Highlights from the 2021 State of the Market Report for the NYISO Markets: Energy & Ancillary Services Market Issues

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Introduction

- As the Market Monitoring Unit for NYISO, we produce an annual State of the Market (SOM) Report to:
  - ✓ Evaluate the performance if the markets;
  - ✓ Identify market flaws or market power concerns; and
  - ✓ Recommend improvements in the market design.
- Given the breadth of the report, this presentation covers only highlights from our 2021 SOM Report related to energy and ancillary services markets, including:
  - ✓ A summary of E&AS market outcomes;
  - ✓ Recommended market enhancements for the:
    - Energy and ancillary services markets

Schedule

- The 2021 SOM is being presented at several meetings:
  - ✓ May 24: MIWG/ICAPWG
    - Capacity Market & Policy focus – 75 minutes
  - ✓ May 25: Market Committee
    - Overview – one hour
  - ✓ May 26: MIWG/ICAPWG
    - Energy and Ancillary Services focus – 75 minutes
  - ✓ Additional slots can be scheduled if there is interest.

Market Outcomes

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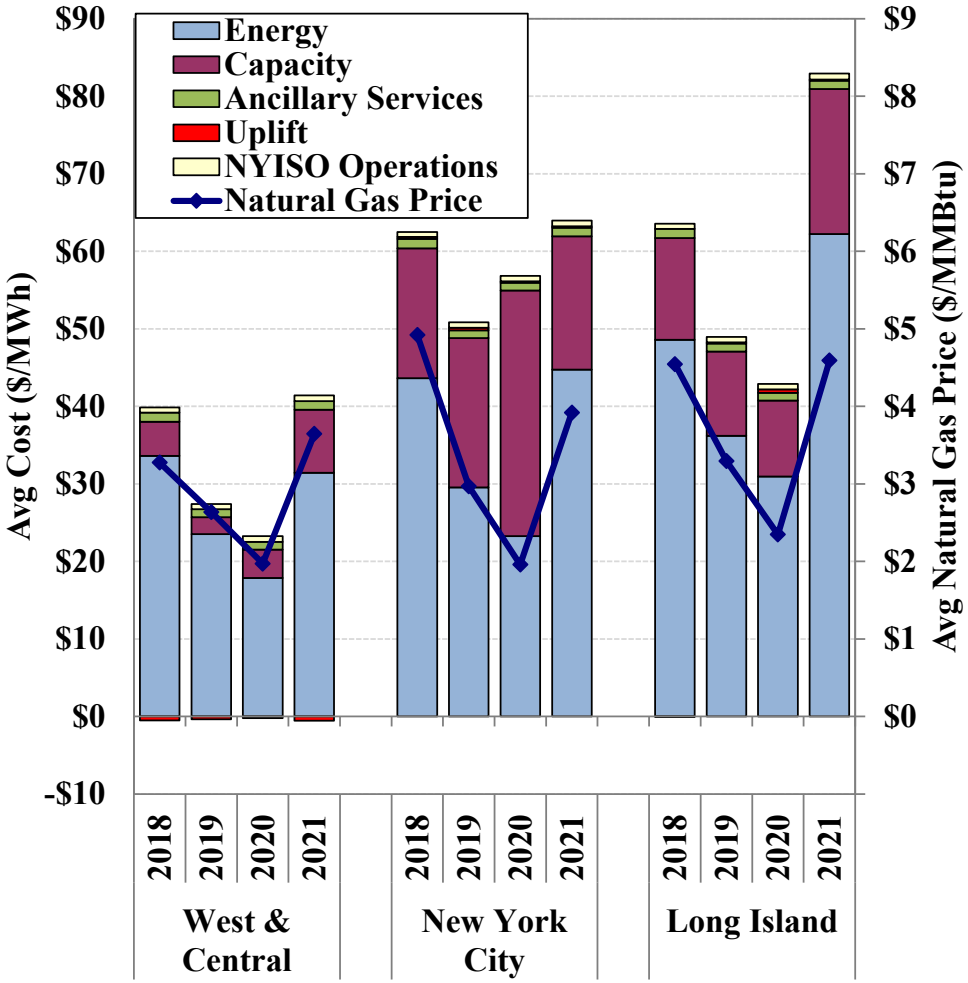
Market Outcomes: All In Price Trends



- Energy prices rose in 2021 because of:
  - ✓ Gas prices
  - ✓ IP nuke retirement
  - ✓ Planned and forced transmission outages
  - ✓ Return of normal demand after year affected by COVID
- Capacity prices in 2021 fell in NYC and rose in other areas

