National Grid: Experience Integrating GETs as Utility Operating in Multiple Regions

“Pop Up” Forum on Grid Enhancing Technologies

Sponsored by the Massachusetts Executive Office of Energy & Environmental Affairs (EEA) Federal and Regional Energy Affairs

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Terron Hill
Clean Energy Development
Terron.Hill@nationalgrid.com

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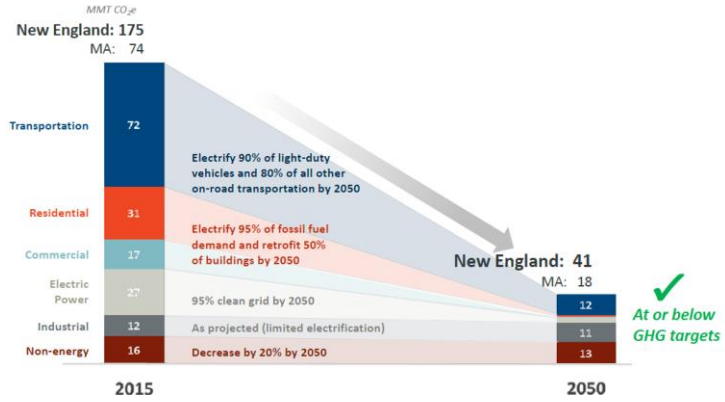
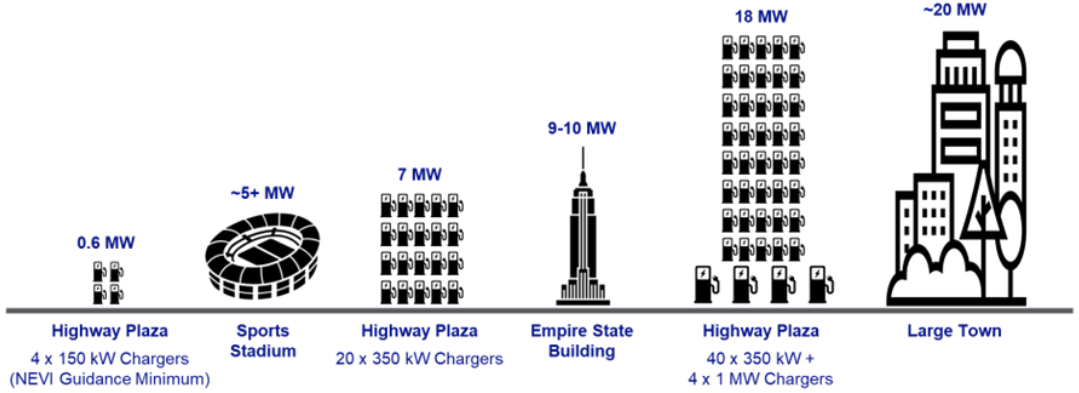
New England has aggressive goals in place to decarbonize

We must rapidly deploy new clean energy resources, noting that Transportation will create significant load demand. Utilizing existing rights-of-way and transmission corridors will be key.



Source: Brattle Group: Achieving an 80% GHG Reduction in Emissions by 2050. https://www.brattle.com/wp-content/uploads/2021/05/17233_achieving_80_percent_ghg_reduction_in_new_england_by_20150_september_2019.pdf

