ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

NYISO 2019/2020 ICAP Demand Curve Reset

Initial Modeling Discussions

ICAP Working Group

December 11, 2019

Today:

- Net Energy and Ancillary Services (EAS) Revenue Estimates Methodology
- Preliminary Discussion of Modeling Energy Storage

Net EAS Revenue Model Methodology

Net EAS Revenues Approach

Overview of approach

- The 2016 ICAP Demand Curve reset (DCR) introduced a historical forecast approach that estimates net EAS revenues based on three years of historical price data.
- The approach was selected over alternatives given multiple considerations:
  - Provides an accurate, simple and transparent approach to estimating expected net EAS revenues
  - Allows the estimate of net EAS revenues to be readily and transparently updated each year between resets (facilitated extending the period between resets from 3 to 4 years)
  - Based on stakeholder feedback and review of model outcomes, we intend to retain the current approach
- In today's presentation:
  - We provide preliminary recommendations on the approach we will take to estimating net EAS revenues for fossil peaking resources
  - We provide a preliminary discussion of approaches and considerations to estimating net EAS revenues for storage resources

Net EAS Revenues Approach

Potential evaluation of current net EAS revenue approach

- We considered the possibility of undertaking analysis to assess the performance of the net EAS approach (e.g., a "backcasting" analysis)
- We do not consider this a useful analysis to undertake in the current context
  - The findings of our backcasting analysis performed in the 2016 DCR that compared different net EAS approaches remain valid with respect to the alternatives considered in that comparison
  - Alternative net EAS revenue approaches have not been proposed, and it would be costly and time consuming to develop for the purposes of comparison with hypothetical alternative approaches, given our review last time around
  - Comparison of estimated expected net EAS revenues to actual net EAS revenues does not *per se* provide useful information about the approach's performance

Net EAS Revenues Approach

- The current approach estimates expected net EAS revenues as the net revenues earned over a three-year historic period from actual market outcomes (as adjusted for the DCR required level of excess conditions)
  - Market prices represent actual historical prices with adjustments for the level of excess
- In principle, if all impacts were known and measurable, a one-time change to the net EAS approach could be made to account for the impact on price of future, anticipated changes in market rules and/or market conditions
  - Stakeholders have identified several potential market rule or policy changes that may affect future market prices over the next DCR period
    - Ongoing discussions regarding potential changes to reserve requirements and reserve pricing
    - Impacts of the changes resulting from implementation of the Climate Leadership and Community Protection Act (CLCPA)
- These factors were evaluated to determine whether one-time adjustments to net EAS revenues may be appropriate

Net EAS Revenues Approach

- In the context of the DCR, several considerations affect whether one-time adjustments to account for the potential impacts of these considerations are appropriate
  - Accounting for a known and measurable future change in market rules or policies could lead to a more accurate estimate of net EAS revenues
  - The increased accuracy gained from a one-time adjustment would depend on many factors, including whether adoption of the market rule/policy is certain, whether its details are known, and whether the actual market impact can be easily and accurately estimated
  - Absent a one-time adjustment, annual updates using historical data allow the impacts of new market rules and policies to be gradually phased into net EAS revenues estimates over time based on the actual impacts of market rule or policy changes
  - Any one-time adjustment would need to be phased out as the market rule/policy began to actually affect market outcomes to prevent double-counting

Issues Potentially Meriting One-Time Net EAS Adjustment

- 2019 Master Plan initiatives that could affect peaking plant net EAS revenues
  - Ancillary Service Shortage Pricing
    - The purpose of this project is to evaluate the NYISO's Ancillary Services shortage pricing values, considering the implications of the grid of the future and the payment incentives in neighboring markets, including pay-for-performance capacity market designs
    - Current plan calls for study to be completed in 2019, with further market rule development in 2020 based on the study results; market rules changes to be proposed (if any) have not yet been identified and deployment is currently not anticipated until 2022
  - Reserves for Resource Flexibility
    - This project seeks to encourage resources to provide additional upward ramping capability, which will improve grid reliability and flexibility
    - Current plan calls for a market design concept in 2019, completing the market design in 2020 with deployment currently not anticipated until 2021; final market rule changes have not yet been completed

Issues Potentially Meriting One-Time Net EAS Adjustment

- 2019 Master Plan initiatives that could affect peaking plant net EAS revenues (cont'd)
  - More Granular Operating Reserves
    - This project seeks to develop reserve requirements for certain load pockets within New York City
    - Certain load pocket reserve requirements were proposed in 2019, but the implementation plan for this initiative remains undetermined; it is currently anticipated that the proposed load pocket reserve requirement could not be implemented prior to 2021
  - All else, equal, these changes would likely increase expected net EAS revenues by placing upward pressure on future reserve prices

Issues Potentially Meriting One-Time Net EAS Adjustment

- Impact of CLCPA
  - CLCPA GHG reduction and technology-specific requirements would be expected to change the mix of resources participating in New York electricity markets
    - For example, 6,000 MW of solar by 2025; 3,000 MW of storage by 2030; 9,000 MW of offshore wind by 2035; 70% renewable energy by 2030; and 100% emissions free energy by 2040
  - Policies to achieve these requirements (the "Scoping Plan") have not been identified or approved
  - Introduction of new renewables (in- and out-of-state) and storage resources through CLCPA policies could have many market consequences
    - Introduction of large quantity of resources with low variable costs could affect peaking plant economics, including impacts on market prices

