



Abbreviated Final Technical Report: Stakeholder Training for IEEE 1547-2018

David Narang and Michael Ingram

National Renewable Energy Laboratory

**NREL is a national laboratory of the U.S. Department of Energy
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National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, CO 80401
303-275-3000 • www.nrel.gov

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Final Technical Report (FTR)

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f. Principal Investigator (PI)	David Narang Principal Engineer David.Narang@nrel.gov	
g. Business Contact (BC)	Jeff Cook Program Lead Jeff.Cook@nrel.gov	
h. Certifying Official (if different from the PI or BC)	N/A	

David Narang

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Signature of Certifying Official

Date

1. **Acknowledgement:** This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the **Solar Energy Technologies Office (SETO) Award Number 34808**.
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3. **Project Summary:** The revised Institute of Electrical and Electronics Engineers (IEEE) 1547, Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces (IEEE Std 1547-2018), was published in April 2018. This standard is one of the foundational documents in the United States needed for integrating distributed energy resources (DERs), including solar energy systems, with the electric distribution grid.

The new standard is significantly different than the previous 2003 version, contains new concepts and new technical requirements, and requires educational material on the application of these changes. NREL had a principal role in accelerating the revision process through its chairmanship of the IEEE 1547 working group to revise the standard and through technical support provided to the working group.

Under this project, NREL and its partners compiled and developed educational materials for IEEE Std 1547-2018 and made them publicly available. Materials included webinars, white papers, and other resources on topics related to the standard.

4. **Project Objectives and Outcomes:** The project's overarching objective was to identify and make publicly available educational material to assist stakeholders in adopting the revised IEEE 1547 standard.

Early in the project, NREL formed a Technical Education Committee (TEC) of stakeholders to advise on project work products, assist with identifying topics where more educational materials are needed, provide reviews of newly developed materials, and coordinate on outreach activities to avoid duplication of efforts. NREL coordinated with the TEC and SETO to execute the project deliverables. Major outcomes of the project included the following:

- Design and publication of an online platform to disseminate and publicize educational materials on IEEE Std 1547-2018. These include resources developed under the project as well as resources developed by project partners and other authoritative entities. 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. As part of an outreach effort, NREL leveraged a variety of social media channels and direct outreach mailings, including posts in NREL's *ESI Newsletter*, NREL's *Solar Market Research & Analysis Newsletter*, and on NREL's Twitter, Facebook, and LinkedIn social media platforms.
- Compilation, development, and publication of a series of seven educational white papers based on gap analysis and prioritization of topics conducted early in the project.
- Development and publication of a guide to aid state regulators in the adoption of IEEE Std 1547-2018. The *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.
- Delivery of over 10 presentations on the educational materials at in-person and virtual conferences and venues targeted to various stakeholders, including state regulators.

5. Path Forward:

Moving forward, the NREL team plans to leverage the IEEE Std 1547 Resources website and catalog of resources to extend stakeholder education and outreach to other projects, such as Interconnection Innovation e-Xchange (i2X). In addition, stakeholder outreach tools and methods developed under this project will be applied to future technical assistance efforts. The website will be maintained with the addition of new educational resources as relevant publications become available.

6. Inventions, Patents, Publications, and Other Results:

Websites/videos:

- A public website for disseminating educational materials and providing suggested reading lists by stakeholder: <https://www.nrel.gov/grid/ieee-standard-1547/>
- A whiteboard video hosted on NREL's YouTube account to provide an engaging overview of the educational project and promote traffic to the website from social media: <https://www.youtube.com/watch?v=tFYHagzMKZc>.

Technical reports:

- Narang, David, Sigifredo Gonzalez, Michael Ingram, and Michael Ropp. 2022. *Overview of Functional Technical Requirements for Intentional Islands*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-83301. <https://www.nrel.gov/docs/fy23osti/83301.pdf>.
- Mahmud, Rasel, and Michael Ingram. 2022. *Background Information on the Protection Requirements in IEEE Std 1547-2018*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-78704. <https://www.nrel.gov/docs/fy22osti/78704.pdf>.
- Narang, David, Sigifredo Gonzalez, and Michael Ingram. 2022. *A Primer on the Unintentional Islanding Protection Requirement in IEEE Std 1547-2018*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-77782. <https://www.nrel.gov/docs/fy22osti/77782.pdf>.
- Narang, David, Rasel Mahmud, Michael Ingram, and Andy Hoke. 2021. *An Overview of Issues Related to IEEE Std 1547-2018 Requirements Regarding Voltage and Reactive Power Control*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-77156. <https://www.nrel.gov/docs/fy21osti/77156.pdf>.
- Ingram, Michael, Rasel Mahmud, and David Narang. 2021. *Background Information on the Power Quality Requirements in IEEE Std 1547-2018*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-78751. <https://www.nrel.gov/docs/fy22osti/78751.pdf>.
- Ingram, Michael, Akanksha Bhat, and David Narang. 2021. *A Guide to Updating Interconnection Rules and Incorporating IEEE Standard 1547*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-75290. <https://www.nrel.gov/docs/fy22osti/75290.pdf>.
- Ingram, Michael, Rasel Mahmud, and David Narang. 2021. *Informative Background on the Interoperability Requirements in IEEE Std 1547-2018*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-77959. <https://www.nrel.gov/docs/fy21osti/77959.pdf>.
- Narang, David, Michael Ingram, Andy Hoke, Akanksha Bhat, and Shazreen Meor Danial. 2020. *Clause-by-Clause Summary of Requirements in IEEE Standard 1547-2018*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-75184. <https://www.nrel.gov/docs/fy20osti/75184.pdf>.

Conference proceedings, papers, and presentations:

- “Highlights of IEEE Standard 1547-2018,” presented to PJM Technical Workshop on DER Integration with IEEE Std 1547/1547.1 Standards, July 30, 2019. <https://www.nrel.gov/docs/fy20osti/75105.pdf>.
- “Highlights of IEEE Standard 1547-2018—Implementation Considerations,” presented at the Global Power System Transformation Consortium Webinar, August 26, 2021. <https://www.nrel.gov/docs/fy21osti/81028.pdf>.

7. **Project Team:**

- David Narang, principal investigator
- Michael Ingram, co-principal investigator
- Nika Durham, communications campaign and website project lead
- Ryan Ingwersen, communications campaign and outreach coordinator.
- Courtney Hausler, website specialist and writer
- Deborah Lastowka, video services consultant
- Postmodern Company, video contractor