gas Price	Threshold LBMP
June, 2018	June, 2017	15.42	2.93	-0.51	2.42	$37.27
July, 2018	July, 2017	15.17	2.80	-0.57	2.23	$33.89
August, 2018	August, 2017	15.44	3.04	-0.58	2.46	$38.02
September, 2018	September, 2017	13.07	2.93	-0.82	2.11	$27.60
October, 2018	October, 2017	13.43	2.76	-0.72	2.04	$27.39
November, 2018	November, 2017	12.58	3.28	-0.24	3.04	$38.36
December, 2018	December, 2017	11.82	3.78	1.22	5.01	$59.25
January, 2019*	January, 2018	9.69	4.15	5.17	9.32	$86.41
February, 2019*	February, 2018	14.82	3.24	0.47	3.71	$55.00

**January, 2019 and February, 2019 numbers are based on current data and subject to change.*

Research Background

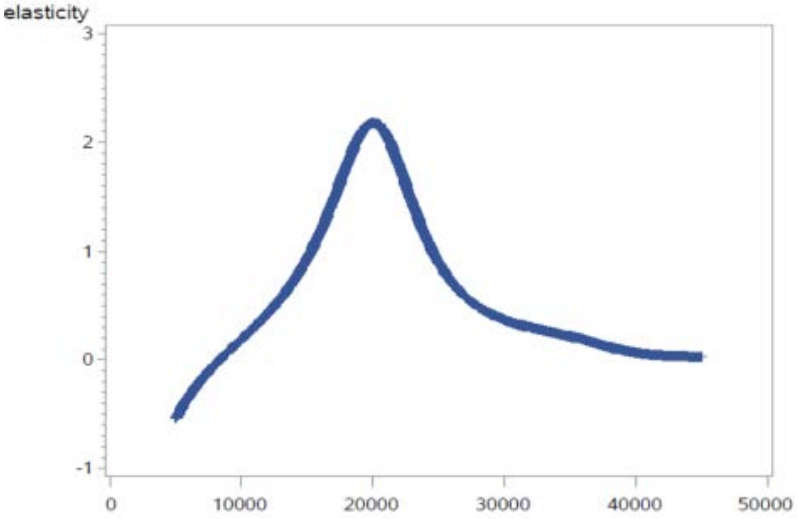
- The original research during the compliance filing was done using 2009-2011 data.
- Based on the original research, the methodology specified using the offers in the range between $5-$350 per MWh to form the supply curve.
- The offers were limited to avoid fitting a supply curve in the extreme ends of the supply curves which can distort the estimation of the smoothed supply curve in the relevant range in which the net benefit threshold will lie.

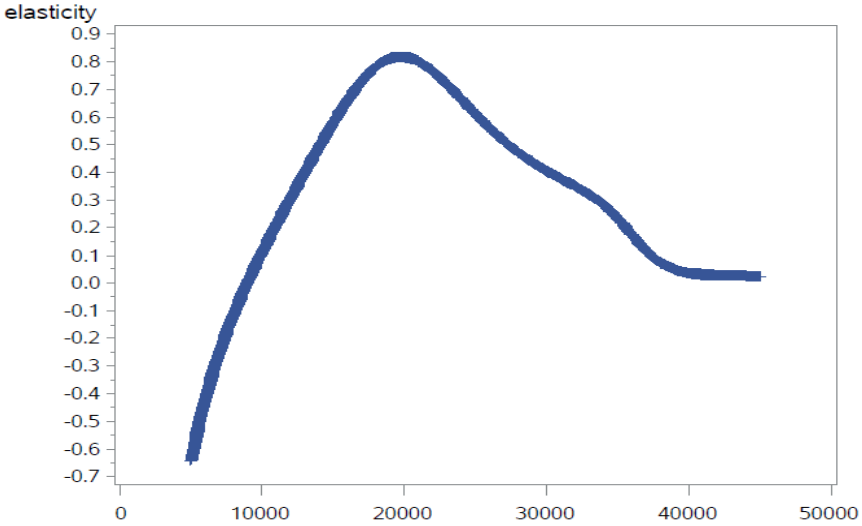
Research Background Contd.

