

# i2X DER Webinar 5

*Catalyzing Grid Stability: Solutions for a Reliable and Secure Grid*

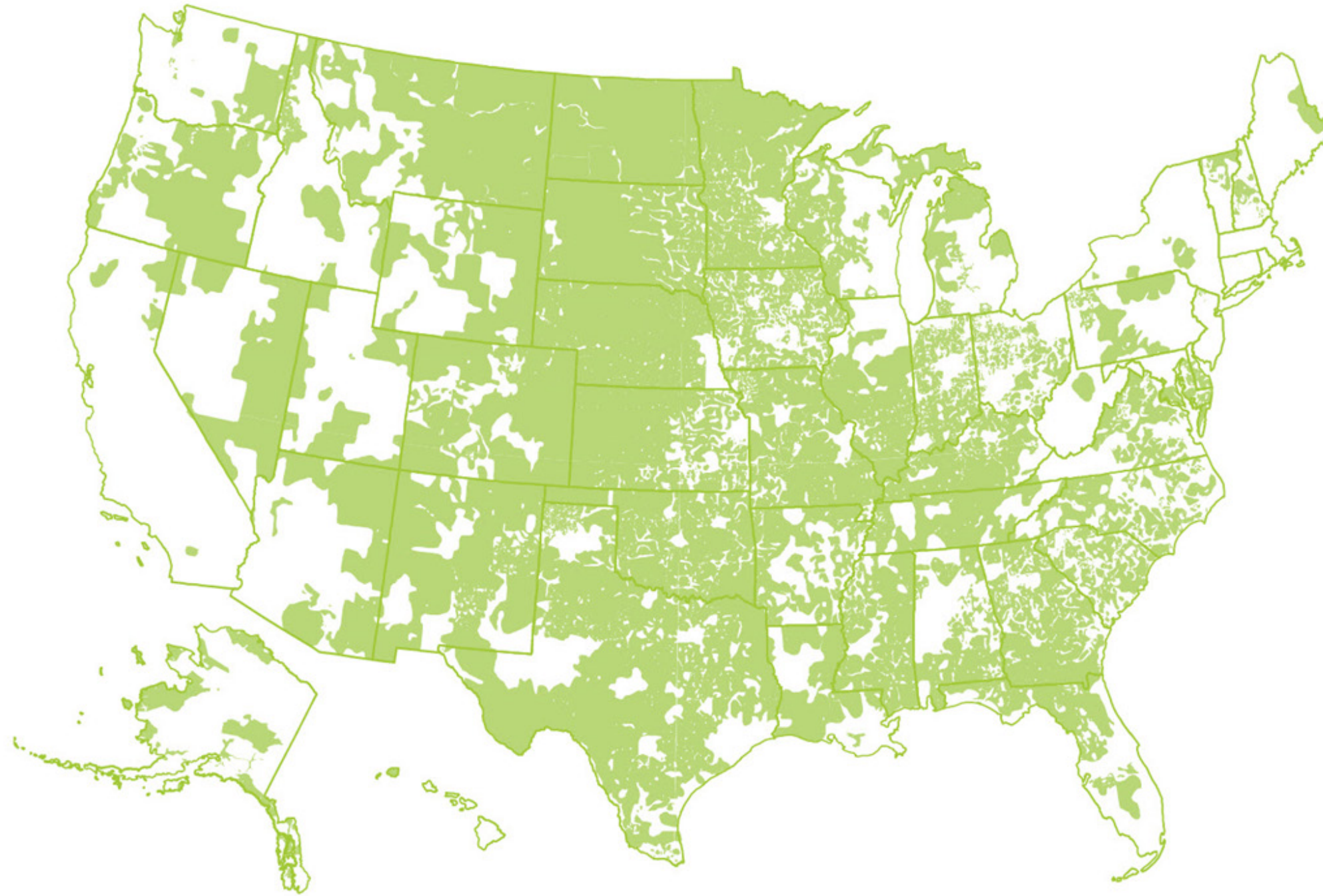
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Presented by Jennah Denney & David Farmer (NRECA)  
December 16, 2025

# Focus: Solutions for Interconnection Standards

- **Solution 4.6:** Accelerating adoption of IEEE 1547 through collaboration among regulators, utilities, and researchers.
- **Solution 4.7:** Developing standards to mitigate inadvertent export.
- **Solution 4.8:** Using IEEE 1547.3 guidance to address cybersecurity concerns during interconnection.
- **Solution 4.9:** Developing cybersecurity risk management plans for DER projects.
- **Solution 4.10:** Adopting standards for emerging technologies like grid-forming inverters and vehicle-to-grid systems.
- **Solution 4.11:** Creating evidence-based best practices that promote safety and reliability while allowing for local flexibility.

