

# Highlights from the Quarterly Report on the New York ISO Electricity Markets Third Quarter of 2016

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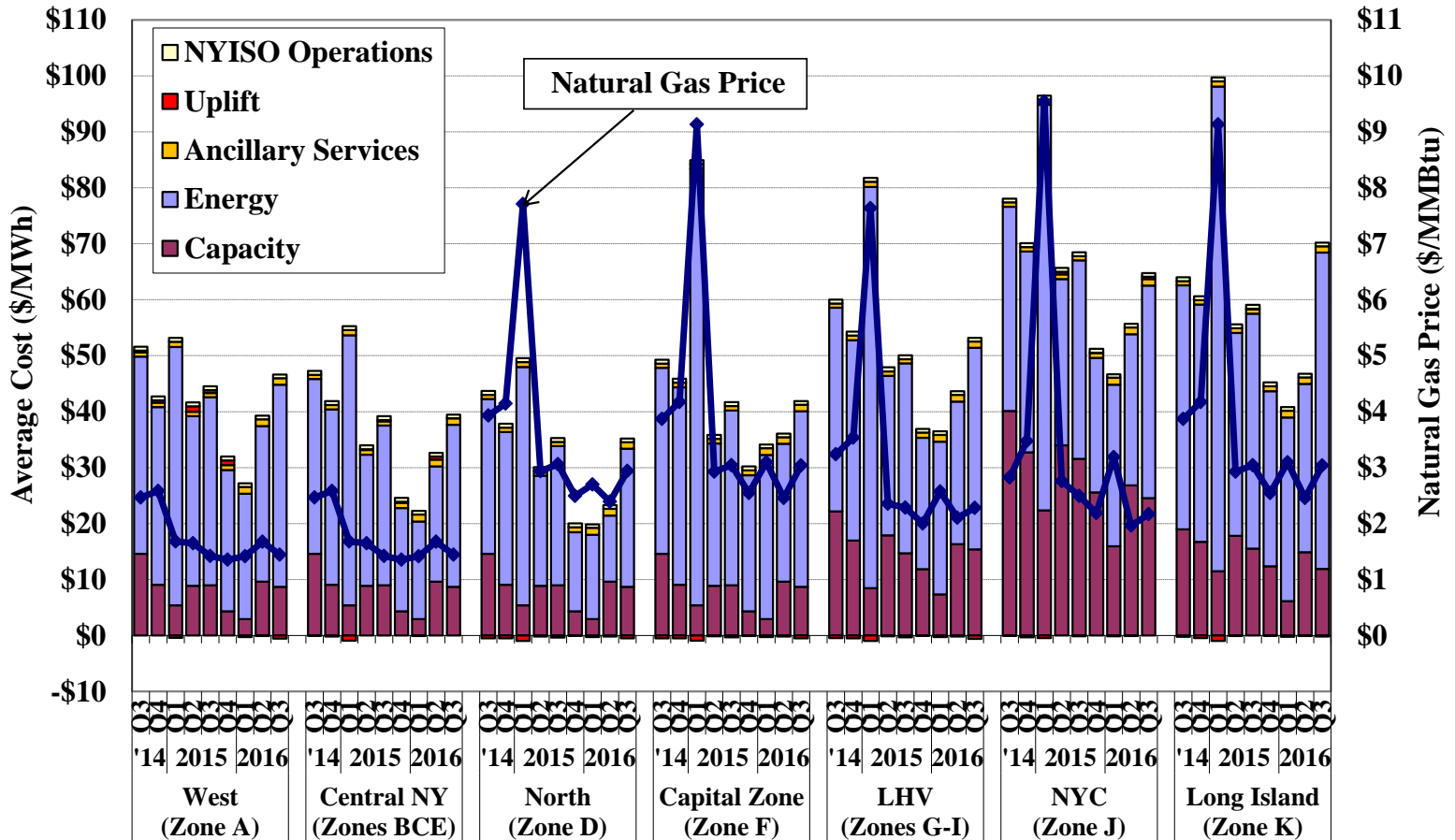


## Highlights and Market Summary: Energy Market Outcomes and Congestion

- This report summarizes market outcomes in the third quarter of 2016.
- The energy markets performed competitively and variations in wholesale prices were driven primarily by changes in fuel prices, demand, and supply availability.
- Average all-in prices ranged from roughly \$35/MWh in the North Zone to \$70/MWh in Long Island. (see slide 9)
  - ✓ LBMPs rose moderately from 2015-Q3 in most areas partly because:
    - Average load levels rose ~600 MW and annual peak load rose by 1 GW primarily because of warmer weather conditions. (see slide 11)
    - Hydro and nuclear output fell ~400 MW. (see slide 15)
    - North Zone was the only region where prices fell because of more frequent congestion in September due to transmission outages. (see slide 20)
    - However, natural gas prices remained very low and actually fell 14 percent in New York City, which helped offset the effect of higher load levels. (see slide 12)
  - ✓ The largest LBMP change (+35%) was in Long Island because the Y49 line outage greatly reduced imports from upstate for most of the quarter (see slide 20).
  - ✓ Capacity costs fell 22 and 23 percent in NYC and Long Island from the previous year. (see slide 9)



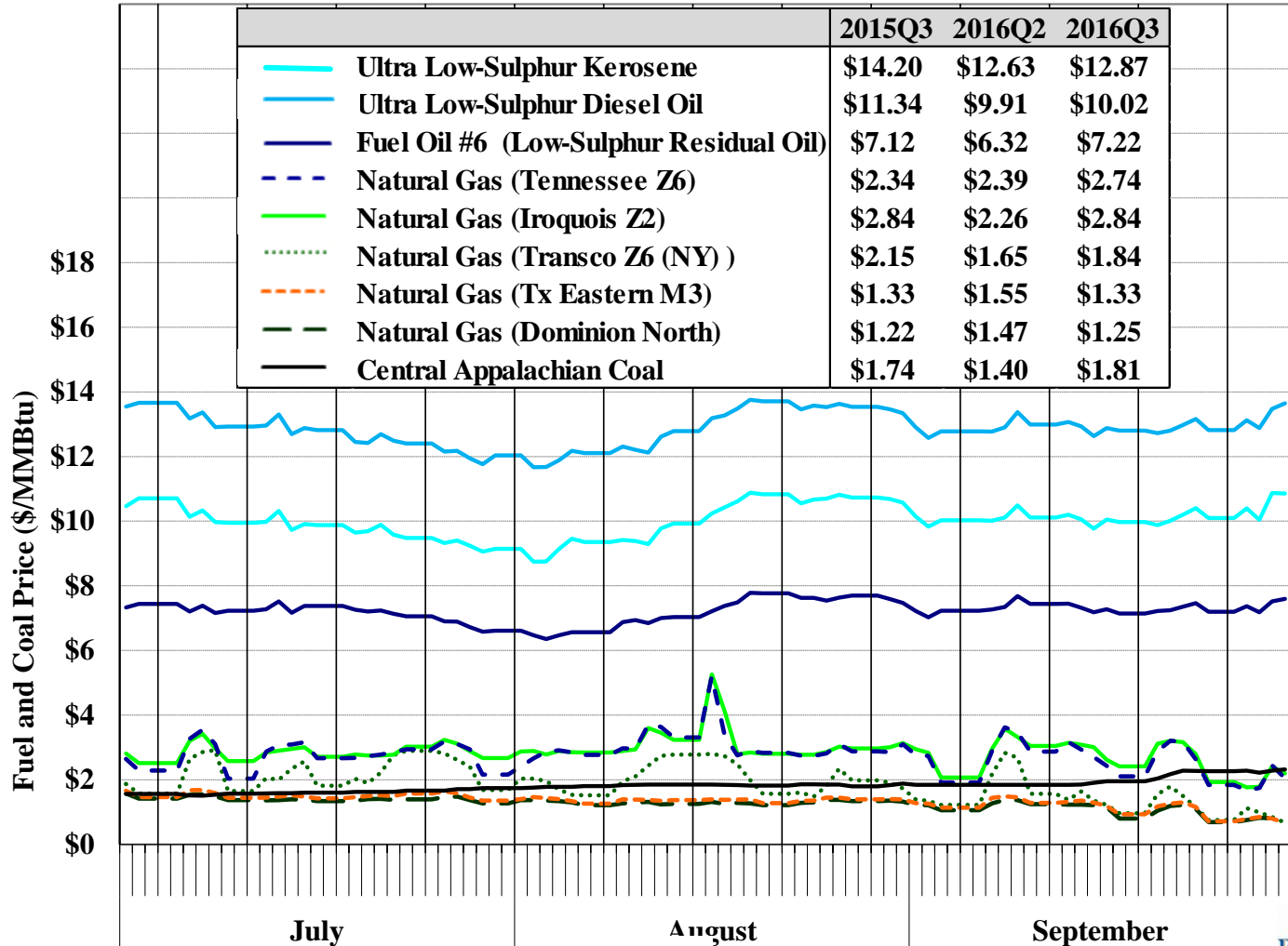
# All-In Energy Price by Region



Note: Natural Gas Price is based on the following gas indices (plus a transportation charge of \$0.20/MMBtu): the Dominion North index for West Zone and Central NY, the Iroquois Waddington index for North Zone, the Iroquois Zone 2 index for Capital Zone and LI, the average of Texas Eastern M3 and Iroquois Zone 2 for LHV, the Transco Zone 6 (NY) index for NYC. A 6.9 percent tax rate is also included NYC.

