



TOGETs Overview

January 2023

Changing the World's Energy Future

Megan Jordan Culler



INL is a U.S. Department of Energy National Laboratory operated by Battelle Energy Alliance, LLC

DISCLAIMER

This information was prepared as an account of work sponsored by an agency of the U.S. Government. Neither the U.S. Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness, of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S. Government or any agency thereof.

TOGETs Overview

Megan Jordan Culler

January 2023

**Idaho National Laboratory
Idaho Falls, Idaho 83415**

<http://www.inl.gov>

**Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517**



The transmission system is critical to ensuring electricity security for our nation. INL is exploring how grid-enhancing technologies can modernize and improve transmission operation.



Transmission Optimization with Grid-Enhancing Technologies Overview

Exploring challenges with grid enhancing technologies to ease the transition to a cleaner, more robust electric system

The Transmission Optimization with Grid Enhancing Technologies (TOGETs) project will guide future research to fill in gaps on publicly available knowledge of Grid Enhancing Technologies (GETs) and conduct a full scale, multi-faceted field exercise. Ultimately the project aims to test, verify and validate deployed GETs in a transmission system.

GRID CHALLENGES

The U.S electrical grid is facing many challenges over the coming decades. Aging infrastructure needs to be replaced, demand for power continues to increase and climate change is driving a push for clean and sustainable energy. Combined, these challenges mean our existing transmission system

struggles to provide reliable power to homes, schools and hospitals. Upgrades to the transmission system can be costly and time-consuming, which has created a backlog of transmission projects across the nation. GETs are technological solutions that can help by providing operational support while larger upgrades are completed

en route to a transmission system that reliably integrates new power sources.

Getting a better understanding of how various GETs can work together will allow regulatory bodies and utility providers to evaluate the benefits and risks of these devices and techniques. The combination of this will ultimately lead to improving



GETs have the potential to help address challenges like transmission congestion and rapidly changing weather conditions, which in turn will support more renewables coming online.

Key Topics and Questions Addressed by TOGETs



Modeling

- What protection studies are needed?
- How do we integrate device models into system models?



Procurement

- What are common lead times?
- How much per span do devices cost?



Installation

- Can we safely do hot-installs?
- Where should devices be installed for maximum impact?
- How many devices are needed?



Energy Management System Integration

- Does it require external connections?
- What data security measures are needed?



Data Collection

- How is data collected?
- How often should data be collected?
- How often should models and calculations be updated?



Data Integration

- How can data be leveraged from GETs to inform operation decisions?

the utilization of existing transmission lines, supporting transmission upgrades as they occur, maximizing power transfer and reducing lost revenue due to congestion and inefficiency.

TWO PARTS, ONE GOAL

The first part of the project consists of compiling information on cost, data,

and outcomes from previous studies. These are vital to understanding the use of GETs devices and allow all entities to leverage lessons learned from earlier efforts to streamline future investments. The study of existing resources will collect these lessons learned into a centralized repository and identify gaps in the publicly

available literature. This will allow the TOGETs team to focus on filling these gaps.

The second part of the TOGETs program is a full-scale demonstration of GETs using INL's full-scale Power Grid Test Bed. Specifically, it will use Dynamic Line Rating (DLR) and Power Flow Controllers (PFCs) to clarify and answer unaddressed concerns such as integration challenges, cyber security and data management. The data collected will be made publicly available to make implementation and operation of GETs more transparent to future users.

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy.

FOR MORE INFORMATION

Program manager

Jake Gentle

208-526-1753

jake.gentle@inl.gov

General contact

Ethan Huffman

208-526-5155

ethan.huffman@inl.gov

www.inl.gov

GETs	Grid Enhancing Technologies: devices or techniques that enhance existing grid hardware to prolong useful life or increase capacity.
DLR	Dynamic Line Rating: Using weather conditions such as wind speed, direction, ambient air temperature, or other measurements to determine the true temperature of a conductor and consequently the maximum power that can safely flow on a transmission line at a given time. This is often greater than the static rating normally assigned to a transmission line.
PFC	Power Flow Controller: A device which can actively push and pull power by changing the reactance in the lines. This is useful for redistributing power flow in a mesh network to relieve congestion.
Other GETs	Other GETs exist other than those being studied in this project such as Topology Optimization, which uses geological space and placement to improve infrastructure systems and Dynamic Transformer Ratings, which is comparable to DLR, but for transformers instead of transmission lines.

A U.S. Department of Energy
National Laboratory

