

NYISO 2025-2029 ICAP Demand Curve Reset

Continued Modeling Discussions

ICAP Working Group

February 29, 2024

Agenda

- Level of Excess Adjustment Factors (LOE-AFs) – proposed approach for the 2025-2029 ICAP Demand Curve reset (DCR)
- Preliminary recommendations of gas hubs for pricing in the thermal/fuel-fired net Energy and Ancillary Services (EAS) revenue model
- Update on battery net EAS model enhancements

Level of Excess Adjustment Factors (LOE-AFs) – proposed approach for the 2025-2029 DCR

Level of Excess Adjustment Factors

Background

- Services Tariff, Section 5.14.1.2.2

“The cost and revenues of the peaking plant used to set the reference point and maximum value for each ICAP Demand Curve shall be determined under conditions in which the available capacity is equal to the sum of **(a) the minimum Installed Capacity requirement and (b) the peaking plant’s capacity equal to the number of MW specified in the periodic review and used to determine all costs and revenues** ([...] hereinafter referred to as the ‘prescribed level of excess’).” (emphasis added)

- LOE-AFs adjust historical LBMPs and reserve prices to account for the tariff-prescribed level of excess (LOE) supply conditions (i.e., applicable minimum requirement plus the capacity of the applicable peaking plant)
 - For example, if actual LBMPs are based on system conditions with resource margins above the tariff-prescribed LOE conditions, net EAS revenues would likely be lower than the peaking plant would experience under the tariff-prescribed level of excess conditions. In this case, the adjustment factors would reflect a multiplier greater than one.
 - For the 2021-2025 DCR, average LOE-AFs were relatively modest, ranging from 1.02 in Load Zones F and J to 1.06 in Load Zone C across all months and periods
- LOE-AFs are calculated as part of the DCR and remain set for the duration of the reset period

Level of Excess Adjustment Factors

Proposed Approach

- At the 01/25/2024 ICAPWG meeting, AG proposed to use the same general methodology from 2017-2021 and 2021-2025 DCRs to determine the LOE-AF values for this reset
 - Production cost model simulations using GE's Multi-Area Production System (GE-MAPS)
 1. A base case represents current system conditions (“as found” conditions),
 2. “LOE” case represents system conditions at the tariff-prescribed LOE (i.e., minimum capacity requirement plus capacity of proposed peaking plant)
 - LOE-AFs are then developed as the ratio of average Day-Ahead LBMPs in the base case to average Day-Ahead LBMPs in the LOE case for each relevant Load Zone
 - LBMPs are first averaged within each month and period (e.g., “on-peak,” “high on-peak,” and “off-peak” as used for the 2021-2025 DCR) across the modeled years
- For the previous two DCRs, the production cost model simulations were run for the years covered by the reset (e.g., for the 2021-2025 DCR, years 2021 through 2025 were simulated in GE MAPS)
 - Potomac Economics recommended consideration of a change to utilize the years encompassed by the net EAS revenue estimates for improved alignment between the LOE-AFs and the historical prices they are applied to (e.g., for the 2021-2025 DCR this would have resulted in using years 2017 through 2023 to calculate LOE-AFs)

Level of Excess Adjustment Factors

Proposed Approach

- AG proposes to incorporate Potomac Economics’ suggestion and determine the LOE-AFs for the 2025-2029 DCR using the years covered by the net EAS revenue estimates throughout the reset period
 - As shown below, years 2021 through 2027 align with the years that will be utilized in determining the estimated net EAS revenues across the reset period

Capability Year	Historical Period Utilized in Net EAS Revenue Estimate
2025-2026	Sept 2021-Aug 2024
2026-2027	Sept 2022-Aug 2025
2027-2028	Sept 2023-Aug 2026
2028-2029	Sept 2024-Aug 2027

- When averaging Day-Ahead LBMPs for the LOE-AF values, the LBMPs for each month, relevant Load Zone, and period (i.e., “on-peak,” “high on-peak,” and “off-peak;” consistent with the groupings used in the 2021-2025 DCR) will be weighted 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 next slide for weightings by month and modeled year)
- The GE-MAPS modeling will continue to use recent data for the relevant model years consistent with other NYISO studies and previously reviewed by stakeholders
 - For model years 2021-2022, AG proposes to use the 2021-2040 System and Resource Outlook Base Case. For model years 2023-2027, AG proposes to use the 2023-2042 System and Resource Outlook Base Case

Level of Excess Adjustment Factors

LBMP Weightings by Month and Modeled Year¹

Modeled Year	<u>Month</u>											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2021	0%	0%	0%	0%	0%	0%	0%	8%	8%	8%	8%
	2022	8%	8%	8%	8%	8%	8%	8%	17%	17%	17%	17%
	2023	17%	17%	17%	17%	17%	17%	17%	25%	25%	25%	25%
	2024	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
	2025	25%	25%	25%	25%	25%	25%	25%	17%	17%	17%	17%
	2026	17%	17%	17%	17%	17%	17%	17%	8%	8%	8%	8%
	2027	8%	8%	8%	8%	8%	8%	8%	0%	0%	0%	0%

¹Over the reset period, the theoretical maximum number of times that LBMPs for a given month could be utilized is 12 (i.e., the rolling three-year historical periods used in the net EAS revenue estimates, multiplied by the four Capability Years covered by the DCR). The LBMP weightings reflect how many times LBMPs from each month and year combination are utilized as an LBMP input over the reset period divided by 12. For example, LBMPs from September 2021 will only be used in the net EAS revenue estimates for the 2025-2026 Capability Year ICAP Demand Curves. Thus, the LBMP weighting for September 2021 is $1/12 = 8\%$.

Preliminary recommendations of gas hubs for pricing in the thermal/fuel-fired Net EAS revenue model

Decision Criteria for Fuel Hub Selection

1. Market Dynamics

- Gas hub price index reflects historical relationship between gas hub pricing and LBMPs
- Ideally, prices should reflect a long-term equilibrium rather than short run arbitrage opportunities (real or apparent), recognizing that other factors (e.g., congestion) influence LBMP price spikes

