ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

NYISO 2019/2020 ICAP Demand Curve Reset

Continued Modeling Discussions

ICAP Working Group

February 25, 2020

Today:

- Demand Curve Shape and Slope
- Financial Parameters
- Additional Discussion of Energy Storage Modeling
- Appendix : Fuel Hub Prices

Demand Curve Shape and Slope

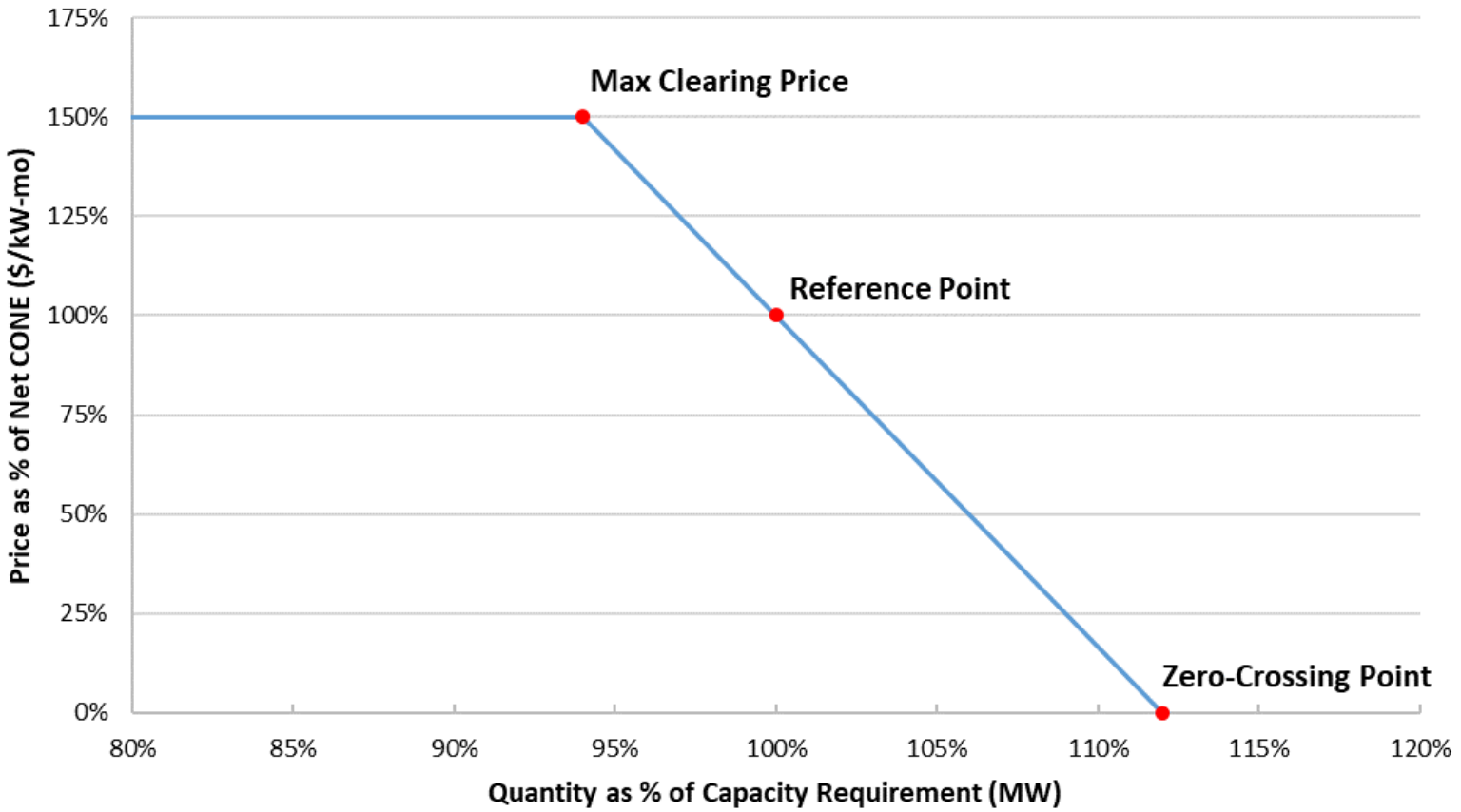
Demand Curve Parameters

Overview

- The shape of the ICAP Demand Curves are set by the following parameters:
  - Applicable Minimum Installed Capacity Requirement – The quantity of installed capacity required to maintain a LOLE criterion of no more than 0.1 days/year, determined by NYSRC (IRM) and NYISO (LCRs)
  - Reference Point – The point at which quantity of supply is equal to the applicable minimum Installed Capacity requirement; and the price is the applicable net cost of new entry (CONE) value (expressed in $/kW-month)
    - Winter-to-Summer Ratio – Captures the difference in quantity of capacity available between winter and summer seasons; this factor is accounted for in translating the applicable annual net CONE values into the reference point price (expressed in $/kW-month)
  - Zero-crossing Point (ZCP) – The point at which additional surplus capacity has $0 value
  - Maximum Clearing Price – The maximum allowable price, set to 1.5 times the applicable gross CONE (expressed in $/kW-month)
- AG does not recommend changing the demand curve shape as part of the current reset

Demand Curve Shape

Example Demand Curve



Demand Curve Shape

Zero-crossing Point (ZCP)

- The ZCPs represent the quantity of supply above the applicable minimum requirement at which the value of additional surplus declines to $0

ICAP Demand Curve	Current ZCP
NYCA	112%
G-J Locality	115%
NYC	118%
Long Island	118%

- AG does not recommend changing the current ZCPs as part of this reset
- A detailed review of the demand curve shape and ZCPs is best addressed as a separate initiative outside the context of the reset process
  - In the *Reliability and Market Considerations for a Grid in Transition* report, the NYISO recommended consideration of a separate initiative to assess the demand curve shape and slope

Financial Parameters

Conceptual Framework

Relevant Issues

- Financial parameters used to calculate the levelized gross CONE values should reflect project specific risk to future cash flows for a merchant developer based on investor expectations over the life of the project
- Financial parameters used to calculate the levelized gross CONE values include:
