



# How federal, state and industry leaders are aligning and moving ahead with advanced grid solutions

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We've seen extensive coverage of the challenges for today's electrical grid: transmission backlogs, extreme weather events, growing loads—the list seems endless. Yet many are not aware of how government agencies and industry are responding to these challenges. In fact, they are converging on a clearly defined set of solutions, finding ways to fund them, and deploying them into the field. We're on the path to a more resilient, flexible, modern grid.

Two recent events brought this positive trend into focus. *Grid Forward* played host at two online sessions with U.S. Department of Energy (DOE) officials, state regulators, and utilities discussing how the emerging advanced grid technologies, coupled with unprecedented levels of federal investment, are impacting utility business models and practices. Bryce Yonker, Grid Forward Executive Director & CEO moderated the sessions.

A promotional banner with a dark red background on the left and a light grey background on the right. The left side features the GridForward logo, a cluster of white and dark blue triangles, and the text "Scaling Advanced Grid Solutions - Pathways in Action" and "Tuesday May 14, 2024". The right side features the text "Watch the recording of the second online session, Scaling Advanced Grid Solutions – Pathways in Action." and a red button with the text "Watch on YouTube".

GridForward

Scaling Advanced Grid Solutions - Pathways in Action

Tuesday May 14, 2024

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## DOE Liftoff report highlights advanced grid solutions

The first event, sponsored by the Utility Business Model (UBM) Working Group, brought together federal and state officials to explain how changes in programs, policies and funding are influencing grid modernization. The session opened with Louise White, advisor to the U.S. DOE Loan Program Office / *DOE Office of Technology Transitions*. She introduced the new *DOE Pathways to Commercial Liftoff: Innovative Grid Deployment Report* which defines commercially available advanced grid solutions that could be used on the existing transmission and distribution system to better leverage the grid we already have today and get more value out of it. The report focused on 20 advanced grid solutions across the following four categories: advanced transmission technologies, system automation solutions, grid enhancing technologies and applications, and foundational systems.

Table 1. Summary of advanced grid technologies and applications (“advanced grid solutions”) in report scope

Category	Advanced Grid Solutions
Advanced Transmission Technologies	<ul style="list-style-type: none"> <li>➤ Advanced Conductors</li> <li>➤ Point-to-point High Voltage Direct Current (HVDC)</li> </ul>
Situational Awareness and System Automation Solutions	<ul style="list-style-type: none"> <li>➤ Advanced Distribution Management Systems (ADMS) and ADMS applications</li> <li>➤ Distributed Energy Resource Management System (DERMS)</li> <li>➤ Advanced Fault Location, Isolation, Service Restoration (FLISR)</li> <li>➤ Volt/VAR Optimization (VVO)</li> <li>➤ Smart Reclosers</li> <li>➤ Power Factor Corrections</li> <li>➤ Substation Automation &amp; Digitization</li> <li>➤ Advanced Sensors</li> </ul>
Grid-Enhancing Technologies and Applications	<ul style="list-style-type: none"> <li>➤ Dynamic Line Rating (DLR)</li> <li>➤ Advanced Power Flow Control (APFC)</li> <li>➤ Topology Optimization</li> <li>➤ Virtual Power Plants (VPPs)<sup>1</sup></li> <li>➤ Energy Storage (as a T&amp;D asset)<sup>2</sup></li> <li>➤ Advanced Flexible Transformers</li> </ul>
Foundational Systems	<ul style="list-style-type: none"> <li>➤ Communications Technologies</li> <li>➤ Data Management Systems</li> <li>➤ System Digitization and Visualization</li> <li>➤ Alternate Timing and Synchronization</li> </ul>

*Note: This list is not exhaustive of all important grid solutions. Technologies were identified and prioritized based on commercial readiness but are not comprehensive of all DOE transmission and distribution grid priorities (i.e., technologies not commercially available today are not included).*

Source: U.S. DOE Pathways to Commercial Liftoff: Innovative Grid Deployment

For a quick overview of the advanced technologies, see the [DOE Pathways to Commercial Liftoff: Innovative Grid Deployment document](#) and the Grid Forward [DOE Comments on Report: Pathways to Commercial Liftoff Grid Deployment](#) article.