2. Liquidity

- Gas hub price index with consistent historical data and trading activity

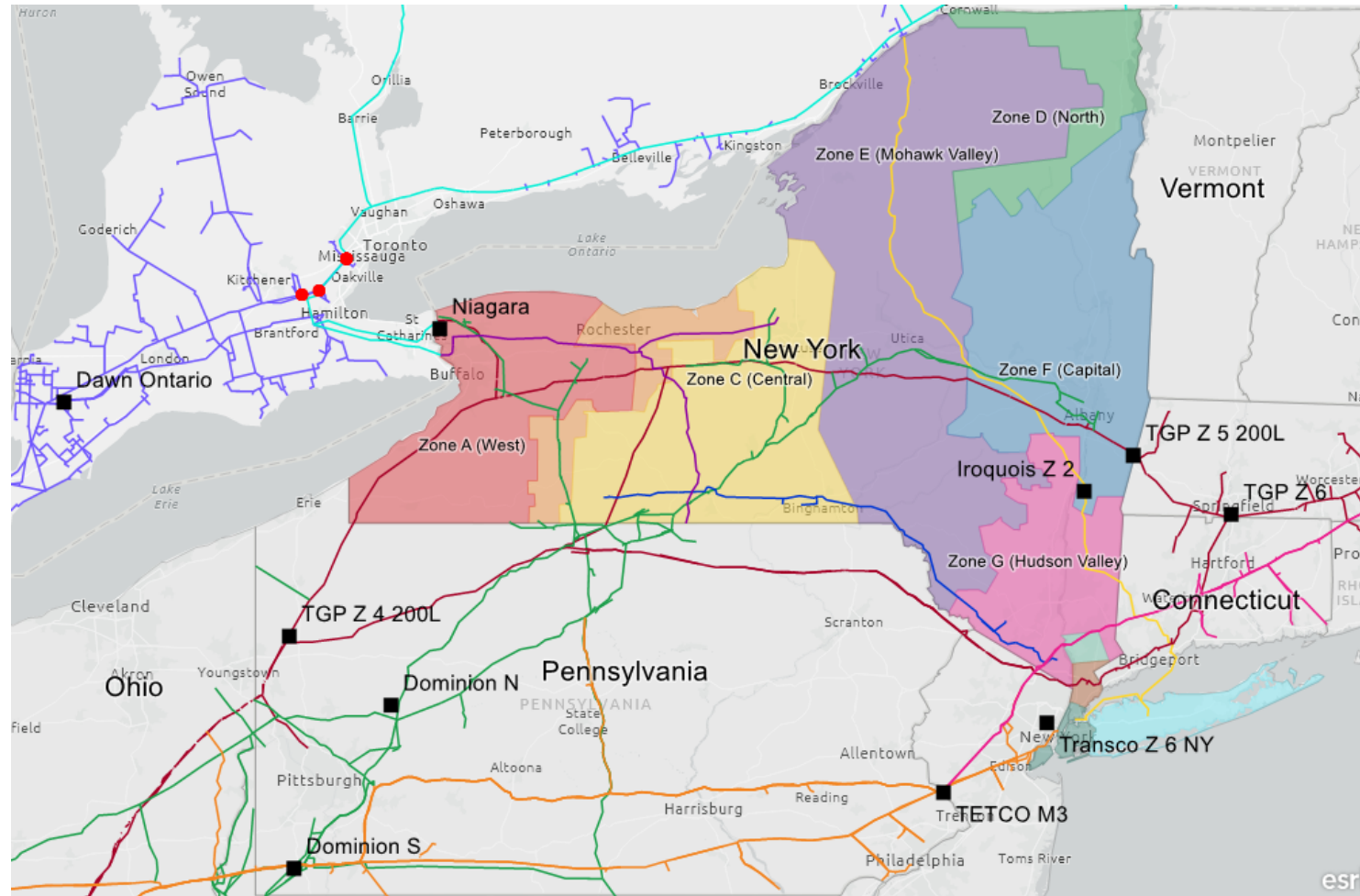
3. Geography

- Pipelines with a geographic relationship that allows for gas delivery to potential peaking plant locations
- Reported hub price indices (which reflect average prices over a broad geographic area) with a logical nexus to relevant delivery points

4. Precedent/Continuity

- Gas hubs supported by information from multiple sources and used for similar purposes (e.g., 2021-2025 DCR, 2022 State of the Market report [2022 SOM], and 2021-2040 System and Resource Outlook [2021-2040 Outlook])

Geographic Locations of New York Natural Gas Hubs



Kirkwall Delivery/Receipt

Receipt/Delivery

● Bi-Directional

Pipeline Operating

Company

— TransCanada PipeLines Limited

Pipeline Operating

Company

— Texas Eastern Transmission, LP

— Algonquin Gas Transmission, LLC

— Enbridge Gas Inc.

Pipeline Operating

Company

— Tennessee Gas Pipeline Company, L.L.C.

— Eastern Gas Transmission and Storage, Inc.

— Millennium Pipeline Company, LLC

— Empire Pipeline, Inc.

— Iroquois Gas Transmission System, L.P.

Preliminary Recommendations for 2025-2029 DCR

Summary of Preliminary Recommendations

Location	2025-2029 DCR (Preliminary Recommendations)	2021-2025 DCR	2022 SOM	2021-2040 Outlook
Load Zone C	Dawn Ontario (December - March) & Tennessee Zone 4 200L (April – November)	Niagara (December - March) & Tennessee Zone 4 200L (April – November)	Niagara (December - March) & Tennessee Zone 4 200L (April – November) [Load Zones B, C, E Blend]	Dominion South (91%), Tetco M3 (7%), & Columbia (2%) [Load Zones A-E Blend]
Load Zone F	Iroquois Zone 2	Iroquois Zone 2	Minimum of Tennessee Zone 6 and Iroquois Zone 2 [Load Zone F Blend]	Tennessee Zone 6 (62%), Iroquois Zone 2 (28%), Algonquin (7%), & Tetco M3 (3%) [Load Zones F-I Blend]
Load Zone G (Dutchess)	Tennessee Zone 5 200L	Iroquois Zone 2	Average of Iroquois Zone 2 and the Tetco M3 [Load Zone G Blend]	
Load Zone G (Rockland)	Tennessee Zone 5 200L	TETCOM3		
Load Zone J	Transco Zone 6 NY	Transco Zone 6 NY	Transco Zone 6 NY	Transco Zone 6 NY (100%)
Load Zone K	Iroquois Zone 2	Iroquois Zone 2	Iroquois Zone 2	Iroquois Zone 2 (51%) & Transco Zone 6 NY (49%) [Load Zone K Blend]

Preliminary Recommendations for 2025 – 2029 DCR

Load Zone C

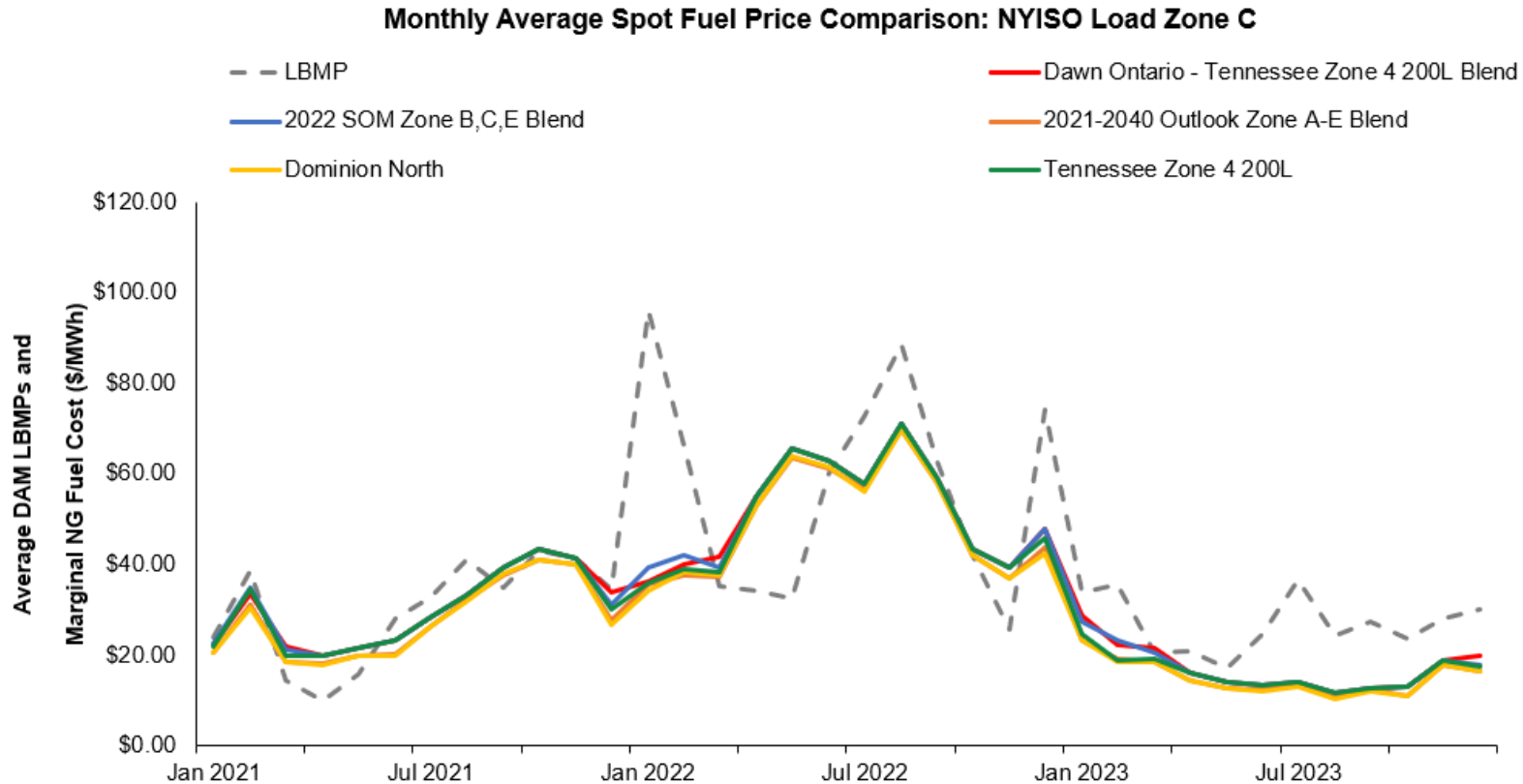
- Preliminary Recommendation: Tennessee Zone 4 200L (April to November) and Dawn Ontario (December to March); good historical precedent as a proxy gas hub in Load Zone C, is sufficiently traded, and is geographically well situated.
- Potential options considered to date are summarized below

