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NYISO 2025-2029 ICAP Demand Curve Reset (DCR)

Summary of Preliminary Findings in Draft Report and Updated Preliminary Reference Point Prices

ICAP Working Group

Results and recommendations contained herein are preliminary and subject to change. The results herein use data for the period September 1, 2020 through August 31, 2023. The results will be updated in September 2024 to reflect data for the period September 1, 2021 through August 31, 2024.

June 13, 2024

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Agenda

- Summary of Preliminary Findings in Draft Report
- Updates to Previously Discussed Assumptions
- Updated Preliminary Reference Point Prices
- Ongoing Work

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Summary of Preliminary Findings in Draft Report

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Summary of Preliminary Findings in Draft Report

1. Simple cycle gas turbine (SCGT) and energy storage plants satisfy 1898 & Co. and AG's economic viability screening criteria for evaluation as potential peaking plant technology options for the 2025-2029 DCR.
   - The GE 7HA.03 unit with selective catalytic reduction (SCR) emissions controls and GE 7HA.02 unit without SCR emissions controls were evaluated as simple cycle technology options, with dual fuel capability in all locations and, for certain locations, without dual fuel capability.
   - Lithium-ion battery energy storage system (BESS) units with 2-hour, 4-hour, 6-hour, and 8-hour durations were evaluated as energy storage technology options for all locations.
2. While hydrogen fuel could, in theory, serve as a potential peaking plant design, the evaluation for this study identified that retrofitting a simple cycle turbine to operate on hydrogen fuel and store hydrogen fuel onsite starting in 2040 would not be economic in comparison to other technology options for the 2025-2029 DCR. 1898 & Co. and AG recommend that technologies capable of complying with the 2040 zero-emission energy supply requirement of the Climate Leadership and Community Protection Act (CLCPA) continue to be monitored for potential consideration in future resets.
3. The weighted average cost of capital (WACC) used to develop the levelized gross cost of new entry (CONE) for the potential peaking plant should reflect a capital structure of 55% debt and 45% equity; a 6.7% cost of debt; and a 14.0% cost of equity, for a WACC of 9.99%. Based on current tax rates in NY State and New York City, this translates to a nominal after tax WACC (ATWACC) of 9.02% for all locations other than Load Zone J and 8.76% for Load Zone J.
4. In order to comply with CLCPA's requirement for 100% of load to be served by zero-emissions resources by 2040, a 13-year amortization period for the recovery of capital costs is recommended for all fossil peaking plant options.

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Summary of Preliminary Findings in Draft Report

5. After careful consideration of operational experience, performance risk, and market risk for BESS technologies, a 15-year amortization period is recommended for all BESS technologies. Additionally, capacity augmentation costs should be incorporated in operations and maintenance costs over the assumed life of the asset, and battery capacity should be initially overbuilt (with costs of such overbuild incorporated in the initial capital costs) to mitigate performance risk.

6. The net energy and ancillary services (EAS) models from the 2021-2025 DCR using hourly prices for both Day-Ahead and real-time markets should continue to be used to estimate potential revenues for fossil peaking plant options. AG recommends the use of an updated net EAS model with Real-Time Dispatch (RTD) prices (i.e., nominal 5-minute intervals) for BESS technologies to better estimate potential energy arbitrage opportunities. The BESS net EAS model should use seasonal hurdle rates that, once finalized, would be held fixed for the four-year reset period.

7. The appropriate method to evaluate candidate peaking plant technologies is to identify the technology that minimizes the cost of Unforced Capacity (UCAP) in order to account for variation in Capacity Accreditation Factors (CAFs) and derating factors across technology options.

8. Given 1898 & Co. and AG's preliminary recommendations and preliminary estimates of gross CONE and net EAS revenues, the 2-hour BESS option minimizes UCAP costs among all candidate technologies and represents the appropriate peaking plant technology option for all locations.