- The rationale behind choosing this offer range is the min-max LBMP that was observed in 2010.
- Therefore, it's not expected the same range will be reasonable for every month.
- Analyses of recent months revealed some issues with the current offer range of $5-$350 per MWh.
- There are several factors that can influence the relevant offer range.

Limitations of the Current Offer Range

- There are several months where a model fit failed to satisfy the threshold heat rate identification criterion.





Limitations of the Current Offer Range

- There are certain circumstances in which using a fixed range ($5-$350) can distort the model fit and therefore the elasticity plots. Examples include:
  - Extremely low or high gas prices
  - Distribution of the offers

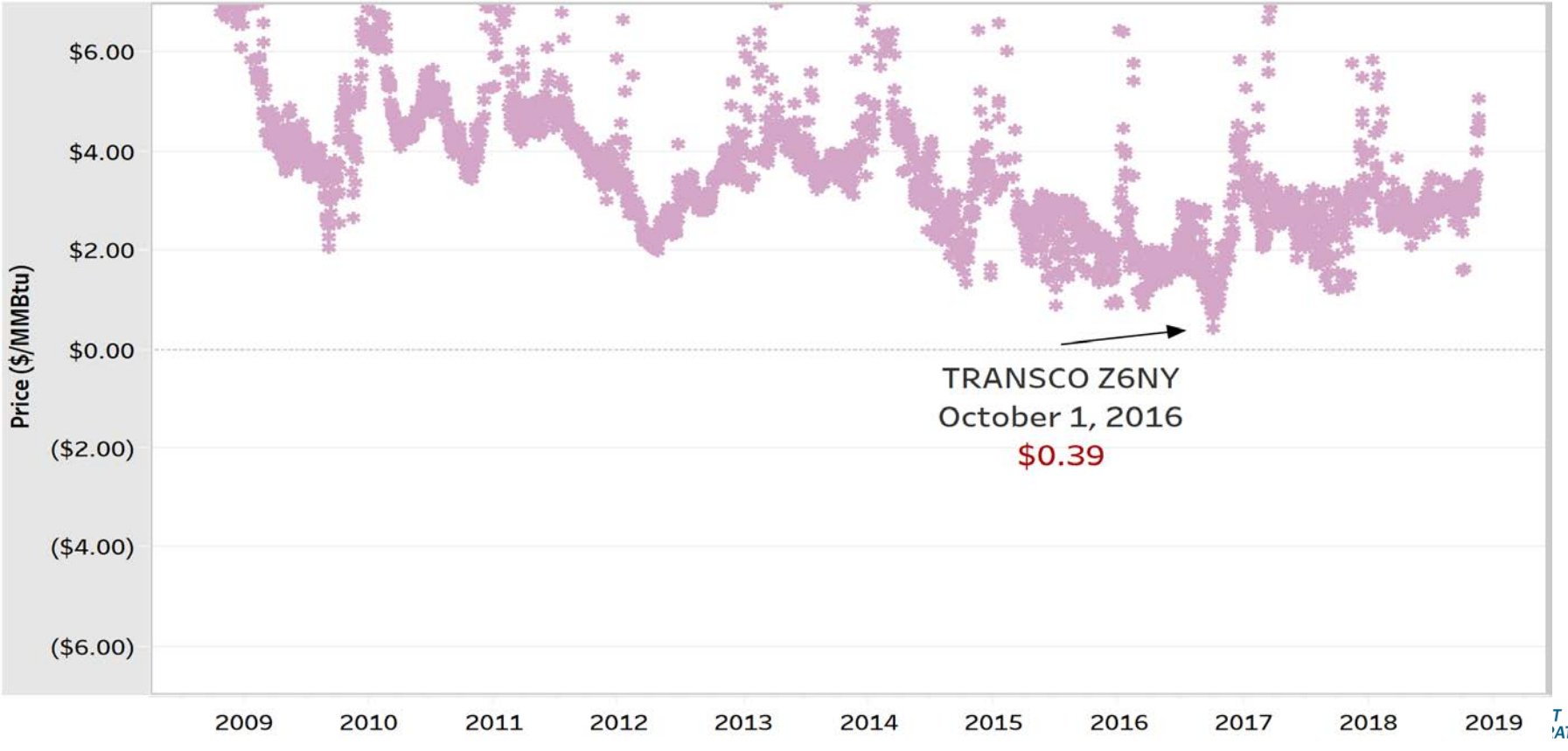
Scenario 1: Very Low Gas Prices

- Heat rate : offer price/gas price
- Offer price range used: $5 - $350
- If gas price > 1 then heat rate is capped at $350.
- If gas price is below 1 then heat rate range could be higher than $350.

  e.g. $350/$0.40 = 875

- This low gas price re-introduces the fitting issue the offer range was trying to eliminate (*October, 2017*).
- One way to remove such anomalies is to impose a heat rate cap (350) in combination with an offer range ($350).

Transco Z6NY Prices (2008-2018)



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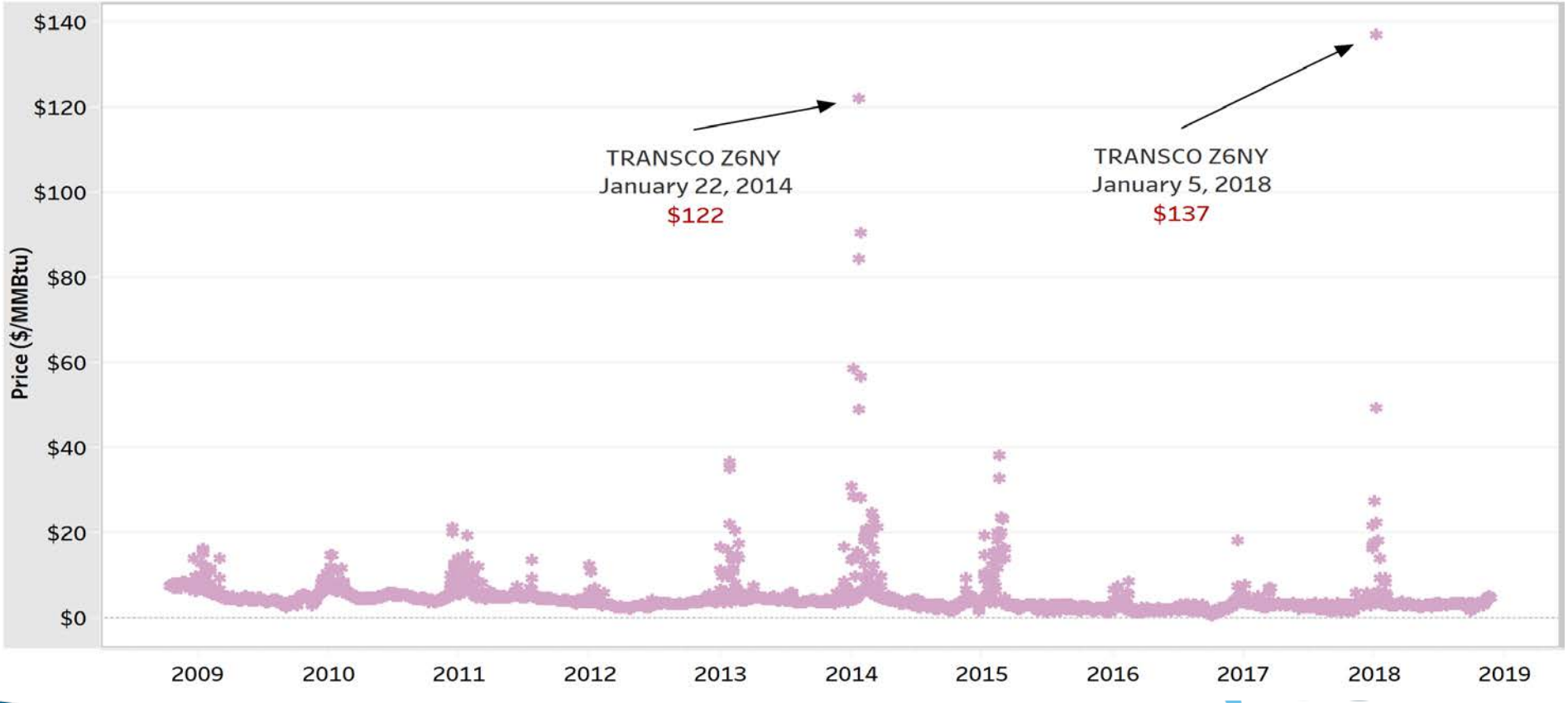
Scenario 2: Very High Gas Prices