## Focus of the DOE Grid Deployment Office

Ariel Horowitz, deputy director for grid modernization, [U.S. DOE Grid Deployment Office \(GDO\)](#) described GDO goals and areas where the office is investing. GDO is a new office at DOE that is primarily funded through the Bipartisan Infrastructure Law and the Inflation Reduction Act.

According to Horowitz, “Our mission and goals include ensuring resource adequacy with critical generation source support, expanding and enhancing the functioning of wholesale electricity markets, developing new and upgraded high capacity transmission lines, and improving the functioning of our electric distribution system. We’re happy to help folks navigate the state processes and encourage them to form connections with industry to make best use of funding dollars,” states Horowitz.

## FUNDING AVAILABLE THROUGH GDO

- The GDO office has approximately \$2.3 billion in funding available through the [Grid Resilience State/Tribal Formula Grants Program](#).
- The state and tribal formula grant program is a formula program that supports grid hardening and grid resilience investments across the country. Funding goes through states, territories, and tribes, and then is sub awarded to grid operators and other eligible entities.
- GDO has already awarded more than \$800 million dollars to direct awardees who are working through their sub awards.
- [Grid Resilience and Innovation Partnerships \(GRIP\) program](#): GDO administers the \$10.5 billion GRIP Program to enhance grid flexibility and improve the resilience of the power system against growing threats of extreme weather and climate change.
- Other DOE programs include a [Coordinated Interagency Transmission Authorizations and Permits program](#), the [Transmission Facilitation Program](#), and four [DOE Loan Program Office Programs](#) available for funding.
- GDO grants include 58 different projects in 44 states, which is the largest single direct investment in grid infrastructure in the United States history. It will enable over 35 gigawatts of new renewable capacity to come online.

## States implementing real-world grid modernization solutions


Speakers representing state Public Utilities Commissions (PUCs) and Commerce Commissions described how their utilities are already implementing solutions and achieving real-world results to address near-term hotspots and prepare the grid for future challenges.

### ILLINOIS IMPLEMENTATION OF GRID PLANNING AND DOE FUNDING











Ann McCabe ([Illinois Commerce Commission](#)) indicates that Illinois has been progressive in legislation and planning. In 2021, the legislature passed the Climate and Equitable Jobs Act. Now their two electric utilities have submitted their first Multi-Year grid and rate plans. Illinois encourages utilities to demonstrate development of strong programs that manage the electrification load versus simply building bigger infrastructure. “The federal incentives definitely encourage and help us meet our clean energy and renewable goals and encourage electrification, and they’re open to community’s co-ops, and local government,” states McCabe.

- The Illinois Finance Authority has become the green or climate bank and is working with the governor’s office, Illinois Commerce Commission, the Illinois Power Agency and Economic Opportunity Agency, Illinois EPA, utilities, stakeholders, and others on grant and loan applications.

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		<b>\$250 million</b> Solar for All
		<b>\$100+ million</b> National Clean Investment Fund
		<b>\$14 million</b> Revolving Loan Fund
		<b>\$15 million</b> Charging and Fueling Infrastructure
		<b>\$16 million</b> Grid Resilience Grants

Source: Presentation by Ann McCabe to UBM Working Group April 30, 2024

- Illinois has received grants to expand and support the existing Illinois Solar for All program from the Greenhouse Gas Reduction Fund.

**DOE AWARDS TO COLORADO FOR GRID AND ENERGY SOLUTIONS**

Eric Blank has served as the chairman of the **Colorado Public Utilities Commission** since his appointment in January 2024. “Our PUC has many policies relating to long term distribution system planning. We’re working hard to align programs so the utility wins when customers win. We greatly appreciate the support of the federal government in providing funding to meet our state’s grid and energy needs,” states Blank.

