ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

NYISO 2019/2020 ICAP Demand Curve Reset

Update on DCR Progress

ICAP Working Group

April 22, 2020

Today:

- Updated Preliminary Fuel Hub Recommendations
- Preliminary Recommendations: Fossil Unit Selective Catalytic Reduction (SCR) Emission Controls and Dual-Fuel Capability
- Financial Parameters: Updated Amortization Period Considerations
- Financial Parameters: Considerations for Risk and Recent Market Conditions
- Energy Storage Net EAS Modeling Discussion
- Appendix: Additional Load Zone G Fuel Hub Data

Updated Preliminary Fuel Hub Recommendations: Load Zones C and K

Fuel Hub Selection

Preliminary Recommendations:

- Note: natural gas hubs and pricing points remain fixed for the duration of the ICAP Demand Curve Reset (DCR) period
- Preliminary natural gas hub recommendations by location:
  - Load Zone C: Dominion North (subject to ongoing consideration)
  - Load Zone F: Iroquois Zone 2*
  - Load Zone G (Rockland): TETCO M3*
  - Load Zone G (Dutchess): Iroquois Zone 2*
  - Load Zone J: Transco Zone 6 NY*
  - Load Zone K: Iroquois Zone 2

  **Unchanged from 3/26/2020 ICAPWG meeting*
- The following slides present additional support for the preliminary recommendations for Load Zone C and Load Zone K
  - Information supporting the initial recommendations for all other locations was presented at the March 26, 2020 ICAPWG meeting

Alternative Gas Hub Choices from Previous Studies

Zone	2020 DCR (Preliminary Recommendation)	2016 DCR	2018 State of the Market Report (MMU)	CARIS Phase I (2019)
NYCA - C	**Dominion North (subject to ongoing evaluation)**	TETCO M3	Dominion North	Zones A-E: Dominion South (65%) TCO - Columbia(5%) Dawn (30%)
NYCA - F	**Iroquois Zone 2***	Iroquois Zone 2	Iroquois Zone 2	Zones F-I: Iroquois Zone 2 (30%) Tennessee Zone 6 (45%) TETCO M3 (20%) Iroquois Waddington (5%)
LHV – G (Rockland)	**TETCO M3***	Iroquois Zone 2	Iroquois Zone 2 (50%) Millennium East (50%)	
LHV – G (Dutchess)	**Iroquois Zone 2***			
NYC - J	**Transco Zn 6 NY***	Transco Zn 6 NY	Transco Zn 6 NY	Transco Zn 6 NY
LI - K	**Iroquois Zone 2**	Transco Zn 6 NY	Iroquois Zone 2	Iroquois Zone 2 (60%) Transco Zone 6 (40%)

**Presented at 3/26/2020 ICAPWG meeting*

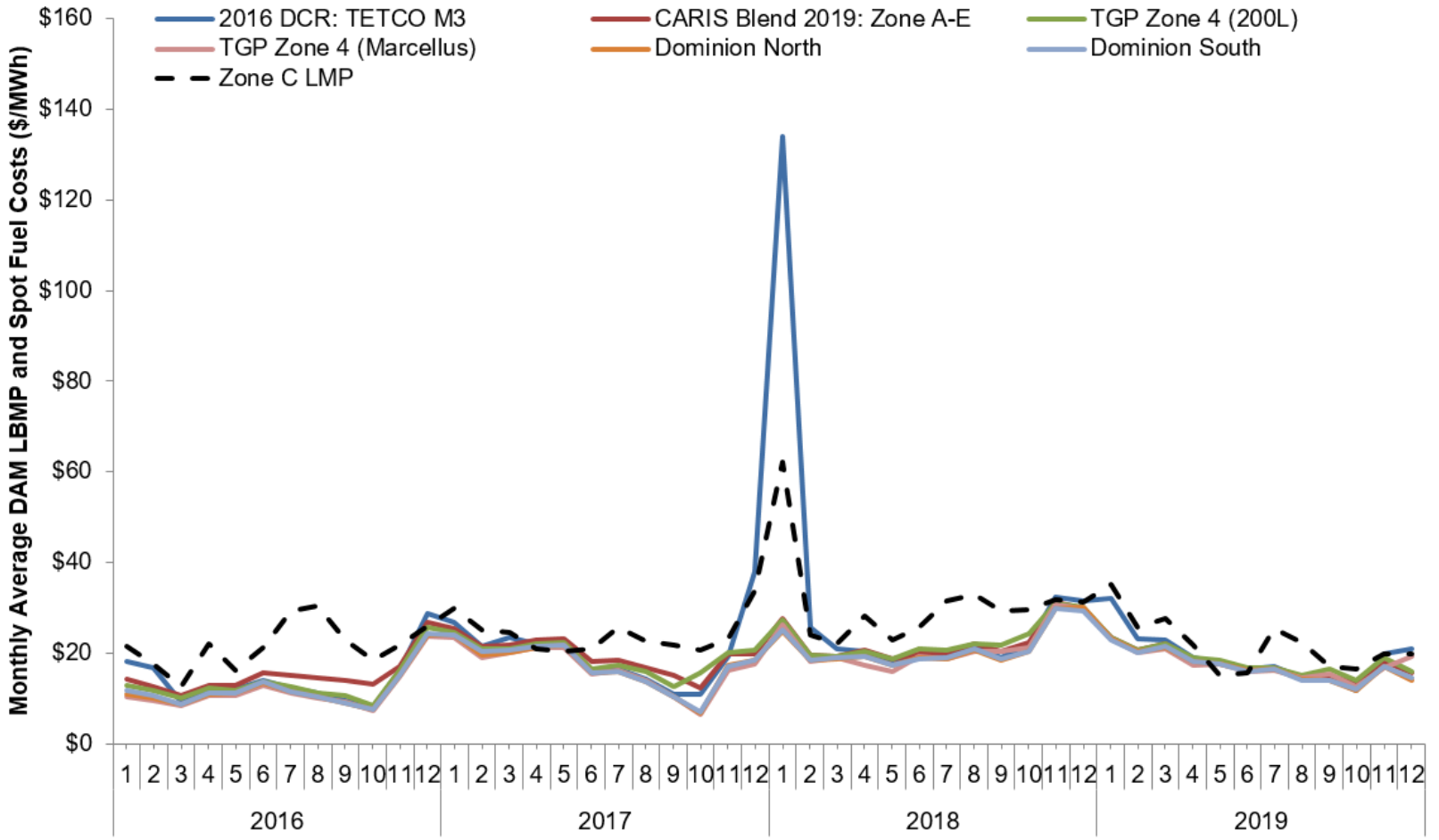
Load Zone C

- Preliminary Recommendation: Analysis Group is currently considering use of Dominion North; however, further assessment remains ongoing of various options noted in the table below