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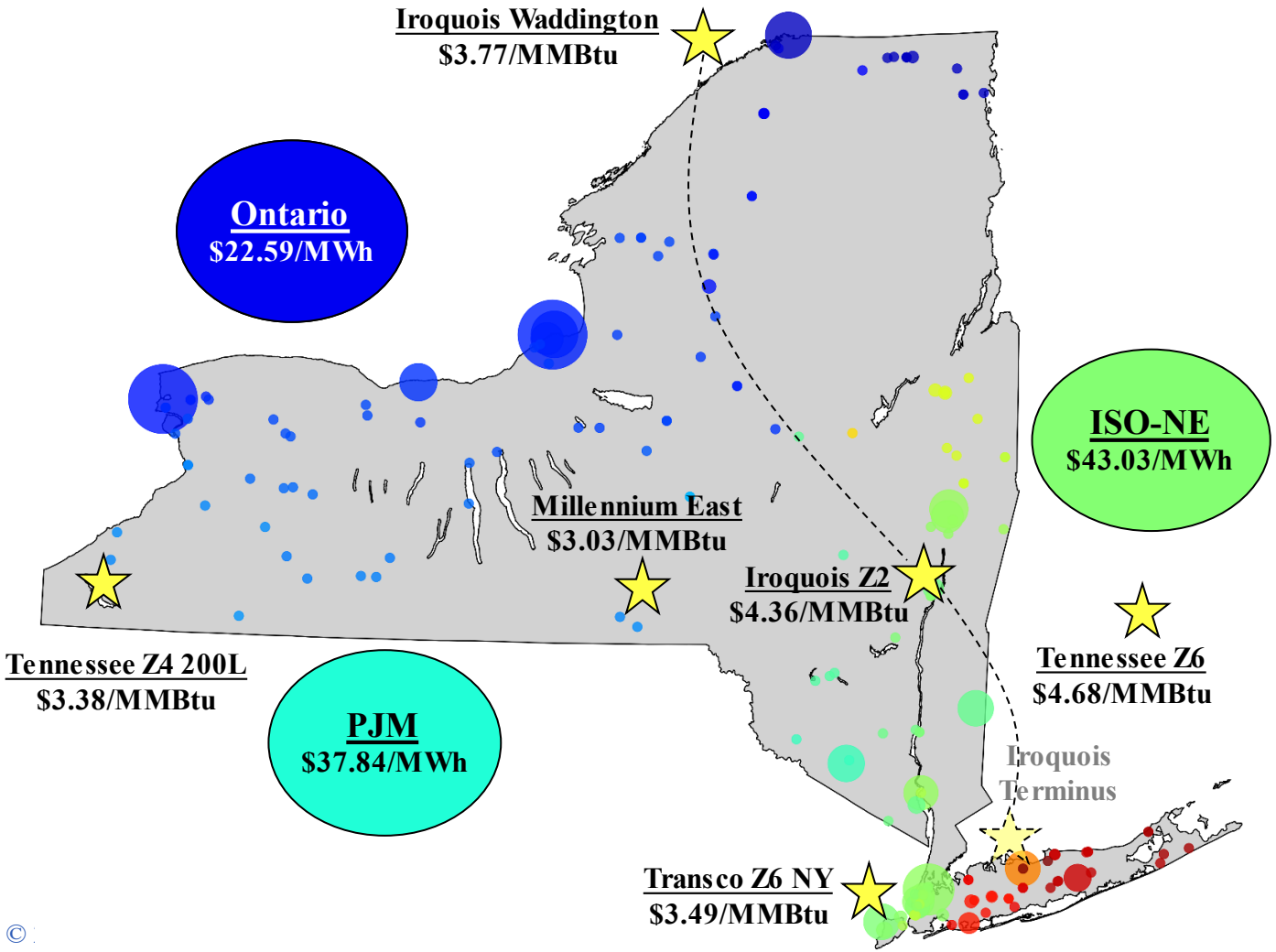
Market Outcomes: Congestion Patterns



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Recommended Market Enhancements

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Prioritizing Market Enhancements

- Unprecedented levels of policy-driven investment expected over the coming decade
- The NYISO should focus on enhancements that:
  - ✓ Guide renewable investment to where it is most deliverable
  - ✓ Provide incentives for investment in flexible resources that help with:
    - Integrating intermittent renewables, while
    - Maintaining reliability
  - ✓ Encourage retirement of inflexible existing generators
- Accomplishing this will require prudent improvements to better value energy and ancillary service providers.

Investment Signals: Enhancing Incentives for Key Attributes

- Increasing E&AS net revenues for flexible units would:
  - ✓ Reduce the capacity revenues needed to maintain reliability
  - ✓ Encourage older inflexible units to retire
- NYISO is working on addressing two key recommendations:
  - ✓ 2015-16: Dynamic reserve requirements
  - ✓ 2017-1: NYC locational reserve requirements
- We also recommend enhancements to E&AS markets:
  - ✓ 2016-1: Compensate reserves that increase transfer capability
  - ✓ 2017-2: Reserve demand curve increases for statewide
  - ✓ 2019-1 & 2021-2: Full representation of Long Island reserves
  - ✓ 2020-2: Eliminate offline fast-start pricing
- Increased intermittent penetration will increase benefits.