  - Weighted Average Cost of Capital (WACC), comprised of:
    - Cost of debt
    - Target return on equity
    - Debt-equity ratio
  - Tax rates/PILOT rates (vary by location)
  - Amortization period
- Financial parameters are inter-related, require internal consistency, and should be evaluated holistically. Parameters could differ by unit type

Conceptual Framework

Potential Risk Factors

- Developer must assess potential to earn expected net EAS revenues over the physical life of the plant given a host of possible market changes:
  - Changes in state or national energy and environmental policy, which can work in opposite directions
    - New procurement requirements (wind, solar, storage, hydro)
    - Electrification (growth in transportation, building sector electrification)
  - Prices (input and output) and load growth uncertainty
  - Technological change (e.g., DERs, storage, renewable natural gas, biodiesel, hydrogen)
  - Transmission development
- Parameters could differ by unit type
- Other risks manifested in financial parameters are inherent to the development of new resources (e.g., development and siting risks)

Financial Parameter Development

WACC Components

- WACC will be developed considering available relevant market data and information:
  - Market data on the cost of debt and equity
    - Cost of debt (e.g., from recent debt issuances)
    - Return on equity
  - Information on cost of debt and equity from other sources (e.g., literature and equity analyst opinions) and for various financing approaches (e.g., project finance)
- Appropriate WACC for a new merchant project in New York is informed by the range of WACCs for publicly traded independent power producers (IPPs) and "project finance" developments

Financial Parameter Development

Property Taxes, Insurance, and Depreciation

- Property Tax/PILOT Payments
  - Generators are sometimes able to negotiate site specific, individual Payment in Lieu of Tax (PILOT) agreements with local authorities
  - Industrial development authority data is under review
  - New York City property tax includes 15-year tax abatement for the peaking unit technology underlying the NYC ICAP Demand Curve
- Insurance
  - Yearly cost will be calculated as a percentage of project capital costs, based on input from Burns & McDonnell
- Depreciation
  - Peaking units will be depreciated using the 15 year Modified Accelerated Cost Recovery (MACR) schedule, consistent with IRS Publication 946