Decision Criteria		TETCO M3	TGP Z4 (200L)	TGP Z4 (Marcellus)	Dominion North	Dominion South	CARIS 2019 A-E Blend
Market Dynamics		Yes	Low Correlation	Low Correlation	Low Correlation	Low Correlation	Low Correlation
Liquidity		Yes	Yes	Variable	Variable	Yes	Yes
Geography		No	No	Yes	Yes	No	No
Recommendation					✓		
Precedent	2016 DCR	Yes (Zone C)	No	No	No	No	No
	CARIS (2019) Phase I	No	No	No	No	Part of Zone A-E Blend	Yes
	SOM (2018)	No	No	No	No	No	No

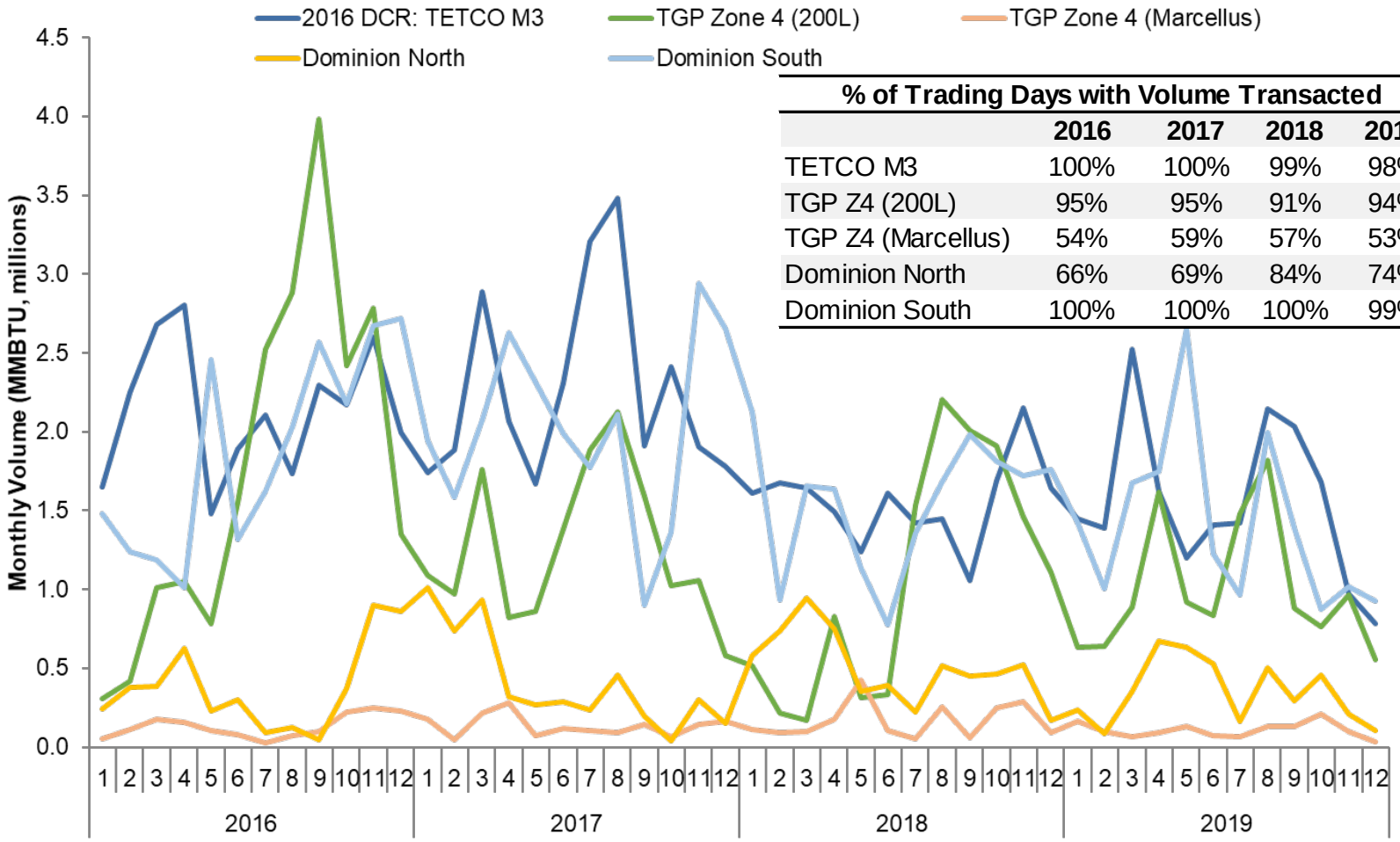
Note: CARIS Blend (Zones A-E) is comprised of a weighted average of spot prices at Dominion South (65%), Dawn Ontario (30%), and TCO Pool (5%).