# Cooperatives Power 56% of the Nation's Landmass



# DER Areas of Interest



**Microgrids** – local networks that integrate DERs to improve resilience for communities or critical facilities.



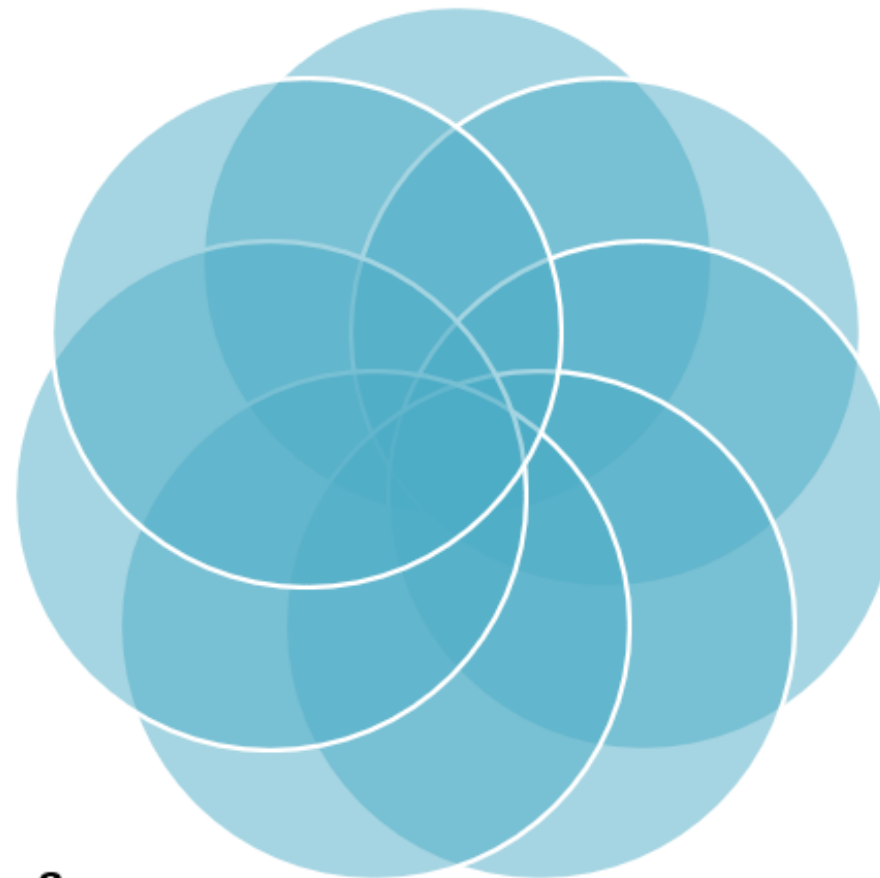
**Solar PV (rooftop & community solar)** – member-owned or co-op-owned arrays.



**Battery Energy Storage Systems (BESS)** – for peak shaving, resilience, and backup power.



**Backup & Distributed Generation** – small natural gas or diesel gensets for critical loads.



**Demand Response & Smart Devices** – water heaters, thermostats, electric vehicle (EV) chargers controlled to lower peak demand.



