

GMLC Technical Assistance to States

DER Interconnection Workshop #2

NREL Team: Michael Ingram, David Narang and Xiang Li

Guest Speakers: Brian Lydic, Andy Hoke, Michelle Rosier, and Derek Duran

Presented 03/08/2023

Agenda: Modern DER Capabilities and Deployment Considerations



- Introduction and background (Michael Ingram, 5 min)
- **Brian Lydic:** What decisions need to be made and by whom? (45 min + 15 min Q&A)
 - 5 min break
- **Andy Hoke:** What are DERs and how can they be used? (45 min + 15 min Q&A)
 - 5 min break
- **Michelle Rosier and Derek Duran:** Lessons learned (45 min + 15 min Q&A)
- **Michael Ingram:** Summary of Educational Resources and Activities + Wrap-up (15 min)

Workshop Goals



1. Increase awareness of existing materials & support to help state PUCs move forward on DER interconnection activities
2. Help participants make connections to colleagues with similar challenges (and solutions!)
3. Help GMLC/NREL project team understand context and implementation challenges

Workshop Origin: GMLC Technical Assistance to State Public Utility Commissions

Purpose: Provide customized support on issues specific to state's needs and unique situation

Approach: Work with awardees on content and delivery method to maximize the efficacy of the TA

Budget/Scope: \$2.25M across 37 different technical engagements, in over 20 states.

Equity & Justice

Grid Planning

Utility
Ratemaking

DER Adoption & Integration

DER Adoption

Interconnection
Process

Hosting Capacity

Utility
Regulation

Grid Planning

Integrated
Resource

Comprehensive
System

Load Forecasting

Resilience

Microgrids

Regulation &
Policy

Utility Regulation

Performance
Based
Ratemaking

NREL at-a-Glance



2,926



More than
900



Workforce, including
219 postdoctoral researchers
60 graduate students
81 undergraduate students

World-class
facilities, renowned
technology experts

Partnerships
with industry,
academia, and
government

Campus
operates as a
living laboratory



Renewable Power

Solar
Wind
Water
Geothermal



Sustainable Transportation

Bioenergy
Vehicle Technologies
Hydrogen



Energy Efficiency

Buildings
Advanced Manufacturing
Government Energy Management



Energy Systems Integration

Grid Integration
Hybrid Systems
Security and Resilience

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Summary of Educational Resources and Activities

Topic Highlight

NREL's IEEE 1547-2018 Resources Website

nrel.gov/grid/ieee-standard-1547

An online platform with educational resources to aid stakeholders in the successful adoption and implementation of IEEE 1547-2018.

Sponsored by:
Solar Energy Technologies Office

Partners and Advisors:

- Sandia National Laboratories
- Institute of Electrical and Electronics Engineers
- Electric Power Research Institute
- National Association of Regulatory Utility Commissioners
- National Rural Electric Cooperative Association
- Interstate Renewable Energy Council
- Regulatory Assistance Project
- Western Interstate Energy Board




Illustration by Fred Zietz, NREL

NREL's well-catalogued and publicly accessible online platform includes **presentations, industry white papers, and topic-specific NREL technical reports for utilities, states, solar developers, transmission operators, and other stakeholders.**

Resources on the Site

IEEE 1547-2018 Resources



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Educational Materials

Learn about the revised Institute of Electrical and Electronics Engineers Standard 1547-2018 (IEEE Std 1547-2018) through these educational materials, which include webinars, white papers, and other resources.

The revised version features new concepts and new technical requirements, which enable the use of modern distributed energy resources to improve performance of the electric grid during day-to-day operations and improve grid resilience during abnormal grid conditions.

The revised standard was published in April 2018 and is now [available from IEEE](#). Qualified parties may [request a discounted copy](#).

