IEEE 1547 Standard & Conformity Assessment

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Conformity Assessment Program Director

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The world's largest professional association

Advancing Technology for Humanity

Global Reach

426,000+ Members

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1,600+ Annual Conferences

Technical Breadth

39 Technical Societies
6 Technical Councils

3,500,000 Technical Documents

180+ Top-cited Periodicals

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- 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
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- Dielectrics and Electrical Insulation
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- Electron Devices
- Electromagnetic Compatibility
- Engineering in Medicine and Biology
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- Industry Applications
- Information Theory
- Instrumentation and Measurement
- Intelligent Transportation Systems
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- Nanotechnology Council
- Nuclear and Plasma Sciences
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- Power Electronics
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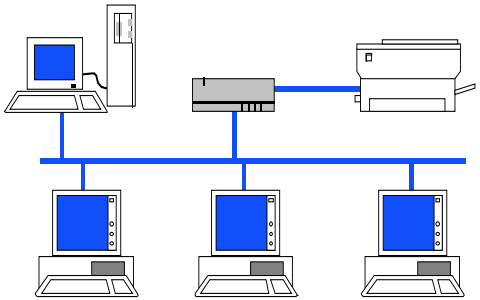
- Product Safety Engineering
- Professional Communications
- Reliability
- Robotics and Automation
- Sensors Council
- Signal Processing
- Social Implications of Technology
- Solid-State Circuits
- Systems, Man, and Cybernetics
- Systems Council
- Technology and Engineering Management
- Ultrasonics, Ferroelectrics, and Frequency Control
- Vehicular Technology

Standards

Some Areas Covered

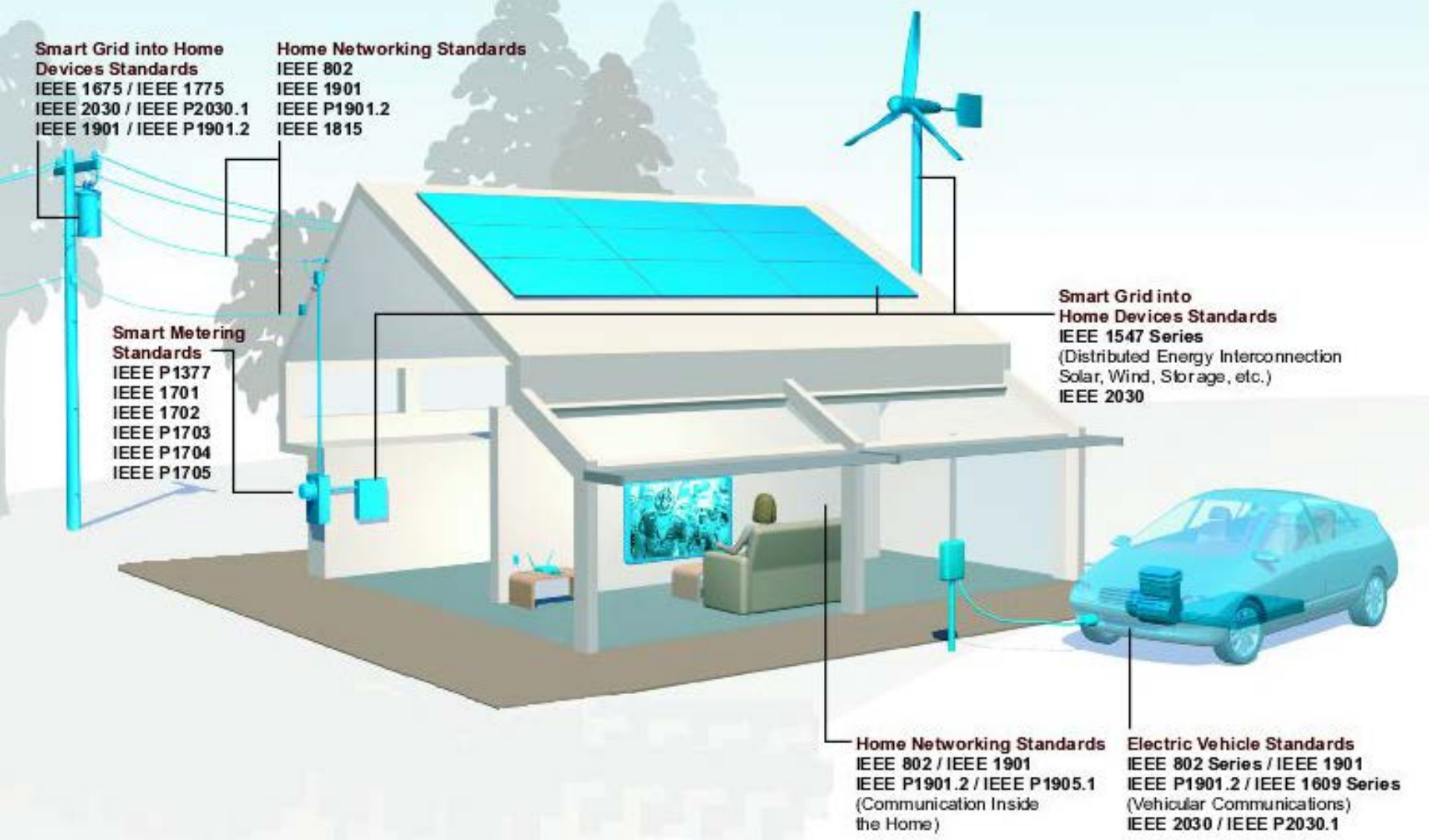
- Interoperability
- Networking and Communications (including the home)
- Cyber Security
- Substations Automation
- Distribution Automation
- Renewables
- AMI
- Power Quality and Energy Efficiency
- Electric Vehicles