**Electric Vehicles & Charging Infrastructure** – managed charging to balance load and bidirectional capabilities.

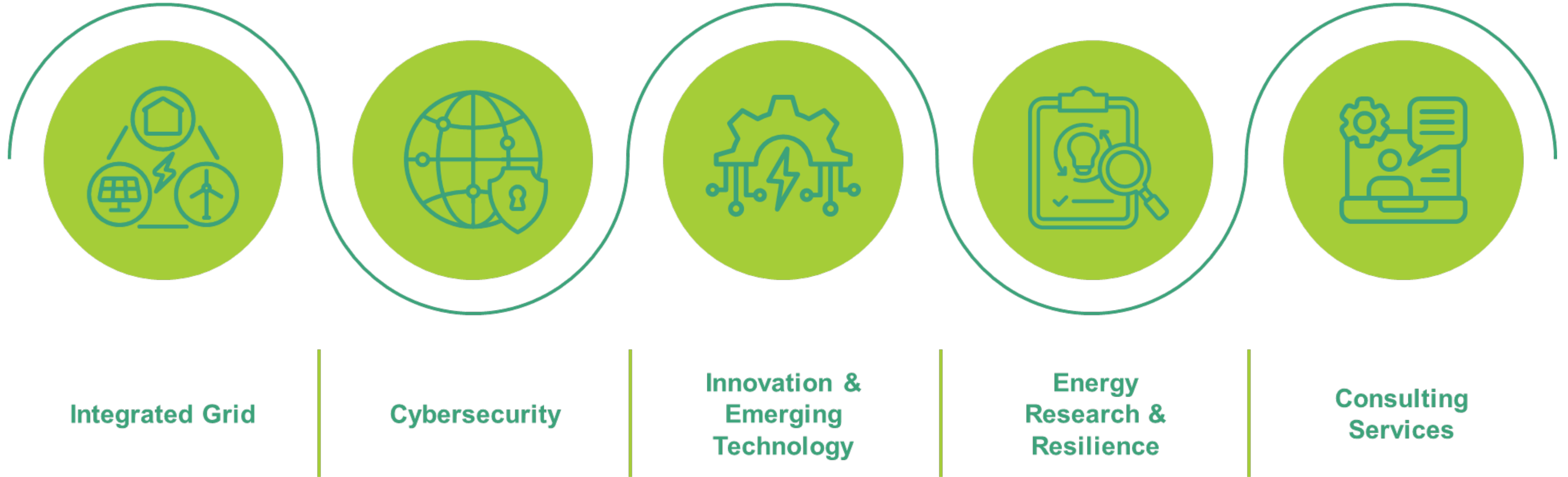
**Energy Efficiency Programs** – weatherization, efficient appliances, lighting upgrades.



# Mission Focused. Member Driven.



# NRECA's BTS Team's 5 Service Lines for Rural Utilities



# What NRECA is Doing to Help: DG Toolkit

NRECA's DG Toolkit gives co-ops clear guidance on the legal, economic and technical questions tied to member-owned generation.

## It includes:

- Updated DG size categories
- New industry resources
- Current standards
- Step-by-step documents that help co-ops create policies, contracts & rates that fit their systems.

### Your Friendly and Caring Member Cooperative

#### **Consumer Guidelines for Electric Power Generator Installation and Interconnection**

Your electric cooperative seeks to provide its members and patrons with the best electric service possible, and at the lowest cost consistent with sound economy and good management. In some cases, cooperative members and patrons may become interested in installing their own electric power generation equipment. In these cases, we stand ready to work with you to ensure that your generation equipment is installed in a proper and safe manner, and in accordance with all applicable codes, standards, regulations, laws, and insurance requirements. In most of these cases, you will also need to coordinate the installation and approval of your electric power generator with the local code inspection authority. Your cooperative engineers and customer service representatives can also help you identify the appropriate contact for this purpose.

e documents required from a customer who is installing distributed

#### ments Required When Installing Distributed Generation

ion Information		Information Required from Consumer				
Inverter Based?	Power Export?	10kW Inverter-Based Process	Application Part 1	Application Part 2	Contract Agreement Short	Contract Agreement Long
-	No					
-	No		x		x	
No	Yes		x		x	
Yes	Yes	x				
-	No		x			
-	No		x			x
-	Yes		x	x		x
-	No		x	x		
-	No		x	x		x
-	Yes		x	x		x

perative means that the generation will be electrically connected to the Cooperative system. n automatic transfer switch is not interconnected with the Cooperative.

ustomer can use the following flow charts to determine the required



### Business and Contract Guide for Distributed Generation (DG) Interconnection

Developed For  
National Rural Electric Cooperative Association

Developed By  
Resource Dynamics Corporation

Updated By  
Power System Engineering

October 2014



# What NRECA is Doing to Help: REWIRED

NRECA Research  
February 2025

## Guidebook: Rural Electric Utility Workflows for Interconnection of Rapid EVSE Deployment



**RAPPAHANNOCK ELECTRIC COOPERATIVE**  
Powered by **brillit**

### Transformer & Meter Look Up

Meters on Transformer

Rate	Tx Number	Banked Tx Count	Meter Count	Annual Peak Load	Additional EV Cars	Additional EV Pickups
A1	100000	107K	180K	2M	94K	22K

Member Meter Number: A1

Tx Location Number: A1

Company Tx Number: A1

Substation: A1

Circuit Name: A1

Rate Code: A1

Additional EV Cars: 0 to 459

Member Meter Location

Legend

kW RANGE	Additional EV Capacity
< 0 kW	Overloaded
0 - 7.69 kW	0
7.7 - 15.18 kW	Car
15.2 kW+	Truck