Show 10 entries

Search:

Educational Resource	Publication Date	Resource Type
Background Information on the Protection Requirements in IEEE Std 1547-2018 (Mahmud, Ingram) This NREL report provides informative material on the requirements related to electrical protection in IEEE Std 1547-2018 as well as context and background to improve understanding and use of the requirements specified.	2022	Report
A Primer on the Unintentional Islanding Protection Requirement in IEEE Std 1547-2018 (Narang et al.) This NREL report provides an introductory summary of the unintentional islanding protection requirements in the revised IEEE Std 1547-2018.	2022	Report
Overview of Functional Technical Requirements for Intentional Islands (Narang et al.) This NREL report provides informative material on the requirements related to intentional islands in Institute of Electrical and Electronics Engineers Standard 1547-	2022	Report

IEEE 1547-2018 Resources



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Suggested Reading

Suggested reading lists are available for stakeholders with roles in implementing Institute of Electrical and Electronics Engineers Standard 1547-2018.

The revised standard contains 11 chapters (clauses) and 8 annexes that comprise 136 pages. The revision is significantly different from the 2003 version, and it contains new concepts and new technical requirements. Each clause specifies information or requirements that apply to certain aspects important to the interconnection of distributed energy resources to the electric power system. Implementing the requirements necessitates a careful study of the underlying technical concept and requires the appropriate information to calculate relevant settings and configurations.

Suggested Reading Lists

[Authorities Governing Interconnection Requirements](#)

[Electric Power System Operators](#)

Portions of the standard are directed toward a specific audience that must possess specialized information and technical training to use and apply the requirements. These suggested lists of references provide an initial knowledge base of information to help stakeholders wishing to implement the standard.

Full List of Publications

See the full list of [educational materials](#).

nrel.gov/grid/ieee-standard-1547

NREL's Guide for Updating Interconnection Rules

A Guide to Updating Interconnection Rules and Incorporating IEEE Standard 1547-2018 presents a structured, step-by-step approach to help governmental authorities that oversee interconnection requirements and other stakeholders develop and update interconnection rules. The NREL-published report considers the incorporation of the new standard from both process and technical standpoints.

- Three main sections to report:



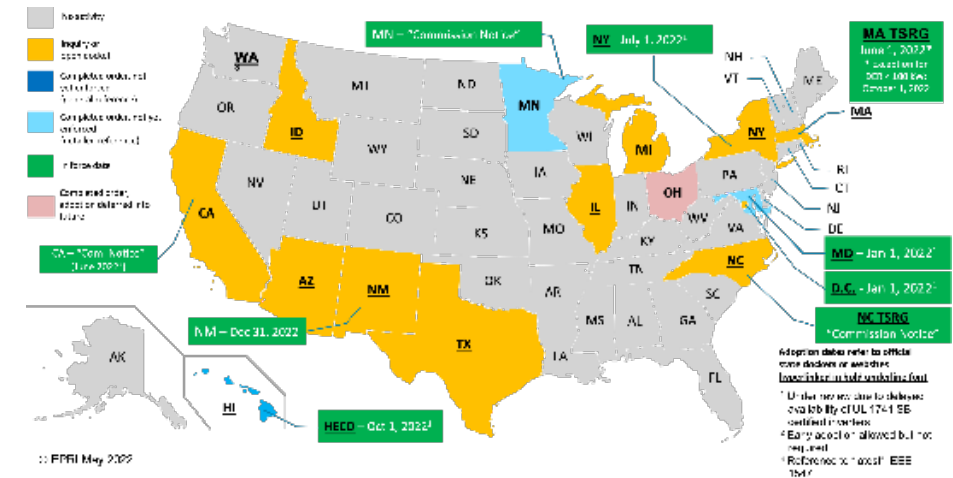
- Key considerations include:
 - Has the governing authority sufficiently identified motivations for updating the interconnection rule? How do the identified technical requirements relate to the desired outcome?
 - Has the governing authority allowed for the use of DER capabilities (even if they are to be used in the future)?

