LINEVISION

Accelerating the **Net Zero Grid**

Massachusetts Clean Energy Transmission Working Group (CETWG)

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Grid-Enhancing Technologies (GETs):

hardware or software that increases the capacity, efficiency, and/or reliability of transmission facilities

Dynamic Line Ratings

Measure the true capacity of transmission lines based on ambient conditions

DLR monitors ambient conditions which heat or cool transmission lines to calculate the true capacity based on their thermal limits.

Advanced Power Flow Control

Reroutes power from congested to underutilized lines

Modular APFC technology actively reroutes flow on transmission lines by adjusting the impedance in real time.

Advanced Topology Control

Identifies grid reconfigurations to reroute flows around bottlenecks

Transmission topology optimization software models the grid's network to find reconfigurations for optimal power delivery.

Interconnection – How DLR can help

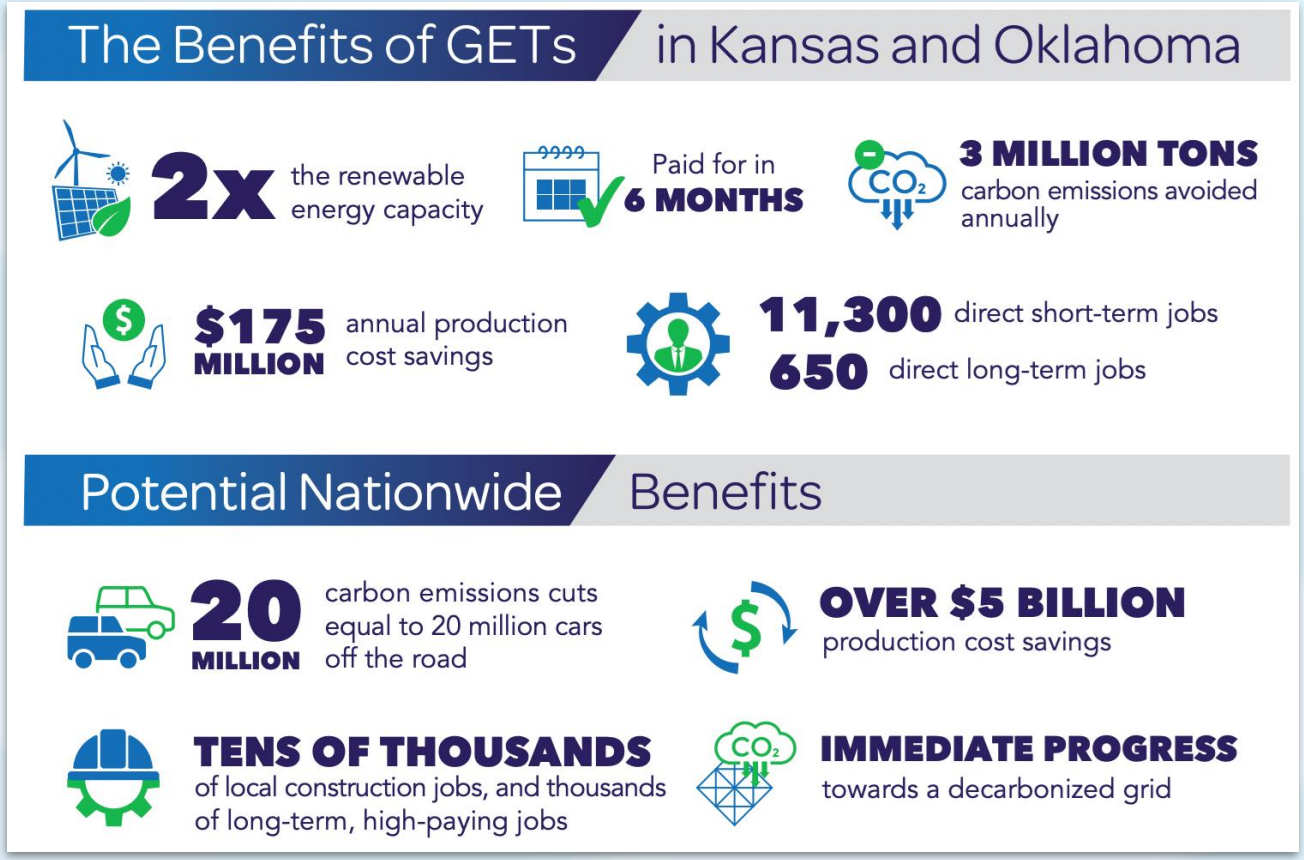
Example: Wind project in the Eastern Interconnection

- Line overload of 3% identified in the interconnection study
- Upgrade identified is a $50M line rebuild
- The overload would only occur in a worst-case loading scenario occurring during windy hours in the summer and winter
- The TO based its line rating on 2ft per second wind input despite the scenario assumptions of higher wind.
- If dynamic line ratings (DLR) are used, line ratings could increase up to 30%
- TO will not consider using DLR