Load Zone C (LBMP and Gas Prices)



Notes: CARIS Blend (Zones A-E) is comprised of a weighted average of natural gas spot prices at Dominion South (65%), Dawn Ontario (30%), and TCO Pool (5%). Natural gas fuel costs are expressed in $/MWh assuming a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Load Zone C (Trade Volume, MMBTU)



% of Trading Days with Volume Transacted				
	2016	**2017**	**2018**	**2019**
TETCO M3	100%	100%	99%	98%
TGP Z4 (200L)	95%	95%	91%	94%
TGP Z4 (Marcellus)	54%	59%	57%	53%
Dominion North	66%	69%	84%	74%
Dominion South	100%	100%	100%	99%

Source: SNL Financial

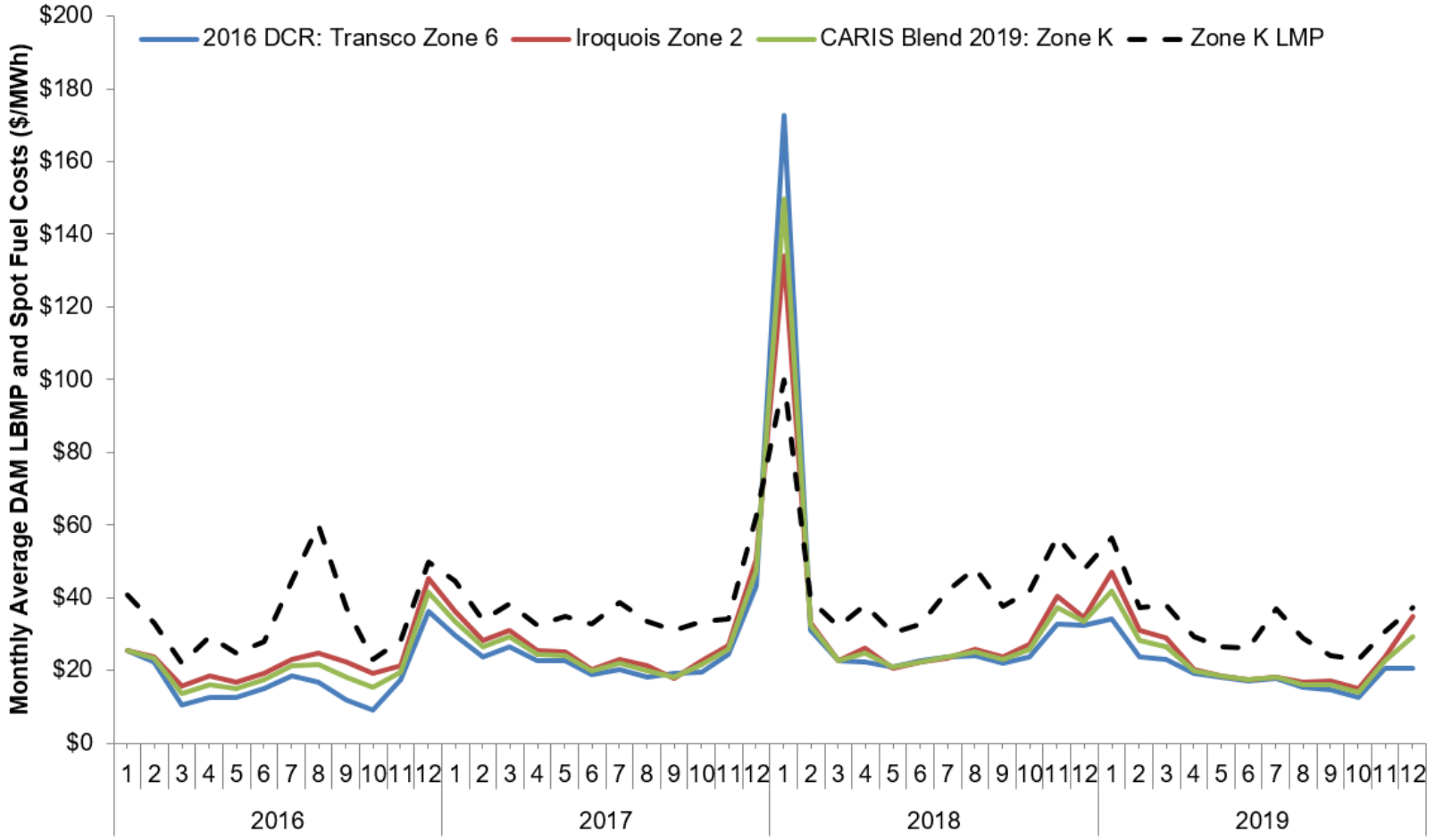
Load Zone K

- Preliminary Recommendation: Analysis Group proposes to use Iroquois Zone 2; represents a reasonable proxy for the gas costs of a peaking plant in Load Zone K

Decision Criteria		Transco Z6	Iroquois Zone 2	CARIS 2019 K Blend
Market Dynamics		Low Correlation	Low Correlation	Low Correlation
Liquidity		Yes	Variable	Variable
Geography		Yes	Yes	Yes
Recommendation			✓	
Precedent	2016 DCR	Yes (Zone K)	No	No
	CARIS (2019) Phase I	Part of Zone K blend	Part of Zone K blend	Yes (Zone K)
	SOM (2018)	No	Yes (Zone K)	No