Meter Data	Transformer Data	Transformer Bank Data	Tx Bank EV Capacity
02085339 Meter Number 150630 Location Number 3 Phase Count B33 Rate Schedule 15319 Creativity Dr Address 1 (Blank) Address 2 (Blank) Address 3 Culpeper City VA State	100000 Company Number 1 Phase Count A Phasing 25.00 Rated kVA 23.75 Rated kW (95%PF)	30448014 Location Number Welltown Pike Circuit REDBU Substation 1.00 Transformers in Bank 15.00 Total Bank kVA 14.25 Total Bank kW (95% PF)	30448014 Location Number WINTER Peak Season 3225 Annual Peak Load (kW) -3,210.27 Capacity (kW) at Max 0 Additional 7.7 kW EV Cap. 0 Additional 19.2 kW EV Cap. 3,057.84 Summer Peak Load (kW) 3,224.52 Winter Peak Load (kW)
074881469 Meter Number 12075 Location Number 3 Phase Count L10 Rate Schedule 485 Brooke Rd Address 1 (Blank) Address 2 (Blank)	100001 Company Number 1 Phase Count B Phasing 25.00 Rated kVA 23.75 Rated kW (95%PF)	30457007 Location Number Park Center Drive Circuit REDBU Substation 1.00 Transformers in Bank 15.00 Total Bank kVA 14.25 Total Bank kW (95% PF)	30457007 Location Number SUMMER Peak Season 7133 Annual Peak Load (kW) -7,118.55 Capacity (kW) at Max 0 Additional 7.7 kW EV Cap. 0 Additional 19.2 kW EV Cap. 7,132.80 Summer Peak Load (kW)
074881469 Meter Number 12075 Location Number 3 Phase Count L10 Rate Schedule 485 Brooke Rd Address 1 (Blank) Address 2 (Blank)	100002 Company Number 1 Phase Count B Phasing 25.00 Rated kVA 23.75 Rated kW (95%PF)	30458002 Location Number RW (North Winchester) Circuit REDBU Substation	30458002 Location Number 7133 Annual Peak Load (kW) -7,118.55 Capacity (kW) at Max 0 Additional 7.7 kW EV Cap. 0 Additional 19.2 kW EV Cap. 7,132.80 Summer Peak Load (kW)

Reducing Soft Costs and Deployment Timelines

Scalable, Replicable Solutions

Improving Grid Integration

# What NRECA is Doing to Help: Cybersecurity Risk Management

## Threat Analysis Center (TAC): Secure Cybersecurity Community and Information Sharing Platform

The NRECA Research Threat Analysis Center (TAC) is a technology platform that empowers a co-op community to focus on high-impact cyber threats, respond quickly with the necessary expertise and engage with the broader intelligence community without sacrificing privacy. The TAC helps co-ops detect, analyze and communicate cybersecurity threats. The goal of TAC is to strengthen our collaborative efforts to protect the industry grid. To learn more about TAC and how to sign-up, visit our website at [www.cooperative.com/TAC](http://www.cooperative.com/TAC), and see [NRECA's Infographic: What is TAC?](#) For questions or inquiries, contact our team at [TAC@nreca.coop](mailto:TAC@nreca.coop).

## Industrial Control Systems for Rural Electric Cooperatives (ICS-REC)

In November 2022, NRECA was awarded \$15M from from the DOE to help our member co-ops expand their cyber monitoring capabilities of their industrial control facilities. NRECA is partnering with member co-ops to identify and deploy industrial control system monitoring technologies that will provide cyber visibility, detection and response capabilities for energy delivery systems. Information for co-ops interested in participating can be found on our website: [cooperative.com/ics-rec](http://cooperative.com/ics-rec). If your co-op is considering deploying OT technologies, be sure to express interest now!

## Co-op Cyber Goals Program – It's Where To Start!

NRECA's Co-op Cyber Goals Program defines specific cybersecurity goals aimed at helping co-ops achieve high-priority security measures and creates a benchmark for implementing cybersecurity fundamentals. This program was created by NRECA as a voluntary way for co-ops to advance their cybersecurity. Over 400 cooperatives have joined NRECA's Co-op Cyber Goals Program to date. Those completing the goals receive a digital badge and commemorative coin, and are recognized in a ceremony at our Co-op Cyber Tech conference. We encourage all co-ops to participate in this self-paced program. Find out more at: [cooperative.com/cybergoalsprogram](http://cooperative.com/cybergoalsprogram), and NRECA's [Advisory: Co-op Cyber Goals – Second Year in Review](#).