Any state or local jurisdictions that are interested in adopting IEEE Standard 1547-2018 should consult this resource!

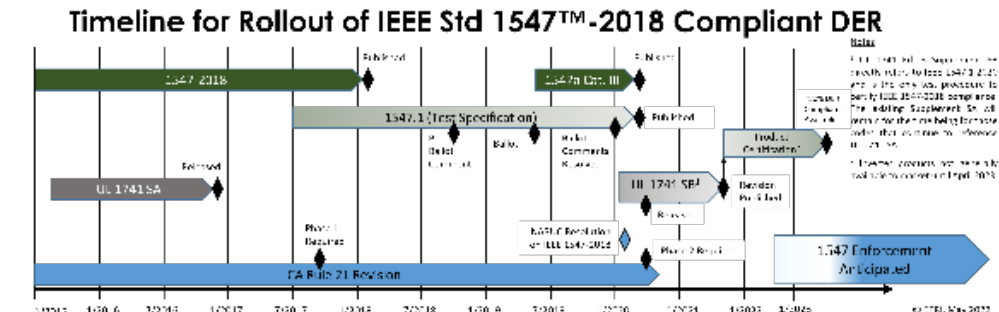
Find the full report on NREL's IEEE Resource Website or at nrel.gov/docs/fy22osti/75290.pdf.

IEEE Standards Coordinating Committee 21 (SCC21) Resources and Outreach

- **Public web site on IEEE Std 1547** <http://sites.ieee.org/sagroups-scc21/standards/1547rev/>
 - Discount/free copies of the standard for select stakeholders (e.g., regulators)
 - Education and training/reading material – papers, webinars
 - “approved” presentation content for SMEs
 - Catalog of ISO/RTO T&D coordination activities
 - State activity map (maintained ~ quarterly)
 - Inverter rollout timeline (“regularly” maintained)
- **Informal industry/stakeholder coordination calls (quarterly)**
- **Coordination with other IEEE societies, committees & related standards (constant)**

