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Mitigation Review Analysis

Data, Assumptions, and Initial Results

September 28, 2021

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Today:

- Reminder: Modeling Structure
- Data and Assumptions Used
  - Supply Curve
  - Demand Curve
- Preliminary Initial Results
- Sensitivities

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Model Structure

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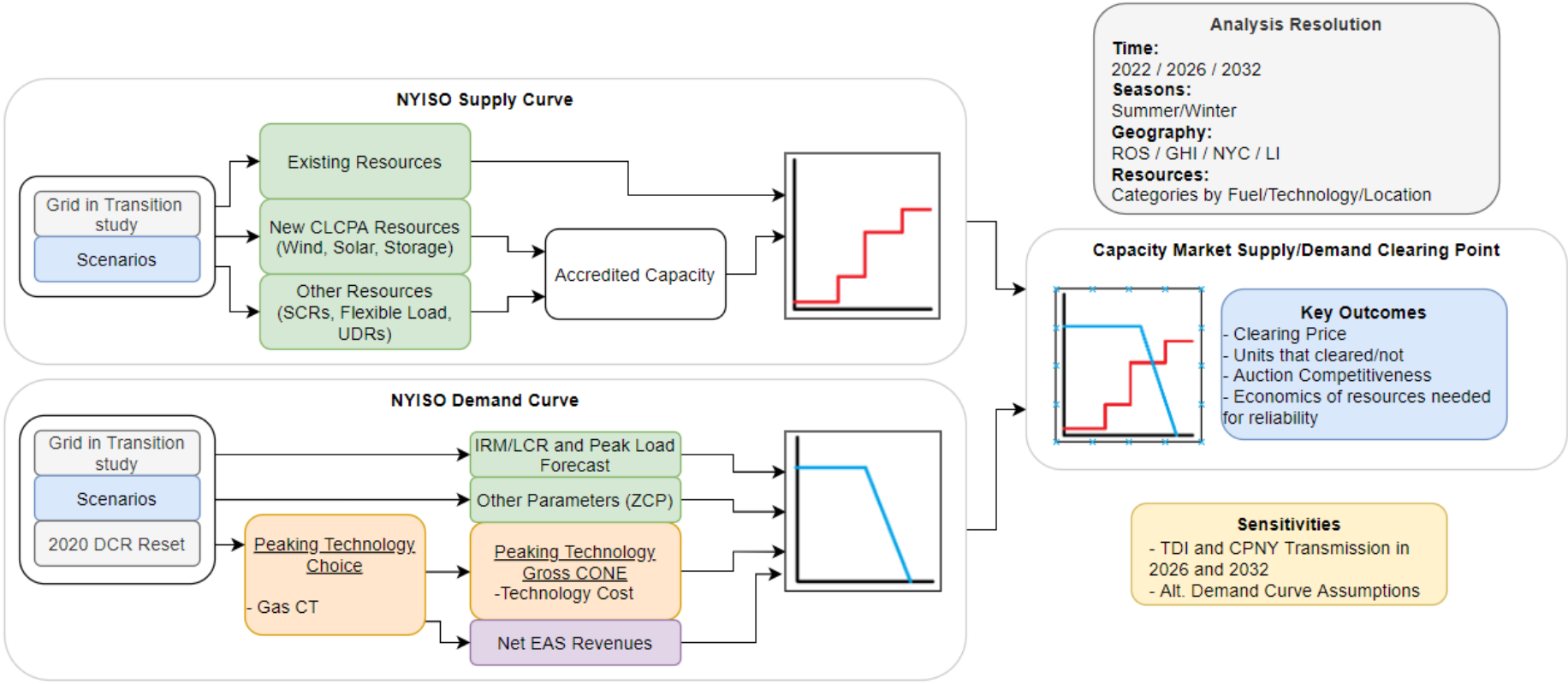
Reminder: Analytic Method



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Data and Inputs

Supply Curve Inputs: Non-CLCPA Resources

- Resource quantities from Grid in Transition study
  - Non-CLCPA resource retirements
    - 2,795 MW ICAP in retirements of fossil CT units by 2026
    - 1,189 MW ICAP in nuclear retirements between 2026 and 2032
  - Non-CLCPA resource additions
    - 248 MW of new NG CT capacity in Zone K by 2026

- Offer prices for Non-CLCPA Resources
  - Offer prices based on output from Grid in Transition study
    - Revenues: net EAS revenues + ZEC revenues
    - Variable Costs: fuel, variable O&M, emissions, start up
    - Fixed Costs: fixed O&M
  - Annual net costs "shaped" to summer/winter seasonal offers consistent with current BSM methodology