Additional Discussion of Energy Storage Modeling

Energy Storage Net EAS Revenues

Refinement of potential approach

- Net EAS revenue model analysis refined to better facilitate arbitrage opportunities in real-time
  - Potential for multiple cycles per day given favorable prices
  - Optimal charge and discharge hours determined daily by unit/zone
  - Unit receives a day-ahead (DA) energy position if offers are below DA LBMPs, where offers reflect charging costs plus other relevant costs (e.g., losses)
  - Allows for unit to earn real-time revenues if real-time prices are higher than day-ahead prices
    - Limitations would be applied for hours during the applicable "must-offer" period during which the unit is committed day-ahead
  - Assumes perfect foresight of high real-time prices
  - Unit assumed to be capable of providing 10-minute reserves if not dispatched to produce energy
- Based on initial estimates developed by Burns & McDonnell, variable O&M costs assumed at $14.50/MWh to account for "cycle degradation," wear and tear on battery due to usage
- Round-trip storage efficiency assumed at 85%

Next Steps

Key issues for discussion in the coming months

- Analysis Group
  - Continued discussion of financial parameters
  - Continued discussion of fuel hubs
  - Discussion of net EAS model assumptions
  - Development and discussion of preliminary modeling results
- Burns & McDonnell
  - Continued development of cost estimates for peaking plant technologies

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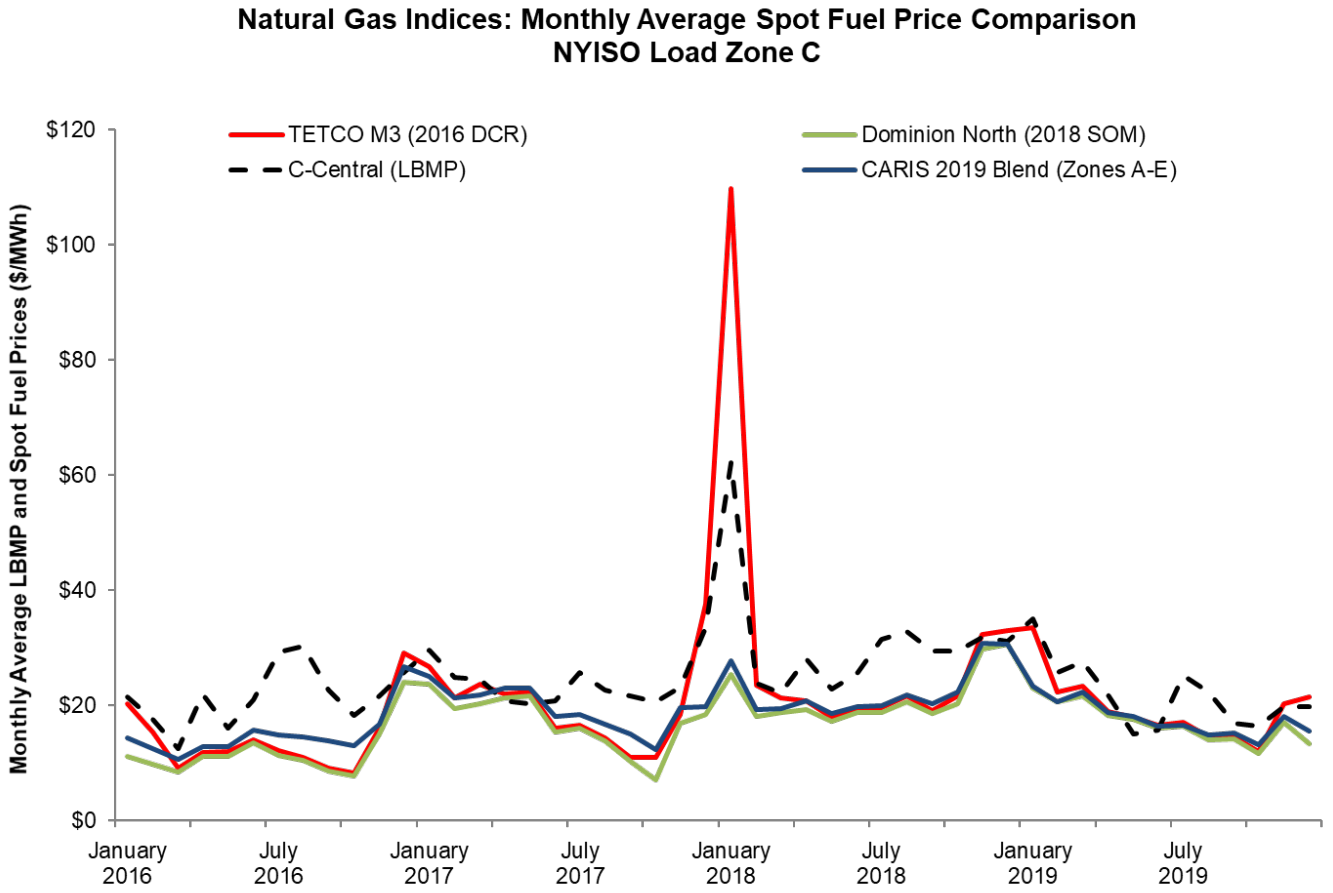
Appendix: Fuel Hub Prices