- Heat rate : offer price/gas price
- Offer price range used: $5 - $350
- Typically, average gas price is in the range of $2-$3.
- If gas price is $20 (or higher) then heat rate range could be as low as:

  e.g. $350/$20 =17
- This high gas price again re-introduces some fitting issues.
- This situation was encountered calculating January, 2019 offer floor using January, 2018 as the reference month.

Transco Z6NY Prices (2008-2018)



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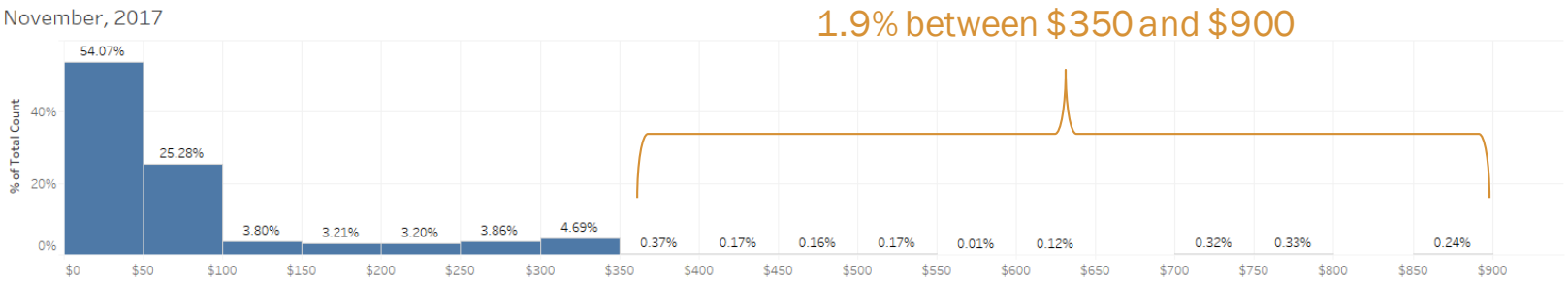
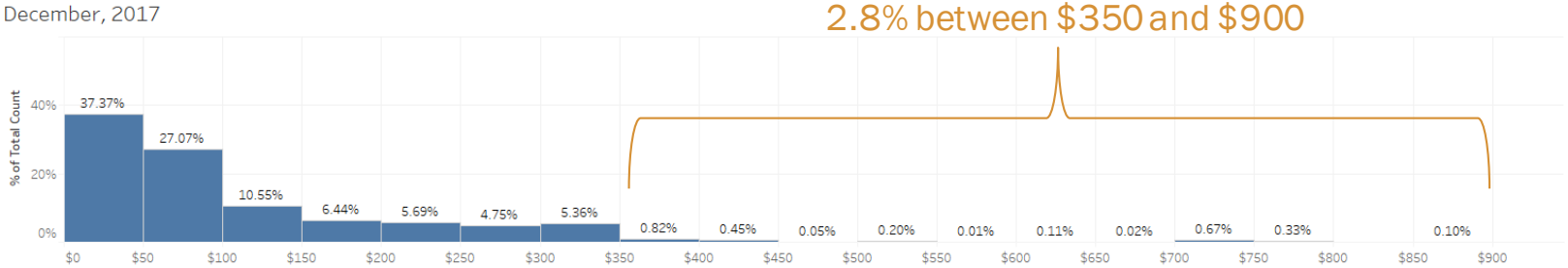
Scenario 3: Offer Distributions

- The distribution of offers, which are closely influenced by the gas prices could also impact the range of heat rate curve and hence impact the model fitting.