Decision Criteria		Dawn Ontario – Tennessee Zone 4 200L Blend	2022 SOM Load Zones B,C,E Blend	Dominion North	2021-2040 Outlook Load Zones A-E Blend
Market Dynamics		Low LBMP Correlation	Low LBMP Correlation	Low LBMP Correlation	Low LBMP Correlation
Liquidity		Medium/High	Low/Medium	Medium	Medium
Geography		Yes	Yes	Yes	No
Precedent	2021-2025 DCR	No	Yes	No	No
	2022 SOM	No	Yes	No	No
	2021-2040 Outlook	No	No	No	Yes
Preliminary Recommendation		✓			

Note: The “Dawn Ontario – Tennessee Zone 4 200L Blend” is comprised of Dawn Ontario spot prices from December to March and Tennessee Zone 4 200L spot prices from April – November; the 2022 SOM utilizes a blend comprised of Niagara spot prices from December to March and Tennessee Zone 4 200L spot prices from April to November for Load Zones B, C and E; the 2021-2040 Outlook uses a blend comprised of the weighted average of spot prices from Dominion South (91%), Tetco M3 (7%), and Columbia (2%) for Load Zones A-E [see Slide 10].

Load Zone C (LBMPs and Gas Prices)

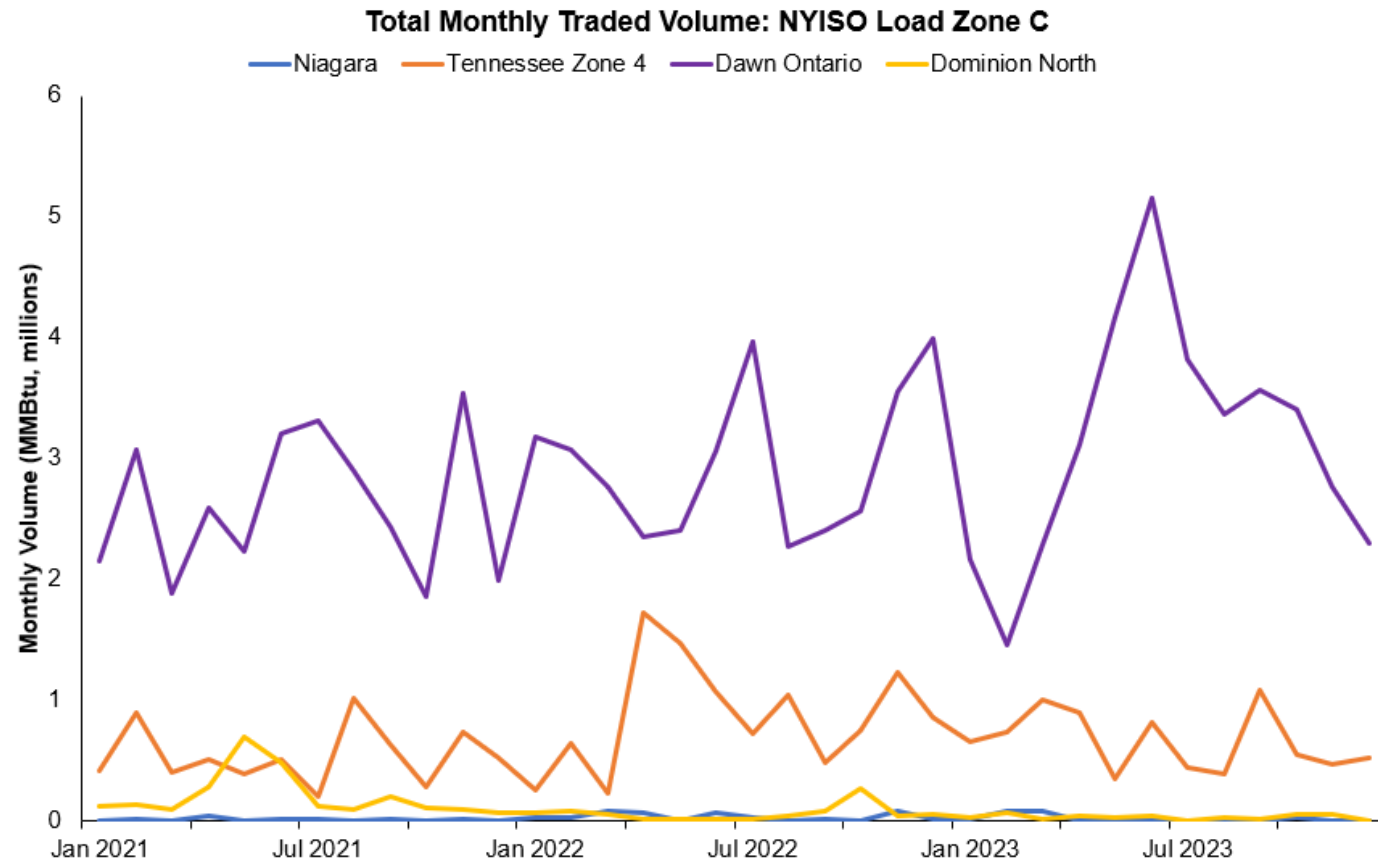
Review of natural gas pricing trends since 2020



Notes: [1] "Marginal NG Fuel Cost" is calculated as the product of the natural gas price index and the heat rate of a GE 7HA.02 turbine, the 2021-2025 DCR reference peaking plant. The assumed heat rate is 8,890 Btu/kWh. [2] The 2021-2040 Outlook Index is comprised of a weighted average of spot prices at Dominion South (91%), Tetco M3 (7%), and Columbia (2%). [3] The 2022 SOM Index and 2021-2025 use the Niagara index during the months December - March, and Tennessee Zone 4 200L index during the rest of the year. **Sources:** [A] S&P CapIQ (Fuel Prices; obtained by AG). [B] NYISO (DAM LBMPs).