Complete Business Lifecycle

IEEE-SA provides industry a framework of solutions to ensure rapid introduction of new technologies to market

Enabling Consumer Connectivity Through Consensus Building



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

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

*National Renewable Energy Laboratory

IEEE Advancing Technology for Humanity

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

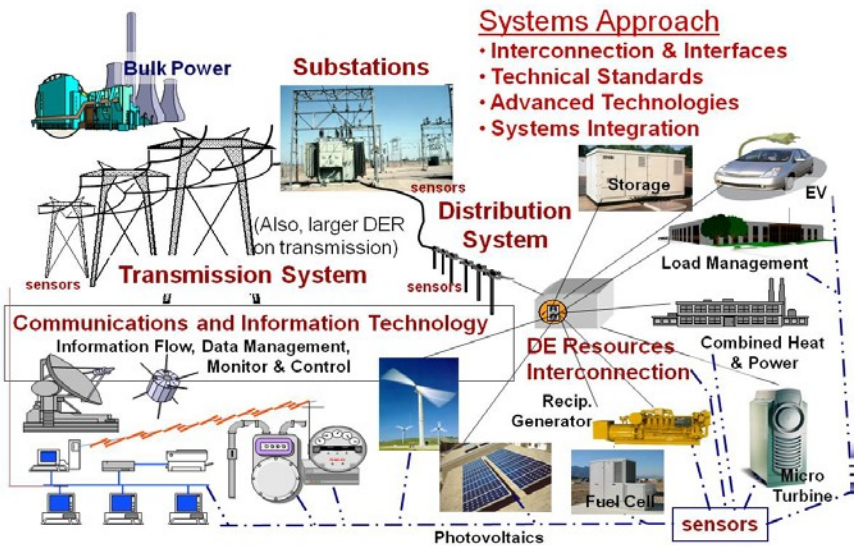
Local Load Simulators

Interconnection & Interoperability Standards

(NREL Work funded by U.S. DOE)

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

IEEE SCC21 1547 Series of Standards

IEEE Std 1547™(2003 and 2014 Amendment 1) Standard for Interconnecting Distributed Resources with Electric Power Systems

IEEE Std P1547™(full revision) Draft **Standard** for Interconnection and **Interoperability** of Distributed **Energy** Resources with **Associated** Electric Power Systems **Interfaces**

IEEE Std 1547.1™(2005 and 2015 Amendment 1) Standard for Conformance Tests Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems

IEEE Std P1547.1 (full revision) Draft **Standard** for Conformance Tests Procedures for Equipment Interconnecting Distributed **Energy** Resources with Electric Power Systems **and Associated Interfaces**