Blank indicates that the Colorado PUC is looking at a variety of grid and energy alternatives. New transmission investment includes both dynamic line ratings and advanced cores, as well as actively trying to promote virtual power plants. Colorado received the following federal funding:

- Xcel Energy Colorado, the largest utility in Colorado, received \$115 million for wildfire mitigation and extreme weather resilience through the GRIP program.
- Colorado received \$40 million in long duration energy storage support.
- Colorado received \$150 million for solar implementations to help benefit low income customers.
- Colorado received \$57 million from the **National Electric Vehicle Infrastructure (NEVI) Formula Program** for fast electric vehicle DC charging ports.
- The Colorado Energy office expects to receive \$250 million for weatherization, grid resilience and beneficial electrification, in addition to the DSM energy efficiency and beneficial electrification.

Blank stated, “Colorado also expects over \$8 billion in tax credits on a net present value. The tax credits from energy and grid investments are almost equal to the entire rate base and exceed the other grants by almost a factor of ten. Federal tax credits and incentives are perhaps the most transformative thing I’ve seen in thirty years in this business, and it certainly creates an incredible set of entrepreneurial opportunities both for the utilities and third parties.”

# How utilities are implementing real-world grid modernization solutions

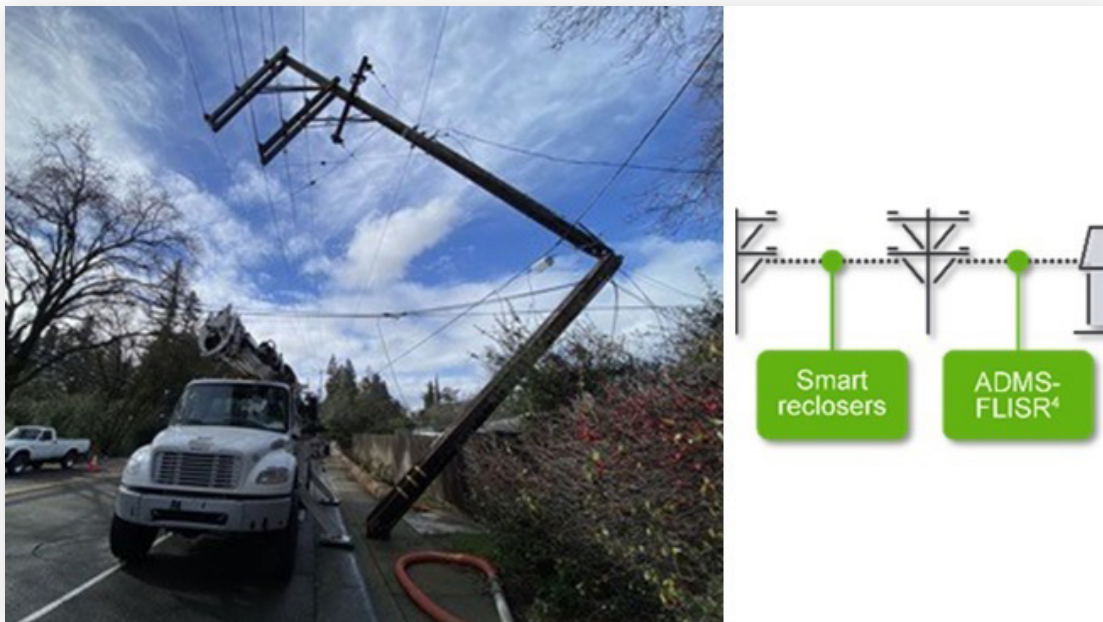
To see how these initiatives are working their way onto the grid today, Grid Forward hosted a second session on May 14, 2024 in which four utilities described how they are using advanced technologies described in the DOE Liftoff Report to help modernize the existing grid capabilities.