Load Zone C (Trade Volume, MMBTU)

Review of natural gas trade volume since 2020



Source: S&P CapIQ (obtained by AG)

Preliminary Recommendations for 2025 – 2029 DCR

Load Zone F

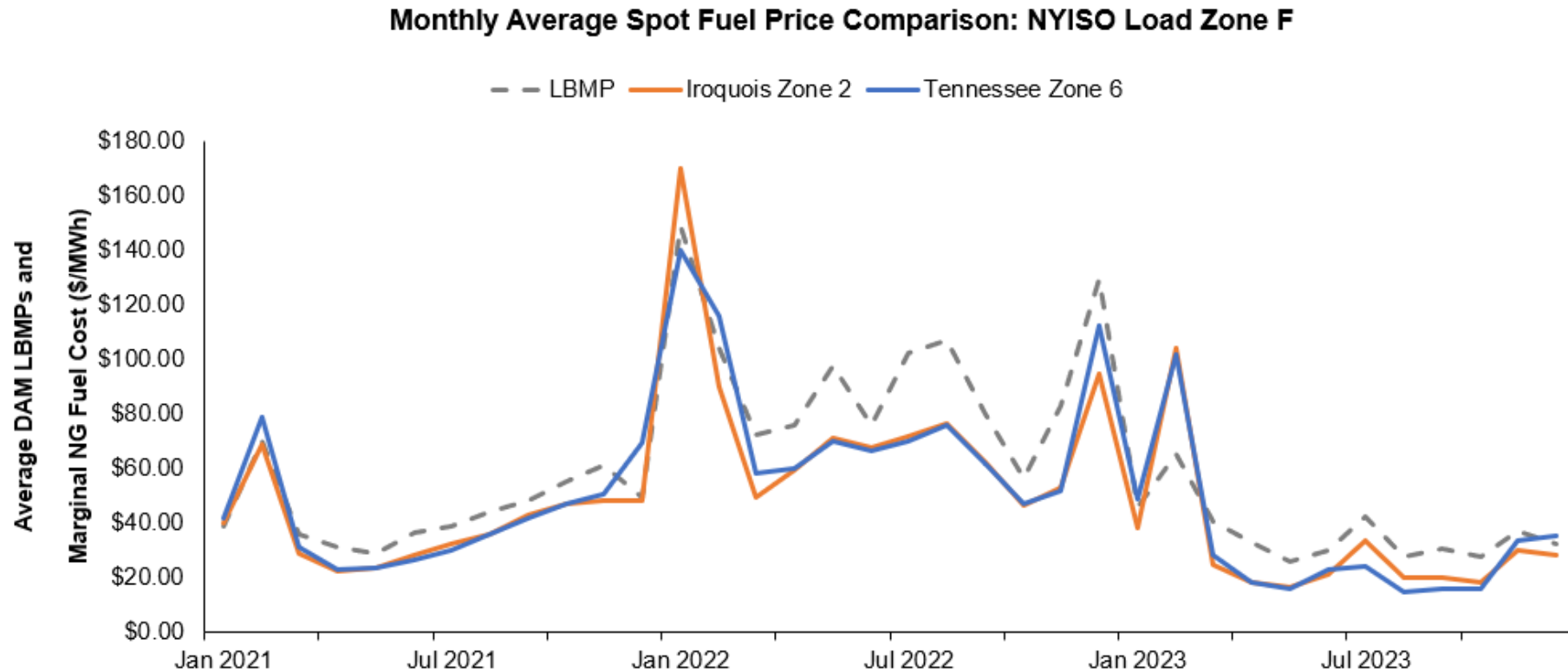
- Preliminary Recommendation: Iroquois Zone 2; has a strong historical precedent as a proxy gas hub in Load Zone F, has a good correlation with market prices, is sufficiently traded, and is geographically well situated.
- Potential options considered to date are summarized below

Decision Criteria		Iroquois Zone 2	Tennessee Zone 6
Market Dynamics		Medium LBMP Correlation	Medium LBMP Correlation
Liquidity		Medium	Medium
Geography		Yes	No
Precedent	2021-2025 DCR	Yes	No
	2022 SOM	Part of Load Zone F Blend	Part of Load Zone F Blend
	2021-2040 Outlook	Part of Load Zones F-I Blend	Part of Load Zones F-I Blend
Preliminary Recommendation		✓	

Note: the 2022 SOM utilizes the lesser of the spot prices from a Tennessee Zone 6 and Iroquois Zone 2 for Load Zone F; the “Load Zones F-I Blend” from the 2021-2040 Outlook is comprised of the weighted average of the spot prices from Tennessee Zone 6 (62%), Iroquois Zone 2 (28%), Algonquin (7%) and Tetco M3 (3%) [see Slide 10]

Load Zone F (LBMPs and Gas Prices)

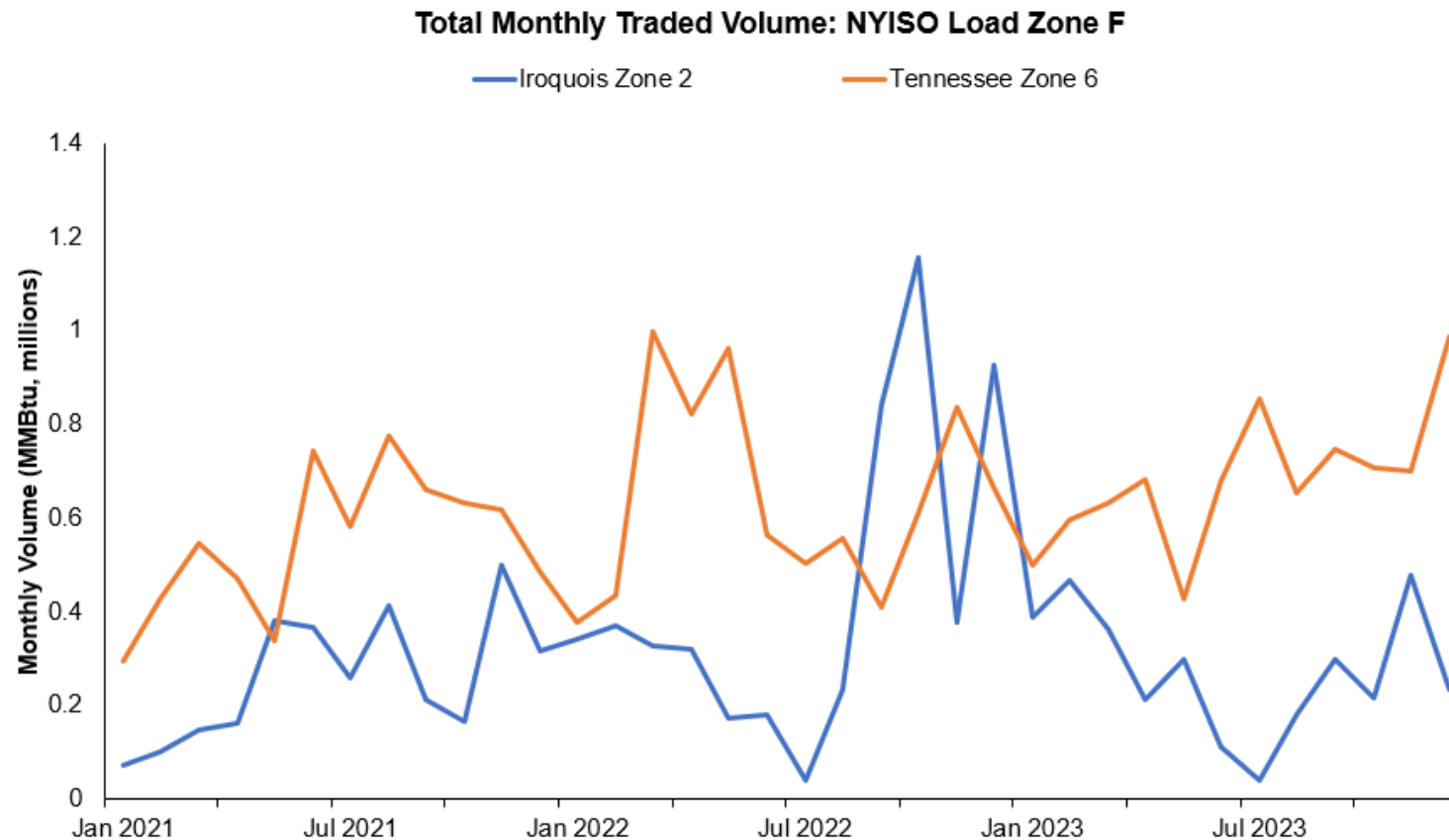
Review of natural gas pricing trends since 2020



Notes: [1] "Marginal NG Fuel Cost" is calculated as the product of the natural gas price index and the heat rate of a GE 7HA.02 turbine, the 2021-2025 DCR reference peaking plant. The assumed heat rate is 8,890 Btu/kWh. **Sources:** [A] S&P CapIQ (Fuel Prices; obtained by AG). [B] NYISO (DAM LBMPs).