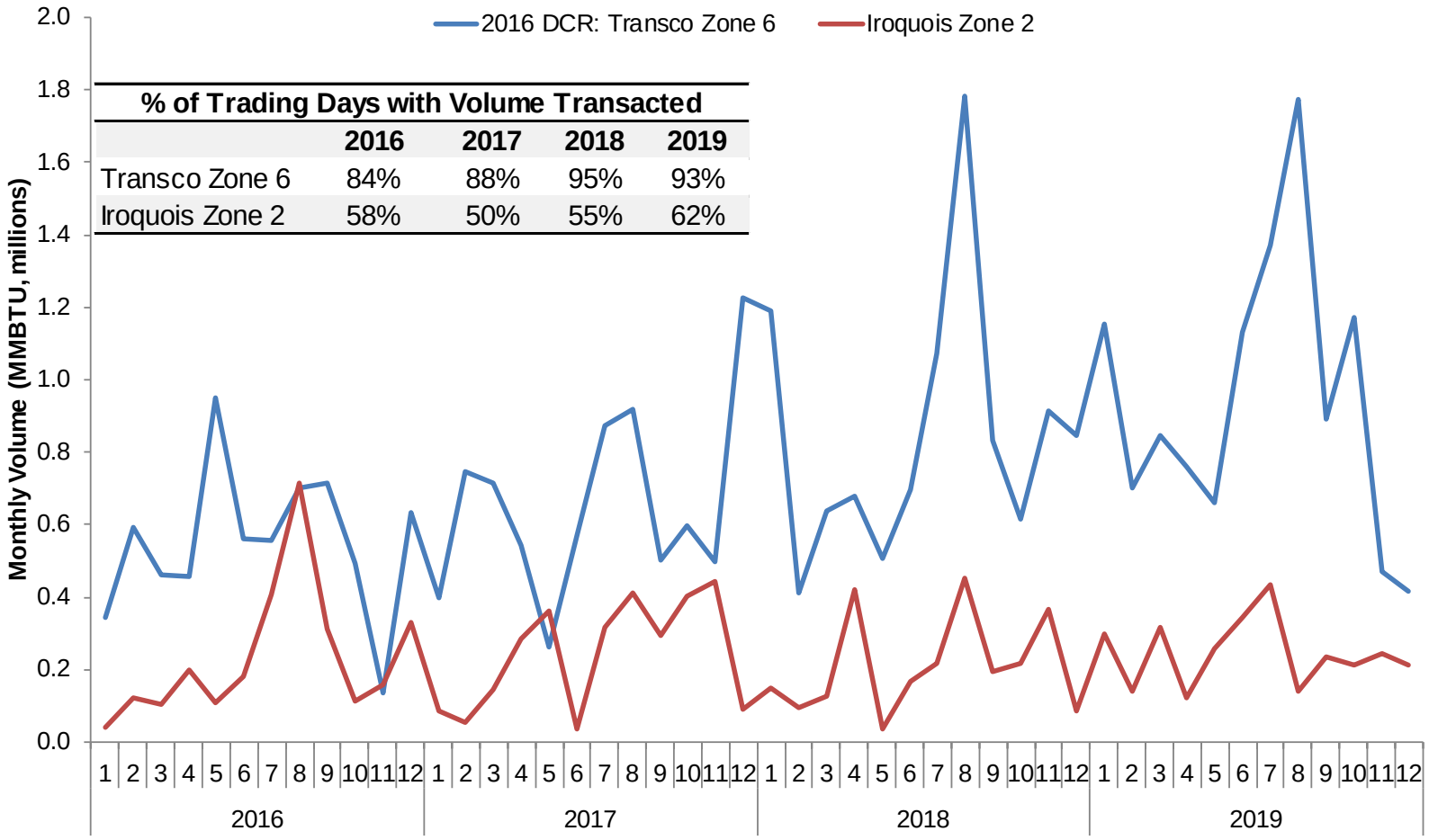
Note: CARIS Blend (Zone K) is comprised of a weighted average of spot prices from Iroquois Zone 2 (60%) and Transco Zone 6 NY (40%).

Load Zone K (LBMP and Gas Prices)



Notes: CARIS Blend (Zone K) is comprised of a weighted average of natural gas spot prices at Iroquois Zone 2 (60%) and Transco Zone 6 NY (40%). Natural gas fuel costs are expressed in $/MWh assuming a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Load Zone K (Trade Volume, MMBTU)



% of Trading Days with Volume Transacted				
	2016	2017	2018	2019
Transco Zone 6	84%	88%	95%	93%
Iroquois Zone 2	58%	50%	55%	62%

Source: SNL Financial

Preliminary Fossil Unit SCR Emissions Controls and Dual-Fuel Capability Recommendations

Fossil Unit: SCR Emissions Controls and Dual-Fuel Capability

Considerations

- Unless otherwise directed by applicable requirements, inclusion of SCR emissions controls and/or dual fuel capability in peaking plant designs are primarily economic decisions by plant developers, and depend on a balance of various factors, including:
  - SCR emissions controls reduce the runtime restrictions otherwise applicable to an uncontrolled unit under applicable NO_x regulations, but add to capital and operating costs
  - Dual fuel increases opportunities to earn energy and ancillary service revenues when gas prices spike or availability is scarce, but add to capital and operating costs
  - Dual fuel provides increased resilience and optionality, serving as a hedge against winter gas availability concerns
- Unit specification also may be set based on local emissions or reliability regulations
  - SCR is required to meet NO_x regulation standards in Load Zones G (Rockland), J, and K
  - Dual fuel capability is required in Load Zones J and K by electric reliability rules and LDC tariff requirements

Fossil Unit: SCR and Dual-Fuel Capability

Preliminary Recommendations

- Based on preliminary analysis of capital costs, revenue opportunities, and operational limits, Analysis Group recommends the following fossil unit design specifications:

Load Zone	GE 7HA.02	GE 7F.05
NYCA - C	15 ppm, Gas-only, no SCR	Gas-only, no SCR
NYCA - F	15 ppm, Gas-only, no SCR	Gas-only, no SCR
LHV – G (Rockland)	25 ppm, Dual Fuel, with SCR	Dual Fuel, with SCR
LHV – G (Dutchess)	15 ppm, Dual Fuel, no SCR	Dual Fuel, no SCR
NYC - J	25 ppm, Dual Fuel, with SCR	Dual Fuel, with SCR
LI - K	25 ppm, Dual Fuel, with SCR	Dual Fuel, with SCR

- It does not appear that SCR emissions controls would be required to obtain an air permit in Load Zone G (Dutchess); even for a dual fuel design
- Analysis Group recommends dual fuel capability for both Load Zone G locations as a hedge against winter gas availability risks and to provide for greater optionality in siting (accommodating interconnections to either LDC systems or interstate pipelines)