Note:
IEEE Std 2030.2 was published Jun 2015

IEEE Std 1547.2™(2008) Application Guide for IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems

IEEE Std 1547.3™(2007) Guide for Monitoring Information Exchange, and Control of Distributed Resources with Electric Power Systems

IEEE Std 1547.4™(2011) Guide for Design, Operation, and Integration of Distributed Resource Island Systems with Electric Power Systems

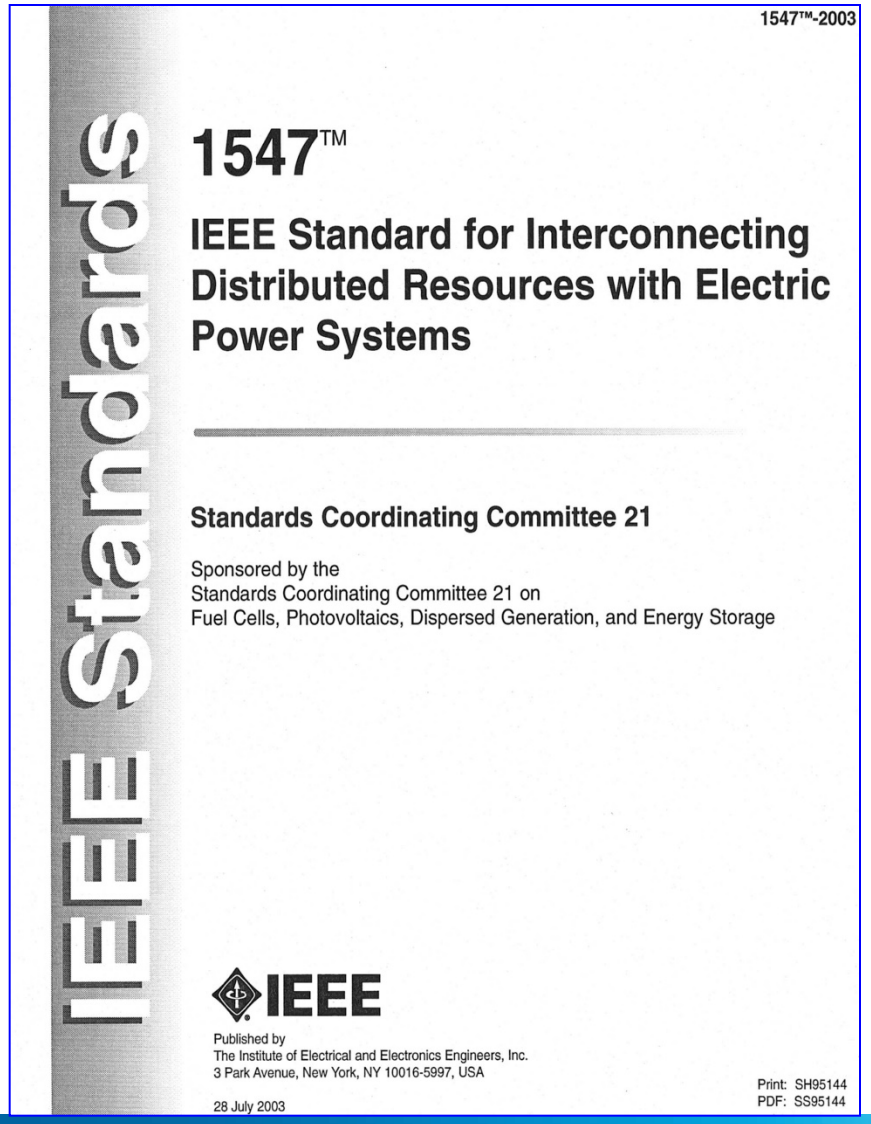
MicroGrid >>

IEEE Std 1547.6™(2011) Recommended Practice for Interconnecting Distributed Resources with Electric Power Systems Distribution Secondary Networks

IEEE Std 1547.7™ (2013) Guide to Conducting Distribution Impact Studies for Distributed Resource Interconnection

IEEE Std P1547.8™ Draft **Recommended Practice** for Establishing Methods and Procedures that Provide Supplemental Support for Implementation Strategies for Expanded Use of IEEE Std 1547-2003

Two-Levels SG System Architecture



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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**

IEEE Std 1547a – Amendment 1, May 2014

(Amendment 1: revisions to 4.1.1, 4.2.3, and 4.2.4)

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.