Load Zone F (Trade Volume, MMBTU)

Review of natural gas trade volume since 2020



Source: S&P CapIQ (obtained by AG)

Preliminary Recommendations for 2025 – 2029 DCR

Load Zone G (Dutchess County)

- Preliminary Recommendation: Tennessee Zone 5 200L; has a good correlation with market prices, is sufficiently traded, and is geographically well situated.
- Potential options considered to date are summarized below

Decision Criteria		Iroquois Zone 2	Tetco M3	Tennessee Zone 5 200L	SOM 2022 Load Zone G Blend
Market Dynamics		High LBMP Correlation	High LBMP Correlation	Medium LBMP Correlation	Medium LBMP Correlation
Liquidity		Medium	High	Medium	Medium
Geography		Yes	No	Yes	Yes/No
Precedent	2021-2025 DCR	Yes	No	No	No
	2022 SOM	Part of Load Zone G Blend	Part of Load Zone G Blend	No	Yes
	2021-2040 Outlook	Part of Load Zones F-I Blend	Part of Load Zones F-I Blend	No	No
Preliminary Recommendation				✓	

Note: the SOM 2022 “Load Zone G Blend” is comprised of the average of spot prices from Iroquois Zone 2 and Tetco M3; the “Load Zones F-I Blend” from the 2021-2040 Outlook is comprised of the weighted average of the spot prices from Tennessee Zone 6 (62%), Iroquois Zone 2 (28%), Algonquin (7%) and Tetco M3 (3%) [see Slide 10]

Preliminary Recommendations for 2025 – 2029 DCR

Load Zone G (Rockland County)

- Preliminary Recommendation: Tennessee Zone 5 200L; has a good correlation with market prices, is sufficiently traded, and is geographically well situated.
- Potential options considered to date are summarized below

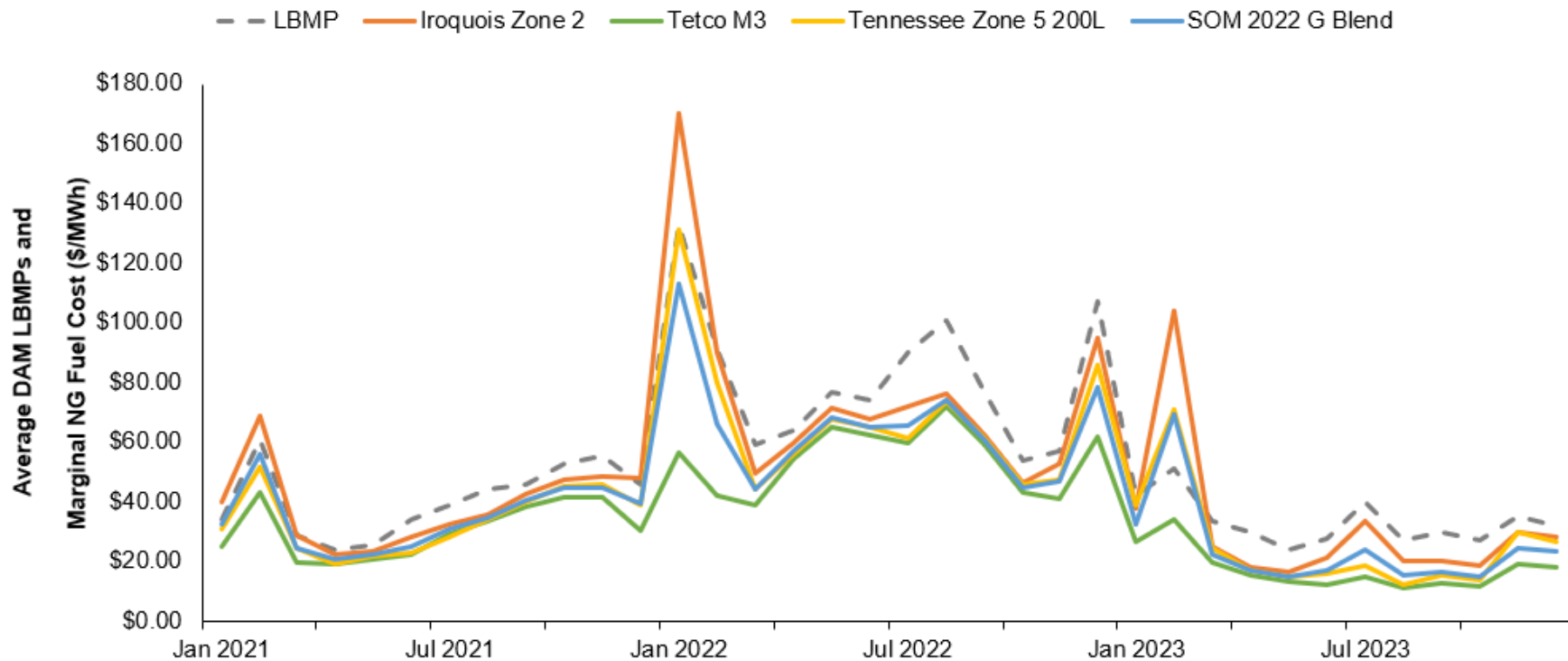
Decision Criteria		Iroquois Zone 2	Tetco M3	Tennessee Zone 5 200L	SOM 2022 Load Zone G Blend
Market Dynamics		High LBMP Correlation	High LBMP Correlation	Medium LBMP Correlation	Medium LBMP Correlation
Liquidity		Medium	High	Medium	Medium
Geography		No	No	Yes	Yes/No
Precedent	2021-2025 DCR	No	Yes	No	No
	2022 SOM	Part of Load Zone G Blend	Part of Zone G Blend	No	Yes
	2021-2040 Outlook	Part of Load Zones F-I Blend	Part of Load Zones F-I Blend	No	No
Preliminary Recommendation				✓	

Note: the SOM 2022 “Load Zone G Blend” is comprised of the average of spot prices from Iroquois Zone 2 and Tetco M3; the “Load Zones F-I Blend” from the 2021-2040 Outlook is comprised of the weighted average of the spot prices from Tennessee Zone 6 (62%), Iroquois Zone 2 (28%), Algonquin (7%) and Tetco M3 (3%) [see Slide 10]

Load Zone G (LBMPs and Gas Prices)