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Summary of Preliminary Findings in Draft Report

9. The ICAP Demand Curves should maintain the current zero crossing point (ZCP) values. The ZCPs should remain 112% for the NYCA ICAP Demand Curve, 115% for the G-J Locality ICAP Demand Curve, and 118% for the NYC and LI ICAP Demand Curves.
10. AG and 1898 & Co. preliminarily recommend continued use of the escalation indices and weighting of cost components from the 2021-2025 DCR for updating gross CONE values.
11. AG recommends calculating level of excess adjustment factors (LOE-AFs) by weighting prices determined for the LOE-AF assessment by how many times the given month and year combination are utilized as an input in the net EAS revenue estimates over the reset period (see the presentation at the 2/29/2024 ICAPWG meeting). Once calculated, LOE-AFs would be held fixed over the 2025-2029 DCR reset period.

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Updates to Previously Discussed Assumptions

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Updates to Previously Discussed Assumptions

Site Leasing Costs in Zone J

- Site leasing costs are equal to the annual lease rate ($/acre-year) multiplied by the land requirement in acres.
- 1898 & Co. initially estimated annual lease rates by escalating the assumed values from the 2021-2025 DCR study to $2024 using the cumulative change in the Gross Domestic Product (GDP) implicit price deflator (Q1 2019-Q1 2024) and then comparing the escalated values to the observed range of leasing costs identified by 1898 & Co's review.
- Based on this assessment, 1898 & Co. determined that escalated values represent reasonable values for all locations, except Load Zone J.
- Load Zone J has experienced increased demand for industrial zoned property resulting in property values that have outpaced growth in the GDP price index.
- 1898 & Co. used the stakeholder provided JLL report data to determine the average sale price over the last 5 years of M-3 zoned property, over 4 acres, without existing buildings, within a 3-mile radius of an existing substation in Load Zone J.
- Based on this assessment, 1898 & Co. identified a lease rate of $644,000 per acre-year as more appropriate in Load Zone J for the 2025-2029 DCR.

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Updates to Previously Discussed Assumptions

Site Leasing Costs in Zone J

Updated Site Leasing Cost Assumptions ($2024)

	Load Zone J	Load Zone K	Load Zones C, F, and G
Land Requirement - Simple Cycle Options (acres)	12	15	15
Land Requirement - BESS 2-hour (acres)	6	9	10
Land Requirement - BESS 4-hour (acres)	9	12	14
Land Requirement - BESS 6-hour (acres)	12	16	18
Land Requirement - BESS 8-hour (acres)	15	20	22
Lease Rate ($/acre-year)	$644,000	$30,000	$26,000

Note: [1] For all locations except Load Zone J, 1898 & Co. estimated annual lease rates by escalating the assumed values from the 2021-2025 DCR to $2024 using the cumulative change in the Gross Domestic Product (GDP) implicit price deflator (Q1 2019-Q1 2024). [2] For Load Zone J, 1898 & Co. used a stakeholder provided JLL report data to determine the average sale price over the last 5 years of M-3 zoned property, over 4 acres, without existing buildings, within a 3-mile radius of an existing substation in Load Zone J.

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Updates to Previously Discussed Assumptions

Amortization Period (AP) for BESS Technologies

- AG recommends an AP of 15 years instead of 20 years for all BESS technologies. This determination reflects the following considerations:
  1. BESS technologies continue to face performance risk including: potential for cell degradation, wear and tear on balance-of-system components, uncertain market dispatch outcomes, and potential variations in operational modes and uses in system operations. Performance risks are only partially captured by assumed O&M augmentation costs and initial capacity overbuild included in the capital cost estimates.
  2. BESS technologies face market performance risks, including future CAF risk. Future CAF values are unknowable today, and will vary according to the exact mix of resources in the system, load profiles, and other factors.
  3. There are no lithium-ion BESS units with the capacity of the potential peaking technology (200 MW) that have operated for more than 10 years.
  4. AG recommended an AP of 15 years for all BESS technologies in the 2021-2025 DCR.