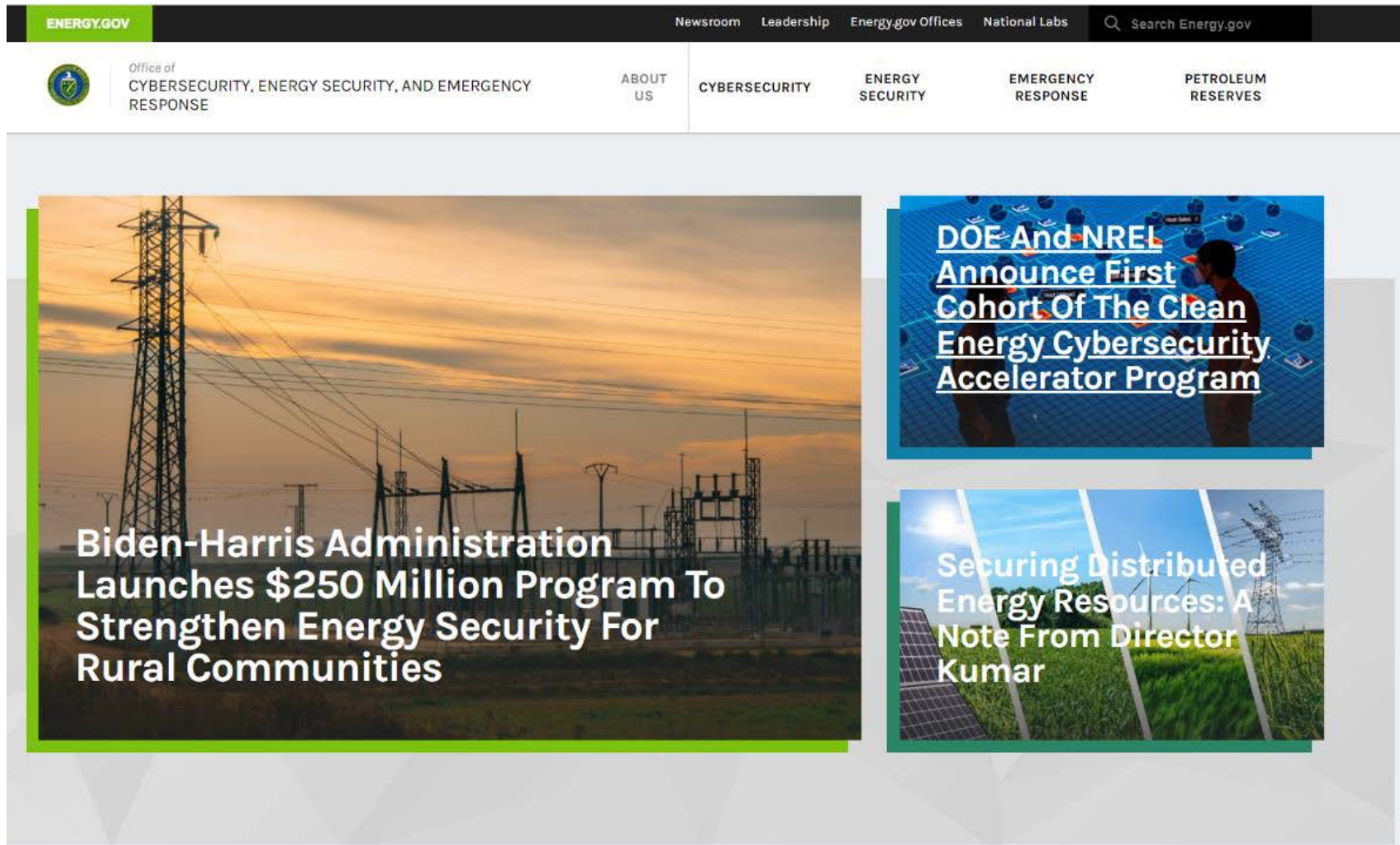


State activity map



Inverter rollout timeline

Cybersecurity



<https://www.energy.gov/ceser/office-cybersecurity-energy-security-and-emergency-response>

Other activities:

<https://www.nist.gov/programs-projects/cybersecurity-smart-grid-systems>)

<https://sunspec.org/cybersecurity-work-group/>



**INTERCONNECTION
INNOVATION e-XCHANGE**
U.S. DEPARTMENT OF ENERGY

Website:
energy.gov/i2X

an EERE collaboration between SETO & WETO

i2X Technical Assistance

Goal: To provide access to various interconnection technical assistance opportunities to support our partners in their implementation of developed reforms

- **Interconnection Office Hours - Fridays**
 - Direct Access to i2X Leadership
 - **“consultation” phone calls available to any interconnection stakeholder**
- **Preliminary i2X Working Groups**
 - Energy Justice Working Group
 - **IEEE 1547-2018 Adoption Support Working Group**
 - Experienced Peer Learning Webinar Series
- **Additional Topics For Consideration**
 - Implementing Queue Management Methods
 - Accelerated Tool Development and Deployment
 - Best Practices and Training
- Others? - **Suggest a topic!**

Next for us

Workshop #3: Improving the Interconnection Process

Focus on approaches to establish or improve process-related elements.

Cohort members placed high priority on the following subtopics:

- Benefits of preapplication processes
- Screening processes for different sized utilities and DERs
- Establishing minimum requirements for various sizes of DERs
- Interconnection application automation
- Improving interconnection timelines
- Metrics, enforcement and reporting
- Data access and privacy

Help Us Prioritize Workshop 3 Topics

<https://app.sli.do/event/w4ifbMMifoivzyw35gWXXe>

Thank You

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www.nrel.gov

NREL/PR-5D00-85557



National Renewable Energy Laboratory – Golden, Colorado

Photo: Dennis Schroder

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Discussion

www.nrel.gov