Supply Curve Inputs: CLCPA Resources

- Resource quantities from Grid in Transition study
  - Entry of wind, solar, and storage capacity based on Grid in Transition entry/exit model
  - CLCPA resource additions by 2032 (ICAP MW):
    - 7,959 MW of onshore wind
    - 7,591 MW of offshore wind
    - 16,669 MW of utility-scale solar
    - 4,264 MW of 2 hour battery storage
    - 386 MW of 4 hour battery storage
- Offer prices for CLCPA Resources
  - Offer prices are assumed to be $0/kW-mo

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Supply Curve Inputs: Summary of Capacity

NYCA Summer Capacity by Unit Type (MW)	2022		2026		2032	
	ICAP	UCAP	ICAP	UCAP	ICAP	UCAP
Fossil Fuel	26,315	24,322	23,481	21,833	23,485	21,836
Hydro	5,018	4,210	5,018	4,210	5,018	4,210
Nuclear	3,345	3,266	3,345	3,266	2,156	2,105
Onshore Wind	1,739	278	1,983	339	9,698	1,038
Offshore Wind	0	0	1,200	346	7,591	835
Utility-Scale Solar	56	26	5,056	1,431	16,669	1,217
Storage (2h and 4h)	594	260	2,165	952	4,651	2,228
Other Resources (Imports, SCRs, etc.)	5,871	5,623	5,772	5,650	6,451	6,310
Total	**42,939**	**37,985**	**48,021**	**38,027**	**75,719**	**39,778**

Supply Curve Inputs: UCAP/ICAP Translation

- Existing Nonrenewable Units
  - UCAP derating factors for dispatchable unit types are based on EFORd by resource type from historical NERC GADS data
- Renewable and Storage Units
  - For 2022, UCAP/ICAP Translation is based on current ICAP Manual seasonal derating factors
  - For 2026 and 2032, UCAP Translation is based on seasonal marginal capacity values from Grid in Transition Study for Onshore Wind, Offshore Wind, Utility-Scale Solar, and Storage units (see next page)
    - Storage units have additional assumed 3% EFORd
  - All "vintages" of units use same marginal capacity value within a season/year

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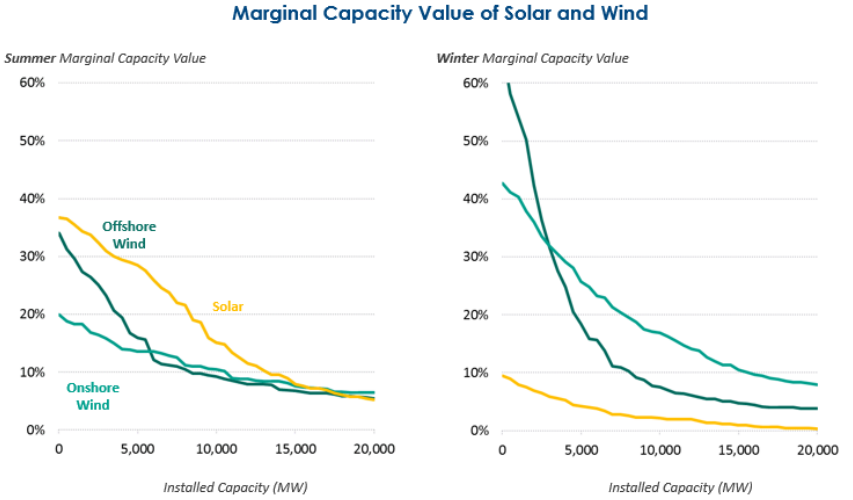
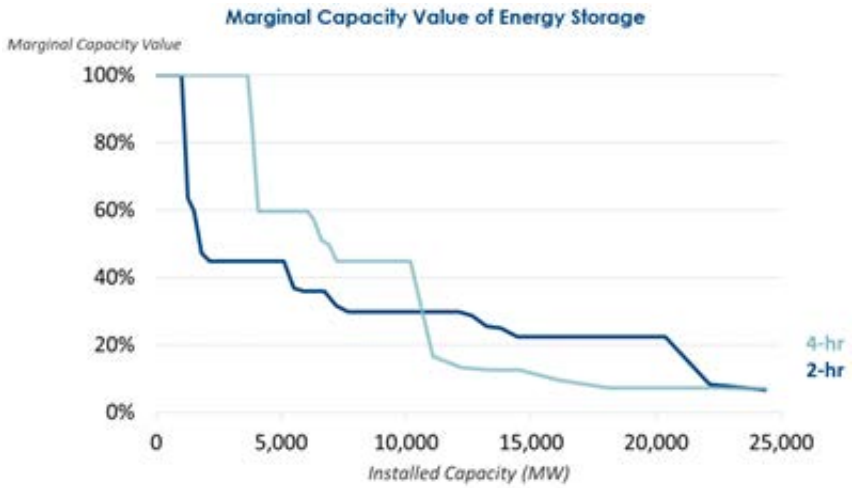
Supply Curve Inputs: UCAP/ICAP Translation





