ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

NYISO 2019/2020 ICAP Demand Curve Reset

Initial Modeling Discussions

ICAP Working Group

January 30, 2020

Today:

- Level of Excess Adjustment Factors
- Choice of Peaking Plant Amortization Period
- Selection of Natural Gas Hubs for Pricing
- Additional Discussion of Energy Storage Modeling

Level of Excess Adjustment Factors

Level of Excess Adjustment Factors

Background and Proposed Approach

- Level of Excess Adjustment Factors (LOE-AFs) are intended to adjust historical LBMPs and reserve prices to account for the tariff-prescribed level of excess (LOE) supply conditions assumed for purposes of the reset process (i.e., applicable minimum requirement, plus the MW value of the applicable peaking plant).
- AG currently proposes to use the same analysis methodology from 2016 DCR to determine the LOE-AF values
  - Run GE-MAPS under representation of "as found" conditions and conditions consistent with LOE
  - LOE-AFs are calculated as the ratio of average LBMPs under "as found" conditions to "LOE" conditions
  - Allows for different LOE-AFs to be applied to LBMPs by time period and zone
  - Uses GE-MAPS data consistent with that used in other NYISO studies and previously reviewed by stakeholders (the 2016 DCR relied on CARIS modeling data)

Choice of Peaking Plant Amortization Period

Amortization Period

Relevant Issues

- The CLCPA includes a provision for zero emissions from the electricity sector by 2040, which may affect the period of commercial operation for new fossil fuel units
- Fossil fuel units constructed during this DCR period may be unable to operate past 2040, and thus may warrant amortization periods that reflect this constraint
  - Units constructed at the end of the reset period could have shorter operational lives than units constructed earlier
  - The following slides provides an illustrative example of how the CLCPA requirements could potentially impact the assumed amortization period for a new fossil fuel unit
    - AG is continuing to consider how best to account for the potential impacts of the CLCPA for fossil fuel units
- In addition, amortization period may differ by technology
  - Energy storage amortization period may reflect technology characteristics and operating assumptions

Potential Considerations for Fossil Fuel Peaking Plant Amortization Period

NYISO 2020 Demand Curve Reset Timeline

Capability Year	Potential Operating Life of Fossil Unit
2021-2022	18.7 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.

Selection of Natural Gas Hubs for Pricing

Natural Gas Hub Selections for Pricing

Initial Considerations

- Based on updated analyses of market dynamics, the previously determined natural gas hubs used in the 2016 DCR may still be appropriate for this DCR
- The table on the next slide provides an overview of the various alternatives that AG has assessed to date

