JUNE 18, 2025 | WESTBOROUGH, MA

Overview of Grid Enhancing Technologies: ISO New England Perspective

Brent Oberlin

EXECUTIVE DIRECTOR, TRANSMISSION PLANNING

Disclaimer

The material accompanying this presentation is provided on an "as is" basis. The presenters and their affiliated organizations, to the fullest extent permitted by law, disclaim all warranties, either express or implied, statutory or otherwise, including but not limited to the implied warranties of merchantability, non-infringement of third parties' rights, and fitness for particular purpose. Without limiting the foregoing, the presenters and their affiliated organizations make no representations or warranties about the accuracy, reliability, completeness, or timeliness of the material and make no endorsement of any products or software referenced in the material. The presenters and their affiliated organizations shall have no liability to you, your employer or any other third party based on your use of or reliance on the material. All rights in and to the material are reserved and the material may not be republished without express written permission by the presenters and their affiliated organizations.

Background

- Today is an important step toward increasing the region's awareness of Grid Enhancing Technologies (GETs), intended to contribute to a common understanding of potential use cases
  - In the future, the ISO intends to provide guidance on the application of these technologies in the planning processes
- ISO staff have engaged industry professionals on the application of Grid Enhancing Technologies (GETs)
  - These discussions have provided valuable insights into the potential use of GETs, but just as importantly, on their limitations

Background, cont.

- Even with the information that the ISO has gathered, in some cases it has been a challenge to separate out the benefits and concerns related to certain GETs
    - Capital costs versus system and operating efficiencies
    - Long-term versus short term costs/benefits
- The ISO's responsibility is to plan the system in the most cost-effective manner possible
- New England has a long history of deploying non-transmission line solutions to address reliability needs

Recent FERC Regulatory Requirements

- FERC Order 1920
  - Thus, under this modification, transmission providers must consider: (1) dynamic line ratings; (2) advanced power flow control devices; (3) advanced conductors; and (4) transmission switching
- FERC Order 2023
  - …require transmission providers to evaluate the following enumerated list of alternative transmission technologies: static synchronous compensators, static VAR compensators, advanced power flow control devices, transmission switching, synchronous condensers, voltage source converters, advanced conductors, and tower lifting
  - However, as stated above, this final rule mandates a process of evaluation of alternative transmission technologies, not outcomes in specific cases, and does not create a presumption in favor of using an alternative transmission technology as a substitute for a traditional network upgrade deemed necessary in a specific case.

Discussion Overview

- While the definition of GETs seems to change depending on the forum, today we will be discussing four general areas over the course of the morning and afternoon sessions
  - Morning session: Topology optimization and dynamic line ratings (DLRs)
    - **Topology optimization** – reconfiguring the system to route power around limitations
    - **Dynamic line ratings** – determine real-time line ratings based on ambient conditions
  - Afternoon session: Powerflow controllers and advanced conductors
    - **Powerflow controllers** – allow for the control of power flows on the system
    - **Advanced conductors** – transmission conductors designed to carry more power than traditional conductors like ACSR (aluminum conductor, steel reinforced), often employing composite cores

Adoption of New Technologies

- New England has a long history of being “early adopters” of new technologies, where appropriate
  - Some examples since the year 2000
    - DVAR at Stony Hill and Bates Rock substations in CT
    - STATCOM at Essex substation in VT
    - STATCOM at Glenbrook substation in CT
    - Voltage source converter HVDC at Cross Sound
    - 345 kV cross-linked polyethylene cables (XLPE) in Southwest CT
    - 345 kV variable shunt reactors
    - SmartValve pilot project at Fitch Road substation in MA
    - Utilization of ACSS
    - Advanced conductors at select locations

The Concepts Behind GETs Are Not New

- While the technology has evolved over time, GETs are intended to accomplish many of the same functions that previous technologies already served
  - Controlling power flow on the system is nothing new; it has only become more refined over time
    - The simplest version of power flow control is opening a transmission element, forcing flow onto other parts of the system (one form of topology optimization)
    - Series reactors and capacitors provide course adjustment of flow
      - They are generally on/off devices
      - New England has two series capacitors and twenty-three series reactors
    - Phase shifting transformers allow for a more precise control of flow
      - Adjustments are made through a mechanical tap-changer, which changes flow in steps
      - New England has ten phase shifters
    - Series power-electronic devices, such as SmartValve, may allow for finer control under certain conditions

The Concepts Behind GETs Are Not New, cont.

- Variable line ratings
  - New England has used four sets of ratings for decades (normal, long-time emergency (LTE), short time emergency (STE), and drastic action limit (DAL))
  - New England has a long history of using seasonal line ratings which take advantage of cooler temperatures during the winter
  - Additionally, when conditions allow, facility owners may provide increased ratings when conditions support them to address specific concerns on the system
  - DLRs were installed as a pilot project as far back as the mid to late-1990's
- Topology adjustment
  - Topology adjustments are made on both a short-term and long-term basis
    - Outage coordination will often consider whether changing system topology will allow for transmission and/or resource outages to occur
    - Transmission Planning has developed projects to change the normal operating condition of devices to improve system performance
      - » The most recent example was opening a circuit breaker at K Street which improved Boston Import limits

The Concepts Behind GETs Are Not New, cont.

- Much like everything else, conductors have also evolved over time
  - In the late 1800's, the state of the art was copper conductor
  - In the early 1900's, aluminum conductor steel reinforced (ACSR) conductors became the technology of choice
  - In the 1970's, aluminum conductor steel supported (ACSS) conductors were introduced
    - These are now often classified as advanced conductors (high temperature, low sag (HTLS))
  - Advanced conductors that implement ceramic/composite technologies became commercially available in the early 2000's

Recent Case Study
The ISO Has Selected Non-Transmission Line Solutions in the Regional Planning Process

- Boston 2028 RFP was issued to address needs in Boston driven by the retirement of Mystic Station
- Multiple submittals, including new transmission lines costing more than $700 M
- Selected project: Boston Area Optimized Solution, ~$50M
  - Two switchable series reactors at North Cambridge
  - A STATCOM at Tewskbury
  - Installation of direct transfer trip between Ward Hill and West Amesbury stations
  - No new transmission lines as part of the solution

Recent Case Study
Interregional Coordination

- New York added their “Segment A” and “Segment B” public policy upgrades to significantly increase transfer capability from upstate to downstate New York
- New York developed two major public policy upgrades (known as “Segment A” and “Segment B”) to significantly increase transfer capability from upstate to downstate New York
- Interregional coordinated study found that these upgrades could degrade the New York – New England transfer capability
  - Overload of a 345 kV line
- To offset this impact, the addition of a phase shifting transformer was identified to regulate power flow on the affected line
  - No new transmission line was added to mitigate this overload

What Questions Does the ISO Have?

- What are the gaps in ISO's understanding of technology alternatives?
- How can very different technology types and use-cases be compared on an apples-to-apples basis?
- What can ISO do to increase the region's understanding of the opportunities for alternative technologies that already exist?

Next Steps

- Following today's discussion, the ISO will continue its research on GETs and develop its recommendations for the guidelines for GETs in various applications
- Further discussion will occur at the Planning Advisory Committee, tentatively early Q4 2025
- Provide guidelines on GETs, most likely in the Transmission Planning Technical Guide

Questions

About the Presenter

Brent Oberlin

Executive Director, Transmission Planning

ISO New England

Office: (413) 540-4512

boberlin@iso-ne.com