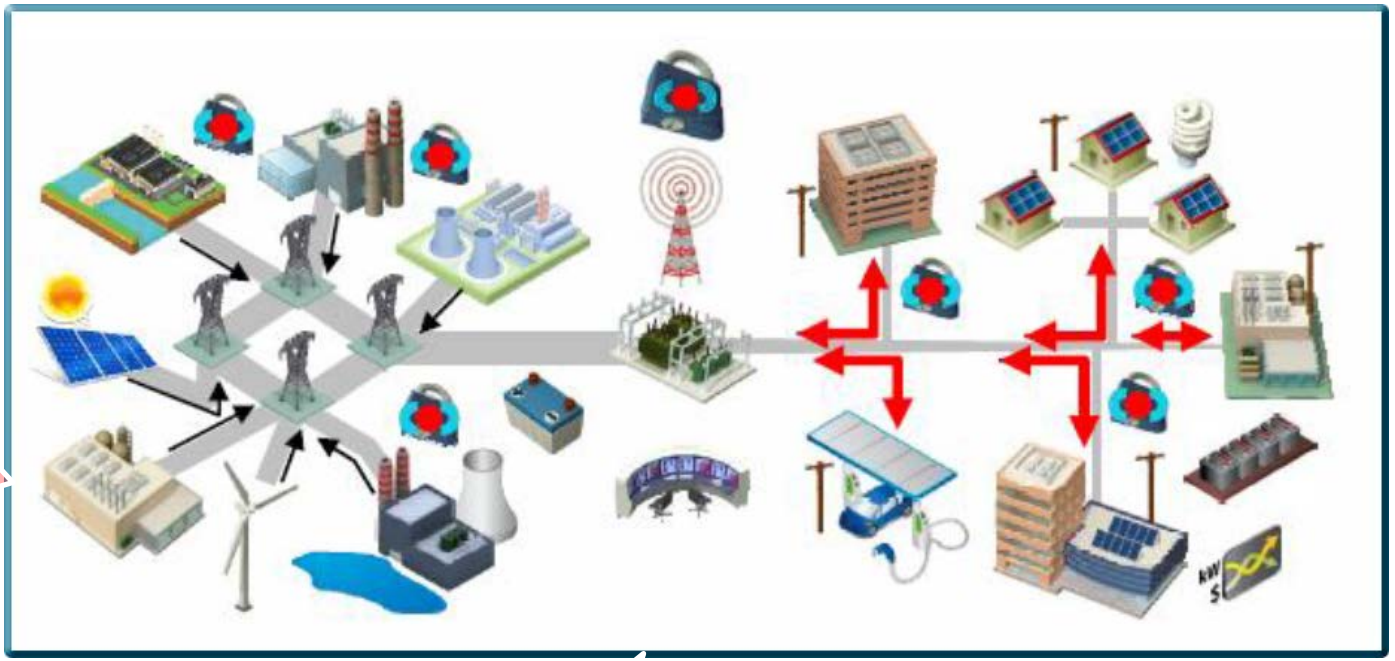
IEEE 1547.1 CASC Consortium Logic

"How Do We Align Mutual Interests?"

Utility Industry
(Wholesale, Retail)

OEM Providers

Gov't Policy/Re



Test Labs

University R&D

Adobe Acrobat Document

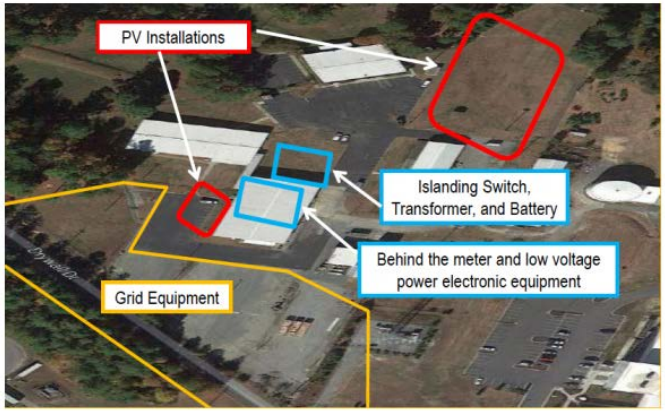
IEEE1547.1 CASCADE

- 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 **C**onformity **A**ssessment **S**teering **C**ommittee – **A**ccelerated **D**eployment **E**ffort (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?"