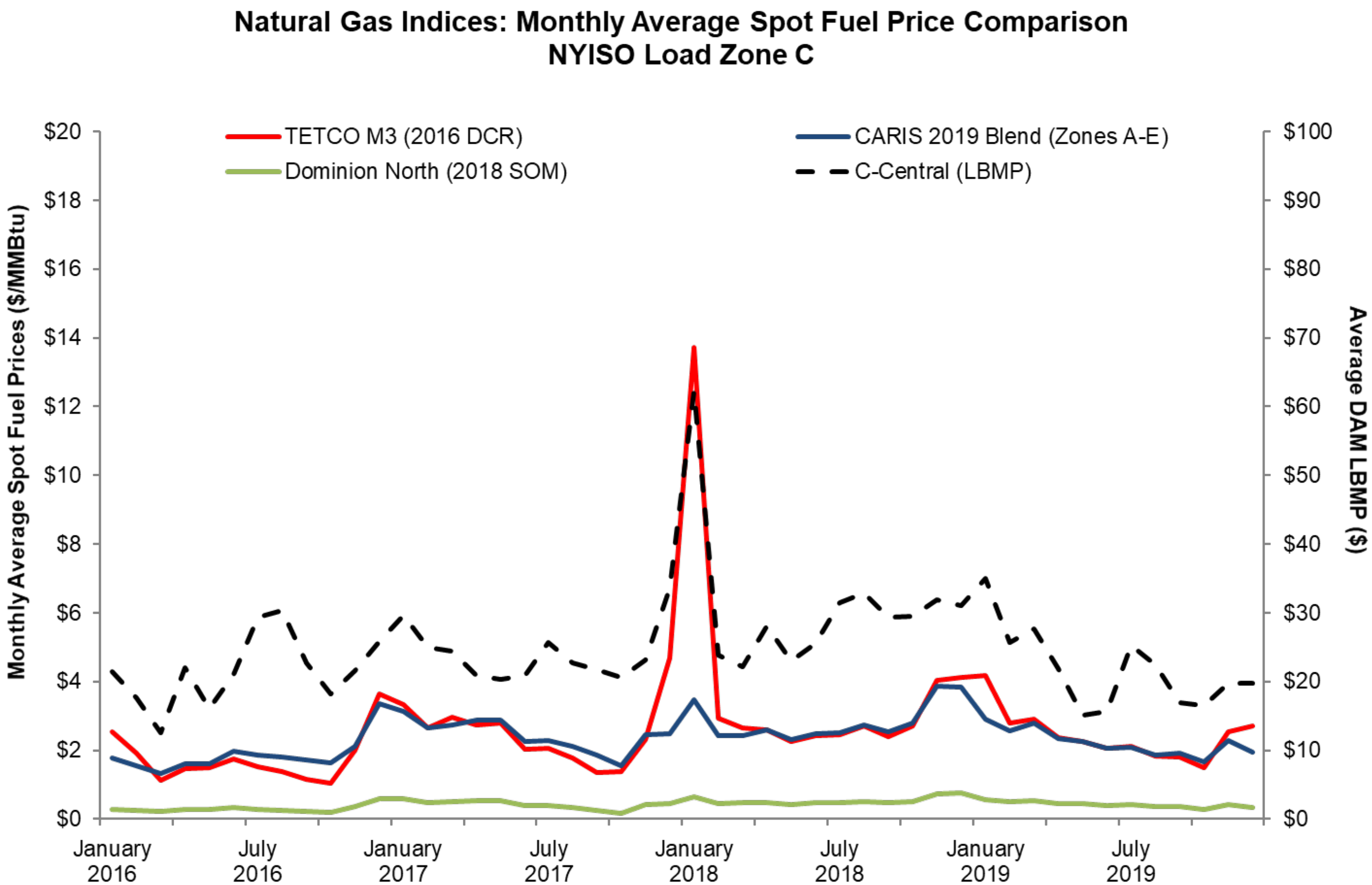
Alternative Gas Hub Choices from Various Studies

Gas hubs used for pricing in previous studies

Zone	2016 DCR	2018 State of the Market Report (Market Monitoring Unit)	CARIS Phase I (2019)
NYCA - C	TETCO M3	Dominion North	Zones A-E: Dominion South (65%) TCO - Columbia (5%) Dawn (30%)
NYCA - F	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	Iroquois Zone 2	Iroquois Zone 2 (50%) Millennium East (50%)	
NYC - J	Transco Zn 6 NY	Transco Zn 6 NY	Transco Zn 6 NY
LI - K	Transco Zn 6 NY	Iroquois Zone 2	Iroquois Zone 2 (60%) Transco Zone 6 (40%)