### Project Guardian 61-7A

Project Guardian 61-7A is multi-faceted cybersecurity program funded under the Bipartisan Infrastructure Law from the U.S. Department of Energy (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER). Through this effort, NRECA is leading a Working Group including distribution, generation and transmission members. The program is focused on ensuring that no co-op is left behind, and developing frameworks for four key focus areas: Cyber Champions; Threat Analysis Center Expansion; Cyber Resilience Initiative; and Education, Training and Workforce Development. Learn more on our website: [www.cooperative.com/guardian](http://www.cooperative.com/guardian), and read NRECA's article, [Co-op Staff From Across the U.S. Help Project Guardian Develop Cyber Resources](#).

At the time of this Advisory, a related effort is currently awaiting funding by the U.S. Department of Energy, through the [Rural and Municipal Utility Advanced Cybersecurity Grant and Technical Assistance \(RMUC\)](#):

**Strategic Program for Advancing Rural Knowledge (SPARK):** NRECA Research will support rural utilities' efforts to increase the quality of appropriate and affordable security education by providing participating co-ops with access to high-quality training on various cybersecurity topics. To date, over 400 co-op members have signed up to participate.

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### TOOLS & GUIDES

#### Cybersecurity Self-Assessment

NRECA's Self-Assessment tool helps co-ops understand their cybersecurity posture. Results of the self-assessment can be used by the co-op to prioritize mitigation actions and develop a cybersecurity action plan for their organization.

#### Cybersecurity Tabletop Exercise Toolkit

The NRECA TTX Toolkit provides relevant cybersecurity incident scenarios with real world implications. There are three categories of scenarios designed to meet a broad range of cooperative skills.

- [Toolkit Request Form](#)

#### Communication Toolkits and Research

NRECA has conducted research and developed the following toolkits in consultation with its members and outside experts. In some cases, samples have been provided by cooperatives, and they are credited. Please use these materials as a starting point for developing your own plans and products.

- [Co-op Cybersecurity Lexicon – A roadmap to communicating on cybersecurity](#)

- [Reputation Management and Cybersecurity Crisis Communications: A Proactive Guide](#)  
Cybersecurity events are dominating news headlines with growing frequency. NRECA has a guide to help co-ops navigate these events. This is designed as a proactive tool to support electric co-ops as they work to implement effective communications and reputation management strategies.

### Cybersecurity Guidebook Series

Like safety, cybersecurity is a concern for everyone at a cooperative. However, each job role in a co-op may have unique cybersecurity responsibilities. NRECA's Rural Cooperative Cybersecurity Capabilities (RC3) Program published a series of cybersecurity guidebooks to provide information pertinent to specific job roles within a cooperative.

- [Guidebook for Electric Cooperative CEOs and General Managers](#)
- [Guidebook on Incident Response for Electric Cooperatives](#)
- [Guidebook for Electric Cooperative Board Members](#)
- [Guidebook for Electric Cooperative Attorneys](#)
- [Guidebook for Human Resources and Benefits Administration Professionals](#)

### ADVISORIES, PODCASTS AND INFOGRAPHICS

[Advisory: Cautions When Using Artificial Intelligence \(AI\) Cloud Recording Software](#)

[Advisory: Cybersecurity Maturity Model Certification \(CMMC\)](#)

[Advisory: Supporting Mental Health in Cybersecurity: Practical Tips for Co-ops](#)

[Advisory: Managing Your MSP Vendor for Cybersecurity](#)

[Advisory Series: Cybersecurity Information Sharing – What it is, how it should be done, and why it is important.](#)

[Along Those Lines Podcast: What Does an Electric Co-op Look Like to a Hacker?](#)

[Along Those Lines Podcast: Balancing AI's Benefits With Cybersecurity Risks](#)

[Along Those Lines Podcast: Co-ops Confront Growing Threat of Third-Party Cyber Incidents](#)

[RE Magazine Infographic: Cybersecurity Threats and Defenses](#)

### ENGAGEMENT OPPORTUNITIES

[NRECA Co-op Cyber Tech Conference](#)

This three-day technical conference is for all NRECA members and supporting organizations with the goal of improving co-op cybersecurity. Here, we build a community of cyber practitioners through opportunities for professional development and collaboration. **Join us on June 24-26, 2025 in Denver, Colorado!** For more information and registration: visit: [cooperative.com/cybertech](http://cooperative.com/cybertech).