Natural Gas Hub Market Dynamics

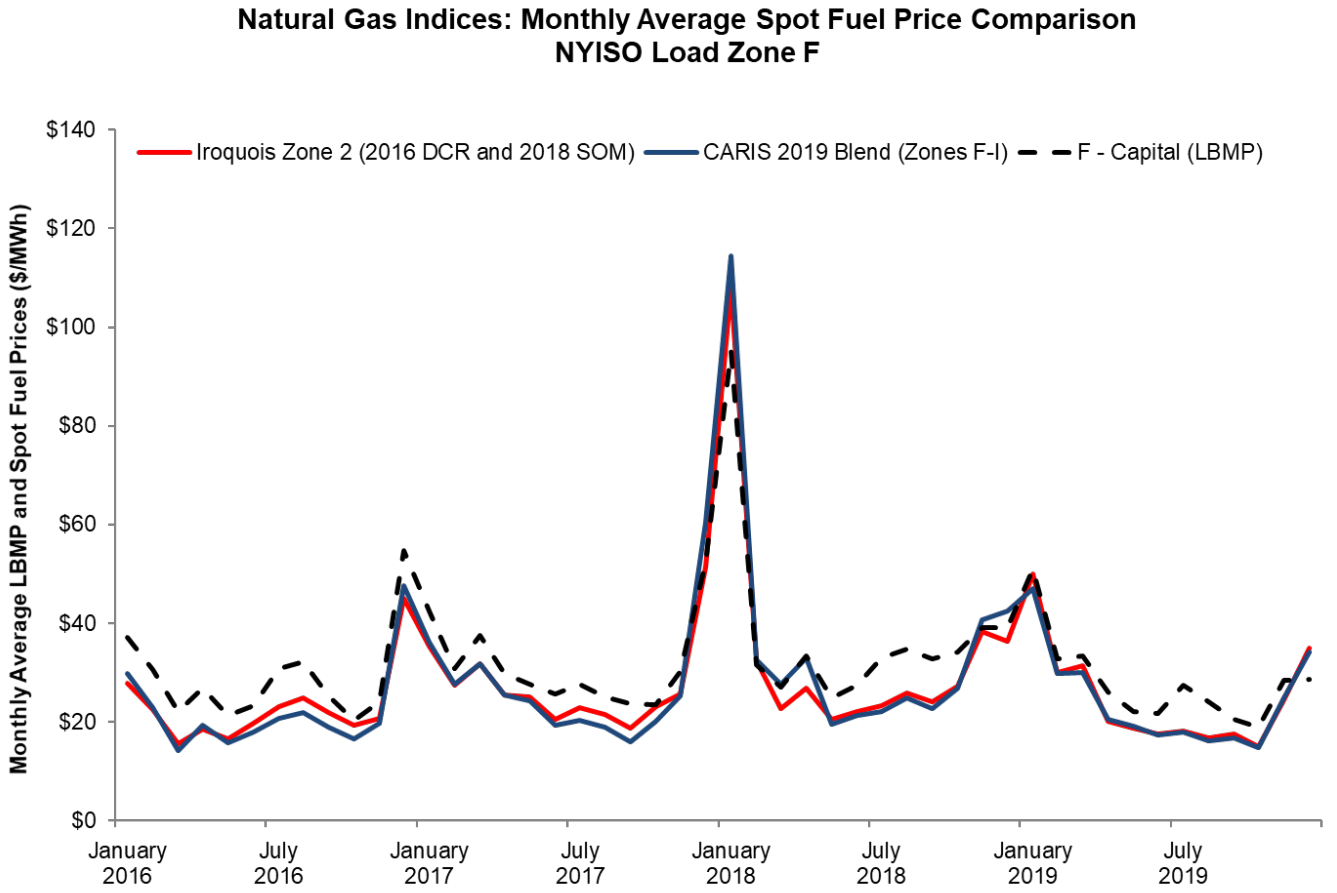
Gas prices converted to $/MWh



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%). Fuel prices are converted using a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Natural Gas Hub Market Dynamics