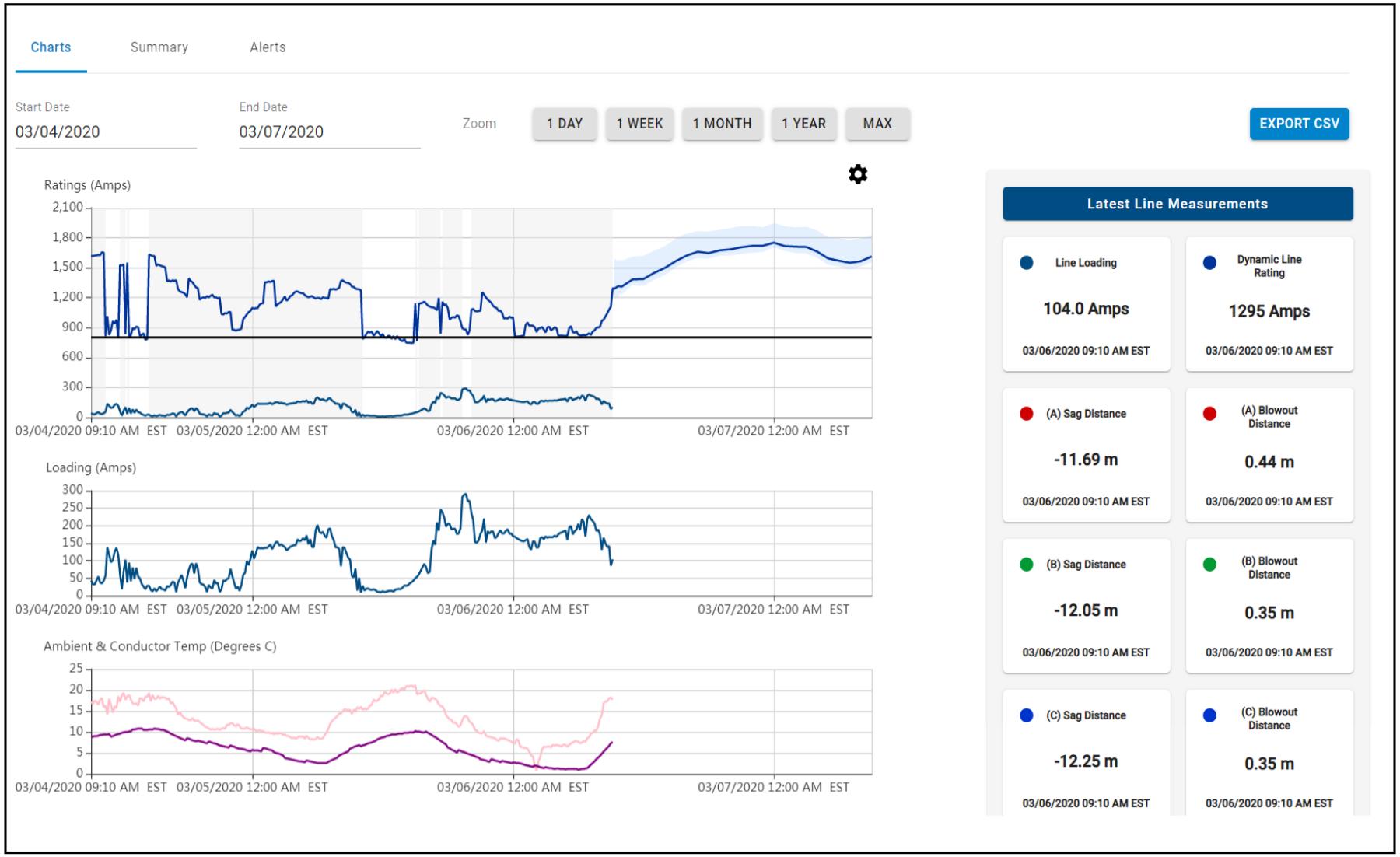


Source: National Grid, Calstart and RMI: Electric Highways: Accelerating and Optimizing Fast-Charging Deployment for Carbon-Free Transportation. November 2022 https://www.nationalgrid.com/document/148616/download

Transmission is essential to a clean energy future

- Stakeholders want utilities to utilize existing transmission corridors and rights-of-way (thus minimizing impacts of new infrastructure on communities)
- Transmission must be deployed ahead of generation resources
- Some GETs do not require line outages and can be deployed quickly
- Complements “traditional” upgrades to utilize existing infrastructure better

Dynamic Line Rating: Massachusetts Demonstration Project



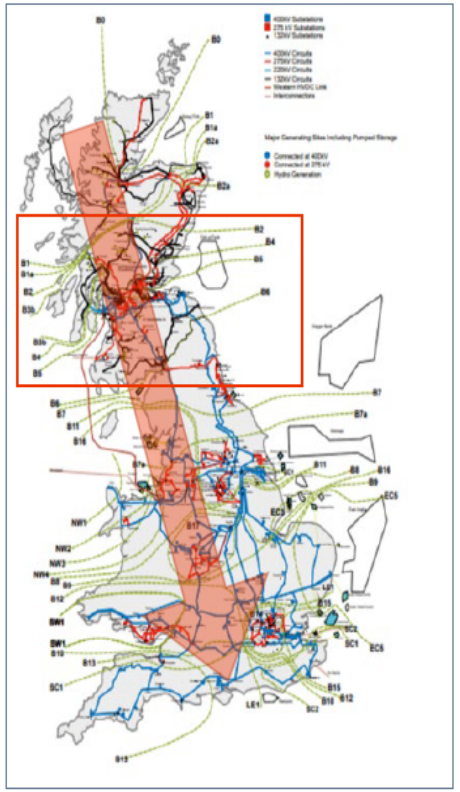
NY CLCPA and National Grid's DLR Deployment