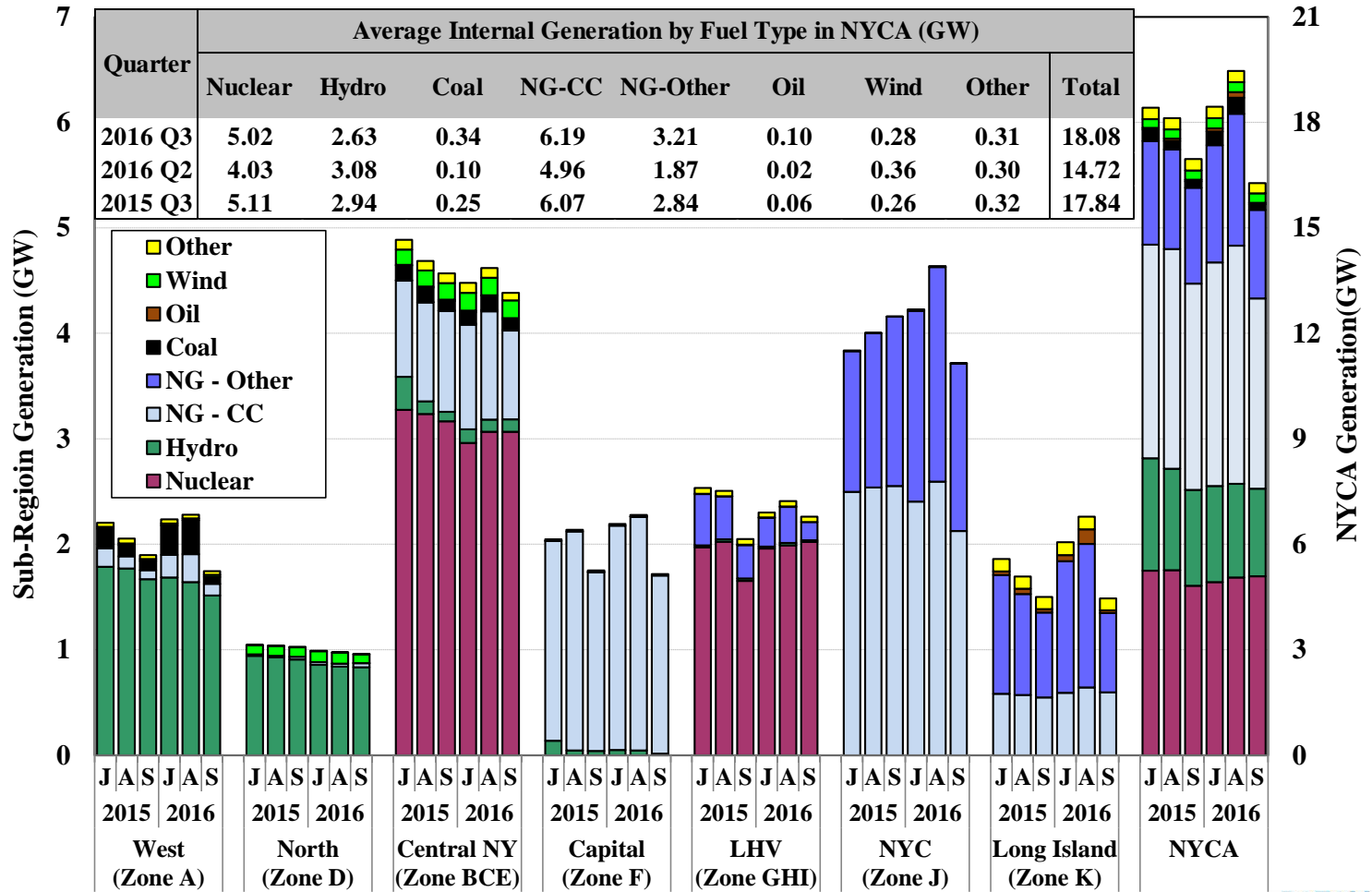


# Coal, Natural Gas, and Fuel Oil Prices





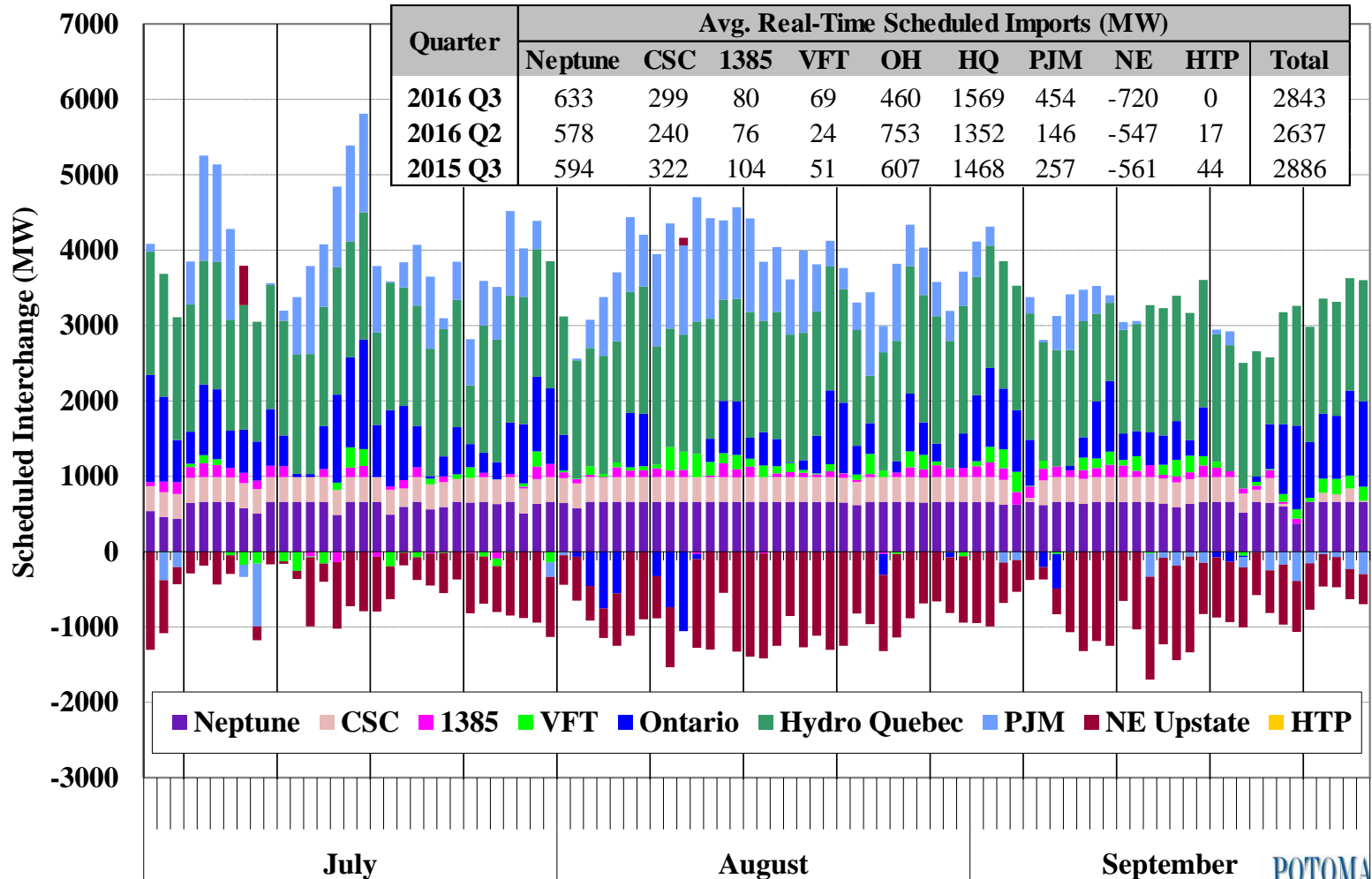
# Real-Time Generation Output by Fuel Type



Notes: Pumped-storage resources in pumping mode are treated as negative generation. "Other" includes Methane, Refuse, Solar & Wood.