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Updates to Previously Discussed Modeling Assumptions

Financial Parameters

- AG recommends a cost of debt (COD) of 6.7% rather than 6.45%. The updated recommendation reflects a number of factors, including:
  - Issuances of BB-rated debt and other corporate debt issued by independent power producers (IPPs)
  - Recent debt costs needed to capture current market conditions
  - Differences between COD for IPPs relative to generic debt indices
  - Differences between corporate and project-specific risks (controlling for comparable BB-rated riskiness)

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Evaluation of Peaking Plant Technology

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Key Assumptions for Calculation of Preliminary Monthly ICAP/UCAP Reference Prices in Draft Report

- Key assumptions (subject to change):
  1. SCGT options represented by GE 7HA.03 (with SCR emissions controls) and GE 7HA.02 (without SCR emissions controls)
  2. Natural gas hub recommendations for the SCGT (see 4/17/2024 ICAPWG presentation)
  3. Enhanced 5-minute battery model (see 05/20/2024 ICAPWG presentation) and hourly pricing model for SCGT options
  4. PILOT rate of 0.6% outside of Load Zone J for the SCGT (all years of the applicable amortization period), and property tax rate equal to 4.77% in Load Zone J for the SCGT for any period not qualifying for a tax abatement
  5. 15-year tax abatement for energy storage facilities statewide (covers entire period of recommended 15-year amortization period), 15-year tax abatement for SCGT units in Load Zone J (depending on effectiveness of such abatement for the 2025-2029 DCR)
  6. SCR emissions control technology and dual fuel capability for SCGT in all locations
     - Results are also presented for the GE 7HA.02 (without SCR) for locations in moderate nonattainment (i.e., Load Zones C, F, and G [Dutchess County]), and gas-only configurations of the GE 7HA.03 and GE 7HA.02 for certain locations (i.e., Load C, F, G [Dutchess County]), and G [Rockland County])
  7. 2021-2025 DCR level of excess adjustment factors (LOE-AFs) as placeholders
  8. Net EAS results reflecting the historical data period: 9/1/2020 through 8/31/2023