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Energy Market Enhancements: Dynamic Reserve Requirements

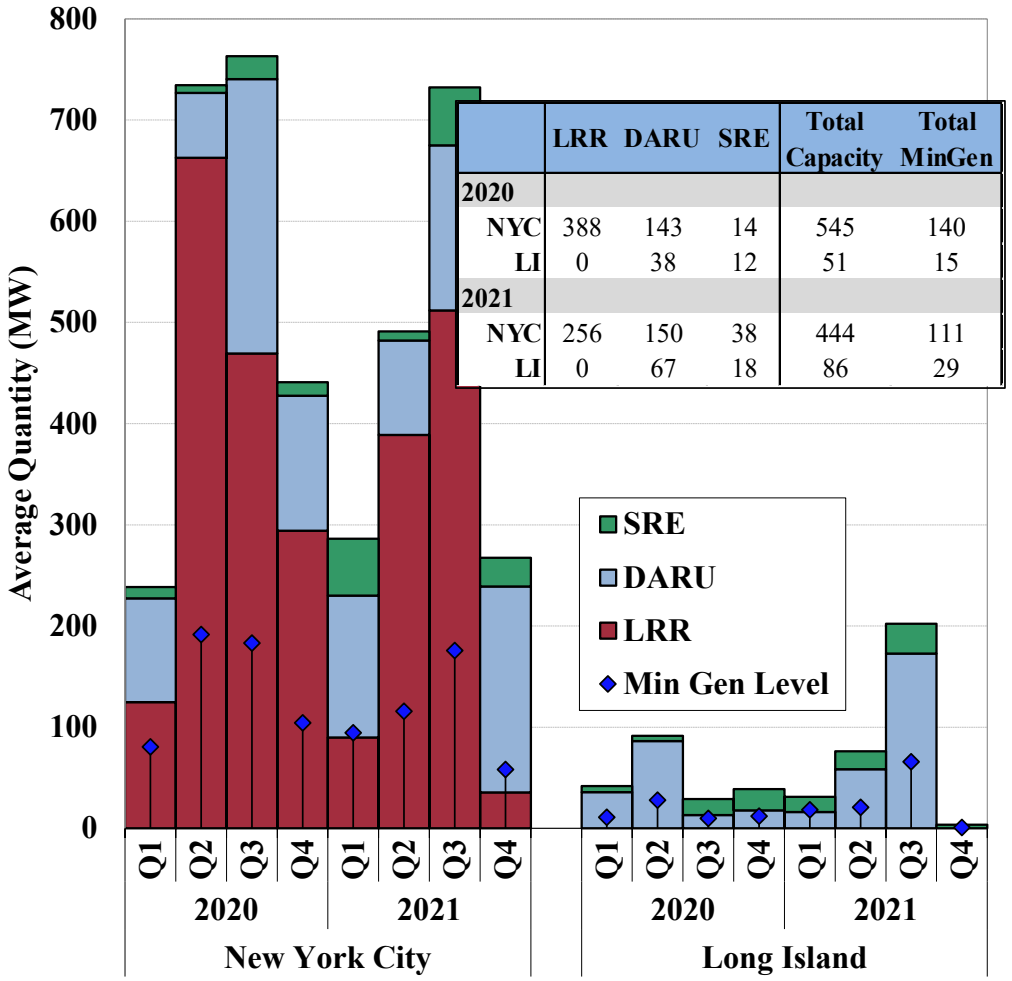
- Dynamic reserves would facilitate improved modeling of:
  - ✓ *Long Island* – allow larger amounts of LI reserves to support the requirements in broader regions
  - ✓ *East NY and SENY* – allow holding reserves on the interfaces to more efficiently satisfy regional reserve requirements
  - ✓ *HQ-NYCA imports* – would increase energy schedules significantly above the level currently allowed
  - ✓ *NYCA* – allow higher reserve requirement to account for under-scheduling of energy – *not addressed by RECA but NYISO has proposed to incorporate this in the design*
  - ✓ *NYC Load Pockets* – allow holding some of local reserves on the interfaces into NYC and its load pockets
  - ✓ *Operator Reserve Adjustments* – avoid OOM actions under temporary conditions – *not addressed by RECA*

Energy Market Enhancements: Reserves for NYC Congestion Management

Transmission Facility		Average Constraint Limit (MW)			Aditional Reserves	
		N-1 Limit Used	Seasonal LTE	Seasonal STE	Above LTE	Percent Increase
345 kV	Dunwodie-Motthavn	986	833	1298	153	18%
	Farragut-E13th ST	1127	935	1345	192	21%
	W49th ST-E13th ST	1210	986	1566	224	23%
	Goethals-Gowanus	951	748	1241	203	27%
	Sprnbrk-W49th ST	1236	944	1529	292	31%
138 kV	Gowanus-Greenwd	316	291	341	25	9%
	Vernon-Greenwd	238	226	248	11	5%
	Foxhills-Greenwd	304	239	371	66	28%

- 66 percent (or $28 million) of real-time congestion during 2021 occurred on constraints that would have been loaded above LTE after a single contingency.