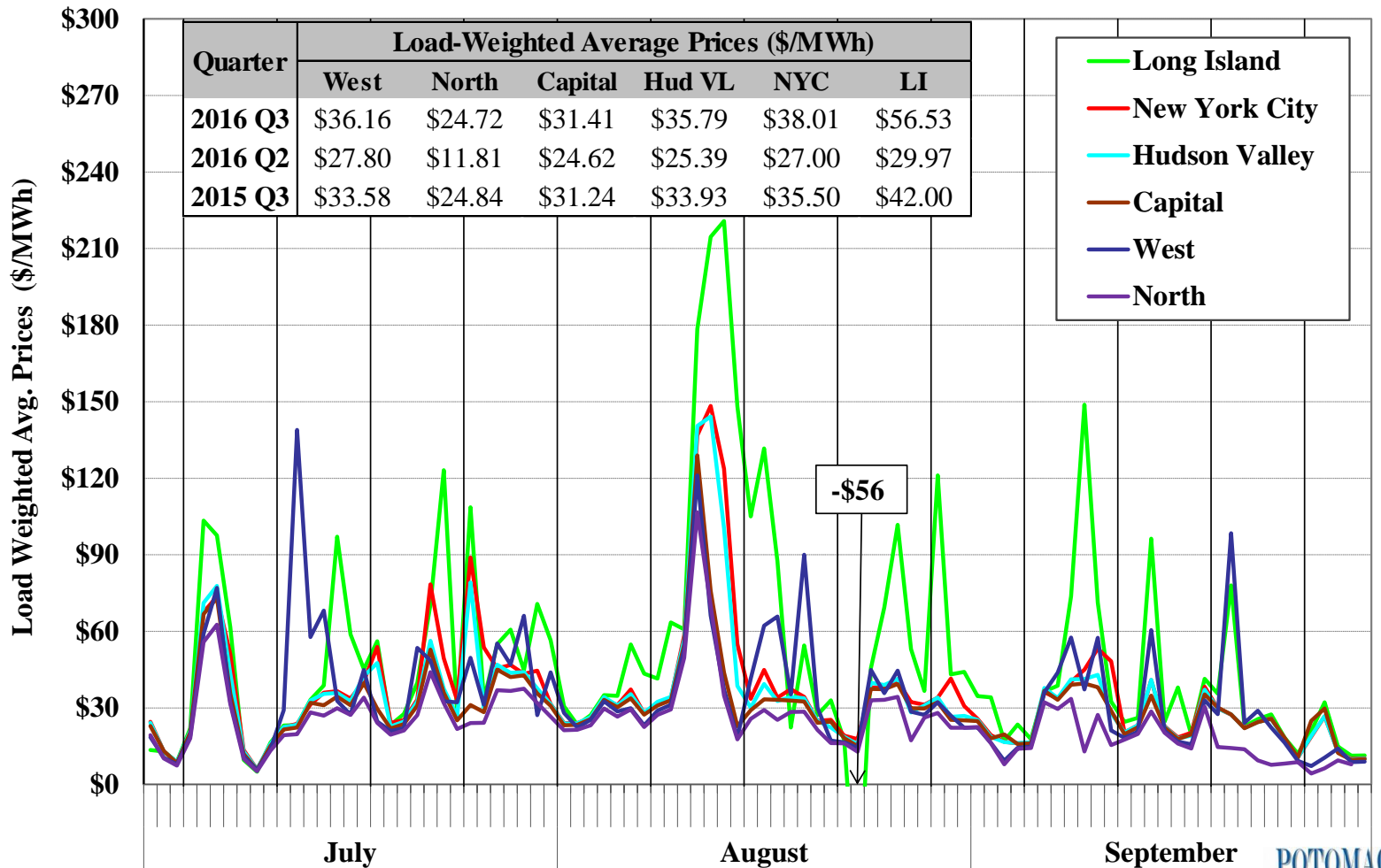


# Net Imports Scheduled Across External Interfaces Peak Hours (1-9pm)





# Real-Time Electricity Prices by Zone





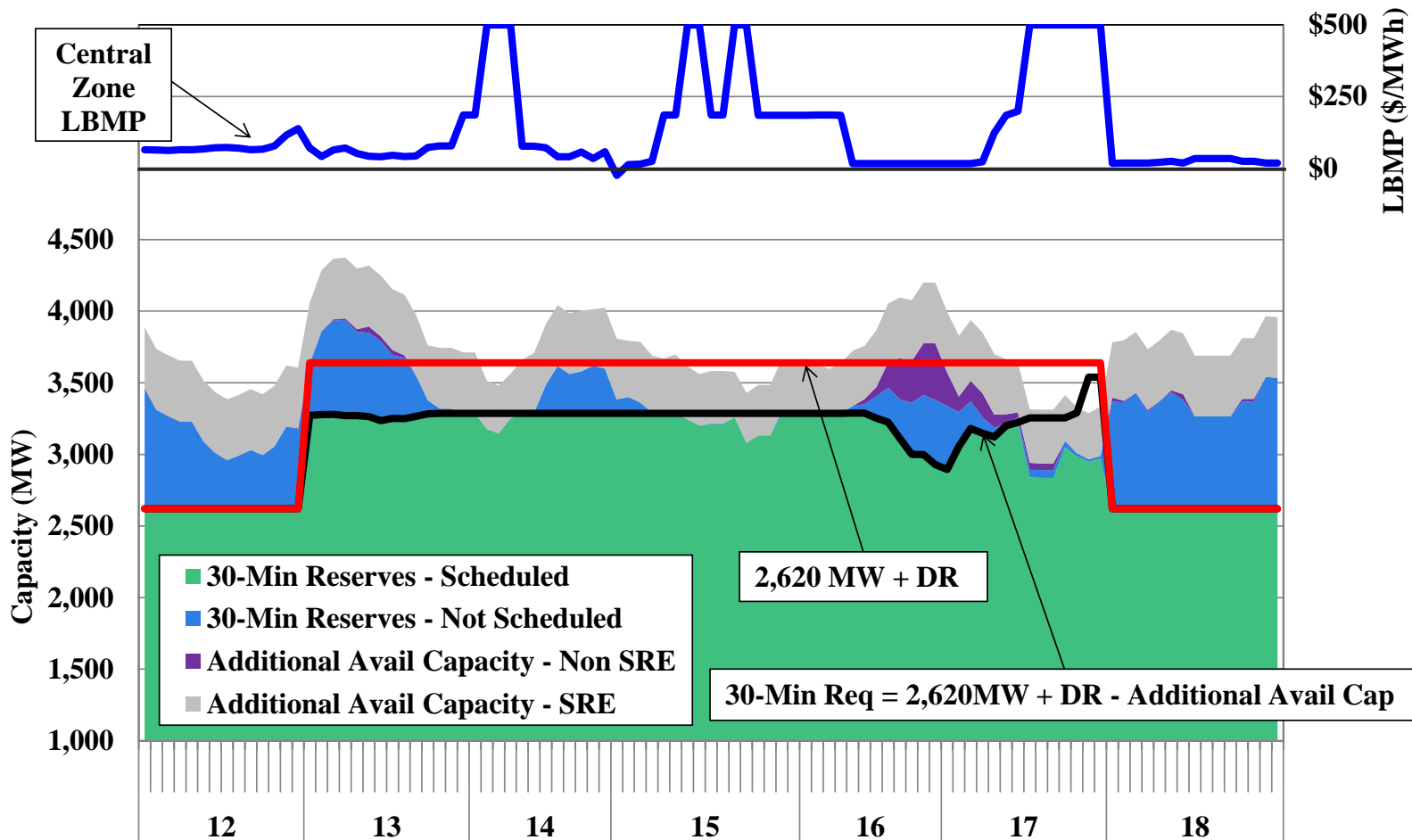
## Highlights and Market Summary: Demand Response Deployments – Scarcity Pricing

- The evaluation suggests that:
  - ✓ In retrospect, DR was needed to prevent a capacity deficiency (i.e., red line > height of all areas) in a total of 18 intervals during the 5-hour deployment period.
  - ✓ 30-minute reserves were priced at \$500/MWh during all 18 intervals.
    - The improved consistency between price signals and actual system needs is a significant enhancement under the new Scarcity Pricing Rule.
- Nonetheless, in retrospect, the actual amount of demand response that was needed to avoid a reserve shortage was just ~350 MW (indicated by the largest difference between the red line and the height of all areas).
  - ✓ This implies an over-deployment of DR (by more than 600 MW), which includes ~150 MW that was activated by utilities from their own DR programs.
  - ✓ A total of \$1.1 million of guarantee payments were made to DR resources for their deployments (see slides 87-88).





