Panel Discussion: ISO/RTO Storage Policies and Market Status

Ron Coutu, Manager, Business and Technology Solutions
ISO New England

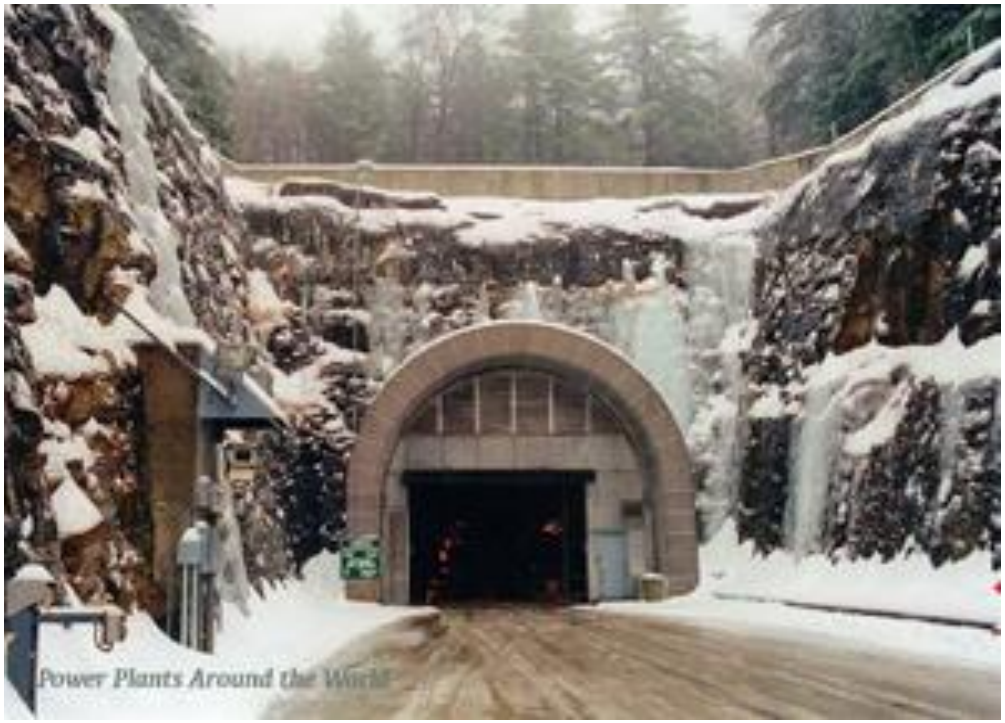
The views presented here are not necessarily attributable to the ISO New England, Inc., and any errors are solely the responsibility of the author

A little history about Storage in New England

- Early 1970's major storage was built in New England to deal with the excess overnight generation of Nuclear and Coal
- Two large Pumped Storage Hydro plants were completed in early 70's

History of Storage in New England

- Northfield Mountain over 1000 MW of generation with 10,000 Mwhs available from a full upper pond

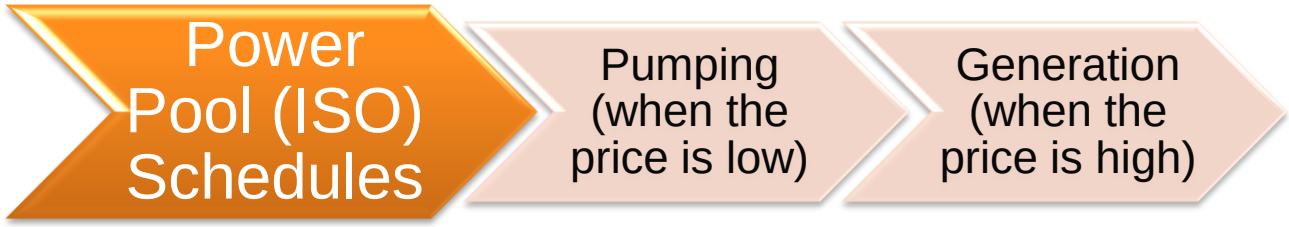


History of Storage in New England

- Bear Swamp with around 600 MW with around 2500 Mwhs available from a full upper pond

History of usage of Storage

- Pre-markets in New England (pre-1999) the ISO scheduled the Pumped Storage pumping and generation to minimize the cost of electricity production New England