## SACRAMENTO MUNICIPAL UTILITY DISTRICT GRID INNOVATIONS

The **Sacramento Municipal Utility District (SMUD)** is a community-owned electric utility in California serving Sacramento County and parts of Placer County. Farakh Nasim, SMUD Supervising Principal Engineer, indicates that challenges faced at SMUD include issues with integrating disparate protocols across systems and vendor solutions across the utility energy system. These highlight the need for interoperable communications between distributed energy resources (DERs) and utility systems.

SMUD implemented many of the advanced technologies advised in the DOE Liftoff Report. SMUD used a distribution management system (DMS), distributed energy resource management system (DERMS) and advanced distribution management system (ADMS) to improve and better integrate management of customer devices and SMUD-owned assets. These systems help distribution control operators have more insight into energy usage and DERs' patterns.

SMUD currently uses an ADMS-Volt/VAR control (VVC) solution to correct violations in their electric distribution system. The Fault location, isolation, and service restoration (FLISR) application within the ADMS aids in locating faults during power outages.



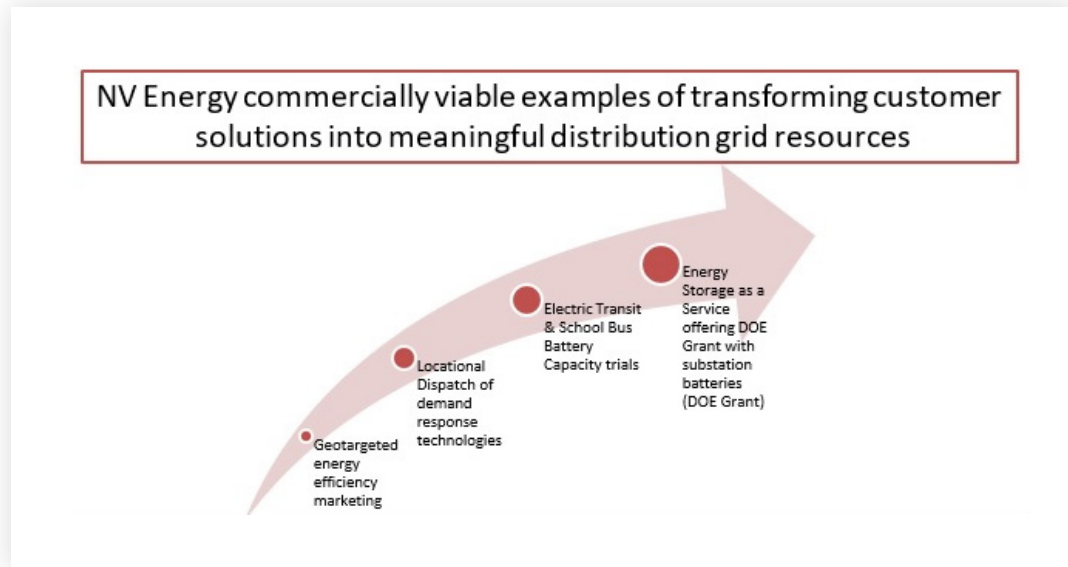
Source: Presentation by SMUD's Farakh Nasim to Grid Forward webinar May 14, 2024

SMUD uses Volt/VAR optimization (VVO) software from **Open Systems International** and is currently testing new features for support in reducing power losses, demand reduction, and power factor correction. Nasim indicates future goals include:

- Enabling the FLISR application to automatically perform switching operations to restore power in the most advantageous way, rather than having an operator manually review data and determine what remote switching operations to perform.
- SMUD V1G DER pilot program with 1,000 residential customers testing how to use DERs (PV, batteries, water heaters) through a third-party aggregator.
- SMUD V2G project looks at using microgrid projects, localizing solutions for local peak patterns (VPP) and EV charger management.
- SMUD's new substation plan uses a 16 MW "research yard" for testing innovative battery technology.