Energy Market Enhancements: Supplemental Commitments for Reserves



	LRR	DARU	SRE	Total Capacity	Total MinGen
2020					
NYC	388	143	14	545	140
LI	0	38	12	51	15
2021					
NYC	256	150	38	444	111
LI	0	67	18	86	29

- Frequent ST DARU/LRR for NYC reserves, accounting for:
  - ✓ 41 percent of NYC ST run hours
  - ✓ 40 percent of NYC ST energy
- High ST DARU in 2021 Q3 for LI reserves during Y49/Y50 outages
- Local energy and reserve prices are understated because they do not reflect these costs
- Model reserve constraints that drive these commitments

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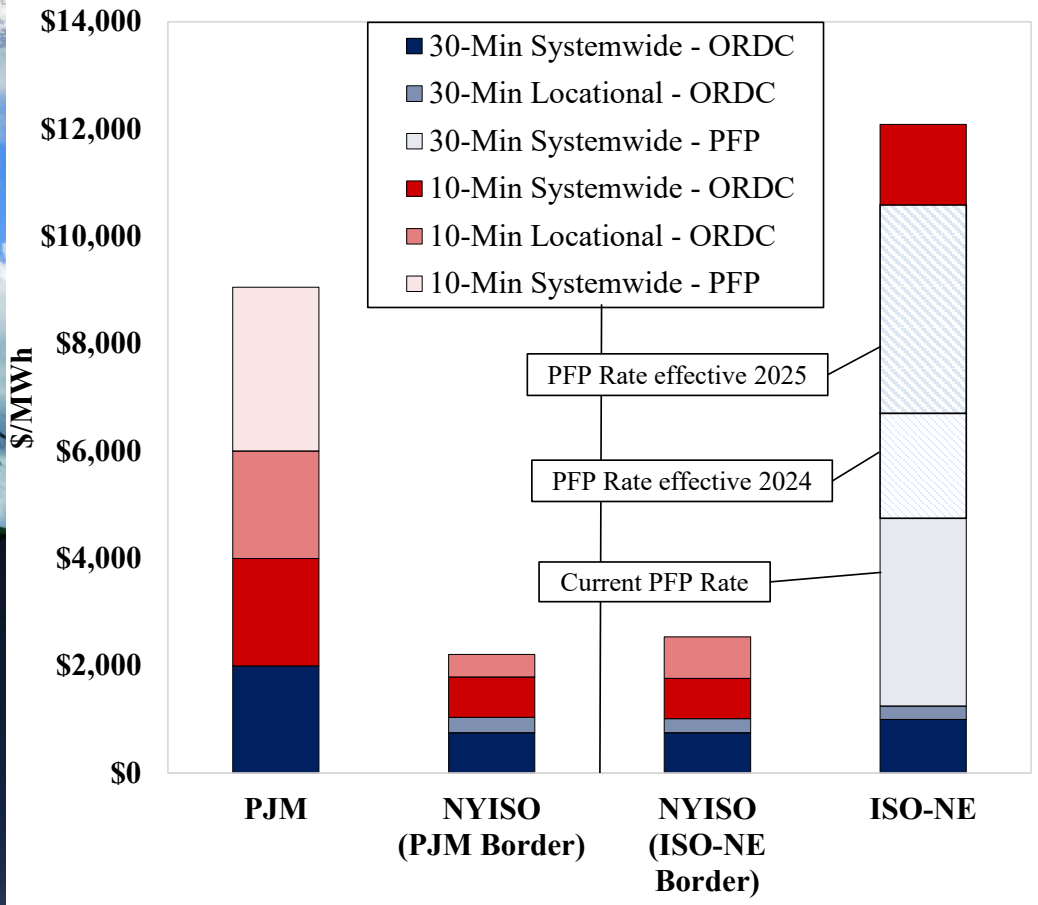
Energy Market Enhancements: Shortage Pricing Disparities and Associated Risks



- Different regional 30-min shortage adders:
  - ✓ NYISO: ~$1,000
  - ✓ PJM: ~$2,000
  - ✓ ISO-NE: ~$10,500
- 10-min shortage adders:
  - ✓ NYISO: ~$2,450
  - ✓ PJM: ~$9,000
  - ✓ ISO-NE: ~$12,000
- Recommend levels that would stop OOM actions to maintain reliability and reflect reliability value.