Natural Gas Hub Market Dynamics

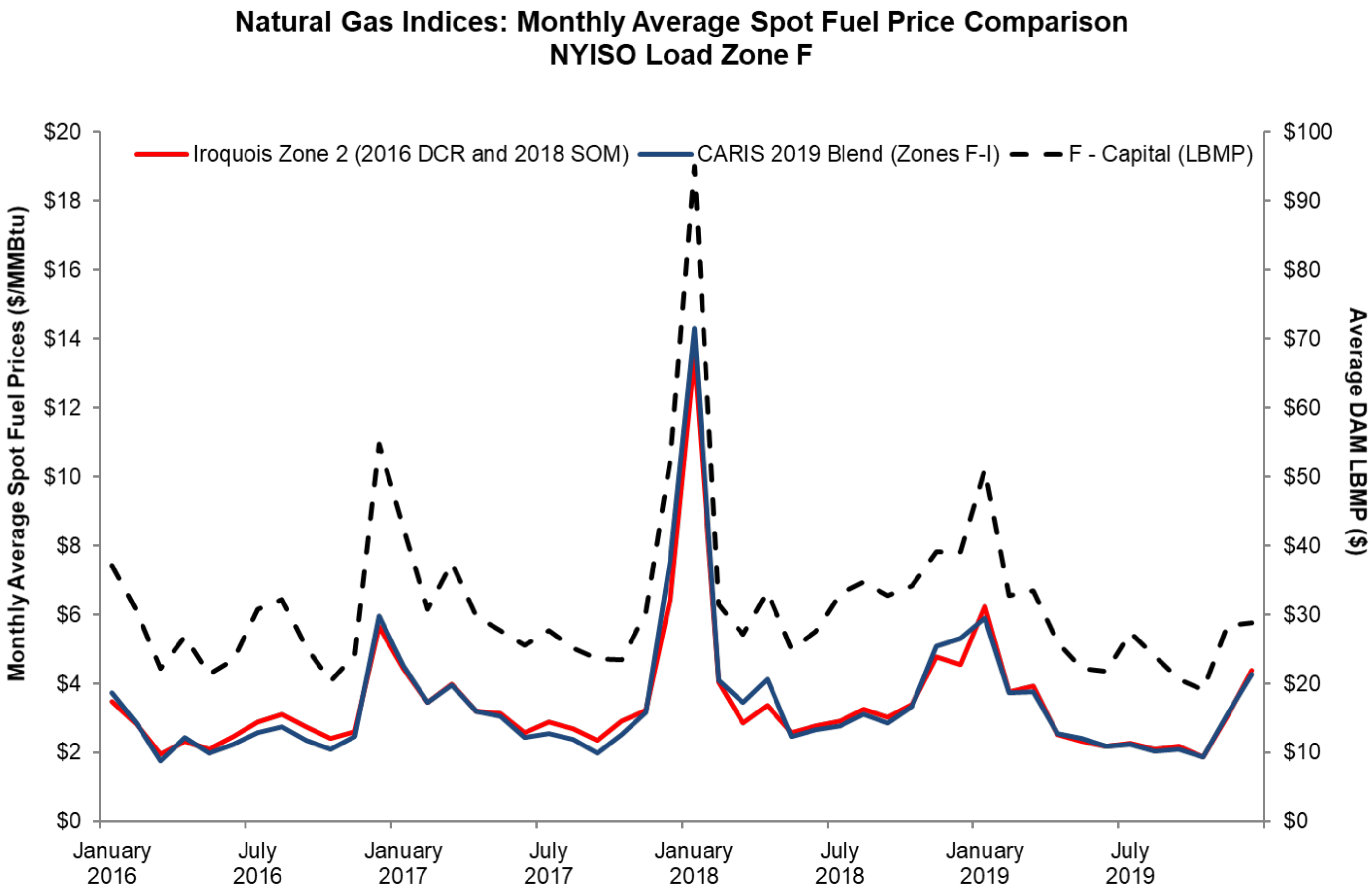
Review of natural gas pricing trends since 2016



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%).
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Natural Gas Hub Market Dynamics