Review of natural gas pricing trends since 2020

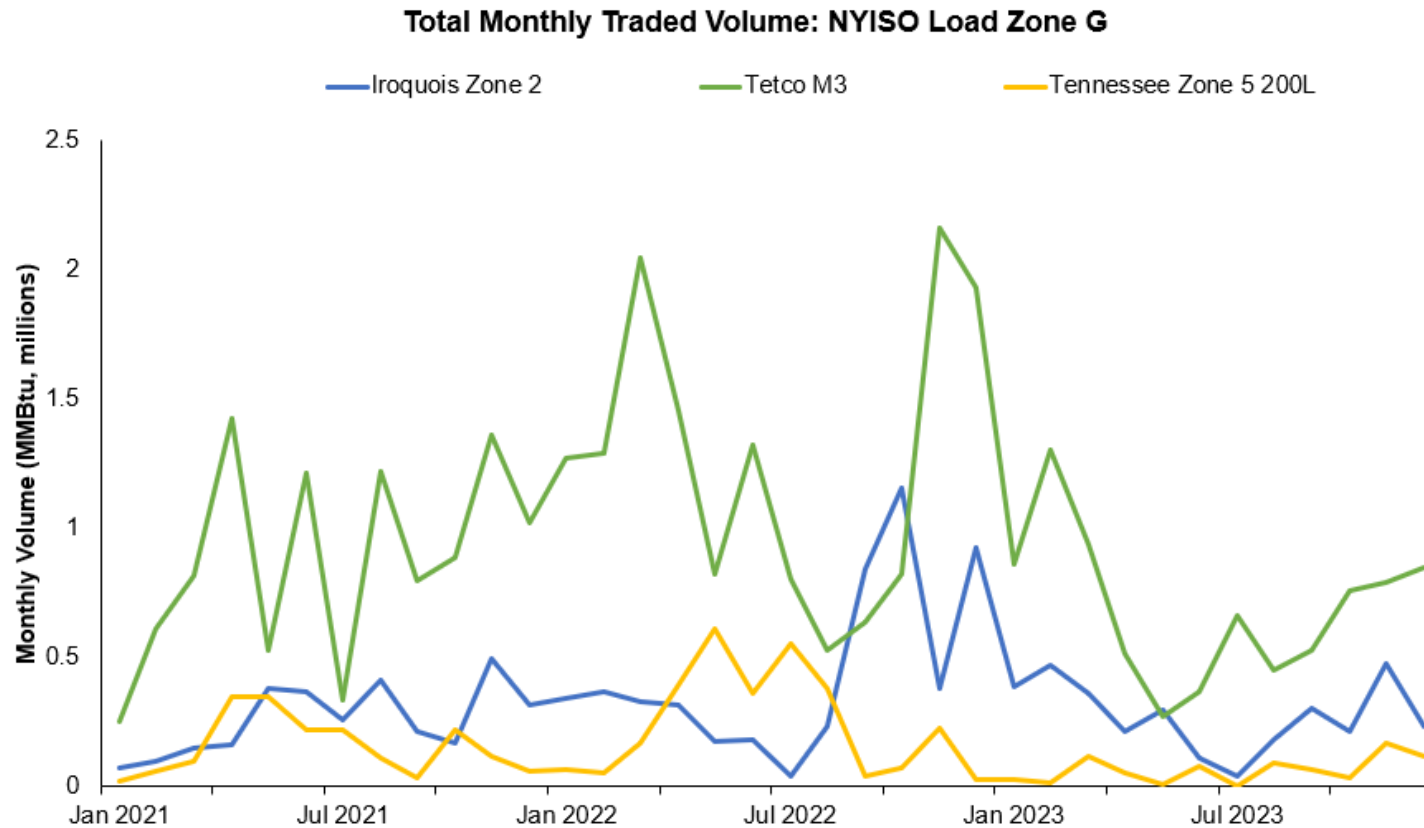
Monthly Average Spot Fuel Price Comparison: NYISO Load Zone G



Notes: [1] "Marginal NG Fuel Cost" is calculated as the product of the natural gas price index and the heat rate of a GE 7HA.02 turbine, the 2021-2025 DCR reference peaking plant. The assumed heat rate is 8,890 Btu/kWh. [2] The 2022 SOM Index is comprised of a weighted average of Iroquois Zone 2 (50%) and Tetco M3 (50%). **Sources:** [A] S&P CapIQ (Fuel Prices; obtained by AG). [B] NYISO (DAM LBMPs).

Load Zone G (Trade Volume, MMBTU)

Review of natural gas trade volume since 2020



Source: S&P CapIQ (obtained by AG)

Preliminary Recommendations for 2025 – 2029 DCR

Load Zone J

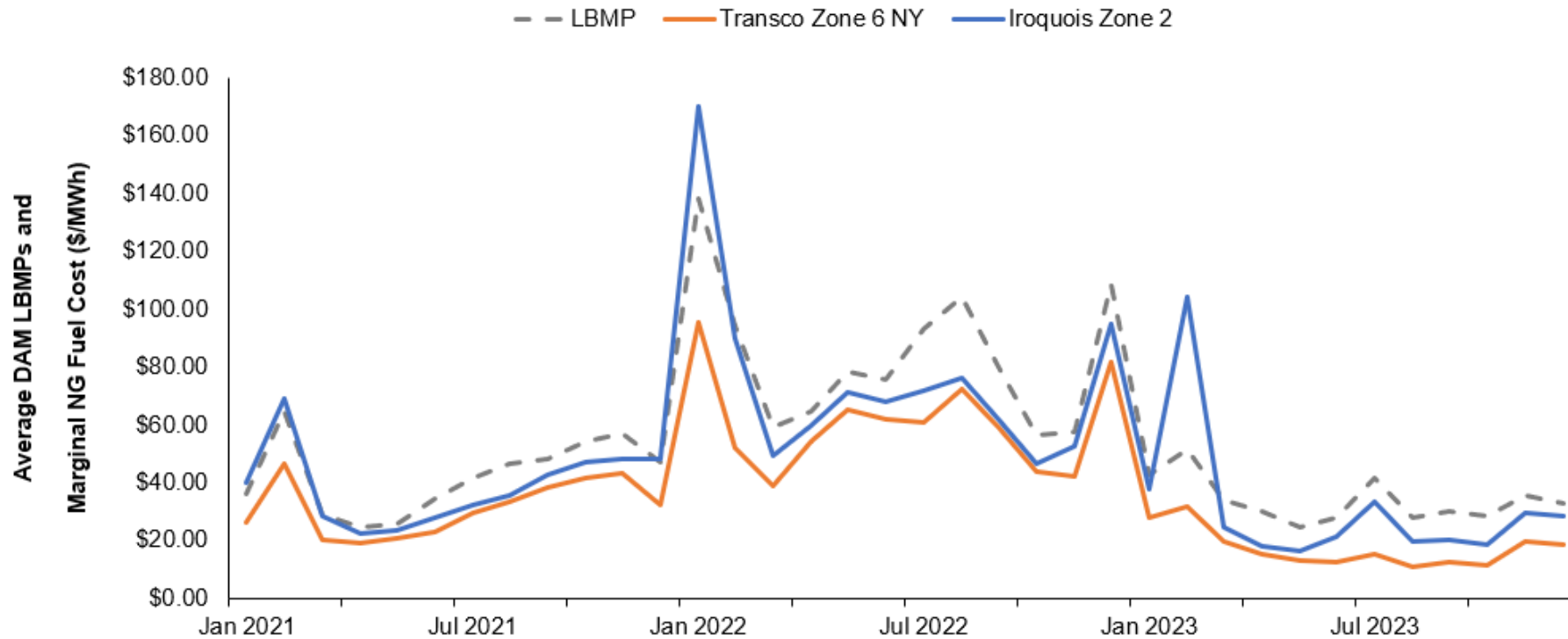
- Preliminary Recommendation: Transco Zone 6 NY; has a strong historical precedent as a trading hub in Load Zone J, has a strong correlation with market prices, is sufficiently traded, and is geographically well situated.
- Potential options considered to date are summarized below