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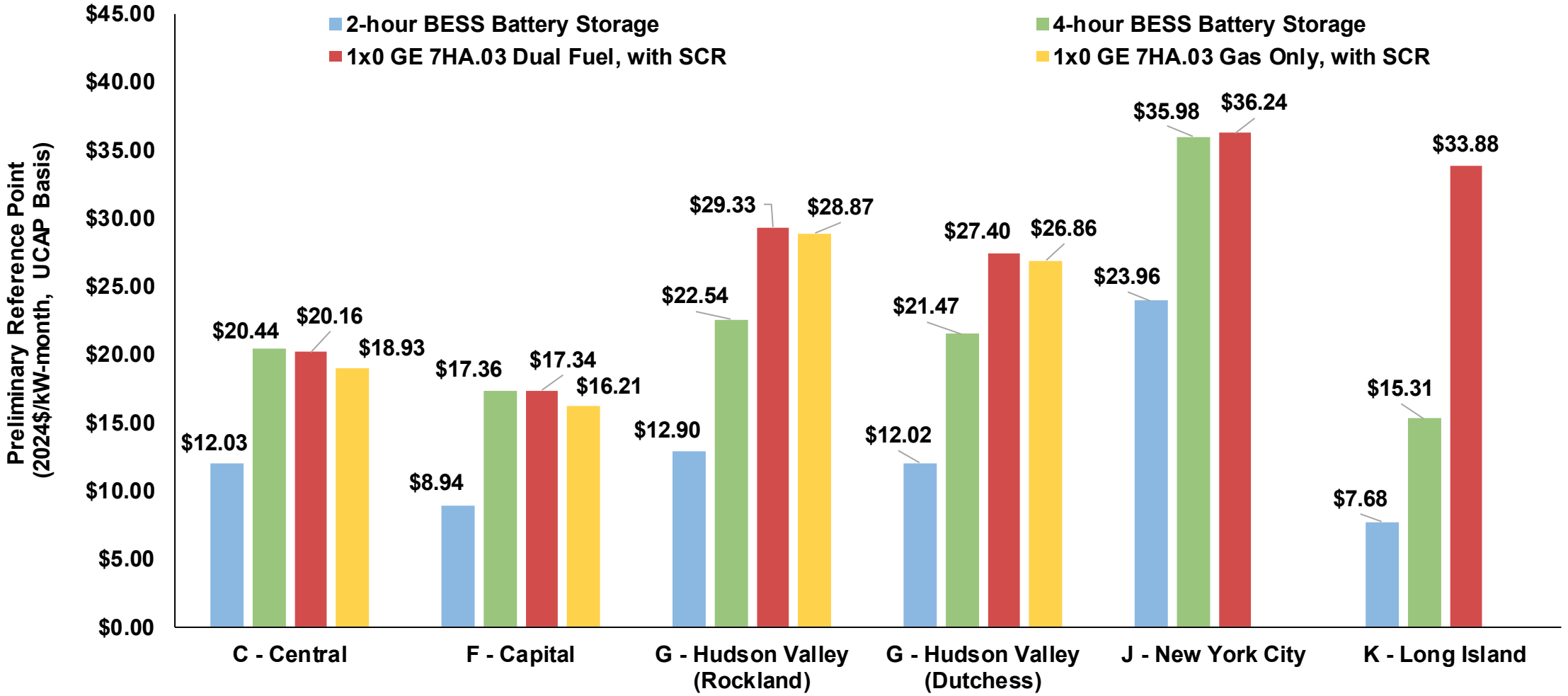
Key Assumptions for Calculation of Preliminary Monthly ICAP/UCAP Reference Prices in Draft Report (cont.)

- Key assumptions (subject to change):
  9. Updated gross cost of new entry (CONE) estimates from 1898 & Co for SCGT and BESS, including updated site leasing costs in Load Zone J
  10. Preliminary ATWACC of 8.76% in NYC, and 9.02% everywhere else, including updated COD (see 05/30/2024 ICAPWG presentation and Slide 8)
  11. Updated AFUDC reflecting preliminary ATWACC
  12. 13-year amortization period for fossil peaking plant options
  13. 15-year amortization period for energy storage technologies
  14. 30% federal ITC for energy storage technologies (no costs associated with tax credit monetization)
  15. Winter-to-Summer and Summer-to-Winter ratios for the 2024-2025 Capability Year
  16. Derating factor for fossil units of 4.1%
  17. Derating factor for battery units of 2.0%
  18. CAFs for the 2024-2025 Capability Year (see Appendix) [1]
  19. Voltage Support Services (VSS) adder of $2.48/kW-year, calculated as average VSS revenues for the time period of January 2020 through December 2023 using the methodology from the 2021-2025 DCR as a placeholder

[1] On June 4, 2024, the NYISO presented a proposal for revising the 2024-2025 Capability Year CAFs beginning November 1, 2024. AG will continue to monitor the status of this proposal for purposes of its assessment for this study

Reference Point Prices by Candidate Technologies ($/kW-month UCAP)



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Evaluation of Peaking Plant Technology Options

Comparison of Preliminary Reference Point Prices by Technology ($2024/kW-month UCAP)