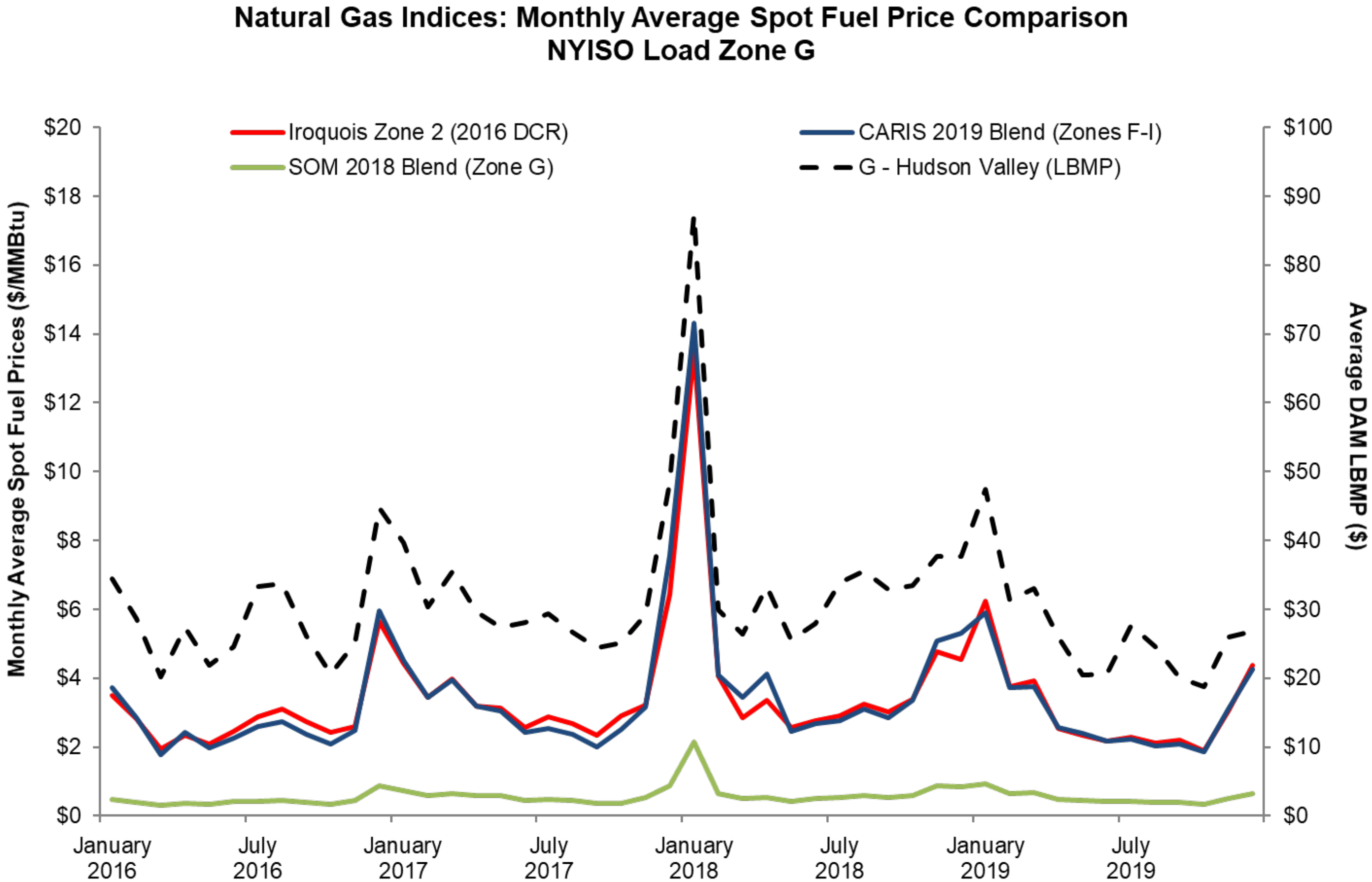
Review of natural gas pricing trends since 2016



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%).
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Natural Gas Hub Market Dynamics