[Cybersecurity Update Webinar Series](#)

Join NRECA's cybersecurity team for this free quarterly webinar series as they provide a high-level overview of the latest information related to cybersecurity risks, as well as current opportunities within our industry to advance your cooperative's cybersecurity posture. Each session will also highlight specific

# NRECA Collaboration – Cooperative Engineering Standards Interest Group (CESIG)

## Mission

*Provide visibility to the standards-making process across the cooperative community and to ensure that our voice is represented consistently in the various entities tasked with electric utility standards development.*

1

**Objective 1.** Collaboration and cooperation among cooperatives.

2

**Objective 2.** Better understand and follow the standards making process.

3

**Objective 3.** Evaluate existing and proposed standards, and their impact on cooperatives.

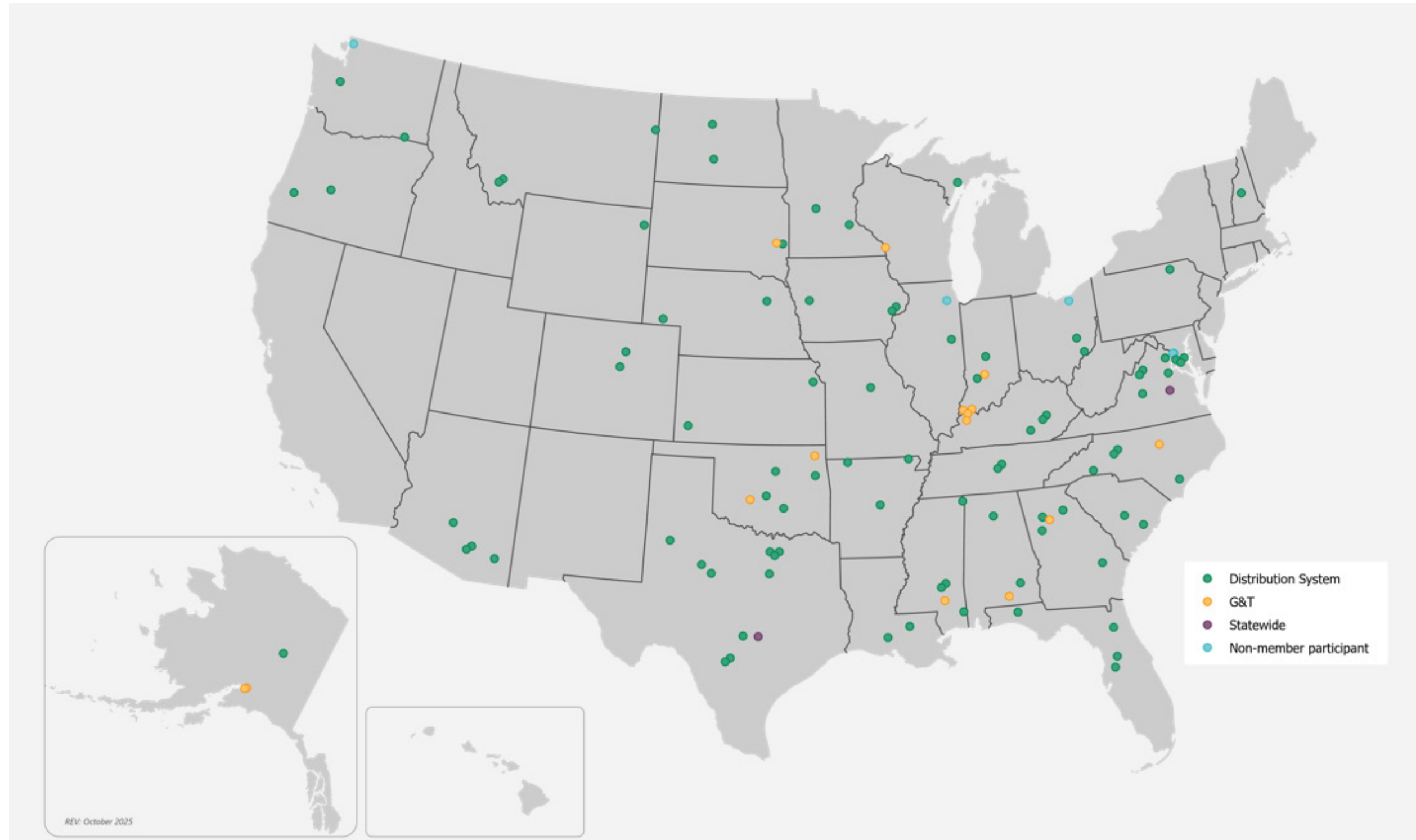
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**Objective 4.** Mitigate the risk of adverse impact on cooperatives caused by standards.