Technology	Fuel Type/ Emission Control	Current Year (2025-2026)					
		C - Central	F - Capital	G - Hudson Valley (Rockland)	G - Hudson Valley (Dutchess)	J - New York City	K - Long Island
Summer Reference Point Prices (UCAP Basis)							
1x0 GE 7HA.03	Dual Fuel, with SCR	$22.89	$19.67	$29.48	$27.54	$36.33	$29.47
	Gas Only, with SCR	$21.49	$18.38	$29.01	$26.99	-	-
1x0 GE 7HA.02	Dual Fuel, no SCR	$26.17	$25.05	-	$29.45	-	-
	Gas Only, no SCR	$24.50	$23.35	-	$28.90	-	-
2-hour BESS	Battery Storage	$13.39	$9.95	$13.14	$12.24	$24.54	$7.46
4-hour BESS	Battery Storage	$22.75	$19.32	$22.95	$21.86	$36.84	$14.87
6-hour BESS	Battery Storage	$25.58	$23.06	$27.62	$26.41	$41.95	$24.12
8-hour BESS	Battery Storage	$32.47	$30.39	$35.35	$33.94	$51.31	$33.31
Winter Reference Point Prices (UCAP Basis)							
1x0 GE 7HA.03	Dual Fuel, with SCR	$16.71	$14.40	$30.48	$28.47	$38.02	$59.74
	Gas Only, with SCR	$15.69	$13.46	$30.00	$27.91	-	-
1x0 GE 7HA.02	Dual Fuel, no SCR	$18.67	$17.87	-	$29.98	-	-
	Gas Only, no SCR	$17.48	$16.66	-	$29.42	-	-
2-hour BESS	Battery Storage	$10.12	$7.52	$12.49	$11.64	$22.97	$8.13
4-hour BESS	Battery Storage	$17.19	$14.60	$21.82	$20.78	$34.48	$16.20
6-hour BESS	Battery Storage	$19.33	$17.42	$26.26	$25.10	$39.27	$26.28
8-hour BESS	Battery Storage	$24.54	$22.96	$33.60	$32.27	$48.04	$36.30

Note: [1] The peaking plant technology choice in all locations is a 2-hour, lithium-ion BESS, which is highlighted in green. [2] The net EAS revenues are estimated using data for the three-year period September 1, 2020 to August 31, 2023 and the seasonal capacity availability values are based on data for the same period. **The values will be updated in September 2024 to reflect data for the period September 1, 2021 through August 31, 2024.** [4] The net EAS revenues for BESS options reflect the net EAS model using RTD interval prices. [4] Assumes a preliminary $2.48/kW-year voltage support service (VSS) revenues, based on settlement data analyzed by NYISO using the methodology from the 2021-2025 DCR. **This methodology and resulting VSS revenue value for each peaking plant technology option remain under review and subject to change.**

Discussion

- Capital and construction costs are significantly higher than in the 2021-2025 DCR.
- Given 1898 & Co. and AG's preliminary assumptions and estimates of gross CONE and net EAS revenues, 2-Hour BESS results in lower preliminary reference point prices (on a UCAP basis) than all other candidate technologies in all locations.
- As such, AG preliminarily recommends the 2-hour BESS technology option as the appropriate peaking plant technology option for all locations for the 2025-2029 DCR.

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Preliminary Recommended ICAP Demand Curve Parameters

Preliminary ICAP Demand Curve Parameters ($2024)
2-Hour BESS (RTD interval pricing net EAS model)