# Available Capacity and Real-Time Prices During DR Activations NYCA, August 12



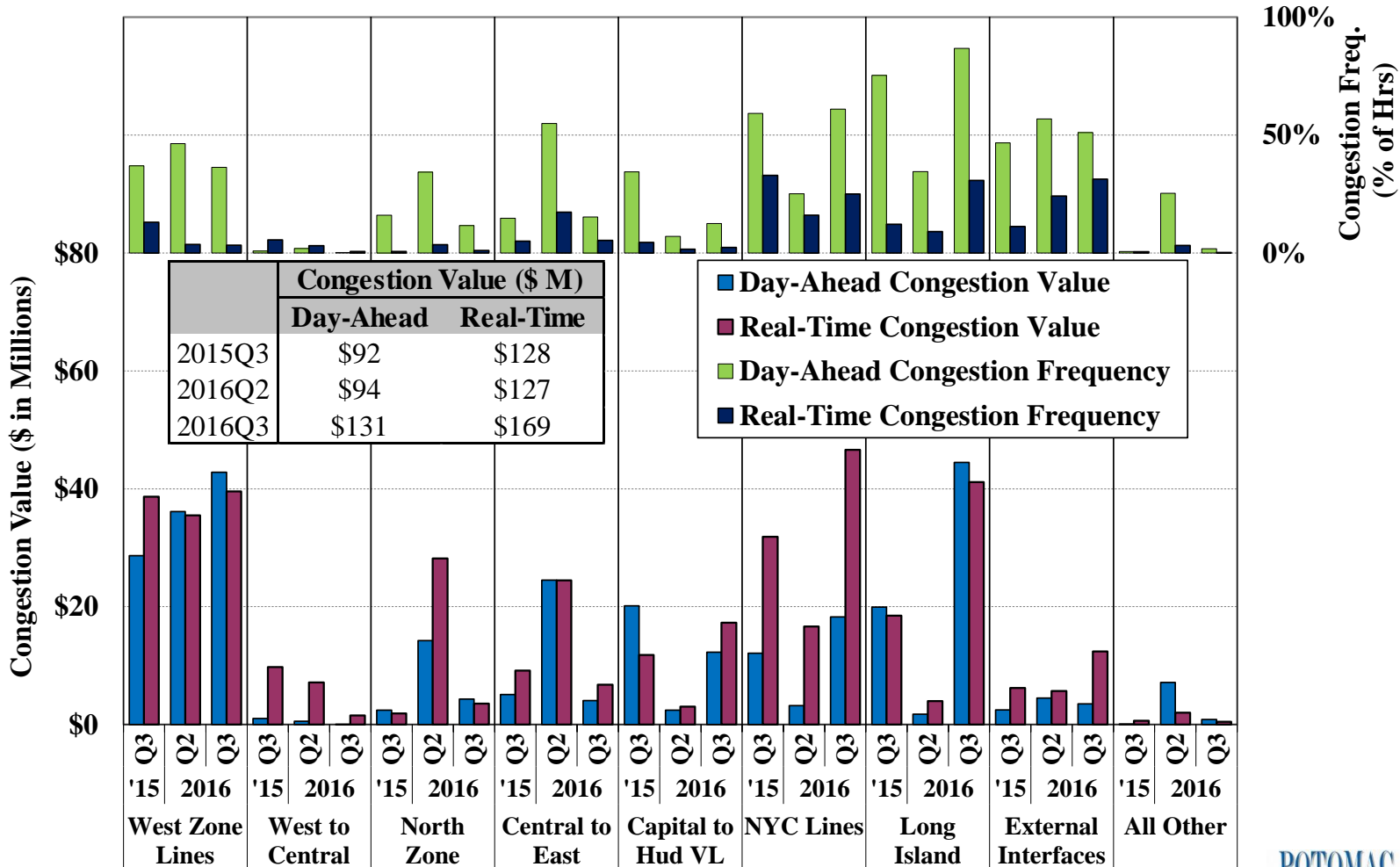


## Highlights and Market Summary: Energy Market Outcomes and Congestion

- DAM congestion revenues totaled \$131 million, up 42 percent from the third quarter of 2015. (see slide 55)
  - ✓ Over 60 percent of the increase occurred on Long Island primarily because:
    - The Y49 line outage reduced imports from upstate during most of the quarter; and
    - The 677 line derating led to congestion from Northport to other areas of Long Island throughout the quarter.
  - ✓ West Zone accounted for most of the remaining increase as the congestion pattern changed because of factors discussed in the next slide.
  - ✓ Although congestion into Southeast New York was generally reduced following the installation of the new “TOTS” projects, the benefits were largely offset by the derating of the Branchburg-Ramapo line.
- The Graduated Transmission Demand Curve (“GTDC”) project has led to higher congestion prices. (see slides 71-75)
  - ✓ Although most shortages (~70%) are still resolved using the constraint relaxation method (rather than the GTDC), the GTDC project changed key parameters used for constraint relaxation that has increased congestion shadow prices.
  - ✓ Constraint relaxation can lead shadow prices to be unpredictably higher or lower than the GTDC (regardless of severity of shortages).

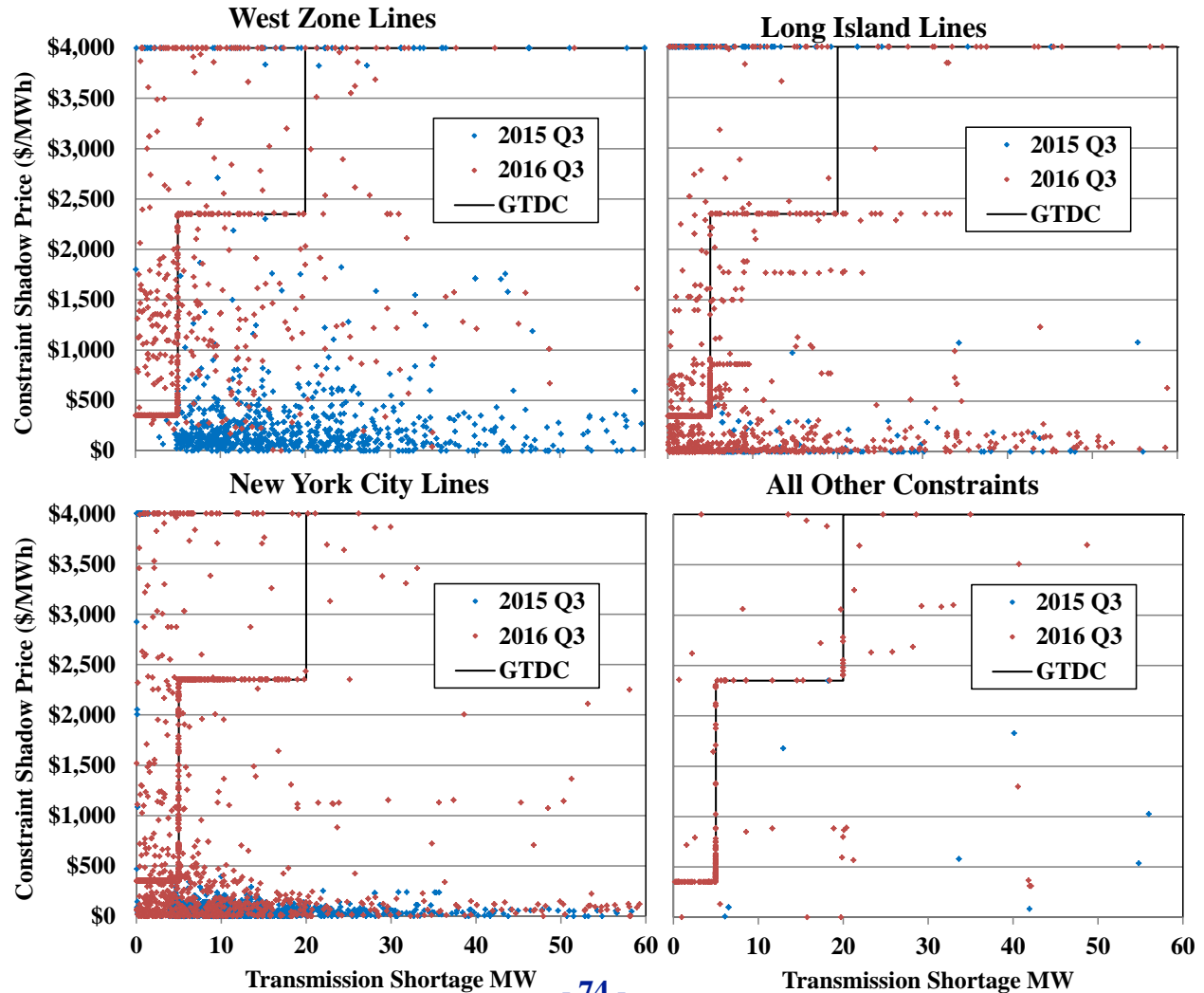


# DA and RT Congestion Value and Frequency by Transmission Path





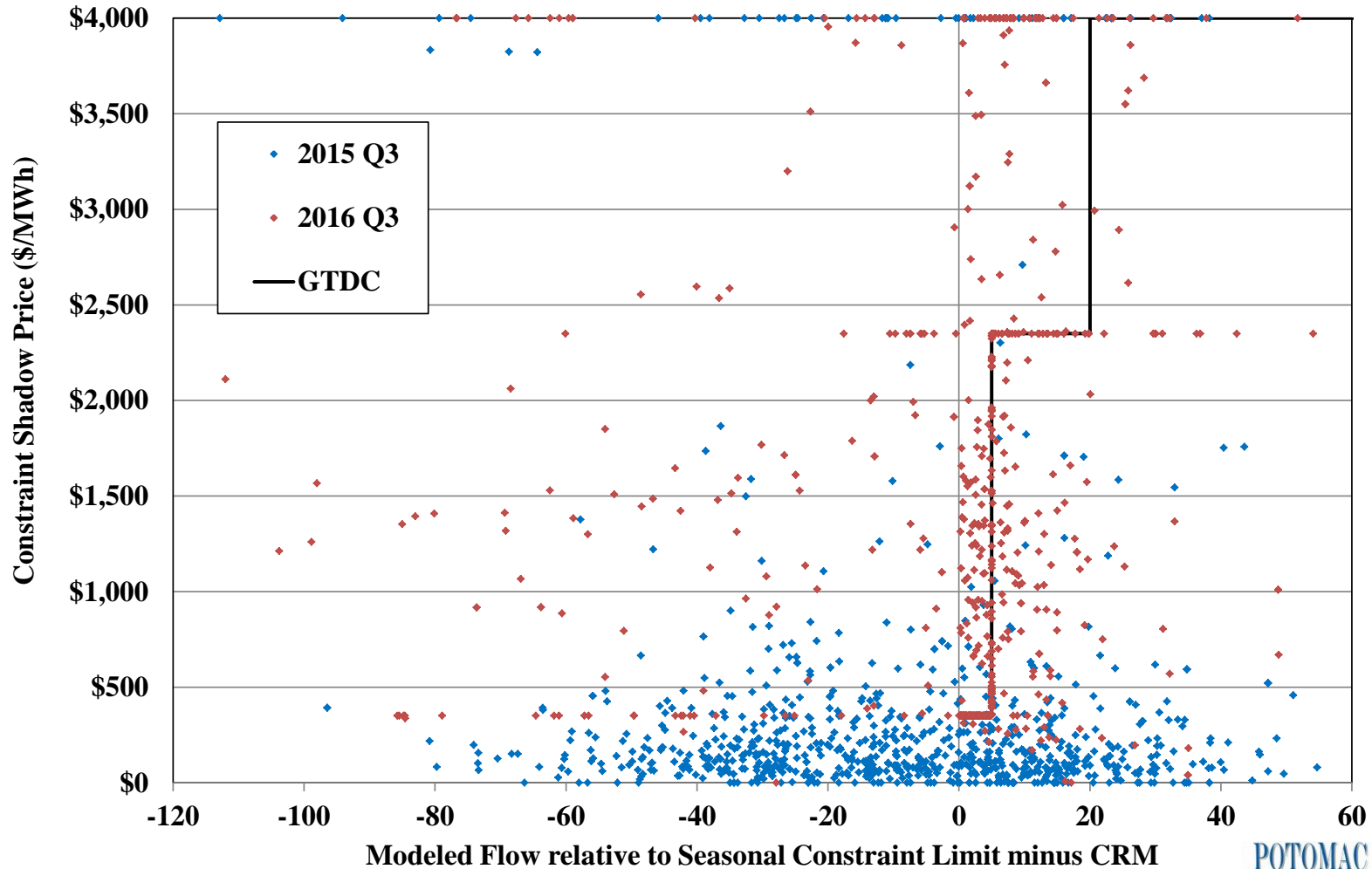
# Congestion Management with the GTDC Transmission Shortage Pricing