UCAP Translation Factors for CLCPA Units	Current ICAP Manual		Marginal Capacity Values			
	2022 Summer	2022 Winter	2026 Summer	2026 Winter	2032 Summer	2032 Winter
Onshore Wind	16.0%	34.0%	17.1%	35.8%	10.7%	17.0%
Offshore Wind	N/A	N/A	28.8%	52.2%	11.0%	10.7%
Utility-Scale Solar	46.0%	2.0%	28.3%	4.1%	7.3%	0.50%
2h Battery Storage	45.0%	45.0%	45.1%	45.1%	44.8%	44.8%
4h Battery Storage	90.0%	90.0%	100%	100%	100%	100%

Note: Battery Storage units have an additional assumed 3% EFORd in calculation of UCAP.

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Supply Curve Inputs: UCAP/ICAP Translation

- UCAP/ICAP Translation Factors used in demand curve are recalculated in each season/year to be consistent with supply curve inputs

UCAP/ICAP Translation Factors	Summer			Winter		
	2022	2026	2032	2022	2026	2032
NYCA	12.4%	22.7%	50.2%	11.3%	23.2%	49.8%
G-J Locality	8.0%	15.1%	35.1%	7.8%	13.5%	34.3%
NYC (J)	7.8%	18.3%	40.1%	7.7%	16.0%	38.8%
LI (K)	14.9%	21.9%	40.4%	15.0%	19.6%	39.7%

Demand Curve Inputs: Reserve Margins

- UCAP Reserve Margins (UCAP Requirement / Peak Load) by locality calculated from historical average 2016-2021 values

	NYCA	G-J Locality	NYC (J)	LI (K)
UCAP Reserve Margin	107.9%	85.7%	77.8%	96.9%

- IRMs and LCRs by year derived from URMs and UCAP/ICAP Translation Factors from supply curve

IRM/LCR by Year	NYCA	G-J Locality	NYC (J)	LI (K)
2022 IRM/LCR	123.1%	93.2%	84.4%	113.8%
2026 IRM/LCR	139.6%	101.0%	95.2%	124.0%
2032 IRM/LCR	216.8%	132.1%	129.7%	162.6%

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Demand Curve Inputs: Capacity Requirements

- Peak Loads from 2021 Gold Book baseline forecast
- ICAP and UCAP requirements calculated for each season based on peak loads, IRM/LCRs, and UCAP/ICAP Translation Factors

UCAP (MW) Requirements	Summer			Winter		
	2022	2026	2032	2022	2026	2032
NYCA	34,709	33,790	34,184	35,121	33,569	34,480
G-J Locality	13,235	13,052	13,448	13,254	13,302	13,619
NYC (J)	8,646	8,580	8,906	8,655	8,821	9,088
LI (K)	4,975	4,597	4,679	4,968	4,735	4,734

- Demand Curve Zero Crossing Points are unchanged from 2021 Demand Curve Reset

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Demand Curve Inputs: Reference Unit Assumptions

- Demand Curve Assumptions
  - Reference technology is Natural Gas CT, consistent with 2021 DCR
  - Gross CONE is calculated based on Grid in Transition estimate of installed costs for CT
  - Net EAS Revenues based on results from 2021 DCR model
  - ICAP-to-UCAP conversion of Reference and Max Prices uses UCAP/ICAP translation derating factor for peaking technology (4.3% EFORd from DCR study)

Demand Curve Inputs: Reference Unit Assumptions

- Adjustments to Demand Curve for 2026 and 2031
  - Reference technology (Natural Gas CT) adjusted by a 1%/year installed cost decline
  - Impact on results of different peaking technology (e.g., 4 hour battery storage) will be reviewed
- Winter-to-Summer Ratios are recalculated based on supply curve in each locality/season
  - With higher renewable penetration, WSR converges towards 100%

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Demand Curve Inputs: Curve Parameters