		Current Year (2025-2026)					
Parameter	**Source**	**C - Central**	**F - Capital**	**G - Hudson Valley (Rockland)**	**G - Hudson Valley (Dutchess)**	**J - New York City**	**K - Long Island**
Gross Cost of New Entry ($/kW-Year)	[1]	$125.81	$126.49	$128.85	$125.85	$182.78	$127.04
Net EAS Revenues ($/kW-Year)	[2]	$61.58	$78.78	$69.33	$70.39	$74.00	$98.87
Annual Reference Value ($/kW-Year)	[3]=[1]-[2]	$64.23	$47.71	$59.53	$55.47	$108.78	$28.17
ICAP DMNC (MW)	[4]	200	200	200	200	200	200
Annual Reference Value	[5]=[3]*[4]	$12,846	$9,543	$11,905	$11,093	$21,756	$5,633
Level of Excess (%)	[6]	100.52%	100.52%	101.62%	101.62%	102.23%	103.77%
Ratio of Summer to Winter DMNCs	[7]	1.033	1.033	1.058	1.058	1.067	1.072
Summer DMNC (MW)	[8]	200	200	200	200	200	200
Winter DMNC (MW)	[9]	200	200	200	200	200	200
Assumed Capacity Prices at Tariff Prescribed Level of Excess Conditions							
Summer ($/kW-Month)	[10]	$6.96	$5.17	$6.45	$6.01	$11.78	$3.05
Winter ($/kW-Month)	[11]	$3.75	$2.78	$3.47	$3.24	$6.35	$1.64
Monthly Revenue (Summer)	[12]=[10]*[8]	$1,392	$1,034	$1,290	$1,202	$2,357	$610
Monthly Revenue (Winter)	[13]=[11]*[9]	$749	$557	$694	$647	$1,269	$329
Seasonal Revenue (Summer)	[14]=6*[12]	$8,350	$6,203	$7,738	$7,211	$14,141	$3,662
Seasonal Revenue (Winter)	[15]=6*[13]	$4,496	$3,340	$4,167	$3,883	$7,615	$1,972
Total Annual Reference Value	[16]=[14]+[15]	$12,846	$9,543	$11,905	$11,093	$21,756	$5,634
ICAP Demand Curve Parameters							
Summer ICAP Monthly Reference Point Price ($/kW-Month)		$7.27	$5.40	$7.23	$6.74	$13.45	$3.86
Winter ICAP Monthly Reference Point Price ($/kW-Month)		$5.50	$4.08	$6.87	$6.40	$12.59	$4.20
Summer ICAP Maximum Clearing Price ($/kW-Month)		$21.37	$21.49	$23.48	$22.93	$33.90	$26.11
Winter ICAP Maximum Clearing Price ($/kW-Month)		$16.15	$16.24	$22.32	$21.80	$31.73	$28.45
Demand Curve Length		12.0%	12.0%	15.0%	15.0%	18.0%	18.0%

Notes: [1] The peaking plant technology choice in all locations is a 2-hour, lithium-ion BESS. [2] The net EAS revenues are estimated using data for the three-year period September 1, 2020 to August 31, 2023 and the seasonal capacity availability values are based on data for the same period. **The values will be updated in September 2024 to reflect data for the period September 1, 2021 through August 31, 2024.** [3] The net EAS revenues for BESS options reflect the net EAS model using RTD interval prices. [4] Assumes a preliminary $2.48/kW-year voltage support service (VSS) revenues, based on settlement data analyzed by NYISO using the methodology from the 2021-2025 DCR. **This methodology and resulting VSS revenue value for each peaking plant technology option remain under review and subject to change.**

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Ongoing Work

Ongoing Work

1. Updated LOE-AFs using new GE-MAPS modeling, and applying the new weighted LBMP methodology (see 02/29/2024 ICAPWG presentation)
2. Consideration of new methodology for computing VSS adder

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Appendix

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Preliminary Gross CONE by Technology

Comparison of Preliminary Gross CONE by Technology ($2024/kW-year)

Technology	Fuel Type/ Emission Control	Current Year (2025-2026)					
		C - Central	F - Capital	G - Hudson Valley (Rockland)	G - Hudson Valley (Dutchess)	J - New York City	K - Long Island
1x0 GE 7HA.03	Dual Fuel, with SCR	$260.72	$257.63	$274.05	$258.67	$321.70	$285.06
	Gas Only, with SCR	$249.23	$246.47	$262.80	$247.43	-	-
1x0 GE 7HA.02	Dual Fuel, no SCR	$274.58	$271.21	-	$270.83	-	-
	Gas Only, no SCR	$260.66	$257.70	-	$257.21	-	-
2-hour BESS	Battery Storage	$125.81	$126.49	$128.85	$125.85	$182.78	$127.04
4-hour BESS	Battery Storage	$198.62	$199.60	$202.96	$198.70	$282.69	$202.45
6-hour BESS	Battery Storage	$278.87	$280.26	$285.02	$278.99	$385.17	$286.45
8-hour BESS	Battery Storage	$358.43	$360.23	$366.43	$358.56	$492.16	$369.82

Notes: [1] The peaking plant technology choice in all locations is a 2-hour, lithium-ion BESS, which is highlighted in green. [2] The 1x0 GE 7HA.03 is tuned to NOx emissions rate of 25 ppm and the 1x0 GE 7HA.02 is tuned to NOx emissions rate of 15 ppm.