Decision Criteria		Transco Zone 6 NY	Iroquois Zone 2
Market Dynamics		High LBMP Correlation	High LBMP Correlation
Liquidity		Medium	Medium
Geography		Yes	No
Precedent	2021-2025 DCR	Yes	No
	2022 SOM	Yes	No
	2021-2040 Outlook	Yes	No
Preliminary Recommendation		✓	

Load Zone J (LBMPs and Gas Prices)

Review of natural gas pricing trends since 2020

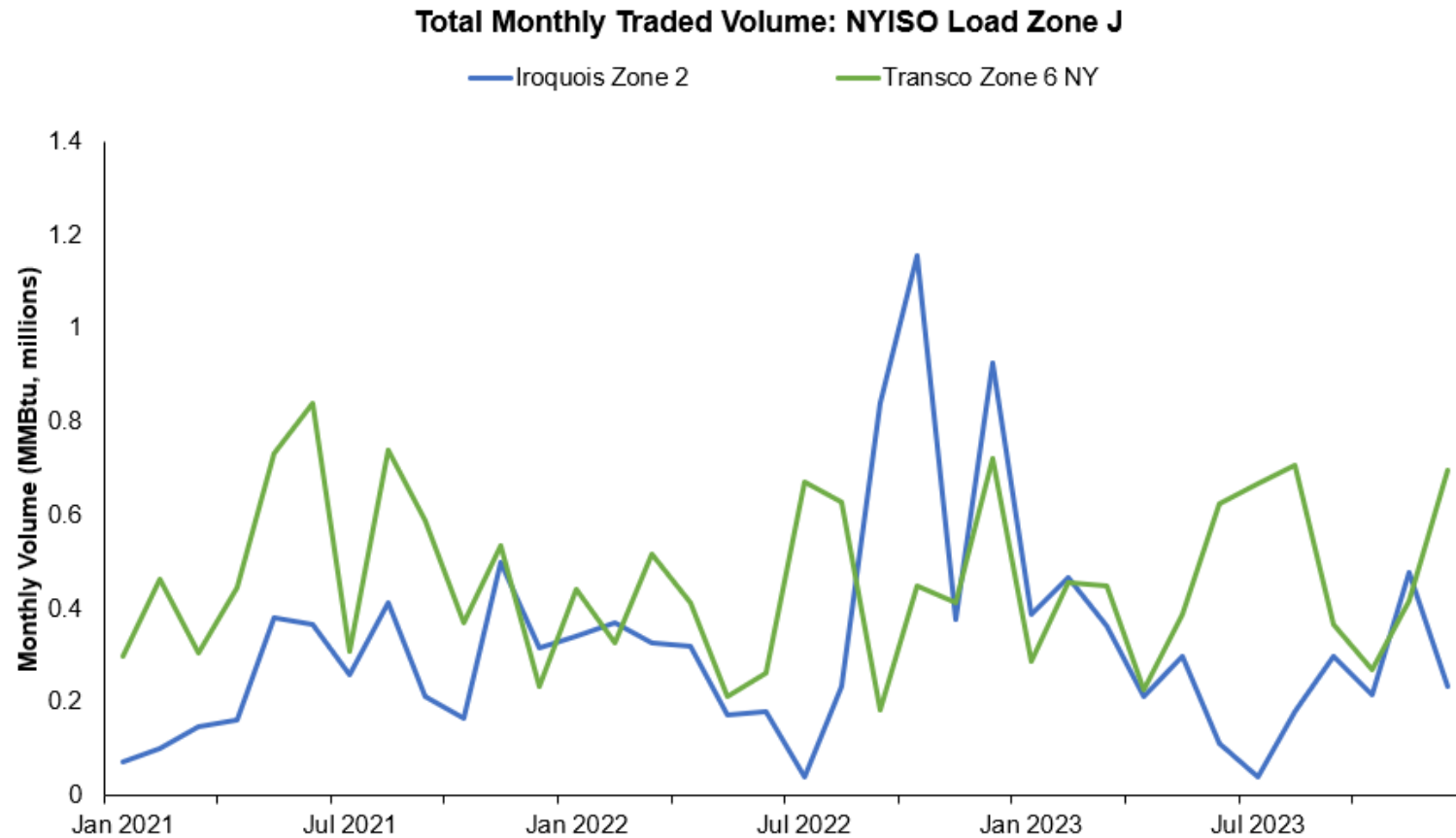
Monthly Average Spot Fuel Price Comparison: Zone J



Notes: [1] "Marginal NG Fuel Cost" is calculated as the product of the natural gas price index and the heat rate of a GE 7HA.02 turbine, the 2021-2025 DCR reference peaking plant. The assumed heat rate is 8,890 Btu/kWh. **Sources:** [A] S&P CapIQ (Fuel Prices; obtained by AG). [B] NYISO (DAM LBMPs).

Load Zone J (Trade Volume, MMBTU)

Review of natural gas trade volume since 2020



Source: S&P CapIQ (obtained by AG)

Preliminary Recommendations for 2025 – 2029 DCR

Load Zone K

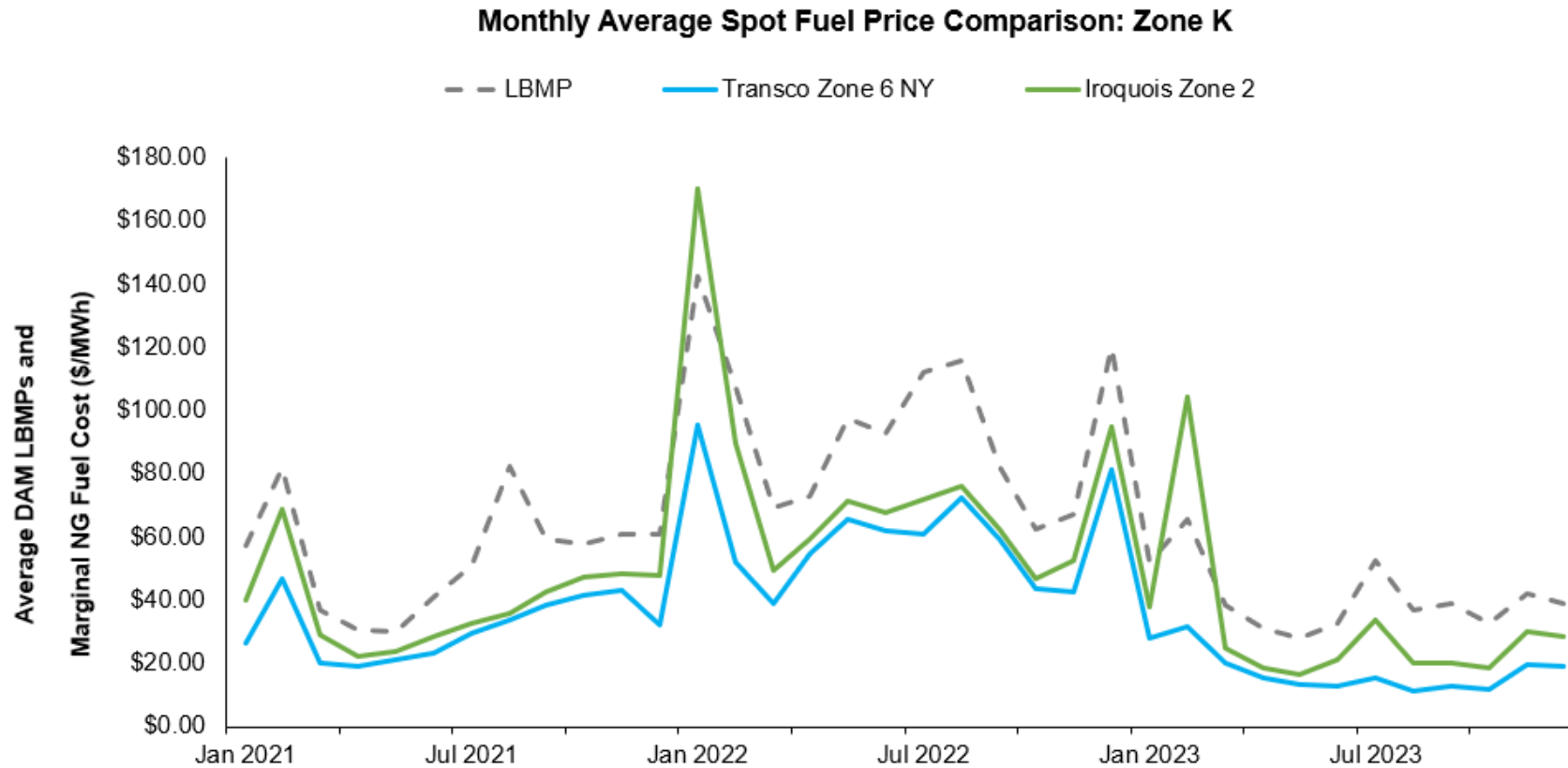
- Preliminary Recommendation: Iroquois Zone 2; has a strong historical precedent as a trading hub in Load Zone K, has a good correlation with market prices, is sufficiently traded, and is geographically well situated.
- Potential options considered to date are summarized below