Review of natural gas pricing trends since 2016

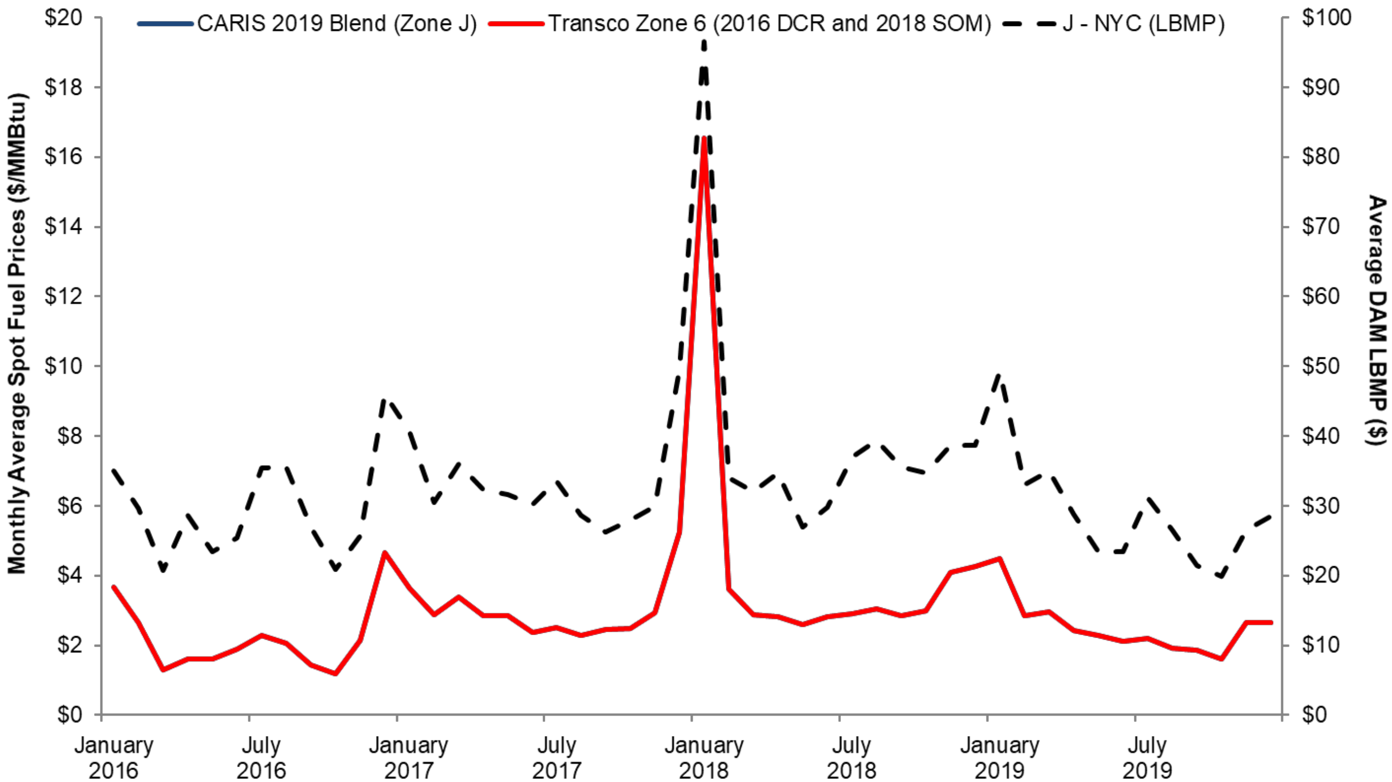


Notes: CARIS 2019 Blend (Zones F-I) is comprised of a weighted average of spot prices at Iroquois Zone 2 (30%), Tennesee Zone 6 (45%), TETCO M3 (20%), and Iroquois Waddington (5%). SOM Blend (Zone G) is comprised of a weighted average of spot prices at Iroquois Zone 2 (50%) and Millennium Pipeline (50%).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