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Preliminary Net EAS by Technology

Comparison of Preliminary Net EAS by Technology ($2024/kW-year)

Technology	Fuel Type/ Emission Control	Current Year (2025-2026)					
		C - Central	F - Capital	G - Hudson Valley (Rockland)	G - Hudson Valley (Dutchess)	J - New York City	K - Long Island
1x0 GE 7HA.03	Dual Fuel, with SCR	$72.82	$96.37	$67.86	$66.07	$80.40	$134.16
	Gas Only, with SCR	$72.82	$95.76	$59.89	$58.64	-	-
1x0 GE 7HA.02	Dual Fuel, no SCR	$56.16	$62.41	-	$54.78	-	-
	Gas Only, no SCR	$56.16	$63.04	-	$45.23	-	-
2-hour BESS	Battery Storage	$61.58	$78.78	$69.33	$70.39	$74.00	$98.87
4-hour BESS	Battery Storage	$71.68	$91.81	$77.13	$78.83	$81.68	$118.50
6-hour BESS	Battery Storage	$75.74	$97.15	$80.20	$83.15	$84.52	$128.55
8-hour BESS	Battery Storage	$77.41	$97.24	$81.24	$84.71	$85.41	$132.17

Note: [1] The net EAS revenues are estimated using data for the three-year period September 1, 2020 to August 31, 2023. **The values will be updated in September 2024 to reflect data for the period September 1, 2021 through August 31, 2024**. [2] The net EAS revenues for BESS options reflect the net EAS model using RTD interval prices. [3] The peaking plant technology choice in all locations is a 2-hour, lithium-ion BESS, which is highlighted in green. [4] Assumes a preliminary $2.48/kW-year voltage support service (VSS) revenues, based on settlement data analyzed by NYISO using the methodology from the 2021-2025 DCR. **This methodology and resulting VSS revenue value for each peaking plant technology option remain under review and subject to change**. [5] Runtime limits were applied based on New Source Performance Standards. All combustion turbine units with SCRs were limited to 3,504 hours of runtime in each modeled year (September 1, 2020 to August 31, 2021; September 1, 2021 to August 31, 2022; September 1, 2022 to August 31, 2023). All units without SCRs were limited to 200,000 lbs of NOx emissions in each modeled year.

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CAFs by Technology

Final CAFs for the 2024/2025 Capability Year

	Zone C	Zone F	Zone G - Rockland	Zone G - Dutchess	Zone J	Zone K
2-Hour Energy Duration Limited	55.4%	55.4%	56.2%	56.2%	55.9%	52.8%
4-Hour Energy Duration Limited	64.5%	64.5%	68.0%	68.0%	68.8%	78.9%
6-Hour Energy Duration Limited	91.8%	91.8%	91.9%	91.9%	90.4%	91.5%
8-Hour Energy Duration Limited	100.0%	100.0%	100.0%	100.0%	100.0%	99.7%
SCGT Options	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Final CAFs for the 2024/2025 capability year were previously presented by the NYISO at the 2/29/2024 ICAPWG meeting. On June 4, 2024, the NYISO presented a proposal for revising the 2024-2025 Capability Year CAFs beginning November 1, 2024. The updated CAFs were presented by the NYISO at the 5/8/2024 ICAPWG meeting. AG will continue to monitor the status of this proposal for purposes of its assessment for this study.