5

**Objective 5.** Influence standards development to enhance NRECA members' ability to fulfill their priorities.

# CESIG Geographic Impact



115 Members

- 89 Distribution Co-ops
- 12 G&Ts
- 3 Statewides
- 1 RUS
- 1 Tribal
- 9 “Other” (Consultants, Testing & Controls, Contractor, GT&D)

[Sign-up form for NRECA's Cooperative Engineering Standards Interest Group \(CESIG\)](#)

# DER Standards – IEEE1547 Series

## Core Standard & Amendment

- IEEE 1547-2018 -- Interconnection and Interoperability of DERs Interconnected with Area EPS
- IEEE 1547a-2020 -- Amendment to clarify voltage/frequency response, particularly with high penetration DER

## Guides for Testing & Application of Standard

- IEEE 1547.1-2020 – Conformance Test Procedures
- IEEE 1547.2-2023 – Application Guide for Implementing IEEE 1547-2018

## Guide for Cybersecurity & Interoperability

- IEEE 1547.3-2023 – Guide for Cybersecurity of DERs Interconnected with Area EPS

## Guides for Islanding and Impact Studies

- IEEE 1547.4-2011 – Guide for Islanded Systems. Revision in progress (PAR 2023)
- IEEE 1547.7-2013 – Guide to Conducting System Impact Studies. Revision in progress (PAR 2024)

## Guide for Energy Storage Systems (ESS)

- IEEE 1547.9-2022 – Guide for Using IEEE 1547 for Interconnection of Energy Storage DERs

# IEEE 1547 Evolution of Grid Support Functions



## IEEE 1547-2003

- Shall NOT actively regulate voltage
- Shall trip on abnormal voltage/frequency



## IEEE 1547a-2014 (Amendment 1)

- May actively regulate voltage
- May ride-through abnormal voltage/frequency
- May provide frequency response (frequency droop)



## IEEE 1547-2018

- Shall be capable of actively regulating voltage
- Shall ride-through abnormal voltage/frequency
- Shall be capable of frequency response
- May provide inertial response

# Implementation Challenges

## Technical Challenges

- Complex analysis required to determine the proper level of voltage, reactive power, and frequency control
- Testing and commissioning is more complex -- specialized skills and equipment are needed
- Ride-through capability requirements
- Legacy equipment limitations