ICAP Demand Curve Parameters	Gross CONE ($/kW-yr)			ICAP Reference Price ($/kW-mo)		
	2022	2026	2032	2022	2026	2032
NYCA	$116	$111	$105	$9.89	$8.38	$7.06
G-J Locality	$133	$128	$121	$13.28	$11.57	$9.47
NYC (J)	$180	$173	$164	$20.56	$17.35	$14.07
LI (K)	$142	$137	$129	$16.81	$11.81	$9.13

UCAP Summer Demand Curve Parameters	UCAP Max Price ($/kW-mo)			UCAP Reference Price ($/kW-mo)		
	2022	2026	2032	2022	2026	2032
NYCA	$16.05	$15.18	$14.14	$10.33	$8.76	$7.37
G-J Locality	$18.97	$18.02	$16.71	$13.87	$12.10	$9.89
NYC (J)	$26.12	$24.65	$22.77	$21.48	$18.13	$14.70
LI (K)	$21.22	$19.47	$18.00	$17.57	$12.34	$9.54

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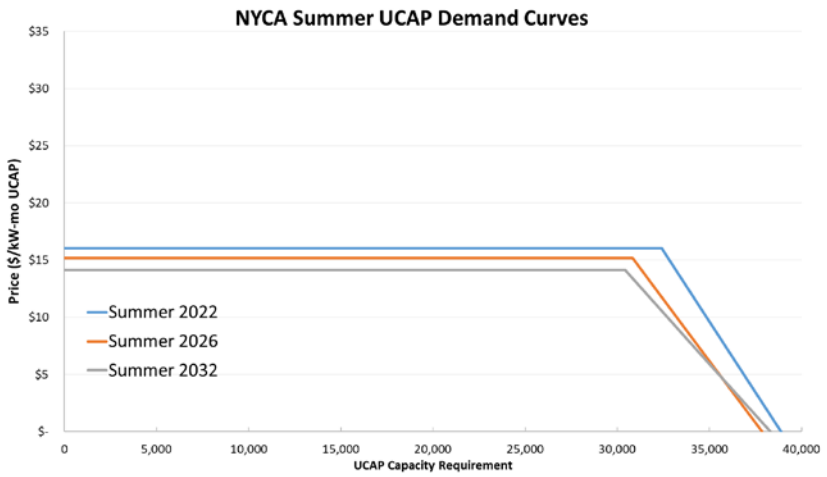
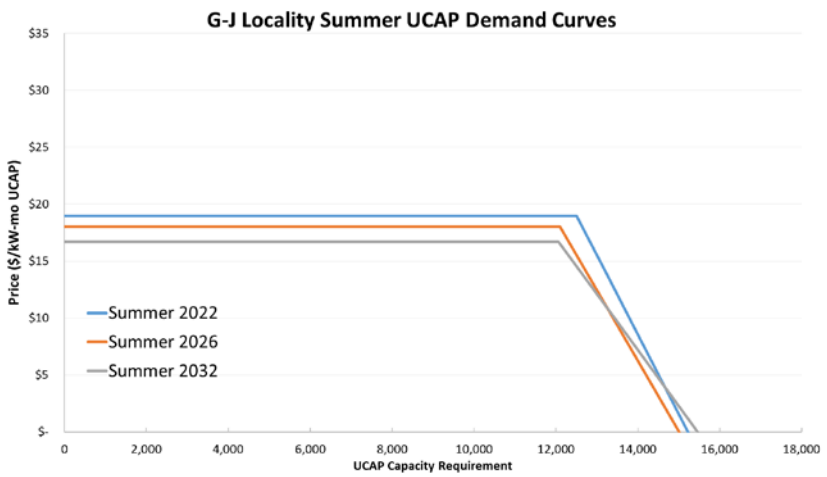
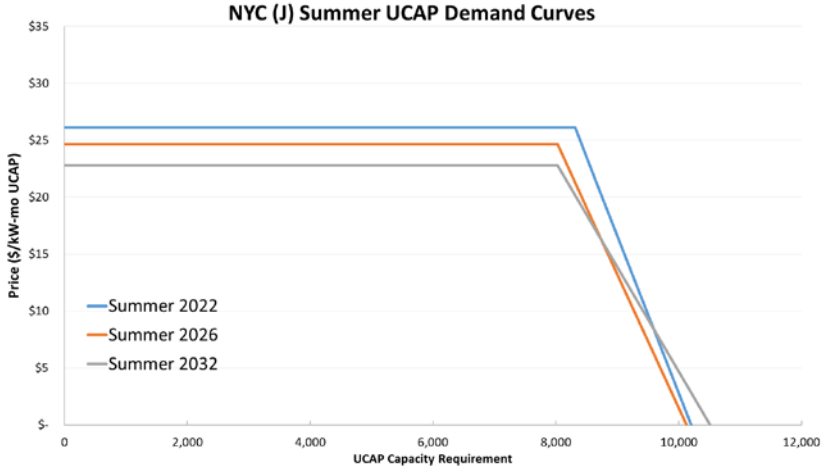
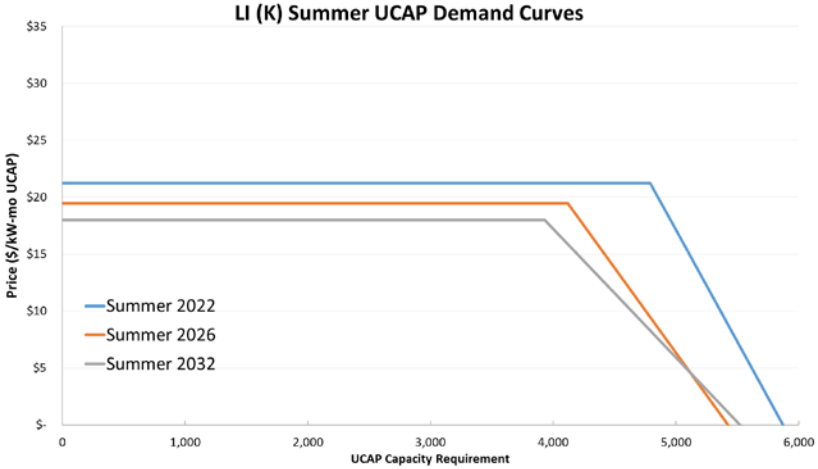
UCAP Summer Demand Curves









