IEEE 1547 Standard & Conformity Assessment

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The world’s largest professional association

Global Reach

- 426,000+ Members
- 160+ Countries
- 1,600+ Annual Conferences

Technical Breadth

- 39 Technical Societies
- 6 Technical Councils
- 3,500,000 Technical Documents
- 180+ Top-cited Periodicals

- Aerospace and Electronic Systems
- Antennas and Propagation
- Biometrics Council
- Broadcast Technology
- Circuits and Systems
- Communications
- Components, Packaging, and Manufacturing Technology
- Computational Intelligence
- Computer
- Consumer Electronics
- Control Systems
- Council on Electronic Design Automation
- Council on Superconductivity
- Dielectrics and Electrical Insulation
- Education
- Electron Devices
- Electromagnetic Compatibility
- Engineering in Medicine and Biology
- Geoscience and Remote Sensing
- Industrial Electronics
- Industry Applications
- Information Theory
- Instrumentation and Measurement
- Intelligent Transportation Systems
- Magnetics
- Microwave Theory and Techniques
- Nanotechnology Council
- Nuclear and Plasma Sciences
- Oceanic Engineering
- Photonics
- Power Electronics
- Power & Energy
- Product Safety Engineering
- Professional Communications
- Reliability
- Robotics and Automation
- Sensors Council
- Signal Processing
- Social Implications of Technology
- Solid-State Circuits
- Systems, Man, and Cybernetics
- Systems Council
- Technology and Engineering Management
- Ultrasonics, Ferroelectrics, and Frequency Control
- Vehicular Technology
Standards

Some Areas Covered
- Interoperability
- Networking and Communications (including the home)
- Cyber Security
- Substations Automation
- Distribution Automation
- Renewables
- AMI
- Power Quality and Energy Efficiency
- Electric Vehicles
IEEE-SA provides industry a framework of solutions to ensure rapid introduction of new technologies to market.
Enabling Consumer Connectivity Through Consensus Building

Smart Grid into Home Devices Standards
- IEEE 1675 / IEEE 1775
- IEEE 2030 / IEEE P2030.1
- IEEE 1901 / IEEE P1901.2
- IEEE 1815

Home Networking Standards
- IEEE 802
- IEEE 1901
- IEEE P1901.2
- IEEE 1815

Smart Metering Standards
- IEEE P1377
- IEEE 1701
- IEEE 1702
- IEEE P1703
- IEEE P1704
- IEEE P1705

Smart Grid into Home Devices Standards
IEEE 1547 Series
(Distributed Energy Interconnection Solar, Wind, Storage, etc.)
IEEE 2030

Home Networking Standards
IEEE 802 / IEEE 1901
IEEE P1901.2 / IEEE P1905.1
(Communication Inside the Home)

Electric Vehicle Standards
IEEE 802 Series / IEEE 1901
IEEE P1901.2 / IEEE 1609 Series
(Vehicular Communications)
IEEE 2030 / IEEE P2030.1

IEEE STANDARDS ASSOCIATION
IEEE 1547 Standards for Integration of Distributed Energy Resources (DER)

SCC21 Chair and P1547 Chair: Thomas (Tom) Basso*

*National Renewable Energy Laboratory
Distributed Energy Resources Interconnection

**Distributed Energy Resources**
- Fuel Cell
- PV
- Microturbine
- Wind
- Energy Storage
- PHEV; V2G
- Generator

**Interconnection Technologies**
- Inverter
- Switchgear, Relays, & Controls

**Functions**
- Power Conversion
- Power Conditioning
- Power Quality
- Protection
- DER and Load Control
- Ancillary Services
- Communications
- Metering

**Electric Power Systems**
- Utility System
- Microgrids

**Loads**
- Local Load Simulators
**Objective**

Facilitate evolution of the electric power system infrastructure to a smarter grid including integration of renewable energy resources by supporting the development of standards and best practices.

**Approach**

Provide leadership to accelerate distributed energy resources (DER) interconnection, interoperability, and integration standards and validation. E.g., IEEE SCC21 1547 & 2030 standards, the NEC, and UL 1741, For background see www.nrel.gov; Technical report: NREL/5D00-63157; Standards for DER -- IEEE 1547 (Interconnection) and IEEE 2030 (Interoperability); Basso, T.; Nov. 2014
4.0 Interconnection Technical Specifications and Requirements:

- General Requirements
- Response to Area EPS Abnormal Conditions
- Power Quality
- Islanding

5.0 Test Specifications and Requirements:

- Type Test/Safety Listing
- Production Tests
- Commissioning Tests
- Periodic Interconnection Tests
4.1.1 Voltage Regulation

... DER allowed to change its output of active and reactive power.