ABB FREEDM systemscenter DUKE ENERGY.



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

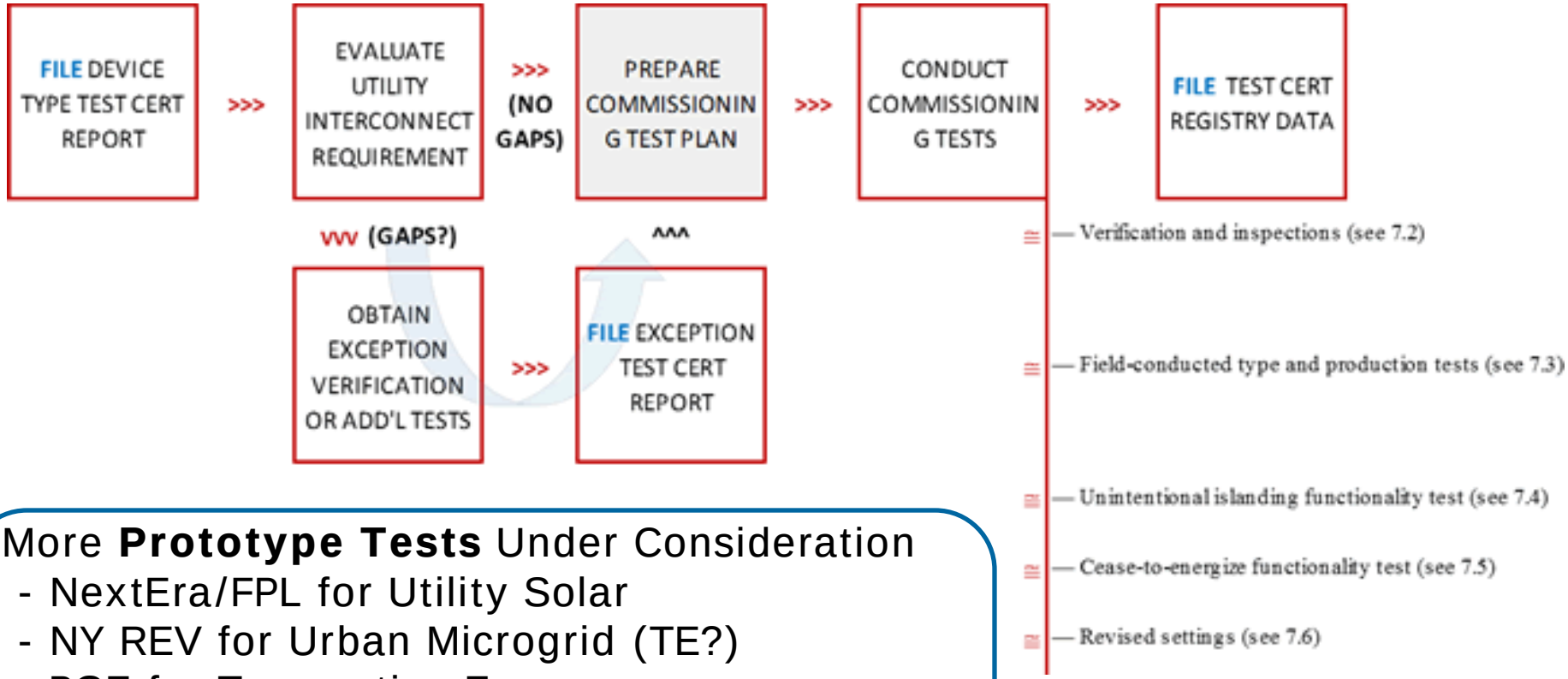
- Agreements Signed
- Inverters Selected
- Inverters Installed
- Software Installed
- Circuits and Sensors Activated