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Preliminary Results

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Capacity Market Modeled Results

Clearing Prices ($/kW-mo)	Summer			Winter		
	2022	2026	2032	2022	2026	2032
NYCA	$6.66	$7.37	$7.81	$3.39	$5.13	$7.36
G-J Locality	$9.99	$11.48	$9.58	$4.56	$8.22	$7.36
NYC (J)	$10.26	$15.43	$9.58	$4.56	$11.62	$7.36
LI (K)	$6.66	$8.06	$8.94	$3.66	$6.73	$7.88

Clearing UCAP Quantities (MW)	Summer			Winter		
	2022	2026	2032	2022	2026	2032
NYCA	36,188	34,430	33,942	37,952	35,235	34,486
G-J Locality	13,791	13,152	13,512	14,588	13,941	14,142
NYC (J)	9,459	8,810	9,497	9,932	9,390	9,905
LI (K)	5,531	4,884	4,732	5,676	5,122	4,882

Note: Results do not assume presence of TDI transmission into NYC.

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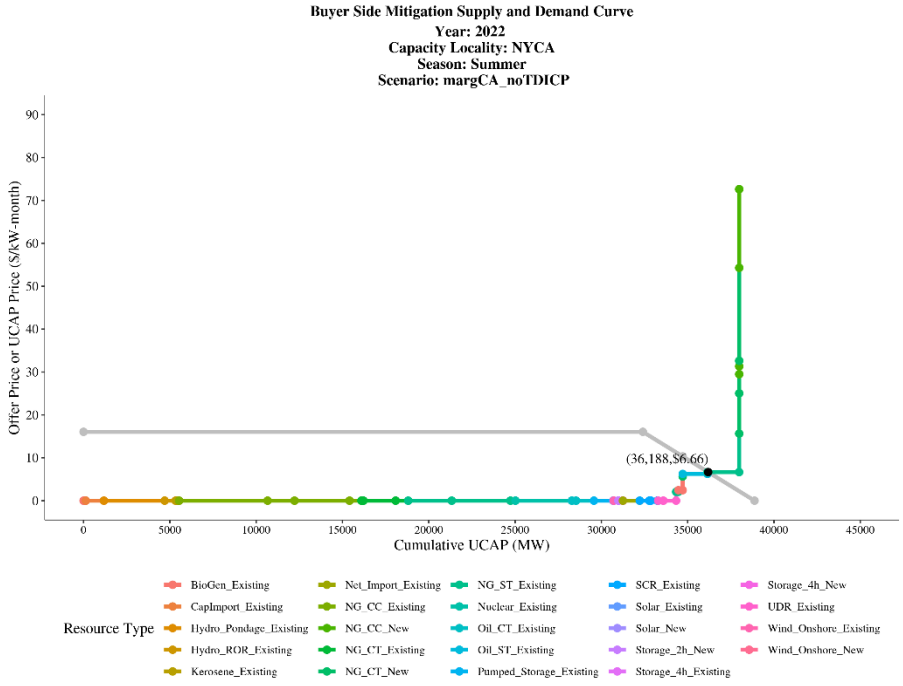
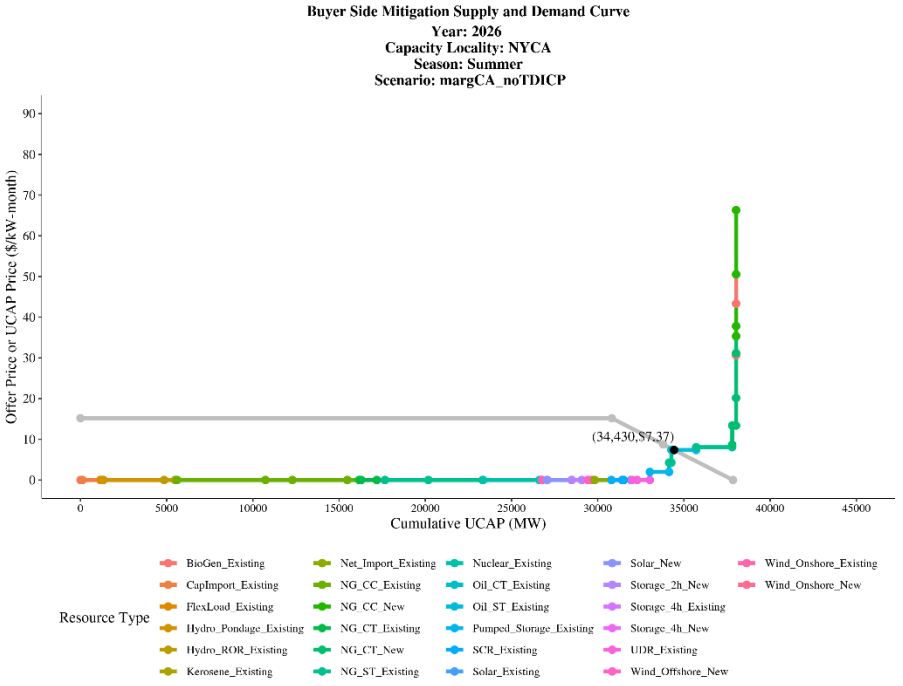
Example Results in NYCA, 2022-2026

Summer 2022, NYCA



Summer 2026, NYCA



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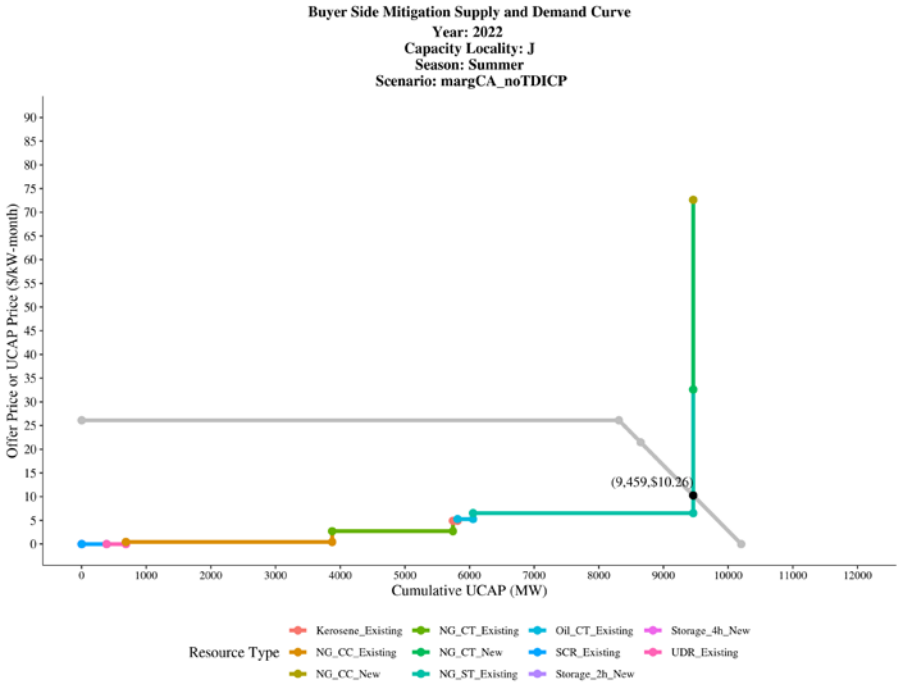
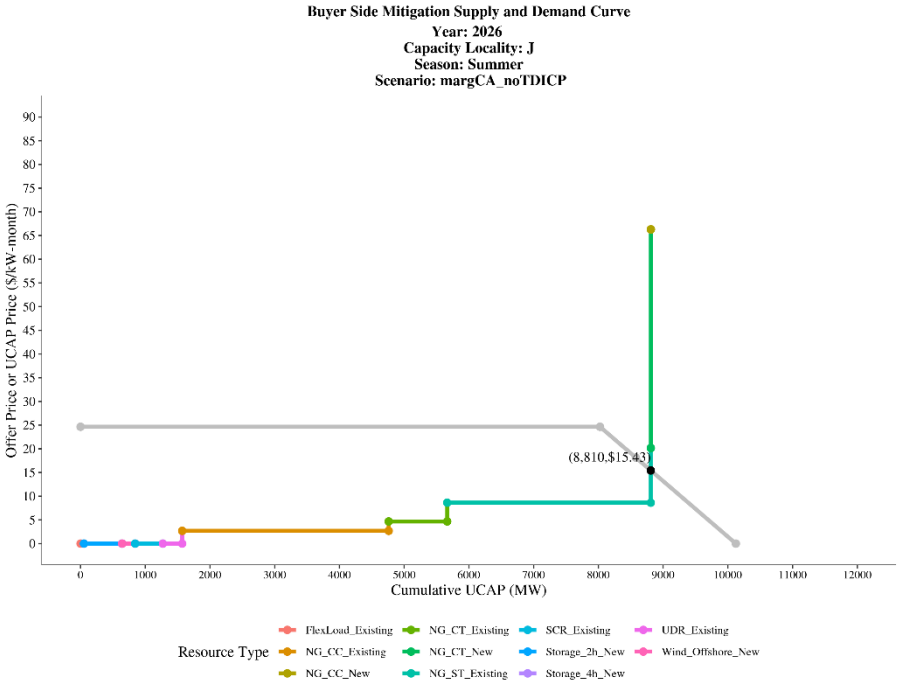
Example Results in Zone J, 2022-2026