Recommendation Regarding One-Time Net EAS Adjustments

- We do not propose to make any one-time adjustments for potential future changes to market rules and policies
  - There is substantial uncertainty about market rule changes and policies and their potential impacts on future pricing outcomes
    - Market rule changes that may result in increased ancillary services revenues have not been finalized and are currently not anticipated to be implemented prior to 2021
    - The policies that will be used to achieve the objectives of the CLCPA (and the market impacts thereof) remain uncertain at this time
      - The initial draft "Scoping Plan" is not required to be published until 2022
  - Net impacts of potential future market rules changes and CLCPA are uncertain, with a mix of items potentially increasing and decreasing prices
    - The ability to accurately forecast the potential market price impacts is highly uncertain

Recommendation Regarding One-Time Net EAS Adjustments

- With annual updates, actual impacts of market rule and policy changes are incorporated into net EAS revenue estimates over time
  - Avoids the integration of an inaccurate adjustment over the multi-year DCR period
    - If adjustment is "too large," net EAS revenues would be over-estimated, leading to reference prices that are too low; if "too small," reference prices would be too high
  - Avoids the complications of an approach that would need to attempt to correct for double-counting of impacts once market prices reflect policy/market rule effects
- Avoiding uncertain and potentially inaccurate ad hoc adjustments aligns with the DCR guiding principles of following economic principles, accuracy, transparency, feasibility, and historical precedent

Updates to CT/CC Net EAS Revenues Model

Progress and Next Steps

- Analysis Group has been migrating the Net EAS model into "R," an open source language available to all stakeholders
- Next steps include:
  - Thorough review of data inputs and their use going forward
  - Presenting updated preliminary net EAS revenue estimates

Preliminary Discussion of Modeling Energy Storage

Assessment of Energy Storage

Overview of approach

- The DCR will include an assessment of energy storage
- Analysis Group is currently evaluating the appropriate methodology to model net EAS revenues for energy storage
- Considerations:
  - Use existing net EAS revenue model, with three years of historic data
  - Develop alternative operating logic that would assume that storage participates in market through (intraday) energy arbitrage and operating reserves (the "use case")
  - Accounting for battery storage subsidies (if any)
    - Currently, Analysis Group does not believe that out-of-market subsidies should be considered in determining net cost of new entry (CONE) for storage
- Currently anticipate reviewing additional details regarding the proposed approach in January 2020

Capacity Market Participation by Energy Storage

Capacity credit depends on resource characteristics

- Capacity credit earned must account for the proposed duration based capacity payment structure
  - For the 2021-22 Capability year:

Battery Duration	Less than 1000 MW of Limited Duration Resources	At or Above 1000 MW of Limited Duration Resources
2 hours	45%	37.5%
4 hours	90%	75%
6 hours	100%	90%
8 hours	100%	100%

Energy Storage Net EAS Revenues

Resource characteristics will determine how resource can participate

- Currently proposing to consider the following storage technology options
  - 4-hour Lithium-Ion (Li-Ion)
  - 6-hour Lithium-Ion (Li-Ion)
- Battery will be designed to participate in energy and ancillary service markets
  - Longer duration battery (e.g., 4- and 6-hours) technically consistent with energy market arbitrage (including operating reserves)
- Resource-specific parameters to consider:
  - Battery charge/discharge rates
  - Loss of energy from charged batteries, change in capacity/production capability over time
  - Operational costs of cycling
  - Limitations associated with warranties (may limit some batteries to one cycle per day and yearly limits on cycling)

Energy Storage Net EAS Revenues

Overview of potential approach

- Currently considering an analysis that evaluates each operating day individually (evening/off-peak, daytime/on-peak cycle)
- Identify relevant charge and discharge periods
  - Identify charge and discharge period given daily maximum and minimum hourly prices, prices across sustained blocks of high/low prices in DA and RT markets, etc.
  - Assume market participation consistent with battery design (e.g., duration) and offer requirements for capacity resources with duration limitations
  - Determine feasible charge/discharge cycle, taking into account energy levels, technical or market requirements, and other operational factors (e.g., "wear and tear" costs)
- Assess relevant costs and revenues
  - Compare potential revenues from dispatch with necessary charging and operational costs
- Day-ahead commitment and dispatch
  - Algorithm will allow for differences in day-ahead and real-time positions, taking into consideration energy storage levels

Energy Storage Net CONE Estimation

Treatment of out-of-market subsidies in calculating net CONE

- Within NYS, multiple programs support the development of battery storage technology:
  - NYSERDA Bulk Energy Storage Incentive Program
  - Utility implemented bulk storage procurement programs
  - Potential investments or incentives offered by NYPA/LIPA in grid flexibility via energy storage
- Subsidies provided through these programs are aimed at, among other things, achieving storage resource targets in both regulatory orders and law (e.g., NYPSC Storage Order, CLCPA)
  - Subsidies are intended, in part, to allow energy storage to realize sufficient revenue to operate in the marketplace until a time when storage is able to operate without such incentives
- Analysis Group is continuing to review potentially available subsidies and other program supporting deployment of storage
  - Our current thinking is to exclude such subsidy payments when calculating net CONE to ensure that market facing price signal is designed to support new entry absent out-of-market payments

Next Steps

Key issues for discussion in the coming months

- Analysis Group
  - Complete review of net EAS revenue model assumptions (non-storage)
  - Discussion of methods of modeling Net EAS for battery storage
  - Continued analysis of data sources and fuel hubs
- Burns & McDonnell
  - Preliminary recommendations of peaking plant technologies to assess
  - Development of cost estimates for peaking plant technologies

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