Policy Opportunity Brief: Grid Enhancing Technologies

Background

Increasing electricity demand, new electric generating capacity, and a growing share of distributed and renewable energy resources require upgrading our existing transmission infrastructure. However, traditional grid upgrades, especially the construction of new transmission lines, are expensive and can take several years to build due to permitting and interconnection challenges, public opposition, and supply chain and other constraints. Grid enhancing technologies (GETs) provide a scalable, cost-effective, rapidly deployable, low risk interim alternative.

GETs – Key Benefits	
Reduced Congestion	GETs increase available transmission capacity.
Transmission Asset Deferral	By "unlocking" unused transmission capacity, GETs enable planners to defer system upgrades and reduce the overall amount of transmission needed to be built out.
Improved Situational Awareness	DLRs, especially, provide line condition information (like icing and wildfire) that improve decision-making and safety.
Improved Resilience and Contingency Response	GETs help operators avoid transmission line overloads and respond quickly to contingencies.
Asset Health Monitoring	The information provided by DLRs can assist in the development of preventative maintenance programs.

Source: DOE 2022, "Grid Enhancing Technologies: A Case Study on Ratepayer Impact." (p. 56)

GETs are hardware and software solutions that optimize the performance of existing electric transmission infrastructure. GETs can help alleviate grid congestion and facilitate the integration of new energy generation, helping states meet demand while avoiding the high fixed costs of building new power lines, which can cost between $1.6-6.3 million[1] per mile. These tools enhance the efficiency, capacity, and reliability of existing electric transmission infrastructure and studies show that widespread adoption of GETs could increase transmission capacity by up to 33%, allowing utilities to manage energy flows more efficiently.

Examples

1. *Dynamic Line Rating (DLR)*

Rather than rely on static line rating (which is calculated under conservative weather conditions that are rarely realized), dynamic line ratings (DLRs) allow operators to adjust power flows by adjusting line ratings in real time based on local conditions like air temperature, wind speed, and other weather variables, which can increase line capacity by 40-90%.[2] While the costs of implementing this technology will vary, costs are significantly lower than new transmission line construction. A Department of Energy (DOE) study of a project in Texas reports that the cost of installing DLRs ranged from $16,000 to $56,000 per mile, noting that DLR costs "are [only] a fraction of the cost of reconductoring or rebuilding a transmission line."

[1] This estimate comes from a study that was done for the Midcontinent Independent System Operator (MISO). Transmission costs depend on several factors, including line type and capacity, permitting and land acquisition costs, and structure (pole/tower) type.
[2] Note, this is an estimate. Results will vary by local conditions, transmission line segment and "downstream equipment ratings," and conductor type (among other factors).

2. *Power Flow Controllers (PFCs)*

Power flow controllers (PFCs) are distributed hardware solutions that "actively push and pull power" along preferred paths to redirect electricity from overloaded lines to underutilized ones, balancing load, improving resiliency, reducing renewable energy curtailment, and enhancing efficiency. PFCs allow the control of power flows in small increments. Some boast fast response times, allowing operators to respond to contingency events. While the cost of this technology varies by device type and electric system requirements, costs are competitive with traditional transmission upgrades.

3. *Topology Optimization*

Topology optimization relies on software to switch circuit breakers on and off to direct electricity around congested or overloaded transmission lines. Topology optimization allows operators to respond to contingencies, minimize outages, and improve planned outage scheduling and coordination, all of which lead to increased reliability. During Winter Storm Elliot in 2022, the Southwest Power Pool (SPP) used grid reconfigurations to release 875 megawatts (MW) of transmission-constrained generation. Studies find that topology optimization can realize congestion cost savings of millions of dollars.

Policy Opportunities

1. *Require utilities to evaluate GETs.*

Require that transmission developers and planners consider GETs before pursuing traditional upgrades. Alternatively, GETs could be evaluated alongside traditional upgrades in transmission plans to ensure that lower-cost, quicker-to-deploy options are considered.

2. *Support pilot projects.*

Authorizing or funding pilot projects to showcase the effectiveness of GETs in addressing grid challenges, such as congestion management and renewable energy integration, can reduce reluctance to adopting these technologies by developers, the public, and regulators. To ensure larger scale adoption, require that utilities report on pilot outcomes, including cost savings.

3. *Provide incentives for the adoption of GETs.*

Clear cost recovery mechanisms will be key for ensuring that utilities consider and invest in GETs. Tax incentives can also be used to encourage transmission operators to invest in these technologies.

4. *Promote regional and interstate collaboration.*

Encourage utility regulators and transmission developers and planners to collaborate with their peers in neighboring states to deploy GETs across the region.

Collaborate with neighboring states to establish agreements to equitably distribute the costs and benefits of GET deployment across the region.

5. *Address data and cybersecurity requirements.*

Require that transmission operators provide access to grid performance and congestion data to enable third-party GET solution providers to identify opportunities for optimization.

Develop and enforce robust cybersecurity standards for GET software to protect critical infrastructure.

More information on GETs is available at: https://inl.gov/national-security/grid-enhancing-technologies/