Summer 2022, NYC



Summer 2026, NYC



Observations

- In all zones and years, market clears with sufficient resources to maintain reliability
- Prices observed rise over time, and are sufficient to retain existing resources and attract new resources
  - In particular, in 2026 prices rise moderately above 2022 levels
  - 2032 results are necessarily more speculative, given uncertain peak loads, renewable buildouts, and technological changes

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Sensitivities

Sensitivities

- Transmission Sensitivity (shown today)
  - 1,250 MW of TDI transmission and 1,300 MW of Clean Path NY transmission into NYC by 2032
- Peaking Unit Risk Sensitivity
  - Alternate demand curves assuming additional risk premium added to peaking unit WACC
  - Based on Potomac analysis for MOPR in ISO-NE
- Alternate Peaking Technology
  - Use of battery storage unit as peaking technology in demand curve

Transmission Sensitivity Assumptions

- TDI (1,250 MW ICAP) transmission line assumed to come in-service in 2025
- CPNY (1,300 MW ICAP) transmission line assumed to come in-service in 2027
- Both lines have assumed 5% derating factor
- TDI modeled as additional 1,188 MW UCAP delivered into Zone J
- CPNY modeled as 1,235 MW UCAP reduction in LCR for both Zone J and G-J Locality

Source: S&P Global Platts, NYSERDA, individual companies

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Transmission Sensitivity Modeled Results