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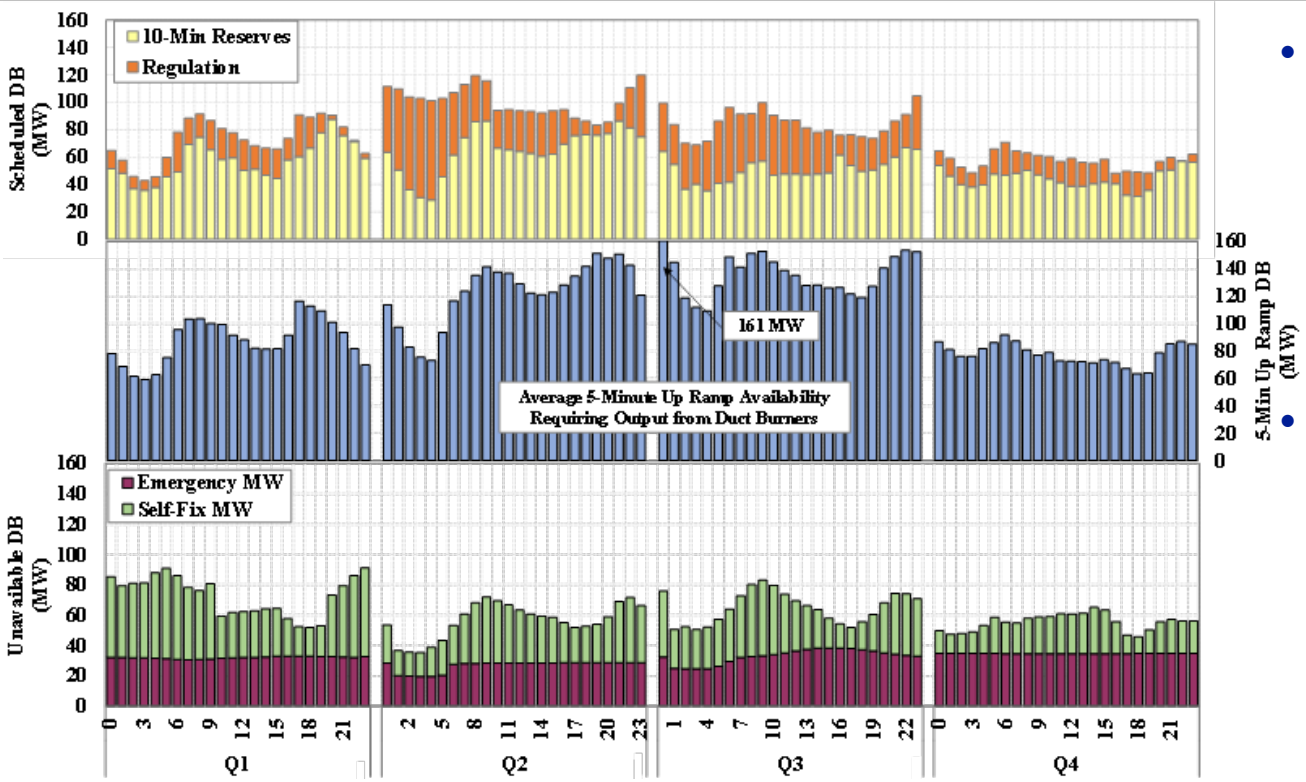
Energy Market Enhancements: Considerations for Fixed-Block Output

- A few of our recommendations address complications that arise due to fixed-block generation such as peaking units and duct-firing ranges of combined cycle units.
  - ✓ 2020-1: Consider enhanced scheduling in real-time of duct-firing capacity.
  - ✓ 2020-2: Eliminate offline fast-start pricing from RTD
  - ✓ 2012-13: Adjust RTD and RTC look ahead evaluations to be more consistent with gas turbine commitment and ramp requirements.
- The following three charts illustrate issues that relate to these recommendations:
  - ✓ Issues with modeling duct burners as "incremental energy step" in the combined cycle output range.
  - ✓ Efficiency of offline GT fast-start pricing performance.
  - ✓ GT commitment efficiency and performance.

Energy Market Enhancements: Consider Duct Burner Modeling Enhancements



- Duct burners include >800 MW Summer Capacity.
- Currently considered 10-minute and regulation capable.

- Physical characteristics to consider:
  - ✓ Slower ramp rate – *Current ISO proposal would address this aspect*
  - ✓ Duct Burner start time may exceed 10 minutes
  - ✓ Limited flexibility prevents use for AGC