# Congestion Management with the GTDC

## Limit Adjustments & Shortage Pricing, West Zone Constraints



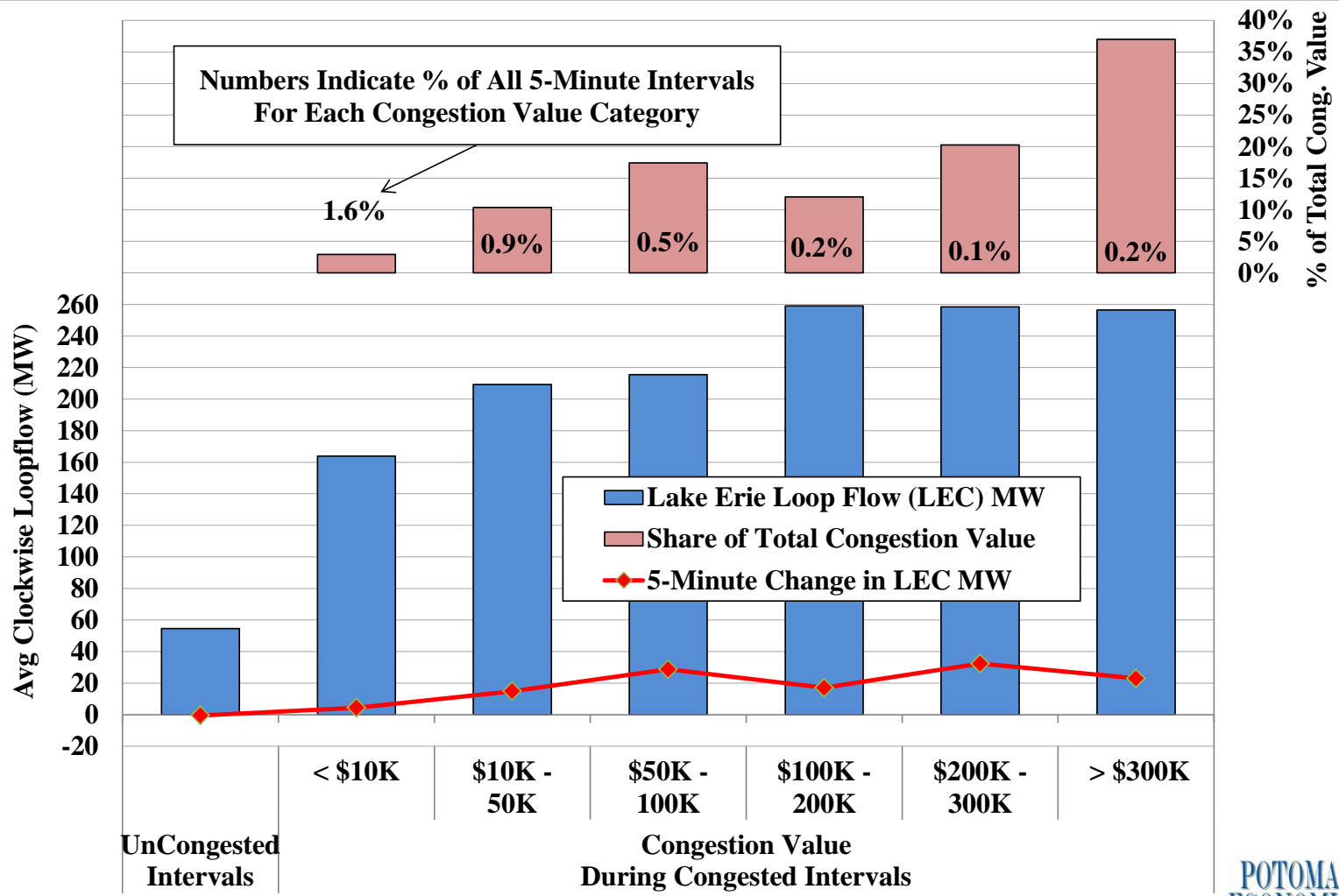


## Highlights and Market Summary: Energy Market Outcomes and Congestion

- West Zone congestion has been affected by significant market changes, including:
  - ✓ (a) the implementation of GTDC in February 2016; (b) the retirements of coal units in December 2015 and in March 2016; (c) the implementation of a composite shift factor at Niagara plant in May 2016; (d) transmission upgrades in May 2016; and (e) the S. Ripley-Dunkirk 230 kV line and Warren-Falconer 115 kV line being taken OOS during most of 2016-Q2.
  - ✓ Also, volatile loop flows continued to exacerbate congestion. (see slides 61-63)
- These challenges increase the need for efficient congestion management in the West Zone.
  - ✓ On 6/28, NYISO implemented enhanced loop flow assumptions in RTC and RTD to deal with uncertainty about loop flows.
  - ✓ However, we continue to observe: (see slides 64-70)
    - Under-utilization of 115kV circuits that are parallel to congested facilities,
    - Inefficiently-high generation from units that exacerbate 230kV congestion,
    - Under-commitment of West Zone units that relieve 115kV & 230kV congestion,
    - Shadow prices are not well correlated with the severity of congestion during transmission shortages, which undermines scheduling incentives for importers and other non-dispatchable resources.