Financial Parameters: Amortization Period

Amortization Period Considerations

- Preliminary proposal was to include an amortization period that extended through December 31, 2039 for fossil units to account for 2040 zero-emission requirements of the CLCPA; would have resulted in a different amortization period assumption for each year of the reset
- The current tariff requirements do not appear to accommodate "re-levelizing" the peaking plant capital costs as part of the annual updates
  - Tariff uses the previously determined levelized cost (referred to as the "peaking plant gross costs") as a fixed value in the annual updates; escalation factor is applied to this value (see MST Sections 5.14.1.2.2 and 5.14.1.2.2.1)
    - Under the recently approved enhancements to the annual update procedures, the levelized costs underlying the ICAP Demand Curves for the first year of the reset period are used as "fixed" inputs for purposes of applying the escalation factor calculated as part of each annual update

Amortization Periods: Updated Recommendations

- This suggests that a tariff change would be required to accommodate using a varying amortization period
- Analysis Group instead proposes a fixed amortization period of **17 years** for all fossil units
  - This is the average of the time between each capability year and January 1, 2040
    - Provides a means of recognizing the intent of preliminary proposal in a manner that can be accommodated under current tariff requirements
  - Analysis Group continues to recommend a 20 year amortization period for energy storage

Capability Year	Potential Operating Life of Fossil Unit	Average Operating Life of Fossil Unit over 4 Capability Years
2021-2022	18.7 Years	17 Years
2022-2023	17.7 Years	
2023-2024	16.7 Years	
2024-2025	15.7 Years	

Note:
[1] The potential commercial operating life was calculated by counting the number of years between May 1st of the Capability Year and January 1st, 2040.

Financial Parameters: Discussion of Risks and Recent Market Conditions

Discussion of Risks and Recent Market Conditions

- Spread of COVID-19 has led to extreme volatility in both debt and equity markets (see Slides 20-23 for further information on recent impacts being observed on certain financial parameters)
  - Analysis Group continues to monitor the potential impact of the recent economic conditions on assumed forward-looking financial parameters to be used over this reset period (2021-2025)
  - Final recommendations may reflect further adjustments based on ongoing review of information on evolving financial market conditions
  - A key consideration will be *whether and how* to update the recommendations to account for recent market developments in forward-looking estimates of financial parameters
- New York-specific risks related to regulatory and other factors are intended to be accounted for in the final recommendations for various after-tax weighted average cost of capital (ATWACC) components (cost of debt and equity, and capital structure)

Reminder: Financial Parameters

After-Tax Weighted Average Cost of Capital (ATWACC)

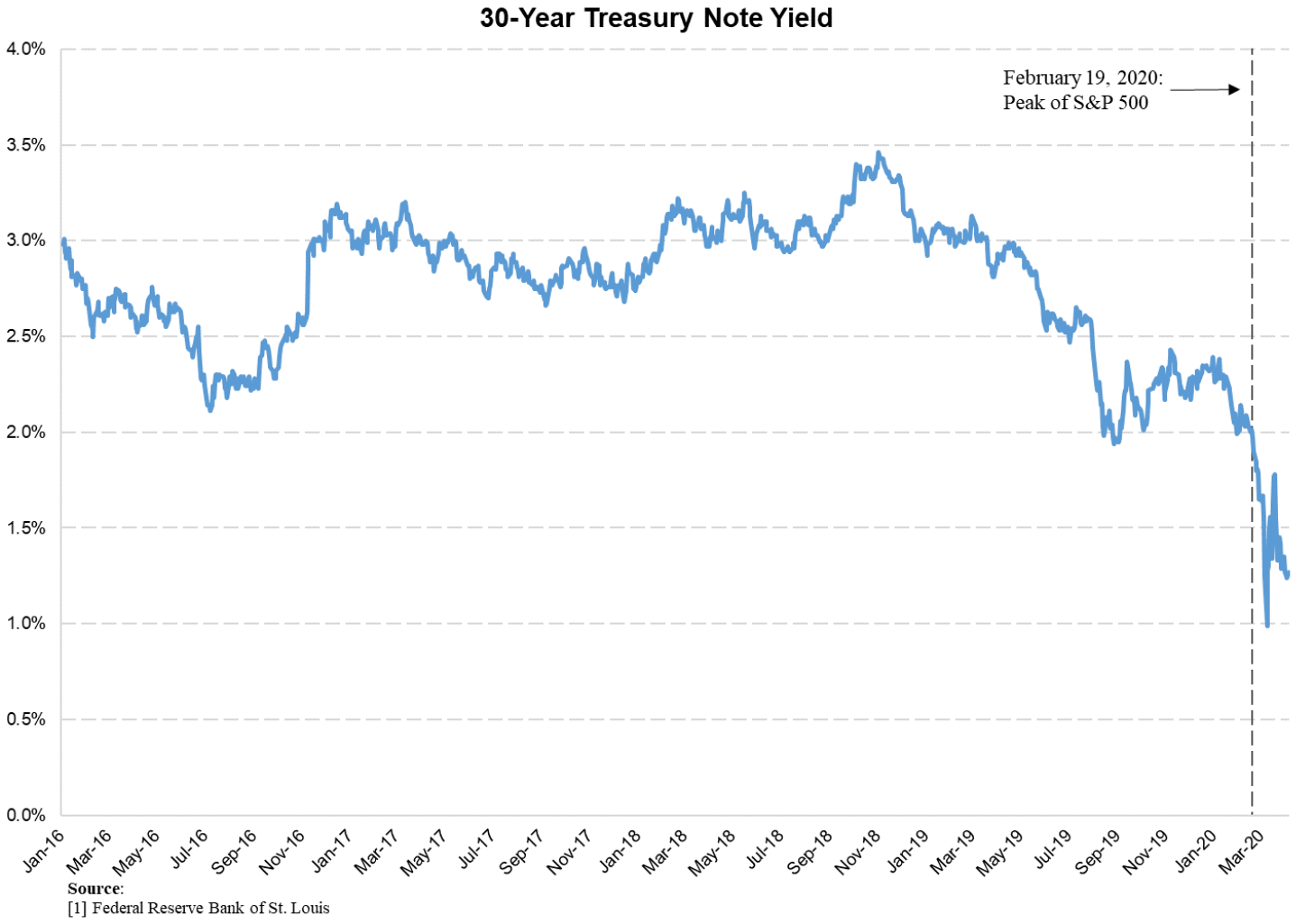
- ATWACC reflects Debt/Equity (D/E) Ratio, Cost of Debt (COD) and Return on Equity (ROE), along with tax rates applicable by location
- **Formula:**
- **ATWACC = (ROE x %Equity) + (COD x %Debt x (1 – Tax Rate))**

Note:
[1] State taxes are no longer deductible from federal taxes, so the tax rate is determined by summing the state (and any local tax) with the federal income tax of 21%.
[2] ATWACC calculations can vary between zones due to differing state/local tax rates. New York City maintains a corporate income tax that leads to a different ATWACC in Zone J (Corporate Income Tax of 36.35% in total).