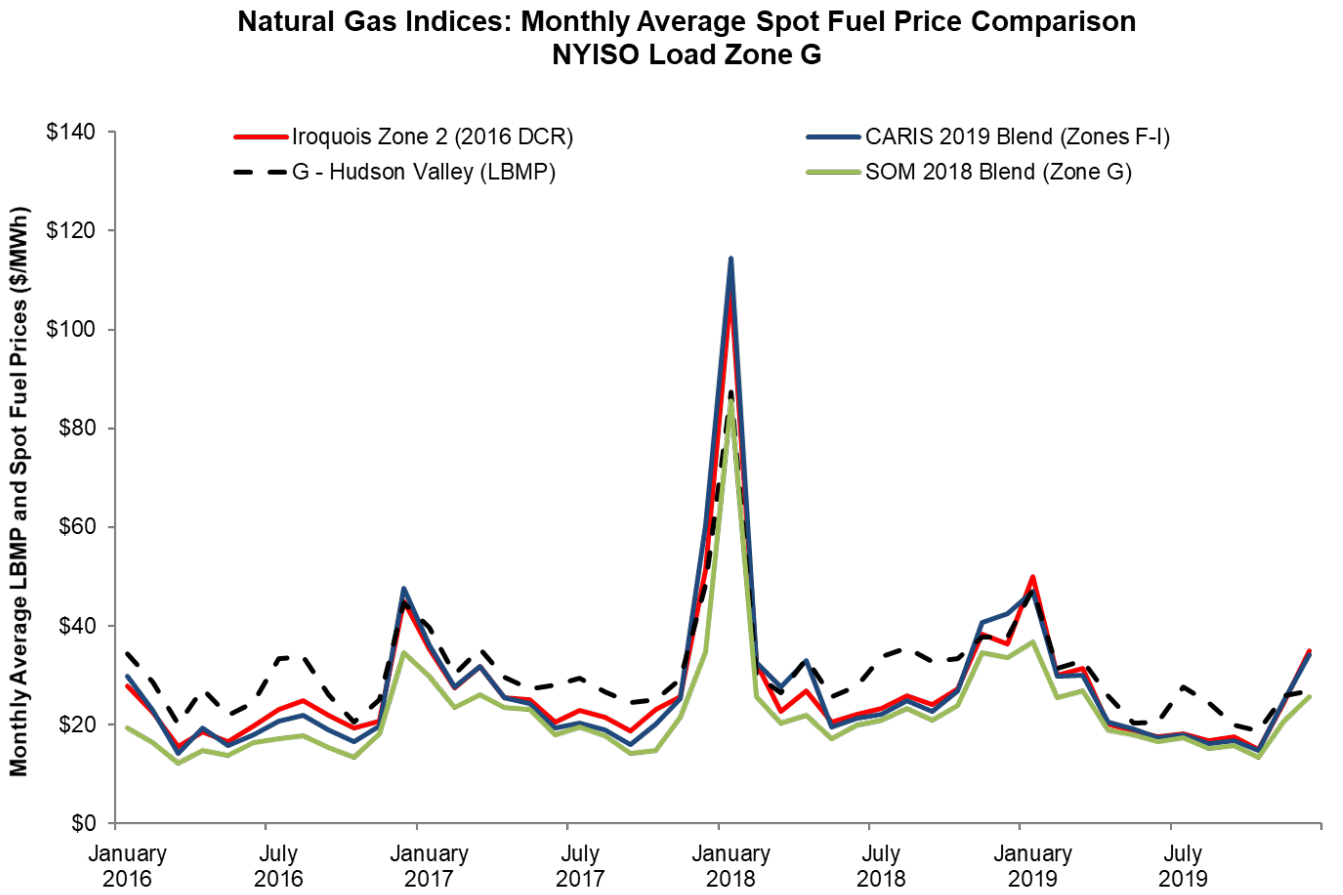
Gas prices converted to $/MWh



Note: CARIS 2019 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%). Fuel prices are converted using a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Natural Gas Hub Market Dynamics