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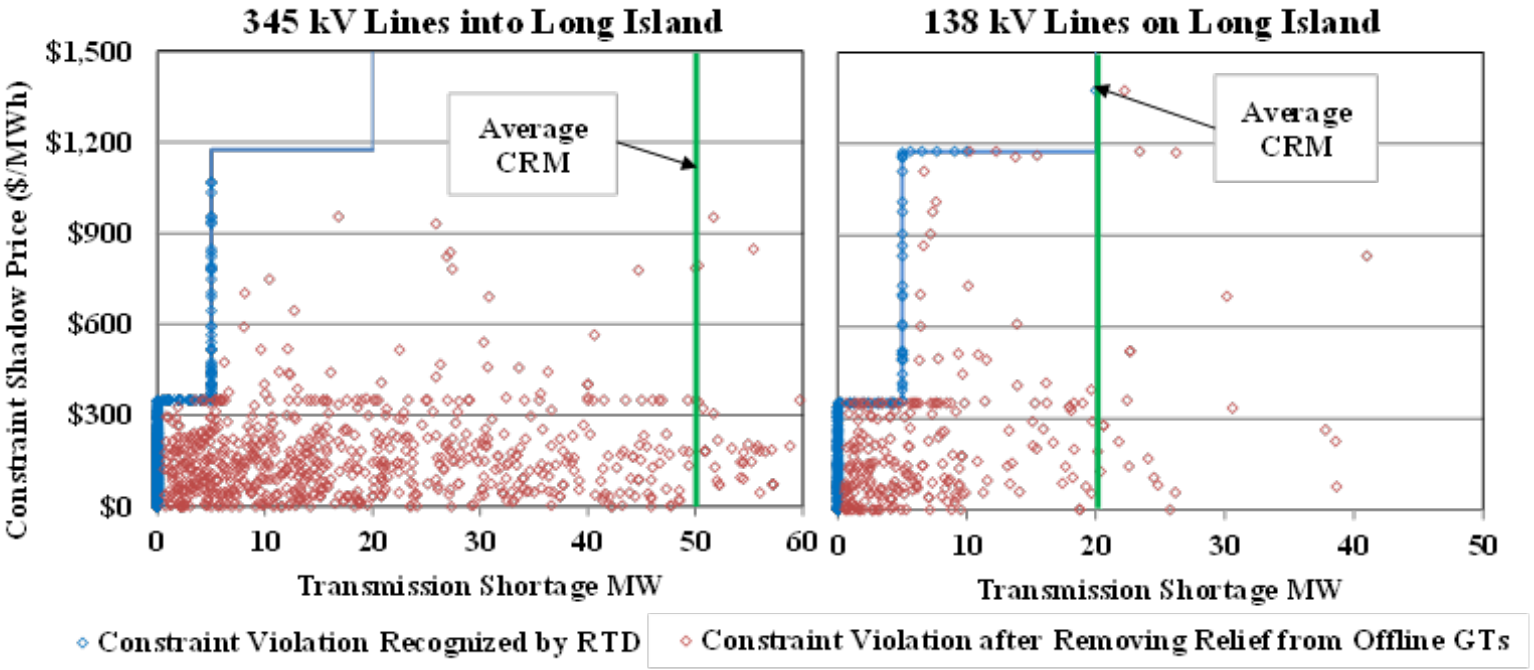
Energy Market Enhancements: Offline GT Price-Setting Elimination



- Offline GT pricing treats offline GTs as able to respond to dispatch instructions when they cannot actually do so.
- Use of offline GT pricing leads to: (a) artificially low transmission limits and flows in areas more reliant on GTs and (b) inefficient dispatch and incentives for battery storage.

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Energy Market Enhancements: GT Commitment Efficiency

Startup Performance	Cost not Covered by LBMP Revenues		
	2019	2020	2021
< 80%	19.2%	19.9%	13.5%
>= 80%	15.6%	16.0%	10.6%
Total	**15.9%**	**16.4%**	**11.0%**

- GT commitment efficiency (relative to RT prices) improved because of quick-start pricing rule enhancements in December 2020
  - ✓ RT prices better reflect the commitment costs of quick-start units when they are the marginal resource
- Two reasons for inefficient GT commitments:
  - ✓ RTC/RTD divergence
  - ✓ Current offline fast-start price setting rules
- Poor RTC/RTD divergence also leads to inefficient decommitment of peaking units and associated price spikes

Energy Market Enhancements: Modeling Constraints on Long Island

Year	Long Island Load Pockets	# OOM Days		# Congested Days		Avg. LBMP	Est. LBMP w/ Modeling Local Constraints
		69 kV	TVR	69 kV	138 kV		
2020	Valley Stream	79			284	$29.15	$33.70
	Brentwood	54			0	$27.97	$28.54
	East of Northport	52			124	$30.68	$35.62
	East End	13	95		1	$31.45	$48.13
2021	Valley Stream	70			161	$53.78	$55.10
	Brentwood	2		129	0	$55.45	$55.46
	East of Northport	28		95	101	$55.79	$57.43
	East End	18	65		0	$56.97	$69.12

- Brentwood & East of Northport 69-kV circuits secured in DAM & RT beginning in April 2021.
- TVR OOM on the East End still frequent and not addressed.
  - ✓ 2021-3: Model TVR needs using surrogate constraints