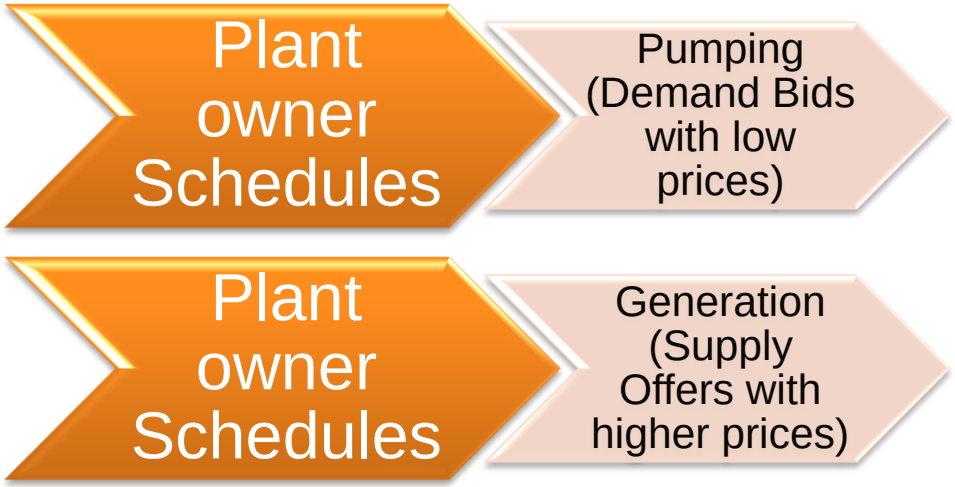


History of usage of Storage

- Also since these are fast-moving generators (both in ramping as well as time on from off-line) these generators provided the reserves of the system in a bulk of the hours.
- When in Generating mode these generators also tend to provide regulation since they are equipped to provide that service and their speed means they can provide a lot of regulation MW

Since Markets were introduced

- Currently it is the responsibility and risk of the plant owner to deal with the scheduling of the pumping and generation



- It is up to the Plant owner to ensure that a proper spread is achieved between cleared demand and cleared supply to cover the efficiency loss of the plant (let's say 75% for example).

Provisions for these resources

- One provision that was provided during market design for these resources was the fact that these resources have a limited amount of “fuel” for each scheduling day
- The Day-Ahead financial markets allows the pumped storage owner the ability to submit this daily limit for the generation such that the Day-Ahead market will not commit them to more Mwhs then they can provide
  - Issue with this is it is based on the pumping for which they are not completely sure how much will occur during the overnight hours until the market clears
- Other than that there is no other provisions for storage facilities in the overall design

Attributes of these Pumped Storage plants

- Time shifting within the day
- Can effectively move large quantities energy consumption from on-peak to off-peak by consuming the energy off-peak and converting it to water storage to create energy for on-peak use
- These are long-term storage devices

- Do the markets all efficient use of these devices?

New types of Resources

- Flywheels

- Batteries (including PHEV)

How are the new storage technologies different than the old?

- New Storage Devices may have moving locations (especially PHEV) with minutes (maybe up to a couple of hours) worth of storage. They can efficiently shift energy generated during one part of an hour to usage during another portion of the hour and to thus smooth deviations during the hour.

New England Pilot Program – Alternate Resources

- What is it?
  - In response to FERC Order 890 regarding the provision of Regulation and Frequency services by non-generating resources, ISO-New England is conducting an Alternative Technology Regulation (ATR) Pilot Program. The goal of the ATR Pilot Program is to allow ISO-NE to identify the impact on the New England system of alternative technologies with new and unique performance characteristics that might previously have been unable to participate in the Regulation market and to allow the owners of the ATR resources to evaluate the technical and economic suitability of their technologies as market sources of Regulation service.

New England Pilot Program – Alternate Resources

- What did all that mean?
  - Focus is on Regulation
    - Regulation is a Frequency following service
    - Well suited to devices that can move quickly for short periods of time
    - Typically movement is required in both directions (consume/produce) during each hour

- Alternative Technology Regulation Pilot Program (ATRPP)

- When did it begin as a Pilot?
  - November 2008

New England Pilot Program – Alternate Resources

- Types of Resources eligible for this Pilot?
  - Flywheel technology
  - Battery technology
  - Certain Demand Response resources
- EARRs - General Terminology for these Resources
  - Experimental Alternative Regulating Resource
- EARRs are used 24x7 and paid for Regulation provided at the price of the Regulation Market (Regulation Clearing Price or RCP)
- EARRs do not submit bids into the Regulation Market they are “price-takers” and are treated as “self-scheduled”

Alternative Technology Regulation Pilot – Lessons Learned

- Have between 1-2 MW currently active and providing Regulation on a 24x7 basis (pilot limited at 13 MW)
- Took some tuning and debugging to get the pilot to work well
- Resources have performed reliably and in accordance with their offered parameters
- Resources often reach a fully charged/fully discharged state where they can only provide regulation in one direction
- Still have some learning to do….

What other things are possible?

- Load Following Service or Imbalance Following Service
  - Similar to Regulation but at a longer time frame
  - Regulation is 4 second interval between changes in consumption/output, Imbalance Following could be between 4 seconds and 5 minutes (typical economic redispatch minimum time frame)
  - May be necessary when amounts of non-controllable devices (wind, solar, etc.) are of greater proportion, might reach higher ratios in Texas or Midwest well ahead of New England
  - No Market has these types of services yet

Conclusion

- Energy Storage in New England is not new
- What is new are some additional types and their limits and additional benefits
- What they do well is different from the “traditional” storage
- Need to define the needs that these resources can provide and then determine if market structures can accommodate these needs