### **NV ENERGY INTRODUCING ADVANCED GRID TECHNOLOGIES**

Next up was **NV Energy**, a Berkshire Hathaway Energy investor-owned utility in Nevada. Marie Steele, NV Energy vice president of Integrated Energy Services, describes how NV Energy is aggressively expanding energy resources and advanced grid technologies. Steele states, "We created a new group two years ago called the Integrated Energy Services team and developed a long-term Integrated Resource Plan evaluating future electric needs and our plan to meet those needs using advanced grid technology resources." Some of the solutions are shown below.



Source: Presentation by NV Energy's Marie Steele to the Grid Forward webinar May 14, 2024

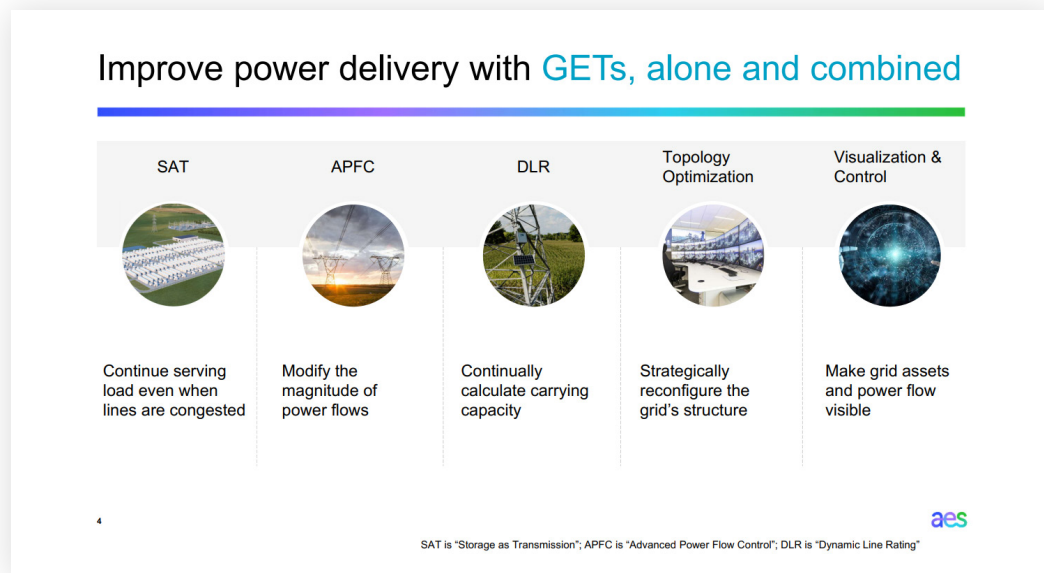


“Since 2017, NV Energy set up a DER tracking, analysis and forecasting system, implemented DERMS and ADMS solutions, and modernized the distribution interconnection,” Steele says. “Integrating federal opportunities and DOE grants has been transformational over the past several years.” Future goals include:

- Removing energy distribution constraints with a goal of having excess renewable energy.
- Investigate DER microgrids to enhance customer and grid resiliency.
- Demonstrate and implement geotargeted energy efficiency marketing as well as implement locational dispatch of demand response technologies.
- Evaluate an energy storage service using substation batteries as an energy source under DOE grant.
- Continue Electric Transit & School Bus Battery Capacity trials. This evaluation is in southern Nevada using a school district with 2,000 school buses to determine if school bus batteries can be used as an energy source.

### AES SCALING ADVANCED SOLUTIONS

AES Corporation is a utility and power generation company that is headquartered in Arlington, Virginia. Alexina Jackson, vice president of strategic development states, “AES has utilities as well as clean energy development in 14 countries, but my comments focus on the US because that is our fastest area of growth AES is laser focused on growing load—particularly step-change load—and getting energy onto the grid is a key challenge both for our customers and our renewables business. This means that not only do we need more energy, but we need a lot of additional transmission capacity and grid capacity is both enhanced and constrained by grid carrying capacity, planning and interconnection, dynamic resources, and how to integrate distributed and bi-directional energy.”