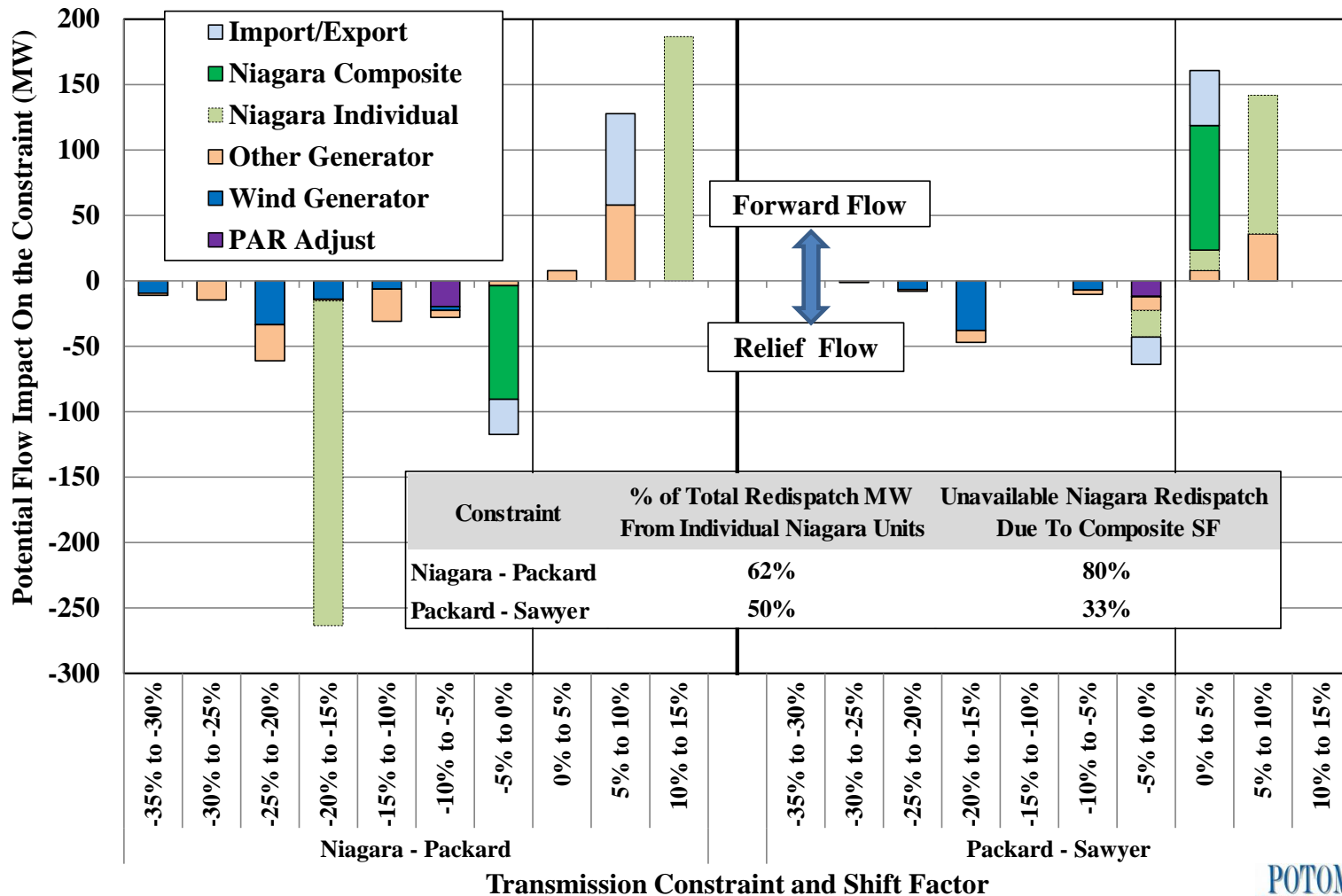


# West Zone Congestion and Clockwise Loop Flows During the Third Quarter of 2016





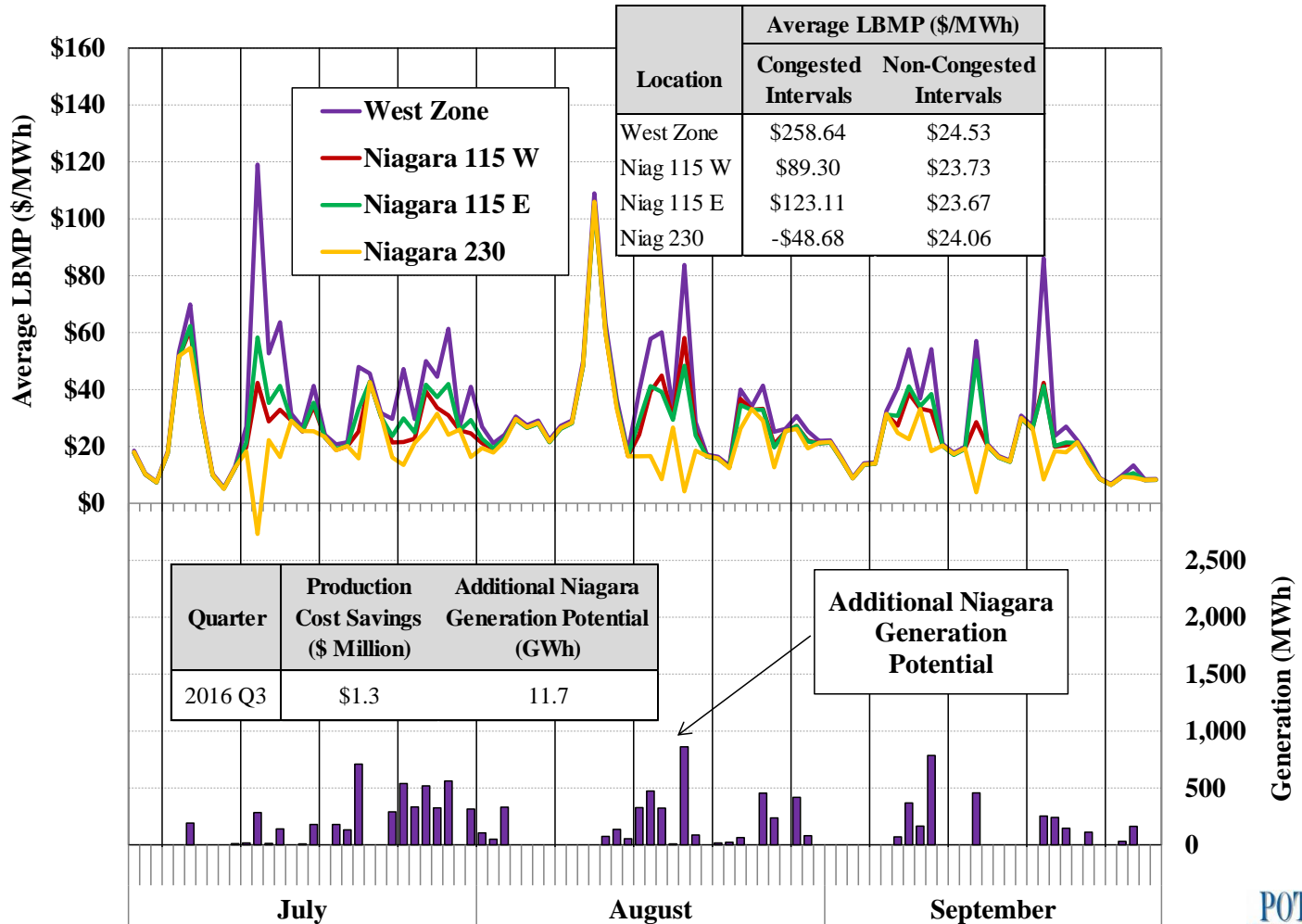
# West Zone Congestion and Niagara Generation Modeling Potential Redispatch Options







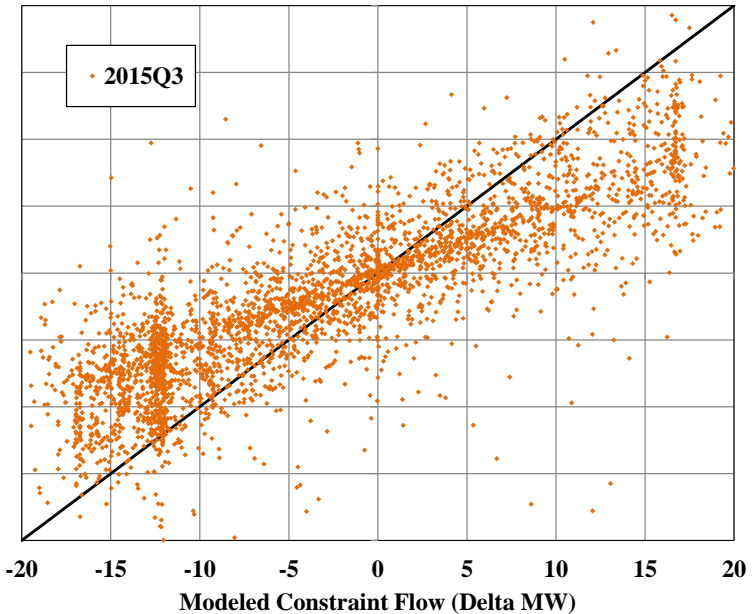
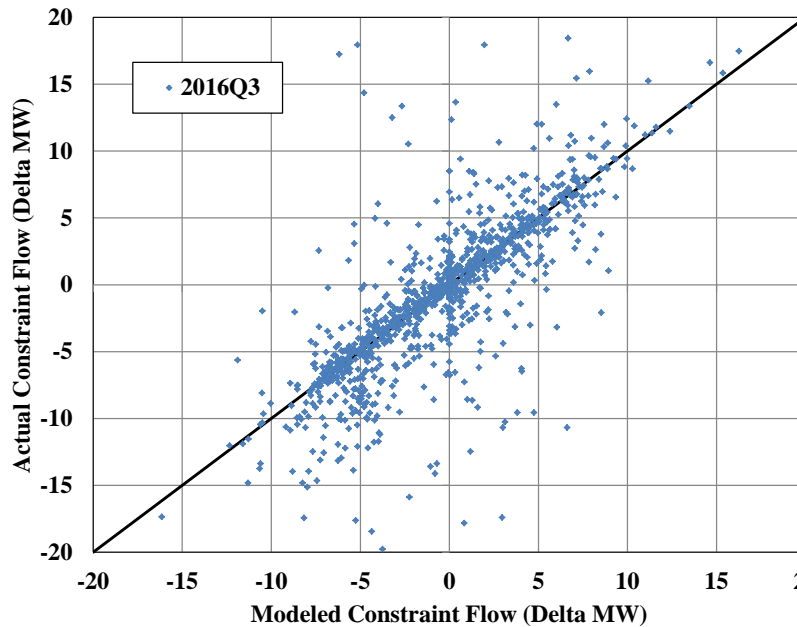
# West Zone Congestion and Niagara Generation Modeling LBMPs by Generator & Under-Utilization of 115kV Circuits





# West Zone Congestion and Niagara Generation Modeling

## Modeled Impact vs. Actual Impact



<b>Average Constraint Flow Impact (Delta MW)</b>		
<b>Absolute Value of:</b>	<b>2016-Q3</b>	<b>2015-Q3</b>
<b>Modeled Impact</b>	<b>3.6</b>	<b>9.6</b>
<b>Actual Impact</b>	<b>5.0</b>	<b>6.0</b>
<b>Modeled v Actual</b>	<b>2.4</b>	<b>4.9</b>