Example: Wind project in the Eastern Interconnection

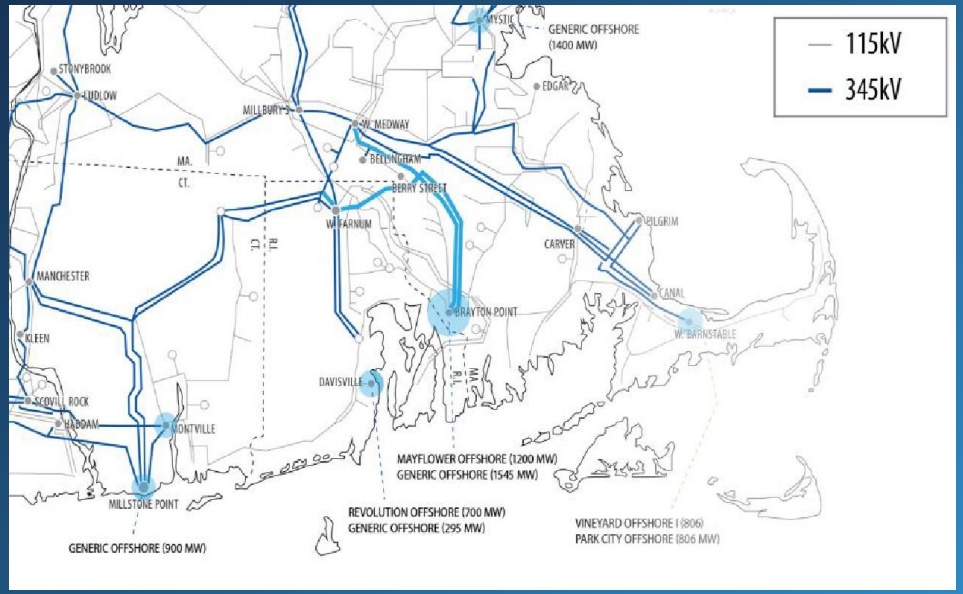
- A constraint between Regional Transmission Organization (RTO) seams triggered a $400 million upgrade in one interconnection study.
- The projected overload was only 1%, and only in high-wind scenarios.
- Line ratings in summer/winter cases calculated with wind at 2 ft/sec
- The upgrade cost made the project inviable, but DLR would likely have resolved the overload at much lower cost. The TO refused to consider it.

Key Takeaway: *System operators and transmission owners (TOs) should take steps to integrate GETs like DLR in the interconnection processes as it can improve interim deliverability for renewable generation as larger grid upgrades are built*



Results from SPP transmission system model, historical power flow snapshots and 2020 generation interconnection queue. **Full report at watt-transmission.org/unlocking-the-queue**

Assessing the Value of Grid Enhancing Technologies: Modeling, Analysis, and Business Justification



This report studies a key offshore wind interconnection point in southeast Massachusetts (SEMA)

Multiple Offshore Wind (OSW) integration points	Multiple paths, voltages (345 & 115kV), orientations (N/S, E/W)	Impacts both New England and New York power systems

- ✓ *It identifies Dynamic Line Ratings and Advanced Power Flow Control deployments to support reliability and reduce production costs under a modeled 2030 resource mix with over 50% renewable energy.*
- ✓ *Optimal deployment of the two technologies reduced renewable curtailment at the interconnection point by more than half.*
- ✓ *GETs deployments would pay for themselves in less than a year.*

Assessing the Value of Grid Enhancing Technologies: Modeling, Analysis, and Business Justification; Idaho National Laboratory – Jake Gentle, Alex Abboud, Megan Culler, Chris Sticht; Telos Energy - Sean Morash, Andrew Siler, Leonard Kapiloff, Derek Stenclik, Matthew Richwine. June 1, 2023. INL/MIS-23-71254

LINEVISION

Optimize + Reinforce + Expand

Recommendations

GETs Study

MA can lead

As part of ISO-NE, MA can push for a regional study or cost-benefit analysis of GETs

Use GETs where they offer a more cost-effective strategy to achieving state transmission goals

Interconnection

Go Beyond Order 2023

GETs evaluation is required, but the utility ultimately determines the final solution

2023 establishes a baseline – ISO NE can go beyond what FERC established in 2023 and formally evaluate DLR alongside the GETs technologies so that the market can realize its benefits in all contexts where the technology is reasonably applied*

**https://blog.advancedenergyunited.org/articles/daymark-isone-interconnection-2023*

Developer Solutions

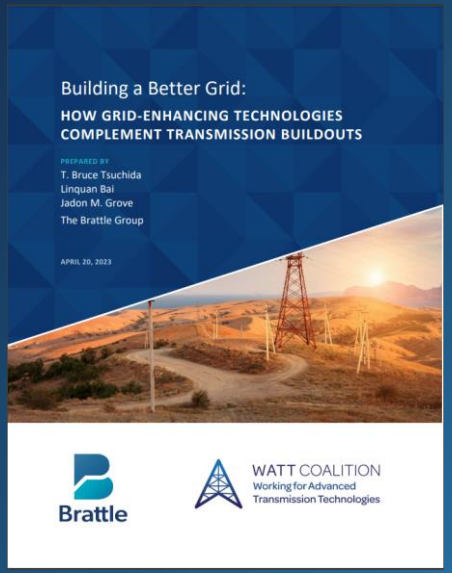
Study & Accept

As part of ISO-NE, MA can encourage the utilization of developer identified GETs solutions to interconnection and curtailment challenges

EX: Sponsored upgrade request (Ex: SPP RR589)

https://www.spp.org/spp-documents-filings/?id=21069

GETs Applications – A Key Tool in the Toolbox



Operations	Planning	Interconnection
Reduce congestion	Resolve near term constraints Bridge solution to larger capex projects	Reduced interconnection costs & faster construction timelines -- fewer withdrawals due to high costs
Increase reliability	Improve value of new lines	Address constraints while larger upgrades are under construction

"These technologies are highly complementary to transmission expansion through new lines. They can magnify the cost effectiveness and capabilities provided by new transmission investments.
They provide short-term solutions to temporary operational challenges, such as during transmission outages or the construction of new lines, and bridge gaps until permanent expansion solutions can be put in place."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