Full integration within Energy Management Systems (EMS) and system dispatch

- Curtailments of onshore wind in Western NY… high wind output days can create more capacity on transmission ("cooling effect")
- Five miles of circuit rebuilds ("reconductoring") was needed to mitigate wind curtailments… we deployed DLR ahead of the rebuilds allowing up to 150 MW of additional capacity under the right system conditions… reconductoring still needed to gain up to 350 MW of increased capacity.
- Sensor data will be fully incorporated into EMS and system operator dispatch thus minimizing electricity market transmission congestion costs (customers pay this congestion in real-time energy prices) (to come online in 2023)

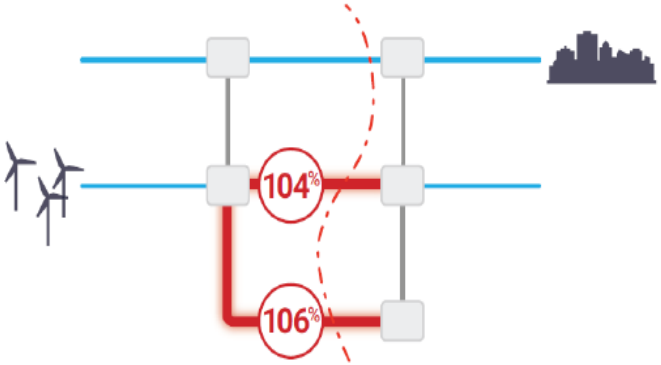
New York's Climate Leadership and Community Protection Act (CLCPA) focuses on upgrades to existing infrastructure to increase capacity and deliver renewables resources to load demand.

Significant customer savings: UK Power Flow Converter Deployments



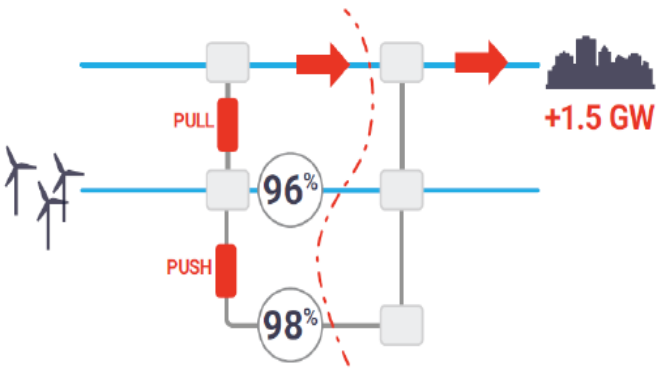
Need to increase transfer capacity
to meet renewable targets
Future demand and generation
scenarios are uncertain

Before Smart Wires



Multiple SmartValve deployments
maximize transfer capacity
Help manage uncertainty as they can
be deployed in under 12 months

After Smart Wires



1.5 GW
of additional transfer capacity

$470 M
in cost savings with same system benefits

10+ GW
when repeated across other boundaries

Regulatory Framework under RIIO: UK Transmission Owners have incentives to deploy technologies and innovation that lowers market costs to customers.

RIIO: Revenues = Incentives + Innovation + Outputs

GETs do come with challenges… “all of the above” strategy needed to decarbonize

- Familiarizing with power electronic technologies and its impact on grid and its protection systems
- Modeling of the technology in planning and operational studies
- Training and workforce development
- Performance during storms and safety guidelines
- New standards and procedures
- Cost of adopting real-time analytics vs traditional approaches (revising of static/ambient ratings seasonally)
- Technology may need to deployed outside of state/region to see benefits downstream (e.g., voltage constraints in NY affecting NE)

Not a substitute for investing in modernized, clean networks – we still must upgrade our existing transmission infrastructure but can utilize these technologies to complement and optimize existing infrastructure.

GETs and new transmission within existing corridors to minimize community impacts.

New England must focus on building out the regional transmission network today for a renewable, clean energy future tomorrow.

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Contact:

Terron Hill, Clean Energy Development Director

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