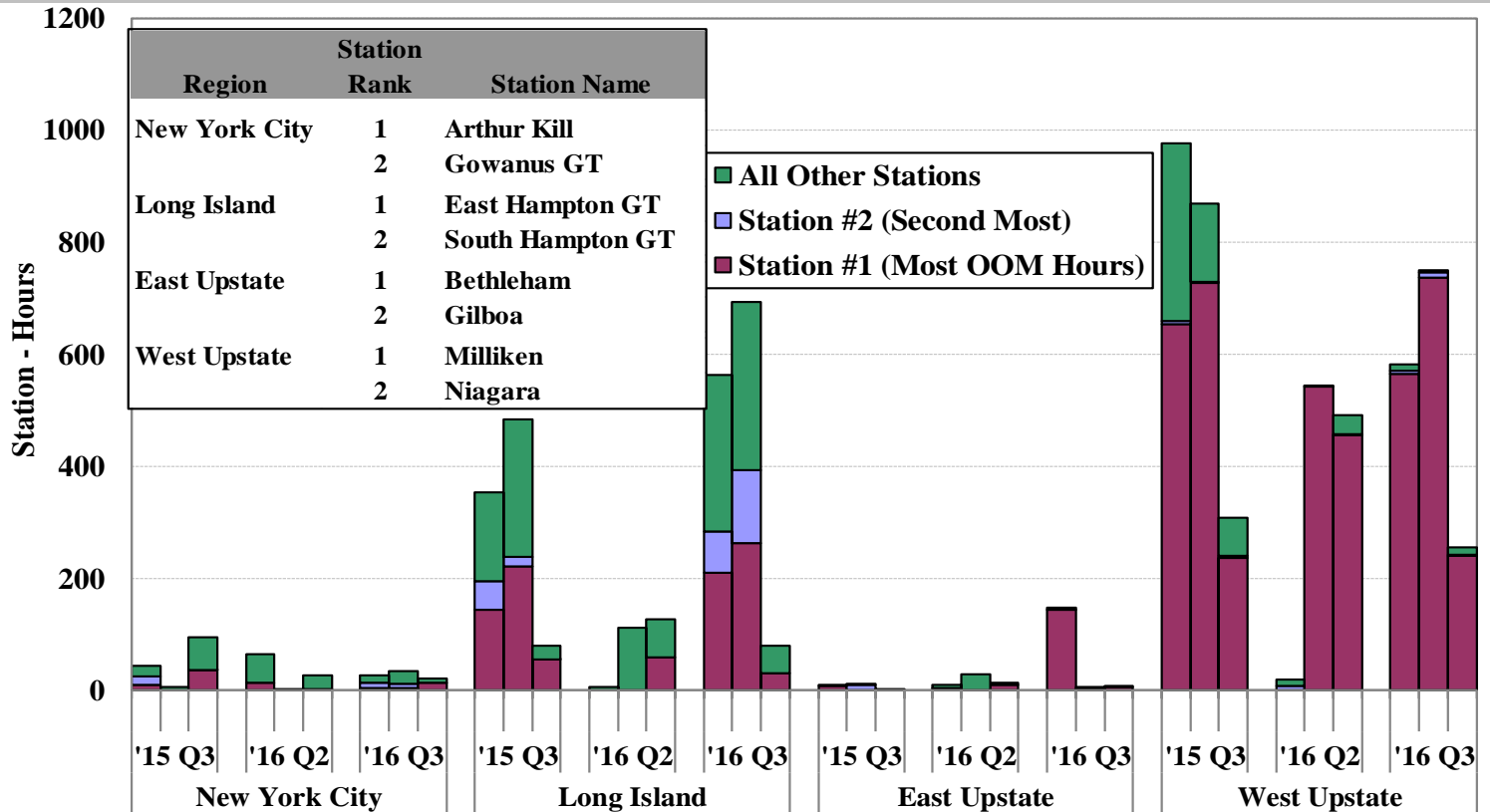


## Highlights and Market Summary: Uplift and Revenue Shortfalls

- Guarantee payments were \$19M, down 7% from 2015-Q3. (see slides 78-88)
  - ✓ Supplemental commitments and OOM dispatches fell in Western NY because of transmission upgrades and in NYC because of generation being more economic (relative to the rest of Eastern NY due to gas market conditions).
  - ✓ However, these were offset by increased supplemental commitments and OOM dispatches in Long Island because of higher load levels and transmission outages.
- DAM congestion shortfalls were \$20M, up \$13M from 2015-Q3. (see slide 56)
  - ✓ Transmission outages were the main driver – over \$11M of shortfalls were assigned to the responsible transmission owners.
  - ✓ The remaining shortfalls accrued primarily on the West Zone constraints, resulting largely from assumptions related to loop flows.
- Balancing congestion shortfalls were \$9M, up \$3M from 2015-Q3. (see slide 57)
  - ✓ TSA events on several days accounted for the majority of shortfalls.
    - TSA-related congestion shortfalls were notably higher than in the prior two summers partly because of: a) higher load levels during TSA events; and b) less congestion relief from the Ramapo line because of its derating.
  - ✓ West Zone 230 kV facilities accounted for most of remaining shortfalls.



# Frequency of Out-of-Merit Dispatch by Region by Month



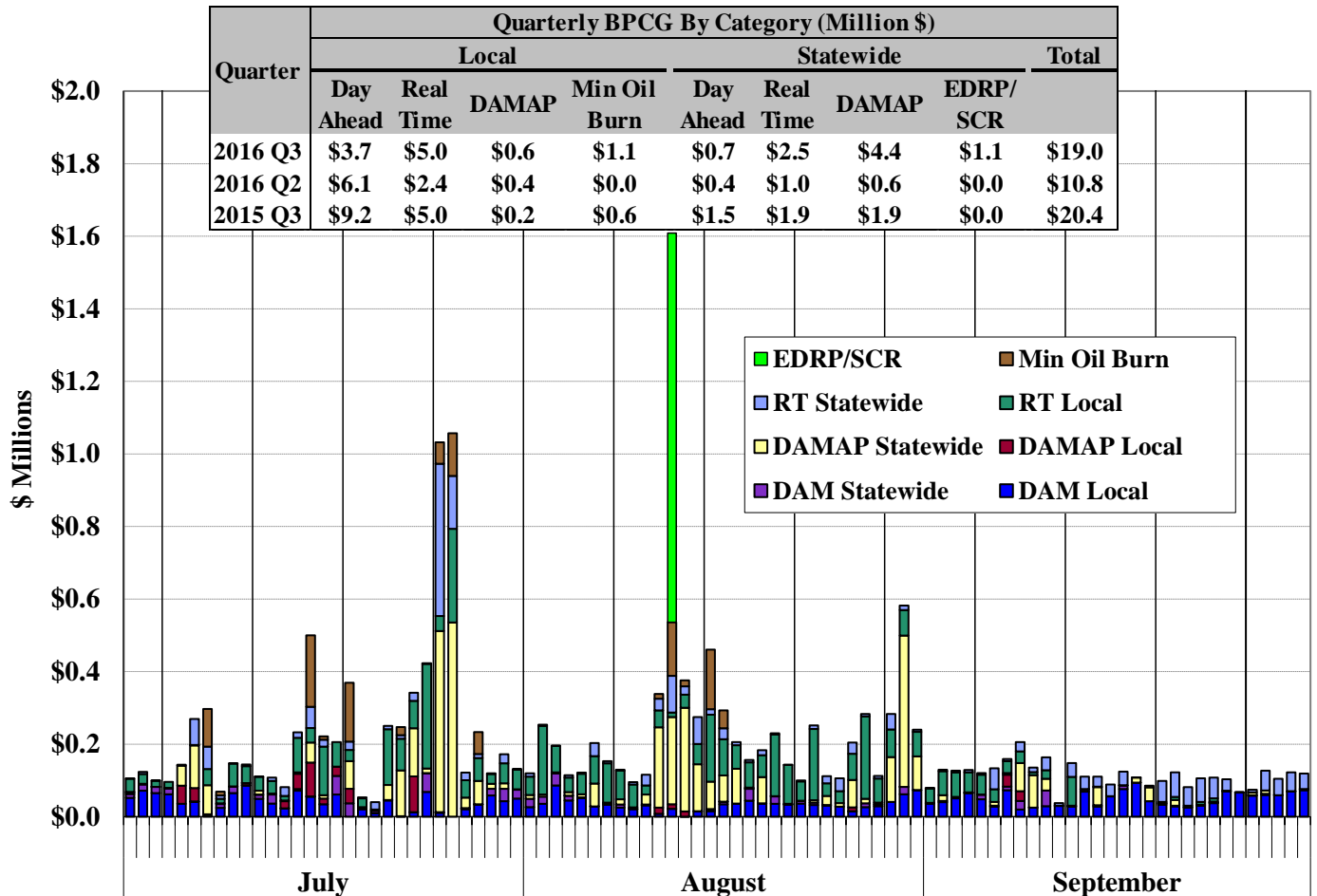
Note: "Station #1" is the station with the highest number of out-of-merit ("OOM") hours in that region in the current quarter; "Station #2" is that station with the second-highest number of OOM hours in that region in the current quarter.

Note: The NYISO also instructed Niagara to shift output among the generators at the station in order to secure certain 115kV and/or 230kV transmission facilities in, 790 hours in 2015-Q3, and 600 hours in 2016-Q2, and 430 hours in 2016-Q3. However, these were not classified as Out-of-Merit in hours when the NYISO did not adjust the UOL or LOL of the Resource.