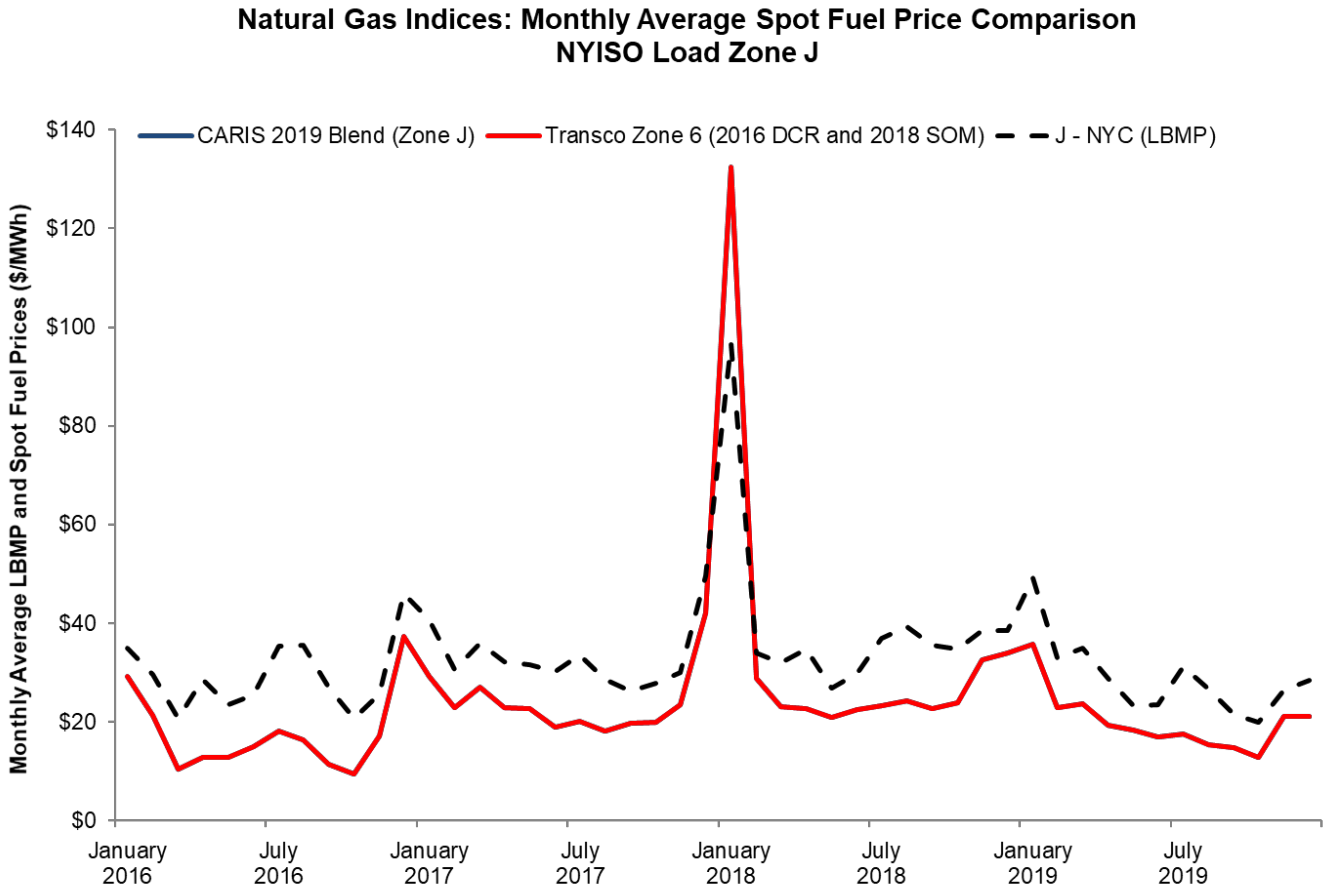
Gas prices converted to $/MWh



Notes: CARIS 2019 Blend (Zones F-I) is comprised of a weighted average of spot prices at Iroquois Zone 2 (30%), Tennesee Zone 6 (45%), TETCO M3 (20%), and Iroquois Waddington (5%). SOM Blend (Zone G) is comprised of a weighted average of spot prices at Iroquois Zone 2 (50%) and Millennium Pipeline (50%). Fuel prices are converted using a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Natural Gas Hub Market Dynamics