Return on Equity (ROE)

- Analysis Group is continuing to consider the potential impact of COVID-19 on the risk-free rates and market risk premium
  - 30-year Treasury note yields have fallen from 1.99% on February 1, 2020 to 1.27% on April 7, 2020
  - Market risk premium required by investors may also be affected by current market conditions

Return on Equity – Risk-Free Rate since COVID-19 Downturn

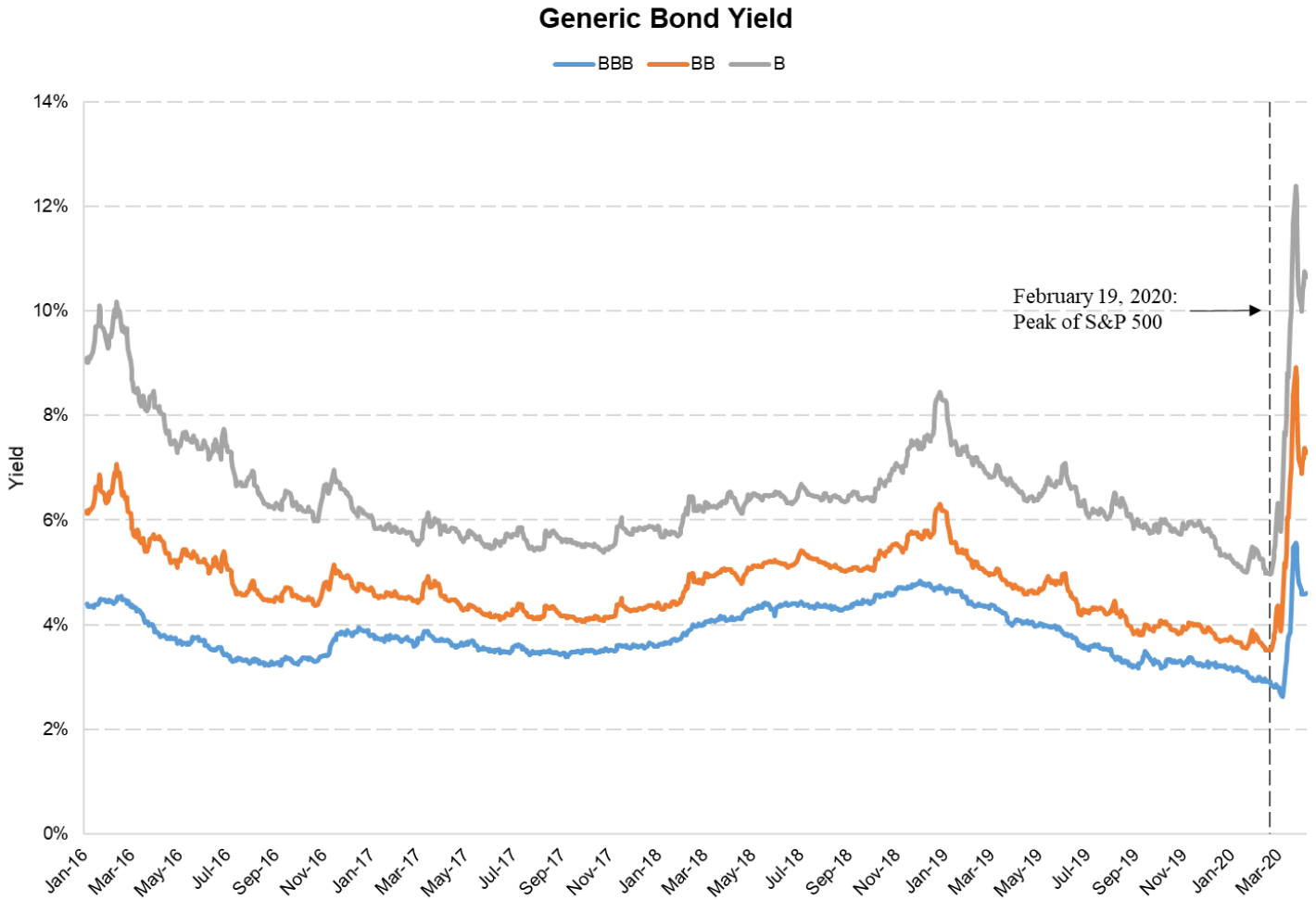


Source:
[1] Federal Reserve Bank of St. Louis

Cost of Debt (COD)

- AG is continuing to consider the potential impact of the COVID-19 on the cost of debt
  - B-rated corporate note rates have increased dramatically, from 5.45% on February 1, 2020 to 10.65% on April 7, 2020