Natural Gas Hub Market Dynamics

Review of natural gas pricing trends since 2016

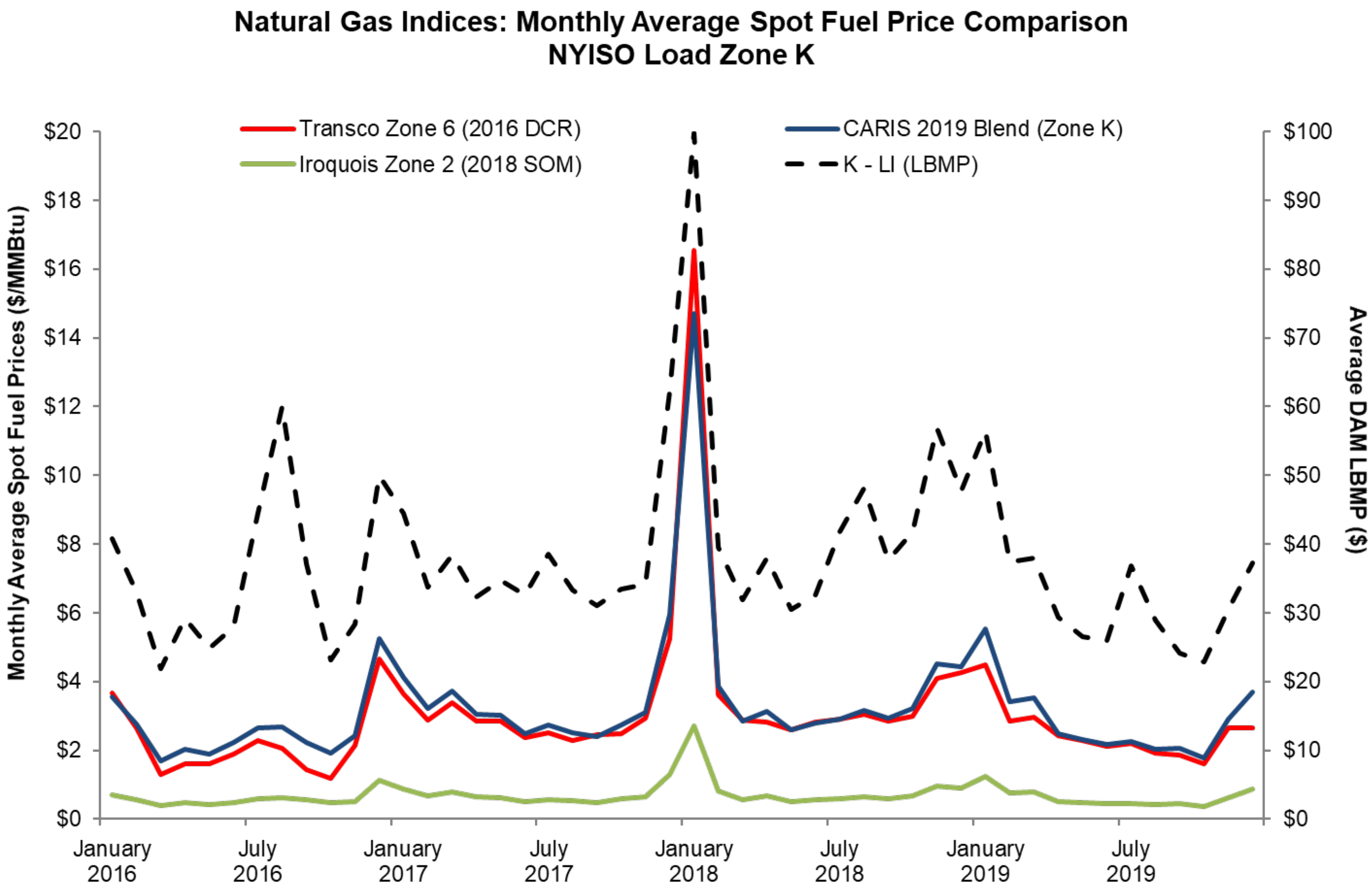
Natural Gas Indices: Monthly Average Spot Fuel Price Comparison
NYISO Load Zone J



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

Natural Gas Hub Market Dynamics

Review of natural gas pricing trends since 2016



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%).
Sources: SNL (Fuel Prices); NYISO (DAM LBMPs).

Additional Discussion of Energy Storage Modeling

Energy Storage Net EAS Revenues

Additional details of potential approach

- Proposing to assess 4, 6, and 8 hour duration storage units
- AG is considering use of a net EAS revenue model analysis that evaluates a single charge/discharge cycle on each operating day
  - Fixed charge and discharge hours will be modeled for each day; assumed charge/discharge periods can be determined on seasonal or other basis (e.g., monthly)
  - Charge period determined by historical analysis of hours with lowest energy prices
  - Potential discharge period determined by seasonal must-offer hours: hours 13-18 in summer and 16-21 in winter
  - 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)
  - Model dispatches storage if total cost to charge is less than total revenue from discharge
  - Unit assumed to be capable of providing 10-minute reserves if not dispatched to produce energy
- Round-trip efficiency will be based on analysis by Burns & McDonnell

Next Steps

Key issues for discussion in the coming months

- Analysis Group
  - Discussion of financial parameters
  - Discussion of LOE-AF values
  - Discussion of net EAS model assumptions
  - Discussion of initial net EAS modeling results
- Burns & McDonnell
  - Finalize technology choice options
  - Development of cost estimates for peaking plant technologies
  - Discussion of additional technology features (e.g., dual fuel and emissions control)

Contact

Paul Hibbard, Principal
617 425 8171
Paul.Hibbard@analyisgroup.com

Todd Schatzki, PhD, Principal
617 425 8250
Todd.Schatzki@analyisgroup.com