Session 1 (Morning)

A. Topic 1 Identify Challenges/System Needs

We tried to understand the system challenges and needs of the ISO-NE grid.

- System needs that were identified by the stakeholder group included:
  - Natural Gas deliverability and access
  - Plant retirements
  - Renewable integration
  - Meeting peak demand
  - Managing cost
  - Congestion
  - Uplift- Net Commitment Period Compensation (NCPC)
  - Environment
  - Reliability
  - Resiliency
  - Transmission + Distribution upgrade/deferral
  - Flicker
  - Voltage
  - Future Needs: Flexibility/Ramping
  - Need for optionality

Note: Prior to listing system needs, a stakeholder commented on the importance of focusing on the relevance of MA to ISO-NE. Discussion focused on how other states that are part of RTOs have state-specific programs and that ultimately they will integrate into the wholesale market design. ex. NJ program in PJM, ISO DER working group, etc)

B. Market Opportunities Through Energy Storage Deployment

We discussed possible ways for storage to participate in ISO-NE. We aimed to answer the following questions:

- In what ISO-NE markets can energy storage participate currently? Next five years?
- How do the interconnection rules incorporate energy storage?
- Can energy storage from behind the meter participate?
- How is energy storage incorporated into transmission planning?

During the discussion, we covered the following topics:

- Capacity Market
- Concept of Flexible Capacity
- Transmission Planning
o Transmission alternatives are integrated into planning process
  - Implementation of FERC Order 1000 changing planning process
  - Storage cannot currently be considered a transmission asset in ISO-NE to receive a regulated rate of return (There was discussion of how this is done in other RTOs/ISOs)
  - Discussion of how storage is included in TOAs and TO use of storage
o Storage in ISO-NE would be considered generation, or a settlement-only generator (SOG)
o Storage could be considered ARD, DARD
o Frequency Regulation

o We also discussed the importance of the following:
  - The need to value stacked services
  - Lack of availability of Grid Data
  - Use Cases to explain the revenue streams and requirements
  - Potential impact of moving to five minute pricing
  - Multi-State requirements / implications for renewable integration
  - Utility-owned storage
  - Duration requirements
  - Aggregations
  - Operating Procedure (OP) 14

Note: ISO-NE said that storage developers have come to them to find out where/how to build; ISO-NE would need to know more about a storage project to better advise the developer.

C. Use Case Discussion

As more questions were asked about how storage can participate in ISO-NE, the group began to consider an example of how a storage project in front of the meter can participate. We initially considered a storage/solar combined resource, and then clarified that it would just be a storage resource participating in the wholesale markets.

o Energy – Day Ahead
  - 1 hour minimum run time, and there is a 1 MW minimum size
  - Settlement only (settlement only generator) can be 100 kW through 5 MW
  - Clarifications were made about ARD and DARD
  - Changes for Pumped Storage design being implemented. Treated as both a generator and an Dispatchable (or not Dispatchable) Asset Related Demand
  - Aggregations are allowed
o Operating Reserves – NERC duration requirement is 1 hour
o Frequency Regulation:
  - (Comment that pricing can be speculative (not guaranteed), and suggestion to have a counterparty)

o Forward Capacity Market (FCM)
  - Duration requirement associated with auditing of resource capability...1 to 2 hrs (ISO was uncertain)
  - Discussion of de-rating capacity value for intermittents
  - Aggregations are allowed
  - No deliverability requirement
- Pairing, in front of the meter, with an existing generator (solar for example) may require modification to interconnection agreement (go to the back of the queue) if results in capacity that is in excess of rated value. Suggests that there may be value in installing ES BTM in order to avoid interconnection issue. But doing so would prevent direct capacity market participation and additional revenue opportunities.

- FCA timeline is 3+ years prior to capacity revenues begin to flow...interconnection process can in almost all cases be navigated within above window.
  - Frequency response and Reactive Power –
  - ISO –NE staff said there were not separate market products for these services today

**Session 2 Afternoon**

**A. Continuation of Use Case Discussion**

*Considerable discussion focused on whether and how utilities could own/buy storage and participate in the wholesale market. Issues discussed included*

- Ownership issues
- Ability to earn a rate of return
- Is power purchase agreement (PPA) a solution for utility-owned storage?
- Is dual use allowed for distribution services and participation in the wholesale market?
- How do load reconstitution rules apply? What is applicability to transmission charge?
- MA specific rules

**B. Barriers and Challenges for Energy Storage Participation at Wholesale Level**

*We aimed to address state and federal jurisdictional issues, ISO market design issues, and highlight manual changes vs. tariff changes. The discussion about barriers focused on the following:*

- There were several issues related to utility ownership that were identified:
  - Distribution-connected storage can provide multiple uses – rules not clear
  - Lack of clarity over whether a utility resource can be a transmission asset vs. generating asset
  - Transmission/Distribution services vs. mandatory participation in ISO-NE (volt/var issue)
  - A resource being utilized for other purposes cannot “pull out” of certain ISO-NE Markets
  - Storage is not defined in the TOAs or public utility commissions or ISO-NE tariff
- Interconnection Rules
- Availability of Grid Data to understand locational needs
- Technology advances are ahead of the market rules and regulations
- Need a better understanding of the cost of energy storage, and the evaluation framework; reference to “levelized cost of storage”
- Inclusion of power to gas in energy storage discussion
- There is a need for better understanding of state/federal jurisdiction
- Duration and size
  - Minimum Resource Size I MW for frequency regulation
  - Clarification of duration requirements
- Lack of incentive for storage; There are not any renewable portfolio standard (RPS) type rules
C. Solutions / Mitigation Strategies

We were planning to identify potential solutions for how can the ISO integrate energy storage on a more holistic level. This could include pilot projects, more information for stakeholders and the ISO. For example: To better understand the technology and how it can provide services to the grid? What parameters are required for operation? What is already done in other regions?

We began to tackle this issue earlier in the session by going through a specific use case to understand where the lack of clarity in the rules and information may exist.