Source: Presentation by AES' Alexina Jackson to the Grid Forward webinar May 14, 2024

Jackson notes that production of energy, consumption of energy and even transmission of energy is inherently dynamic, we just haven't historically thought of the grid that way. This means that the transmission system is a bottleneck despite containing significant reserved carrying capacity. Methods to address the bottleneck include collocation of load and generation, improved efficiency in the use of existing transmission, and flattening the load curves to make them more predictable to the transmission system. To meet efficiency objectives, AES proposes using the following grid-enhancing technologies:

- Storage as Transmission, which can help make full use of renewable energy and continue serving load even when transmission lines are congested,
- Dynamic line rating (DLR) to create visibility into transmission headroom by continually calculating carrying capacity,
- Modify power flows through advanced power flow control (APFC) and strategically reconfigure the grid's structure using topology optimization, and
- Create visibility into grid assets and power flow using visualization and control technology.

In connection to grid data, Jackson states that "Once we have the higher fidelity and clearer view of how the power system actually operates, we should start making different decisions about the ratings that we're putting into operations and into planning because when we have visibility, we can use better information in making power decisions."

Jackson shared a recent AES case study about its DLR demonstration in its Indiana and Ohio utilities, including "a 69Kv power line with a segment with low wind and extensive vegetation that found low power carrying capacity in the area." DLR-enabled analysis of this line found that reconductoring (replacing existing power lines with higher capacity lines) would result in a 10% improvement over existing static line ratings. "So, through a targeted investment strategy, not only are we saving our customers money, but we're providing the benefits of additional headroom," states Jackson.

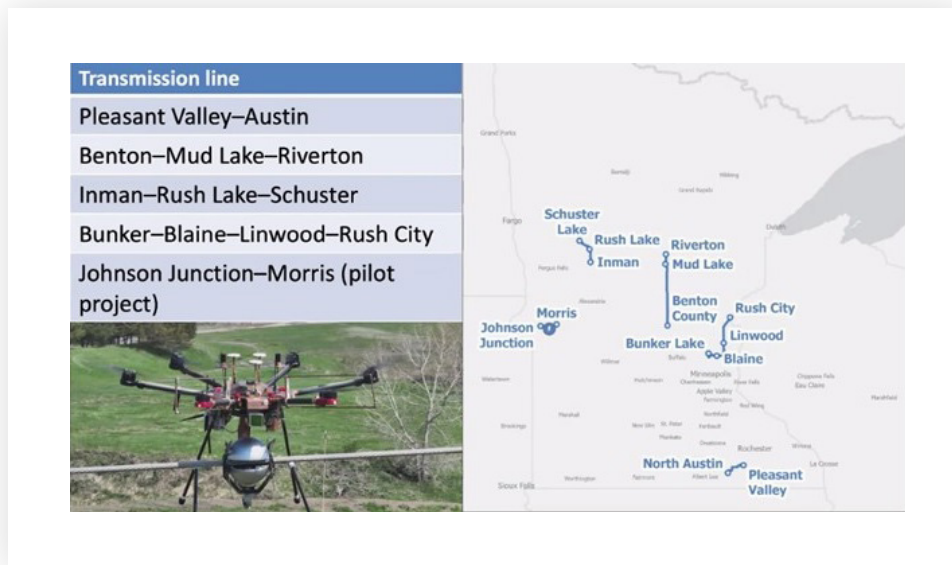
## **GREAT RIVER ENERGY TESTING DYNAMIC LINE RATING TECHNOLOGIES**

**Great River Energy** (GRE) is a wholesale electric cooperative serving 27 member co-ops across Minnesota, and is the fifth largest generation and transmission cooperative in the U.S. in terms of assets.