Cost of Debt – Generic Corporate Bonds since COVID-19 Downturn



Source:
[1] Federal Reserve Bank of St. Louis

Energy Storage Net EAS Modeling Discussion

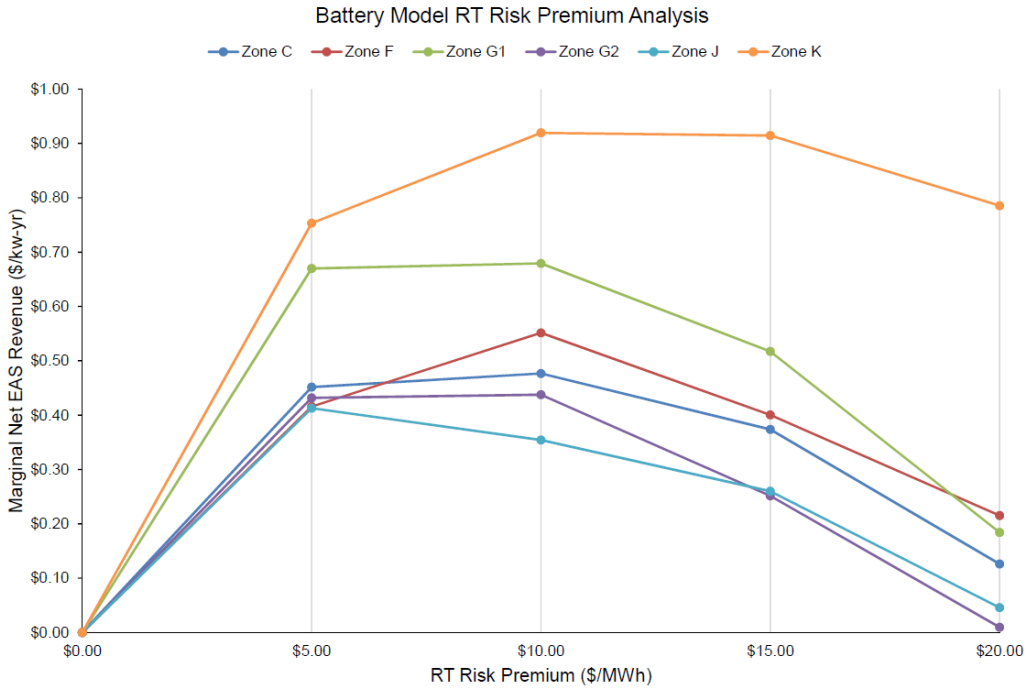
Further Enhancements to Modeling Approach

Overview

- Based on feedback from last stakeholder meeting and discussion with NYISO, modeling logic has been revised to allow battery storage unit to simultaneously earn reserve revenues in hours when it is charging in the energy market:
  - If unit has sufficient stored charge to inject some quantity for an entire hour, it can provide reserves of up to its available MW capacity *in addition* to the MW withdrawn in the energy market
- Refined real-time (RT) risk premium for batteries (which determines required profit for a unit to cycle in RT) consists of two components:
  - Foregone Opportunity Cost (FOC) – Battery could earn more by waiting to discharge in later hour given the limited quantity of stored energy
  - Risk Cost – Cost of foregoing known day-ahead revenues for uncertain RT profit

Foregone Opportunity Cost and Risk Cost

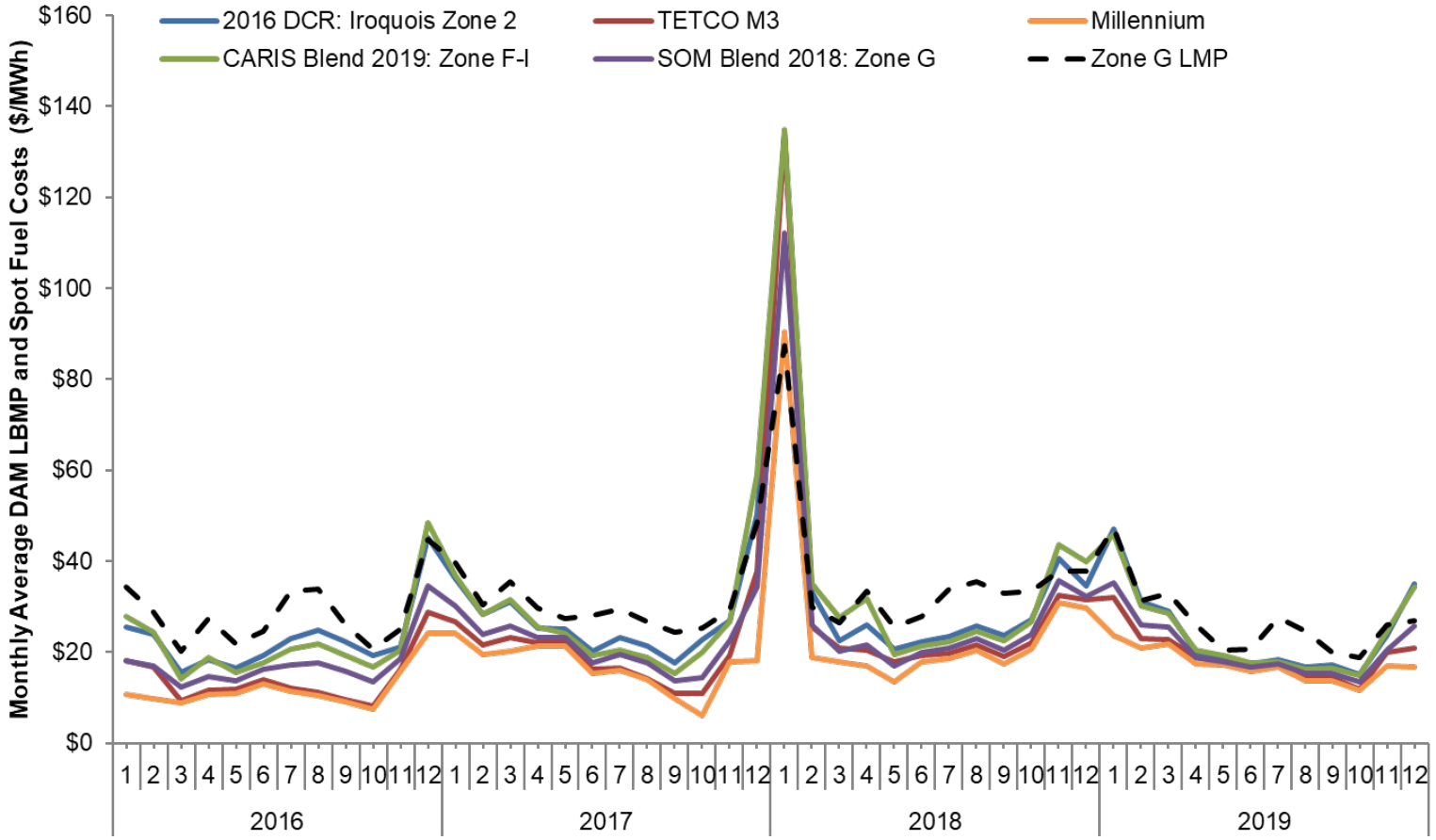
- Optimal Forgone Opportunity Cost value calculated iteratively
  - Setting FOC too low leads battery to cycle too often in RT
  - Setting FOC too high leads to unnecessarily understating the battery's RT revenue earnings potential
- Preliminary iterative analysis suggests optimal forgone opportunity cost of $5/MWh for Load Zone J and $10/MWh for other locations. Risk cost assumed separately at $10/MWh.
  - Total real-time risk premium of $15/MWh in Load Zone J and $20/MWh in all other locations