# Uplift Costs from Guarantee Payments

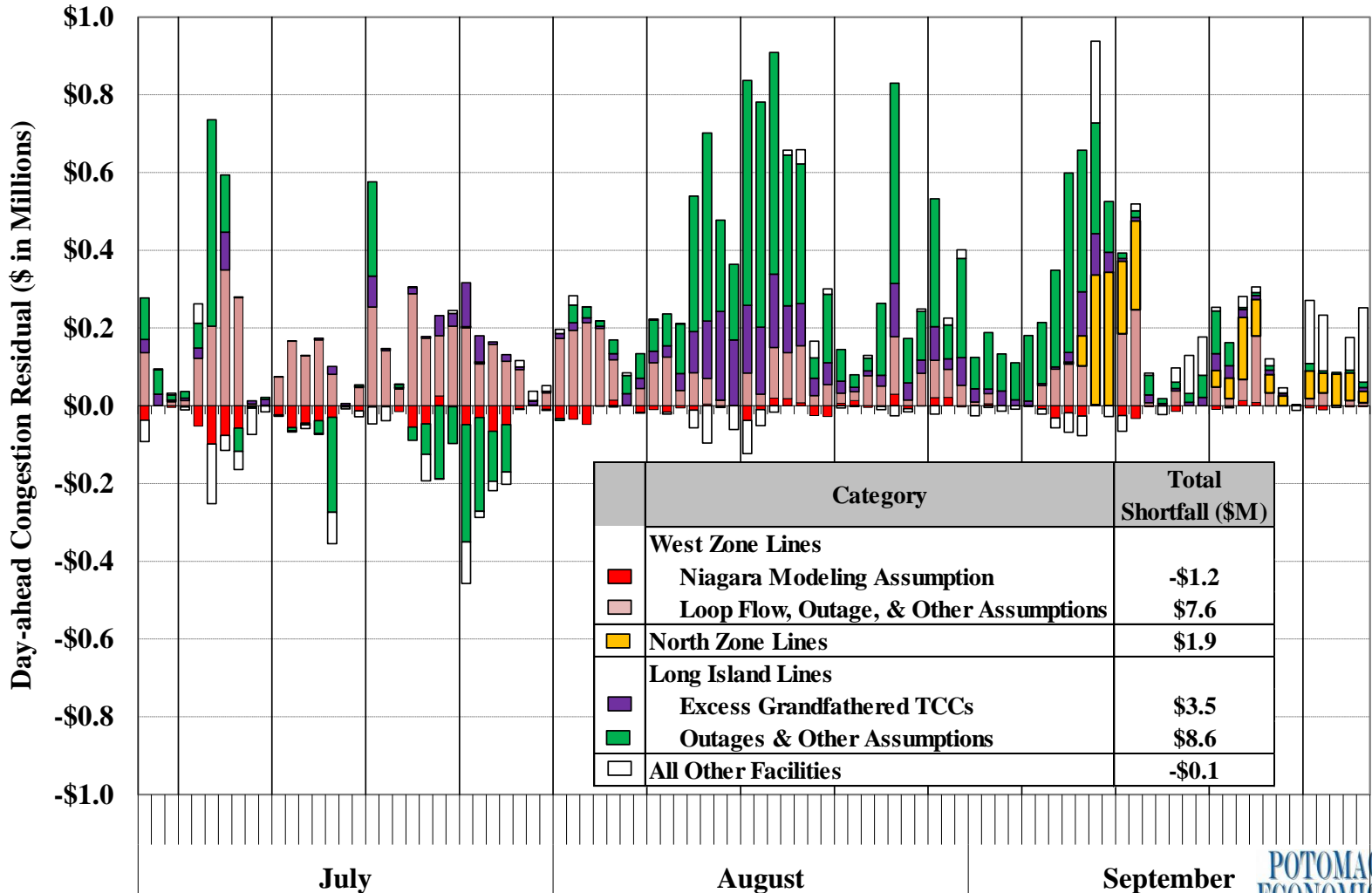
## Local and Non-Local by Category



Note: These data are based on information available at the reporting time and do not include some manual adjustments to mitigation, so they can be different from final settlements.

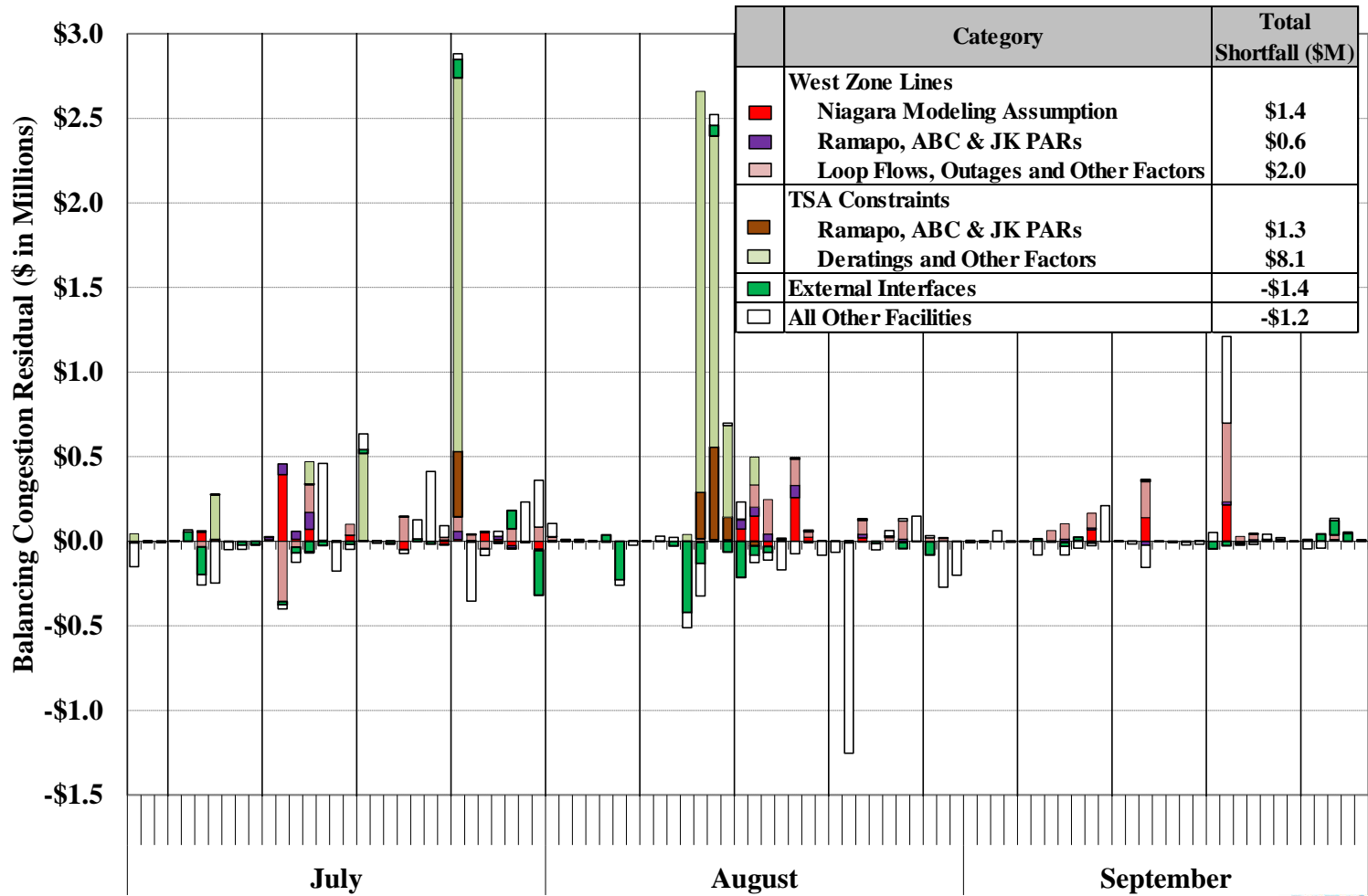


# Day-Ahead Congestion Revenue Shortfalls by Transmission Facility





# Balancing Congestion Shortfalls by Transmission Facility



Note: The BMCR estimated above may differ from actual BMCR because the figure is partly based on real-time schedules rather than metered values.



## Highlights and Market Summary: Capacity Market

- UCAP prices fell 20 percent in New York City and 23 percent in Long Island from 2015-Q3, but rose 11 percent in the G-J Locality. (see slides 98-99)
- Average spot prices fell in NYC and Long Island primarily because of lower ICAP requirements (5% in NYC and 2% in Long Island). These fell because of:
  - ✓ Lower LCRs, which resulted partly from the TOTS projects that increased import capability into SENY; and
  - ✓ Lower peak load forecast.
- G-J Locality spot prices rose because the decrease in capacity supply was larger than the decrease in the ICAP requirement.
- In ROS, average spot prices were relatively unchanged from the previous year because of the combined effect of following factors:
  - ✓ Slightly lower ICAP requirement, which reflected the net effect of lower peak load forecast and a higher IRM.
  - ✓ A decrease in internal ICAP supply because of retirements, mothballing, and outages.
  - ✓ Higher sales from external resources (partly offset by lower SCR sales).



## Key Drivers of Capacity Market Results

	NYCA	NYC	LI	G-J Locality
<b>Avg. Spot Price</b>				
2016 Q3 (\$/kW-Month)	3.74	12.21	4.42	9.21
% Change from 2015 Q3	2%	-20%	-23%	11%
<b>Change in Demand</b>				
Load Forecast (MW)	-209	-136	-61	-31
IRM/LCR	0.5%	-3.0%	-1.0%	-0.5%
2016 Summer	117.5%	80.5%	102.5%	90.0%
2015 Summer	117.0%	83.5%	103.5%	90.5%
<b>ICAP Requirement (MW)</b>	<b>-77</b>	<b>-467</b>	<b>-117</b>	<b>-109</b>
<b>Change in ICAP Supply (MW)</b>				
<i>Reductions Due to: Retirement (R), ICAP Ineligible FO (FO), Mothball (M)</i>				
R - Huntley 67 & 68 (Mar-16)	-375			
FO - Astoria GT 05,07,12,13 (Jan-16)	-58	-58		-58
M - Astoria GT 08,10,11 (Jul-16)	-47	-47		-47
R - Dunkirk 2 (Jan-16)	-75			
M - Ravenswood 04,05,06 (May-16)	-49	-49		-49
<i>Changes Due to: DMNC Test</i>	63	89	19	56
<i>Changes in External &amp; SCR Sales</i>	537	-22	-18	-23
<b>Net Changes (MW)</b>	<b>-5</b>	<b>-87</b>	<b>0</b>	<b>-121</b>