Dick Pursley, Great River Energy director operations and transmission services, indicates that GRE started a DLR pilot project six months ago. "The focus of the pilot is increased capacity of existing transmission lines to reduce MISO market congestions costs and to allow the co-op to delay some capital projects by utilizing existing power assets to their full capabilities. Cost containment is especially important because GRE is a non-profit utility co-op," states Pursley.

GRE partnered with **Heimdall Power**, a grid technology company headquartered in Oslo, Norway. Heimdall added 52 physical line sensors covering eight different GRE power line segments. The sensors measure line temperature, inclination, ampere vibrations, voltage, ambient temperature, CO2 and humidity on various power lines. For 100kV and above systems, sensors are installed via drones using artificial intelligence with LIDAR. The drone installation frees GRE staff from having to install sensors in swampy areas or on high structures. The DLR solution uses information from local weather stations for data such as temperature and humidity readings. Information from the sensors is transmitted to the Heimdall cloud and GRE interfaces with the cloud environment for information.





Source: Presentation by GRE's Dick Pursley to the Grid Forward webinar May 14, 2024

Preliminary project lessons and next steps include:

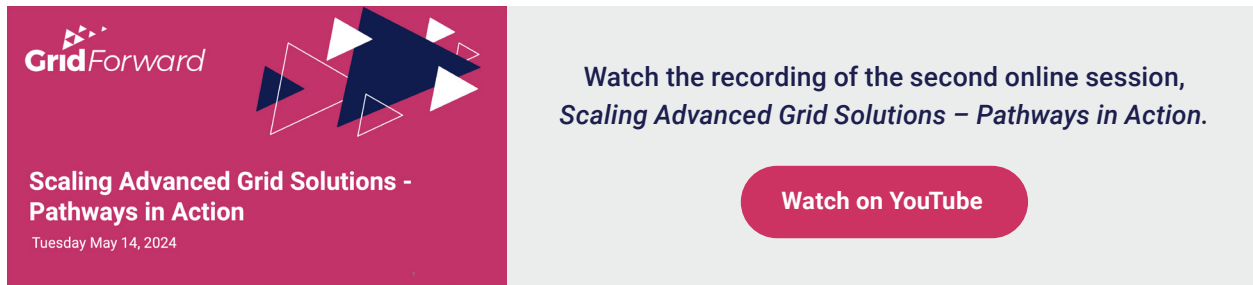
- The DLR solution is a relatively easy and inexpensive way to increase line capacity on identified facilities. There is location installation flexibility with future changes in power congestion. Dynamic line ratings meet and exceed FERCS Order 881 requirements.
- The initial pilot project indicates an average capacity increase of approximately 43%.
- Full-scale project installation is underway, and GRE is working with Heimdall so GRE can have virtual sessions bringing information into the GRE Emergency Management Systems as well as sharing information with MISO and neighboring utilities.

## Grid modernization is more important than ever

A robust portfolio of advanced grid solutions supported by DOE reports and funding programs is available to help meet grid modernization needs. States, utilities and private industry are starting to roll out the advanced grid technologies described in the DOE Liftoff Report to enable the full capacity of the existing grid. These solutions will help make the grid:

- Flexible to meet changing consumer needs
- Secure against natural and man-made threats
- Resilient in the face of climate change and other disasters
- More equitable across all communities
- Adaptable via Increased availability of renewable energy sources

## Watch the webinar for complete utility presentations

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### ABOUT GRID FORWARD

Grid Forward is a 501(c)(6) non-profit, member-driven trade association dedicated to promoting and accelerating innovation on the regional electric system. We deliver community, expertise and resources for leaders who are working to modernize the grid. Learn more and become a member at [GridForward.org](http://GridForward.org).

This article was prepared May of 2024 for Grid Forward by Linda Barney of Barney & Associates.



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