Note: Marginal Net EAS revenue is the extra revenue gained compared to the $0 / MWh risk premium.

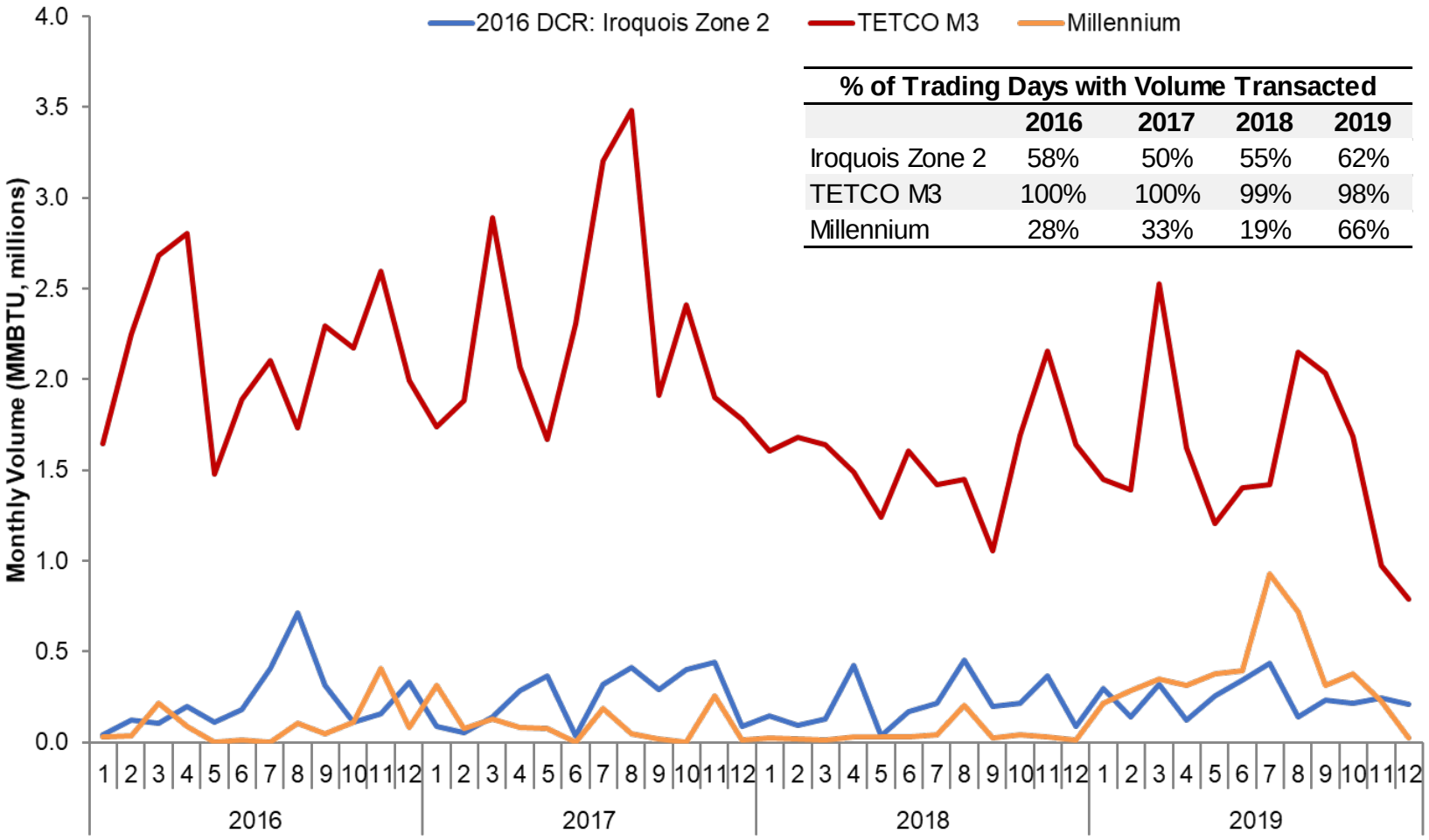
Appendix: Additional Load Zone G Fuel Hub Data

Load Zone G (LBMP and Gas Prices)



Notes: CARIS Blend (Zones F-I) is comprised of a weighted average of spot prices at Iroquois Zone 2 (30%), Tennessee Zone 6 (45%), TETCO M3 (20%) and Iroquois Waddington (5%). SOM (State of the Market) 2018 Blend (Zone G) is comprised of a weighted average of spot prices at Iroquois Zone 2 (50%) and Millennium Pipeline (50%). Natural gas fuel costs are expressed in $/MWh assuming a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Load Zone G (Trade Volume, MMBTU)



% of Trading Days with Volume Transacted				
	2016	2017	2018	2019
Iroquois Zone 2	58%	50%	55%	62%
TETCO M3	100%	100%	99%	98%
Millennium	28%	33%	19%	66%

Source: SNL Financial

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