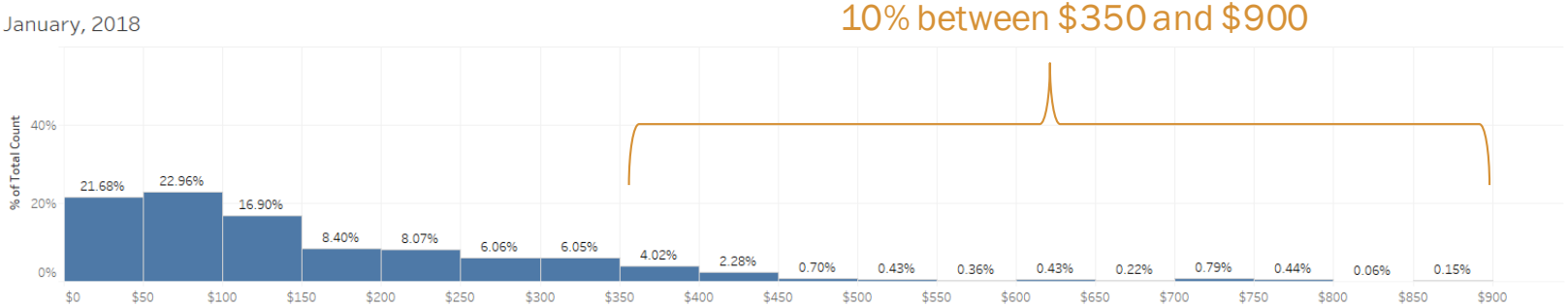
November, 2017



December, 2017



January, 2018



Possible Solutions

- **Reference month November, 2017 (Study Month November, 2018): skewed offers with a thin right tail.**
  - Cap the heat rate to remove the dispersed higher offers to yield a solution.
- **Reference month January, 2018 (Study Month January, 2019): skewed offers with a thick right tail.**
  - Modify the offer cap to allow more offers in the model estimation sample.
  - Used the DAM LBMP as a guide to modify the upper offer cap.

Proposal

- NYISO is proposing to make the offer range of $5-$350 flexible for the monthly offer floor calculation.
- Monthly Min-Max LBMP will be used to determine this offer range.
- NYISO will report the offer range used for the analysis along with other publication requirements.

Next Steps

- Update Technical Bulletin

Questions or Feedback?

Email: CDAS@NYISO.COM

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Appendix

DAM LBMP Summary

Reference Month	Avg. DAM LBMP	Min. Dam LBMP	Max. Dam LBMP
June, 2017	**$26.70**	**-$9.51**	**$186.11**
July, 2017	**$31.30**	**$0.01**	**$304.96**
August, 2017	**$26.97**	**$3.51**	**$364.58**
September, 2017	**$24.88**	**$0.01**	**$282.77**
October, 2017	**$25.24**	**-$14.00**	**$704.96**
November, 2017	**$27.87**	**$2.12**	**$105.18**
December, 2017	**$45.61**	**$2.74**	**$455.13**
January, 2018	**$84.03**	**$4.94**	**$652.36**
February, 2018	**$31.07**	**-$10.74**	**$299.33**

GAS Price Summary

Reference Month	Avg. Gas price	Min. NG Price	Max. NG Price
June, 2017	**$2.38**	**$1.84**	**$3.08**
July, 2017	**$2.51**	**$1.70**	**$3.23**
August, 2017	**$2.25**	**$1.41**	**$3.15**
September, 2017	**$2.38**	**$1.17**	**$3.17**
October, 2017	**$2.50**	**$1.33**	**$2.95**
November, 2017	**$2.99**	**$1.27**	**$5.75**
December, 2017	**$5.55**	**$2.57**	**$21.28**
January, 2018	**$15.11**	**$3.10**	**$136.72**
February, 2018	**$3.25**	**$2.43**	**$8.11**

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