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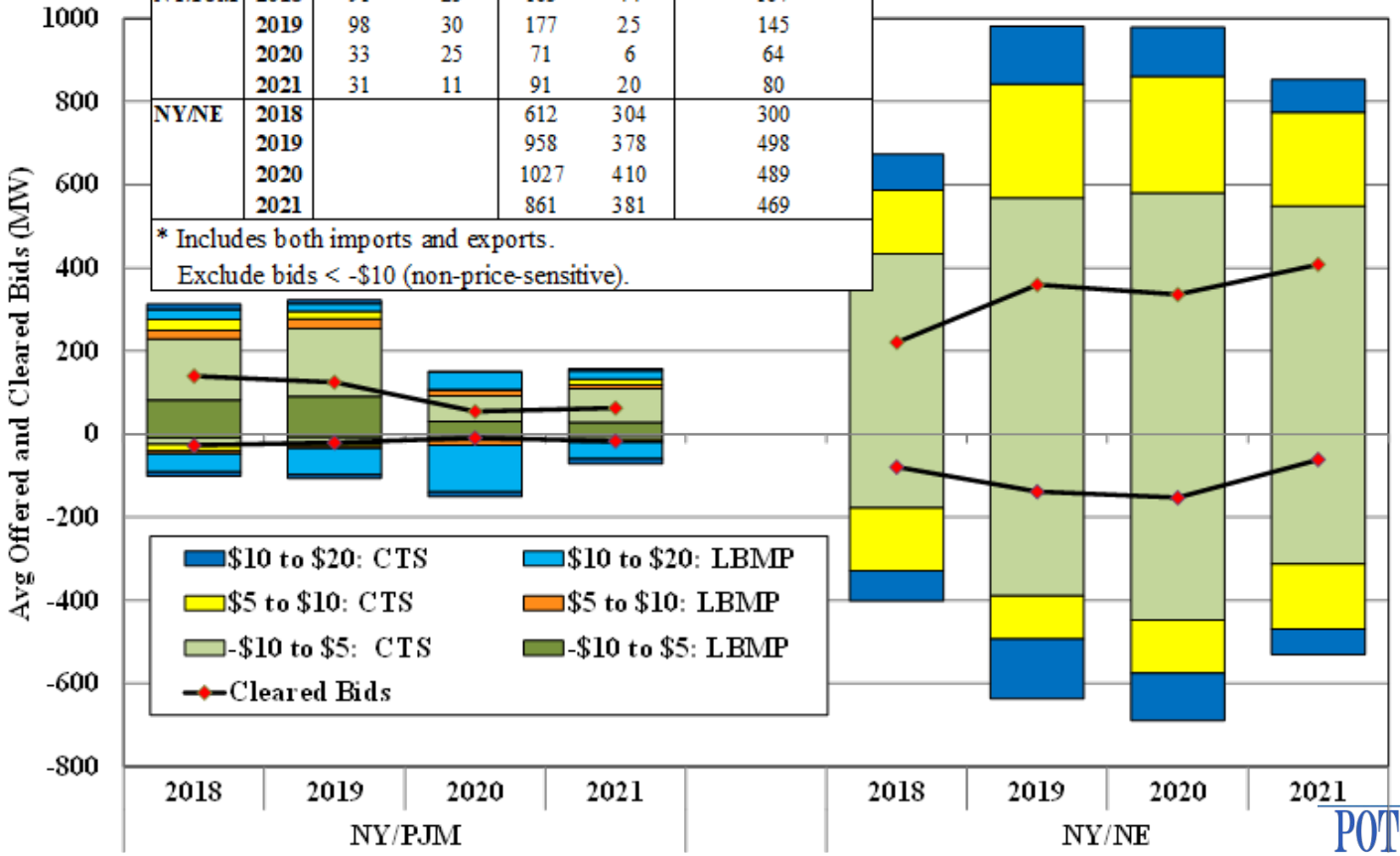
Energy Market Enhancements: Assessment of CTS Transaction Bids and Offers

		Avg Price-Sensitive Bid MW*				Avg Cleared Price-Sensitive Bid (MW)*
		LBMP-Based		CTS		
		< $5	$5-$10	< $5	$5-$10	
NY/PJM	2018	91	25	163	44	167
	2019	98	30	177	25	145
	2020	33	25	71	6	64
	2021	31	11	91	20	80
NY/NE	2018			612	304	300
	2019			958	378	498
	2020			1027	410	489
	2021			861	381	469

* Includes both imports and exports.
Exclude bids < -$10 (non-price-sensitive).



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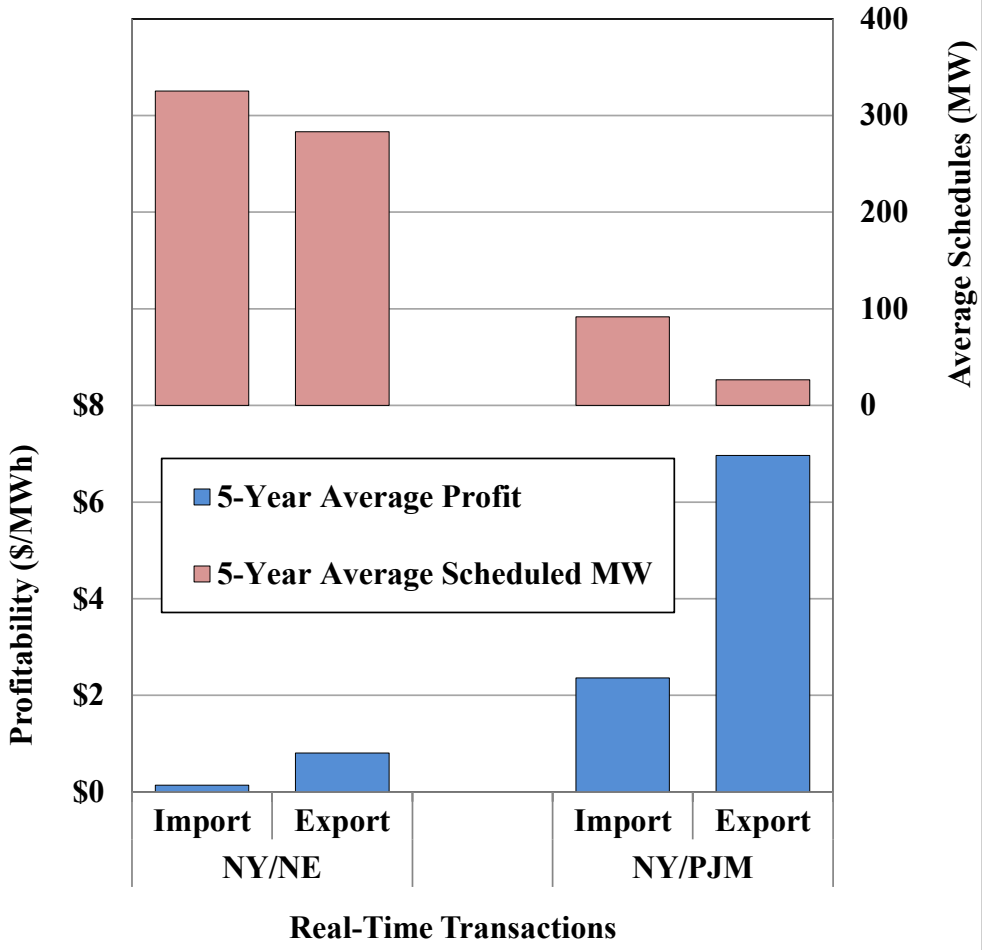
Energy Market Enhancements: CTS Transactions Profitability