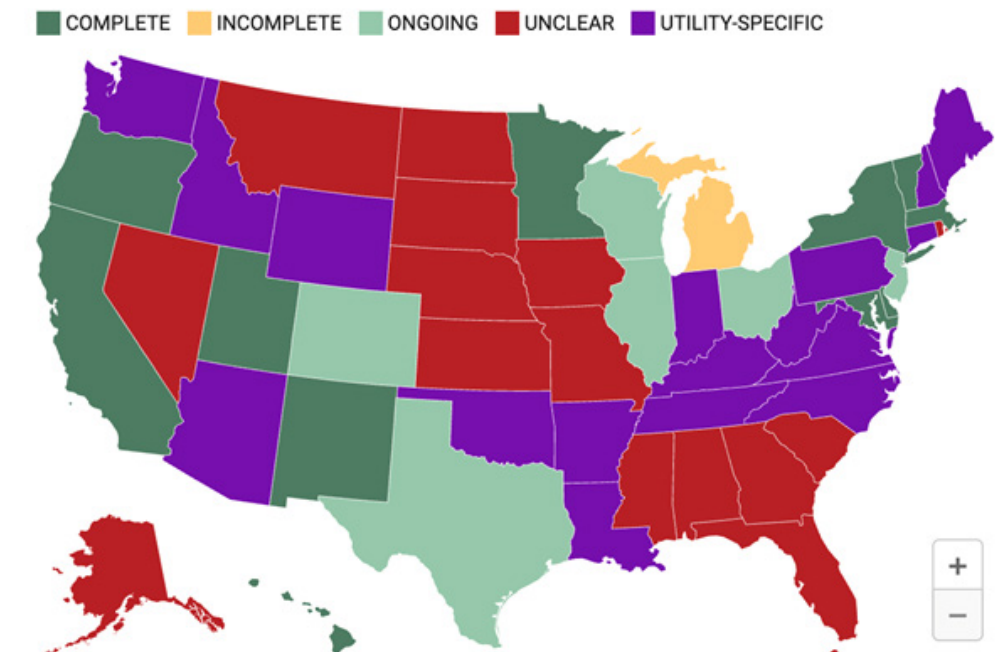
## Operational

- Interoperability challenges and cybersecurity risks
- Smaller utilities often lack expertise and infrastructure to ensure security and interoperability
- Ensuring settings are maintained or adjusted over time as the system changes

## Regulatory challenges

- Inconsistent adoption
- Cost recovery concerns across various regulatory agencies and wholesale markets
- Workforce training – bridging skill gaps, specialized knowledge

### Adoption Status of IEEE 1547-2018



Source: [IREC](#)

# IEEE P1547-20xx Revision

## Initial Focus Towards IEEE 1547 - 2026

*Integrate 2020 amendment*

*Fixes from 1547 adoption*

*Fixes from UL 1741 SB revisions*

*Promote selected P1547.9 guidance to requirements*

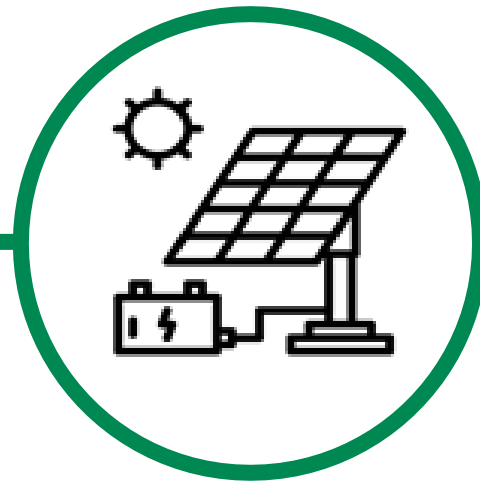
*Fixes for V2G commissioning procedures (as it pertains to the base 1547 standard and not 1547.1)*

*Promote selected P1547.3 guidance to requirements*

*Add recommended DER settings file format based on EPRI working group recommendations*

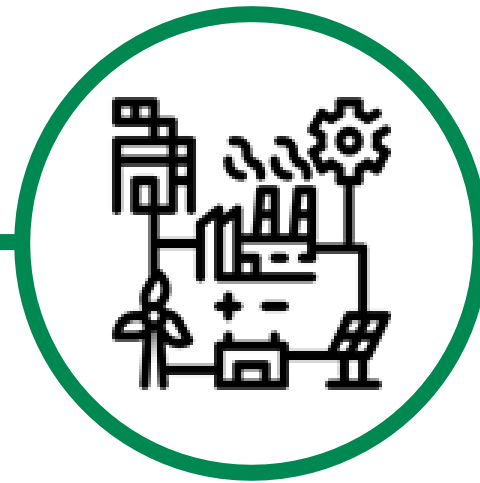
*Remove barriers for Grid Forming Inverters (GFM)*

# Evolution of IBRs from Distribution to Transmission



## SOLAR GROWTH

As solar grew, plants >10 MVA began connecting directly to the transmission system.



## RIDE-THROUGH DISTURBANCES

More MW on grid, heightened focus on keeping facilities online.



## RESOURCE MANAGEMENT CHANGES

Increased focus on transmission-level IBRs led to changes in how these resources are handled.



## IEEE 2800-2022

Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems.



# Summary

## Cooperative Business Model

### *Mission*

*Focused, member-driven; powering 56% of the nation's landmass.*

## Reliability & Resilience

*DERs don't inherently improve reliability, but co-ops are implementing measures and standards to ensure they **do not compromise grid stability**.*

## Standards & Best Practices

*Accelerating adoption of IEEE 1547 series and related guides (testing, application, cybersecurity).*

*Addressing challenges like inadvertent export, interoperability, and emerging technologies (grid-forming inverters, V2G, energy storage).*

## NRECA Support

*Providing tools and collaboration platforms: DG Toolkit, REWIRED, Cybersecurity Risk Management, and CESIG to help co-ops navigate technical, regulatory, and cybersecurity challenges.*

## Collaboration for Reliability

*Influencing standards development and promoting evidence-based practices that balance safety, reliability, and local flexibility.*

# Thank you

*Questions? Contact.*

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