3. (Response to abnormal grid ...) Voltage

... DER allowed to “ride through” abnormalities of grid voltage;
... grid and DER operators can mutually agree to other voltage trip and clearing time settings

4. (Response to abnormal grid ...) Frequency

... DER allowed to provide modulated power output as a function of frequency
... grid and DER operators can mutually agree to other frequency trip and clearing time settings
IEEE1547.1 CASC Key Focus

The following constitute the key goals and activity focus of the 1547.1 CASC:

- Converge on program structure (methods, sequence, documentation) for the certification of DER for safe and controlled interconnection with the Area EPS.
- Act as advisors on test methods and interpretation of standards,
- Define the Test Lab requirements and audit processes,
- Test Tool Validation, Validate Test Report template,
- Determine and stimulate demand drivers that will rapidly mature the commercial processes, Communicate and collaborate with industry.
- Leverage and harmonize with other industry standards for DER integration initiatives, e.g. IEEE 2030, SAE2847, UL1741, SGIP PAP24, IEC61850, etc.
IEEE 1547.1 CASC Consortium Logic
“How Do We Align Mutual Interests?”

Utility Industry
(Wholesale, Retail)

OEM Providers

Gov’t Policy/Reg

Test Labs

University R&D
• IEEE-SA is developing and implementing the Conformity Assessment program for its sponsored **IEEE 1547** Standard, providing certification of applicable Distributed Energy Resource (DER) designs and implementations that utilize Point of Common Coupling (PCC) interconnection to the local utility’s electric distribution system.

• The standard applies to those DER subsystems that are normally connected to the utility electric distribution system and may be decoupled (i.e. islanded) or otherwise managed as energy resources behind a micro grid.

• This IEEE 1547 standard development initiative is utilizing a **Conformity Assessment Steering Committee – Accelerated Deployment Effort (CASCADE)** with the purpose of enabling more effective translation of evolving standards requirements into actionable test methods, which will reduce industry uncertainty and raise adoption of DER.
IEEE 1547.1 CASCADE Pilot: Raleigh NC
“How Do Pursue Agile Conformity Testing?”

Duke’s long-range hopes for this grand experiment in multi-vendor interoperability are twofold, he said. “The first goal is to promote interoperability between devices. The second is for Duke to find out if we can potentially offer microgrid services in the future.”
1547.1 CASCADE Prototype Readiness:

**System Setup**
- Agreements Signed
- Inverters Selected
- Inverters Installed
- Software Installed
- Circuits and Sensors Activated

**Test Plan**
- 1547.1 Document Distributed
- Pilot Scenarios defined
- Test Plan compiled
- Testing scheduled
- Witness Engineer Resource
- Reporting format established

CASCADE Prototypes seeks to align synergistic partners from the Utility, OEM, Academic and Testing communities to build facilities which will allow execution of developing test protocols that can verify conformance to substantial portions of the IEEE1547 standard.
IEEE 1547.1 CASCADE Test Plan

More Prototype Tests Under Consideration
- NextEra/FPL for Utility Solar
- NY REV for Urban Microgrid (TE?)
- PGE for Transactive Energy
- DC ??
- International? (Korea, India, EU...)
Emerging “App”: **Transactive Energy**

Design Concept: **Transactive Energy**

**Vision:** The “grid of people” who manage the “grid of things”

- **Energy Services Parties**
  - Consumers
  - Producers
  - Prosumers
  - Storage Owners

- **Transport Services Parties**
  - Transmission Operators (TO)
  - Distribution Operators (DO)

- **Transactive Energy Platforms**
  - 1547

- **Intermediaries**
  - Exchanges
  - Marketers
  - Retailers
  - System Operators
  - Automated Market Makers

- **Tenders and Transactions**
  - 2030
Implementation: **Transactive Energy**

Retail platforms and tariffs work with current wholesale platforms and distribution operators.

- **Consumers, Prosumers, and DERs**
  - Service Interface
  - Device

- **Tenders and Transactions**
  - One year
  - One month
  - One hour
  - Five minutes

- **Retail TE Platforms**
  - Distribution Transport
  - Energy

- **Interoperable Transactive Retail Tariffs**

- **Existing Distribution Operators**
- **Existing Wholesale Platforms**
  - Wholesale Parties
  - Forwards and Futures
  - Balancing Operators

- **Apps**
- **1547**
- **2030**
Thank You!
IEEE Standards Association
http://standards.ieee.org/

Bill handles all of the Smart Grid related standards development initiatives

Ravi handles the Conformity Assessment certification process for applicable IEEE standards