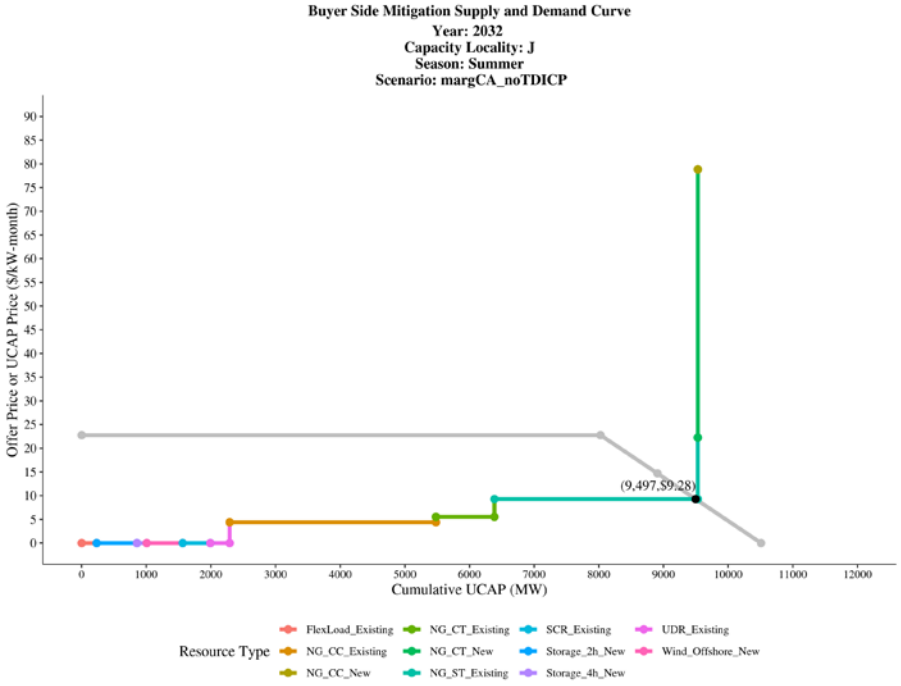
Clearing Prices ($/kW-mo)	2026 without TDI		2032 without TDI and CPNY		2026 with TDI		2032 with TDI and CPNY	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
NYCA	$7.37	$5.13	$7.81	$7.36	$7.37	$5.13	$7.81	$6.10
G-J Locality	$11.48	$8.22	$9.58	$7.36	$9.02	$6.05	$9.28	$7.09
NYC (J)	$15.43	$11.62	$9.58	$7.36	$9.02	$6.05	$9.28	$7.36
LI (K)	$8.06	$6.73	$8.94	$7.88	$8.06	$6.73	$8.94	$7.88

Clearing UCAP Quantities (MW)	2026 without TDI		2032 without TDI and CPNY		2026 with TDI		2032 with TDI and CPNY	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
NYCA	34,430	35,235	33,942	34,486	34,430	35,235	33,942	35,197
G-J Locality	13,152	13,941	13,512	14,142	13,550	14,300	12,353	12,913
NYC (J)	8,810	9,390	9,497	9,905	9,389	9,879	8,204	8,551
LI (K)	4,884	5,122	4,732	4,882	4,884	5,122	4,732	4,882

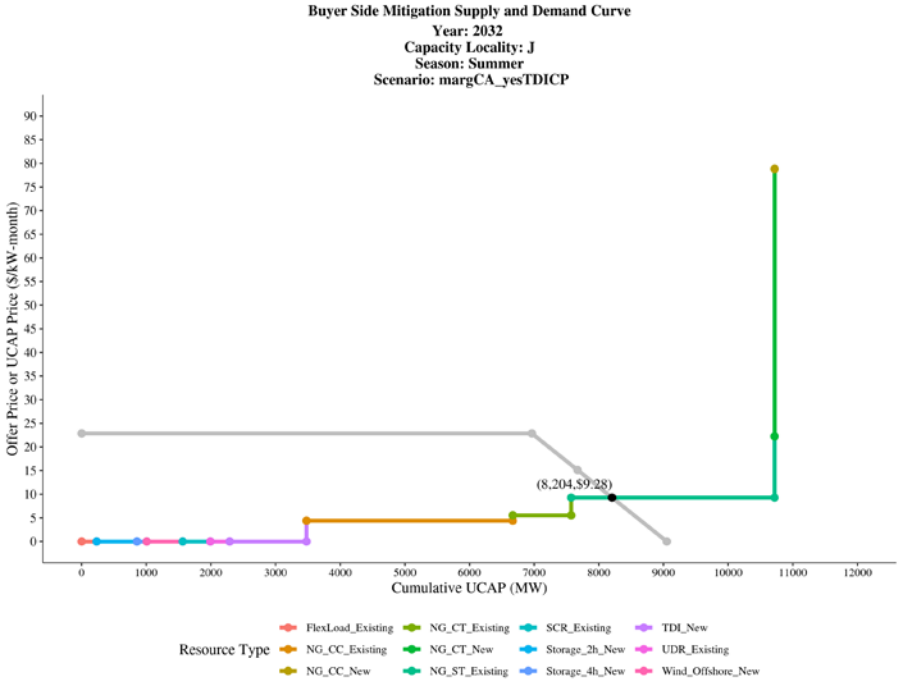
Sensitivity Observations

- In 2026, presence of TDI decreases capacity prices in Zone J and G-J Locality
- In 2032, presence of TDI and CPNY transmission have limited price effect relative to baseline

Summer 2032, Zone J without TDI/CPNY



Summer 2032, Zone J with TDI/CPNY



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Next Steps

Next Steps

- Post draft report
- Finalize report in October

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