Decision Criteria		Transco Zone 6 NY	Iroquois Zone 2
Market Dynamics		High LBMP Correlation	High LBMP Correlation
Liquidity		Medium	Medium
Geography		Yes	Yes
Precedent	2021-2025 DCR	No	Yes
	2022 SOM	No	Yes
	2021-2040 Outlook	Part of Load Zone K Blend	Part of Load Zone K Blend
Preliminary Recommendation			✓

Note: the “Load Zone K Blend” from the 2021-2040 Outlook is comprised of the weighted average of the spot prices from Iroquois Zone 2 (51%) and Transco Zone 6 NY (49%) [see Slide 10]

Load Zone K (LBMPs and Gas Prices)

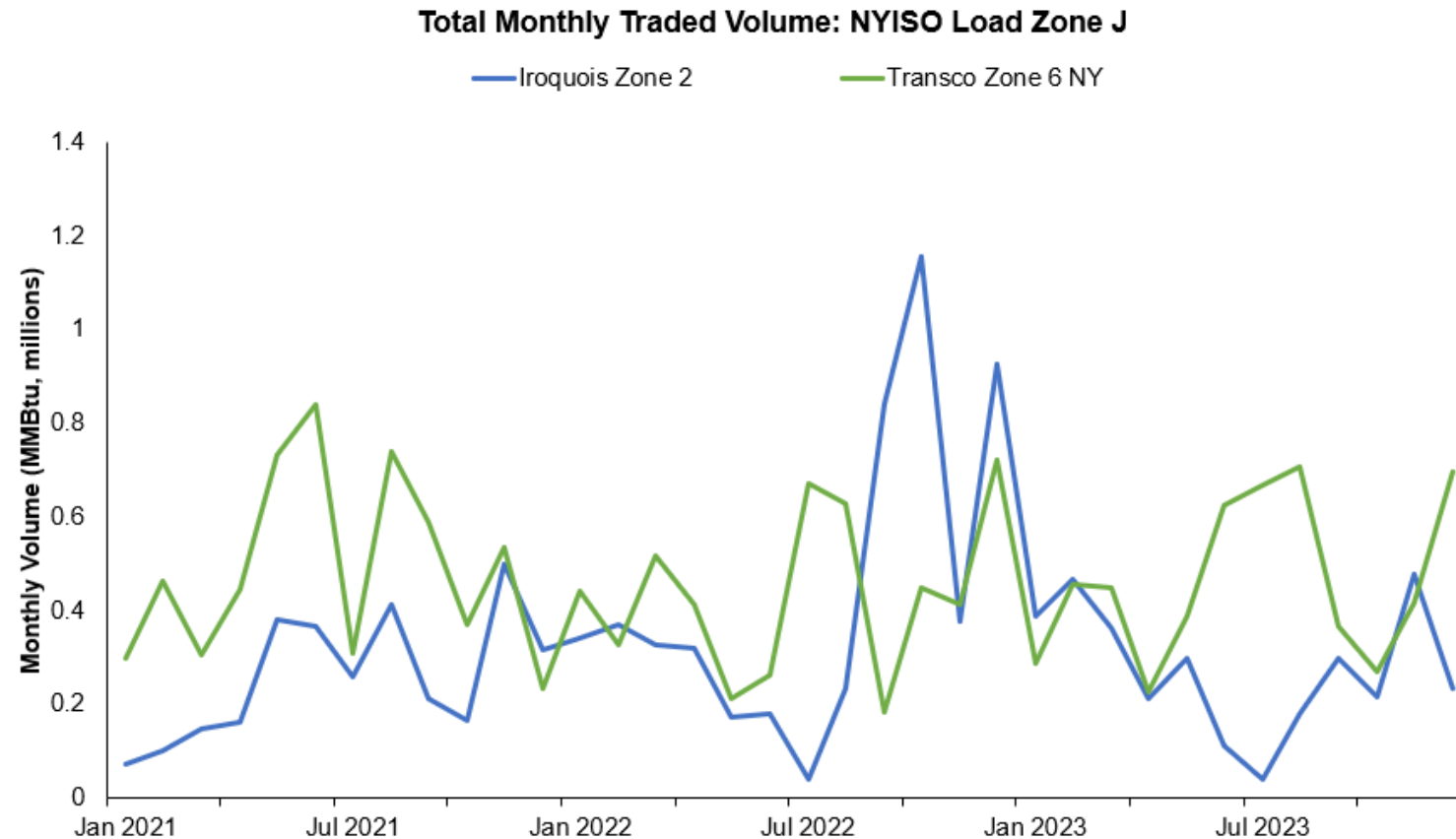
Review of natural gas pricing trends since 2020



Notes: [1] "Marginal NG Fuel Cost" is calculated as the product of the natural gas price index and the heat rate of a GE 7HA.02 turbine, the 2021-2025 DCR reference peaking plant. The assumed heat rate is 8,890 Btu/kWh. **Sources:** [A] S&P CapIQ (Fuel Prices; obtained by AG). [B] NYISO (DAM LBMPs).

Load Zone K (Trade Volume, MMBTU)

Review of natural gas trade volume since 2020



Source: S&P CapIQ (obtained by AG)

Update on battery net EAS model enhancements

Update on Potential 5-Minute Battery Modeling Enhancement

- At the 01/25/2024 ICAPWG meeting, stakeholders raised the prospect of using 5-minute rather than hourly prices in the real-time energy market component of the net EAS model for energy storage
- AG is in the process of conducting initial analysis on the potential impacts from moving to 5-minute interval modeling
- As part of this initial analysis, AG is developing modeling alternatives that seek to balance two key considerations:
 1. Complex enough to reasonably approximate the decisions of a fully optimized model (such as the “hour pair” methodology used in the model for the 2021-2025 DCR)
 2. Simple enough to implement and run in a reasonably short timeframe
- AG currently expects to have initial results and preliminary recommendations for discussion in March 2024

Contact

Analysis Group

Paul Hibbard, Principal

617-425-8171

paul.hibbard@analysisgroup.com

Todd Schatzki, Principal

617-425-8250

todd.schatzki@analysisgroup.com

Joe Cavicchi, Vice President

617-425-8233

joe.cavicchi@analysisgroup.com

Charles Wu, Vice President

617-425-8342

charles.wu@analysisgroup.com

Daniel Stuart, Manager

617-425-8196

daniel.stuart@analysisgroup.com