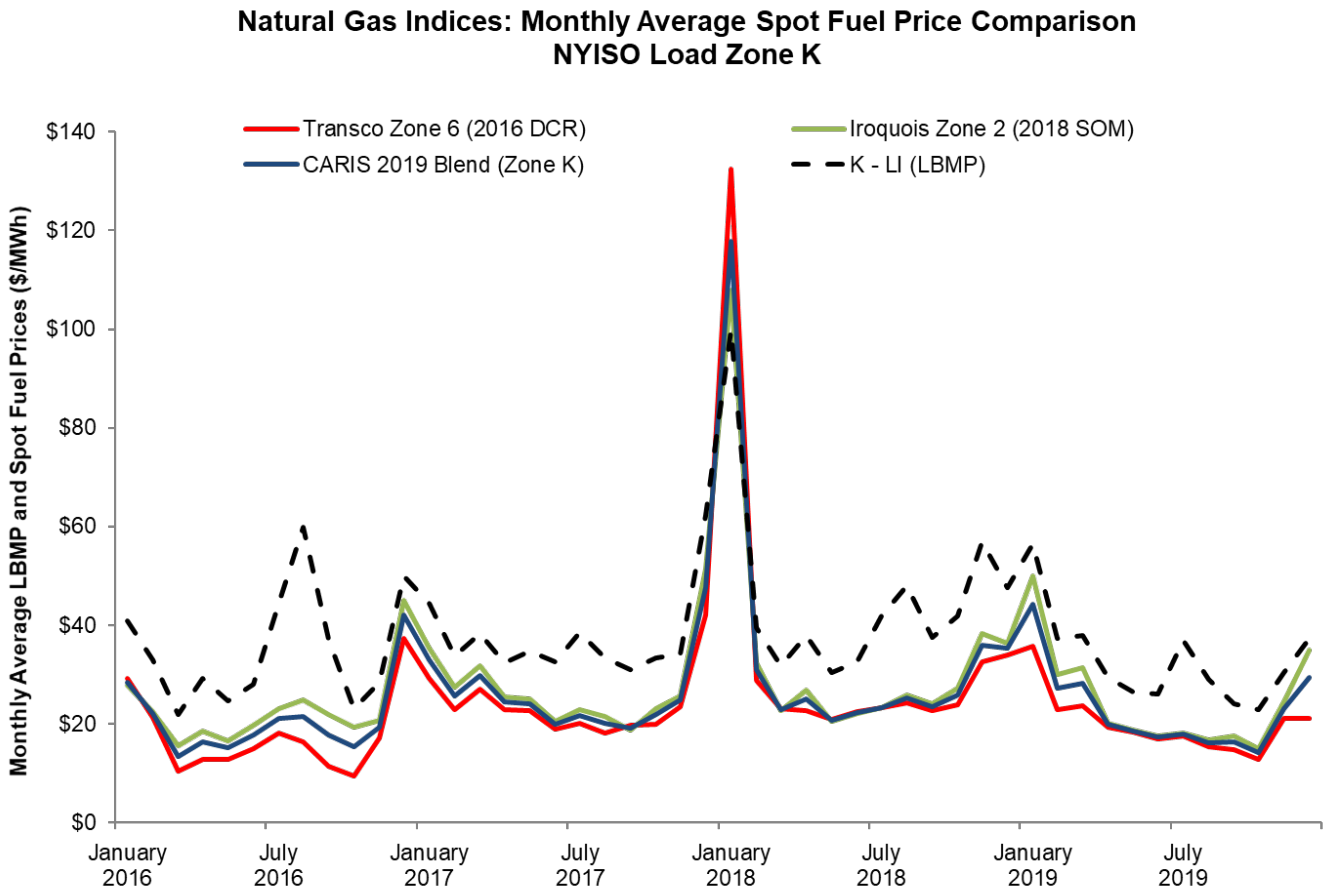
Gas prices converted to $/MWh



Note: All three alternatives (2019 CARIS Blend, 2016 DCR, and 2018 SOM) are comprised only of spot prices at Transco Zone 6 NY (100%). Fuel prices are converted using a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Natural Gas Hub Market Dynamics

Gas prices converted to $/MWh



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%). Fuel prices are converted using a heat rate of 8 MMBtu/MWh.
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).