- #2015-9 would eliminate fees for CTS transactions at NY-PJM border.
- Elimination of fees would improve use of NY-NE interface.
- CTS transactions do not drive transmission investment costs
- Lower fees would:
  - ✓ Encourage price-sensitive scheduling
  - ✓ Potentially increase revenue collection
  - ✓ Help integrate renewables

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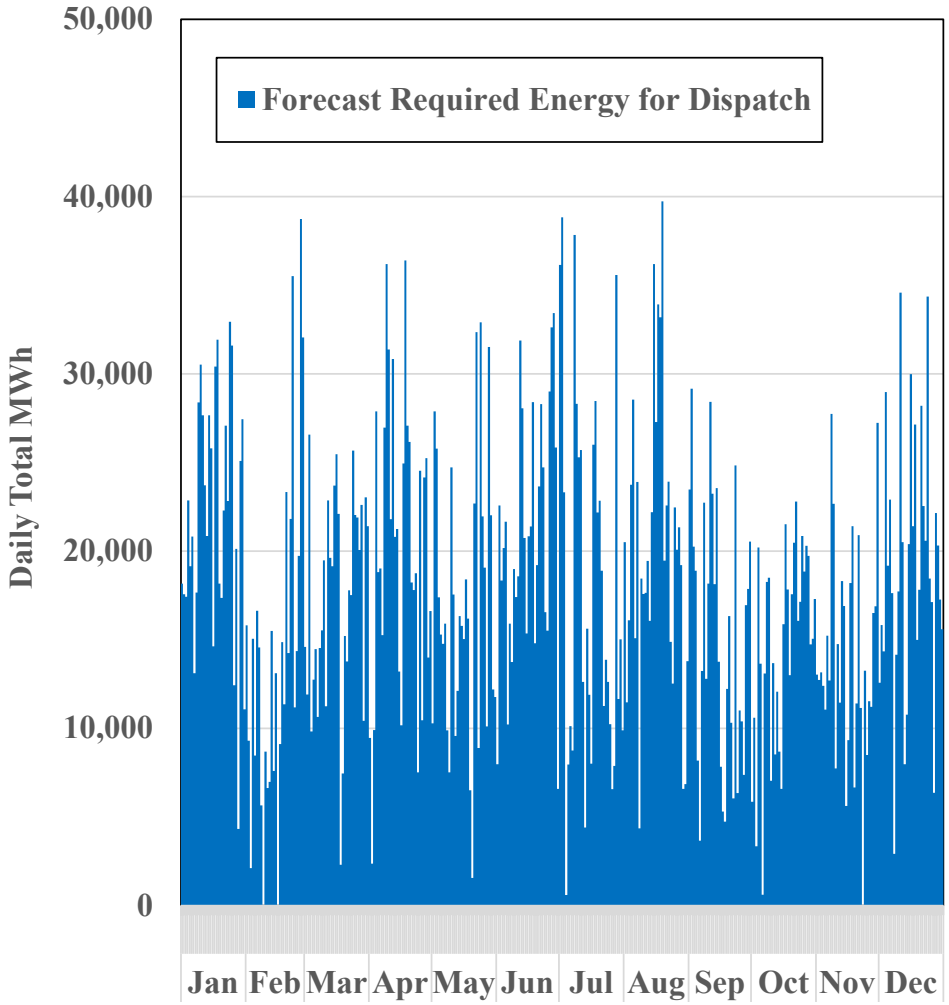
Energy Market Enhancements: Longer Lead Time Reserves



- Growing set of situations in need of more cost-effective longer lead time reserves:
  - ✓ 60-minute reserves for NYC N-1-1-0 requirement
  - ✓ Up to 4-hour reserves for load forecast errors, intermittent renewable variations, and under-scheduling of physical energy
- Avoid OOM and provide better incentives for flexibility
  - ✓ Help integrate renewables