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

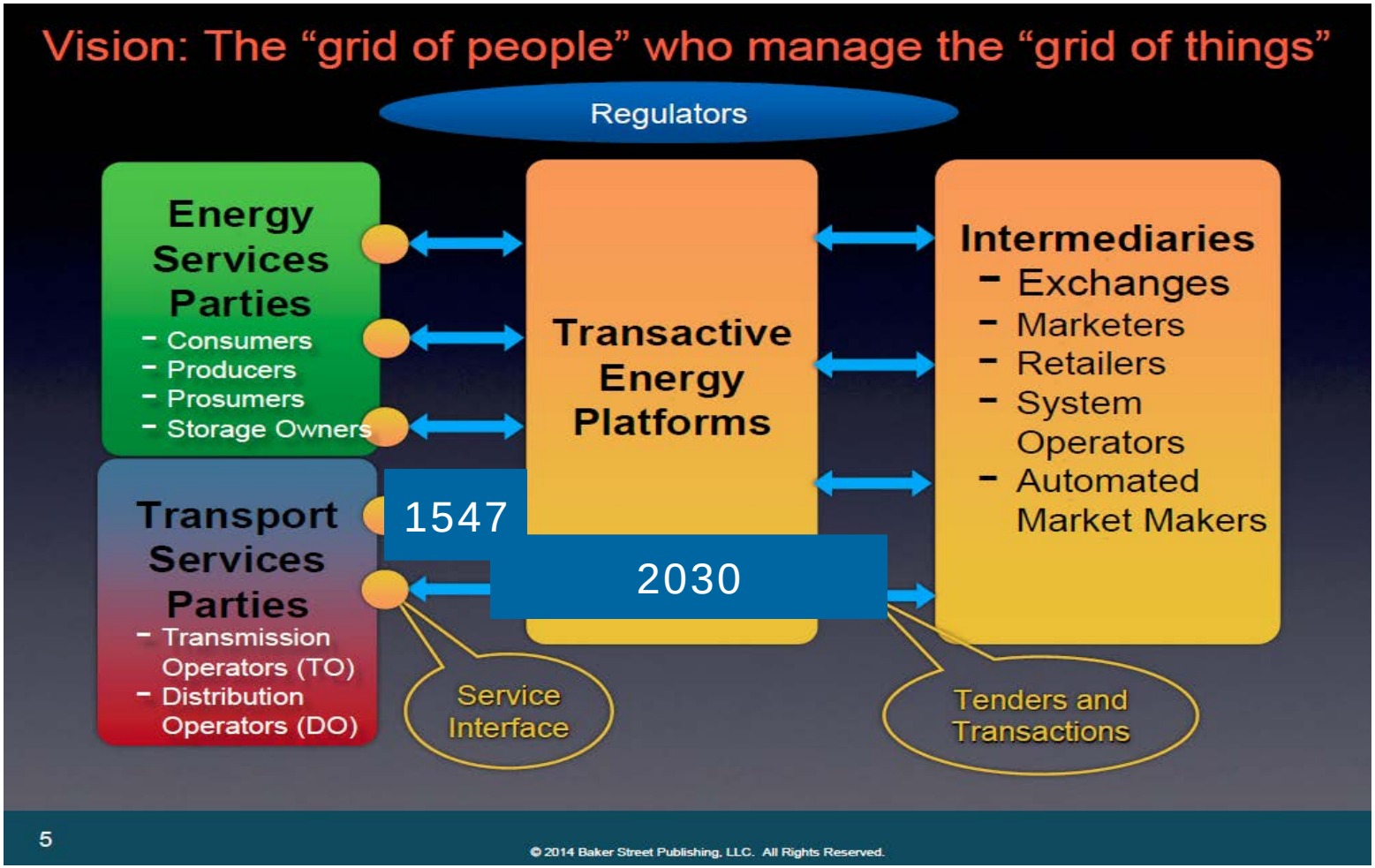
http://www.nist.gov/smartgrid/techallenge.cfm

Apps Apps

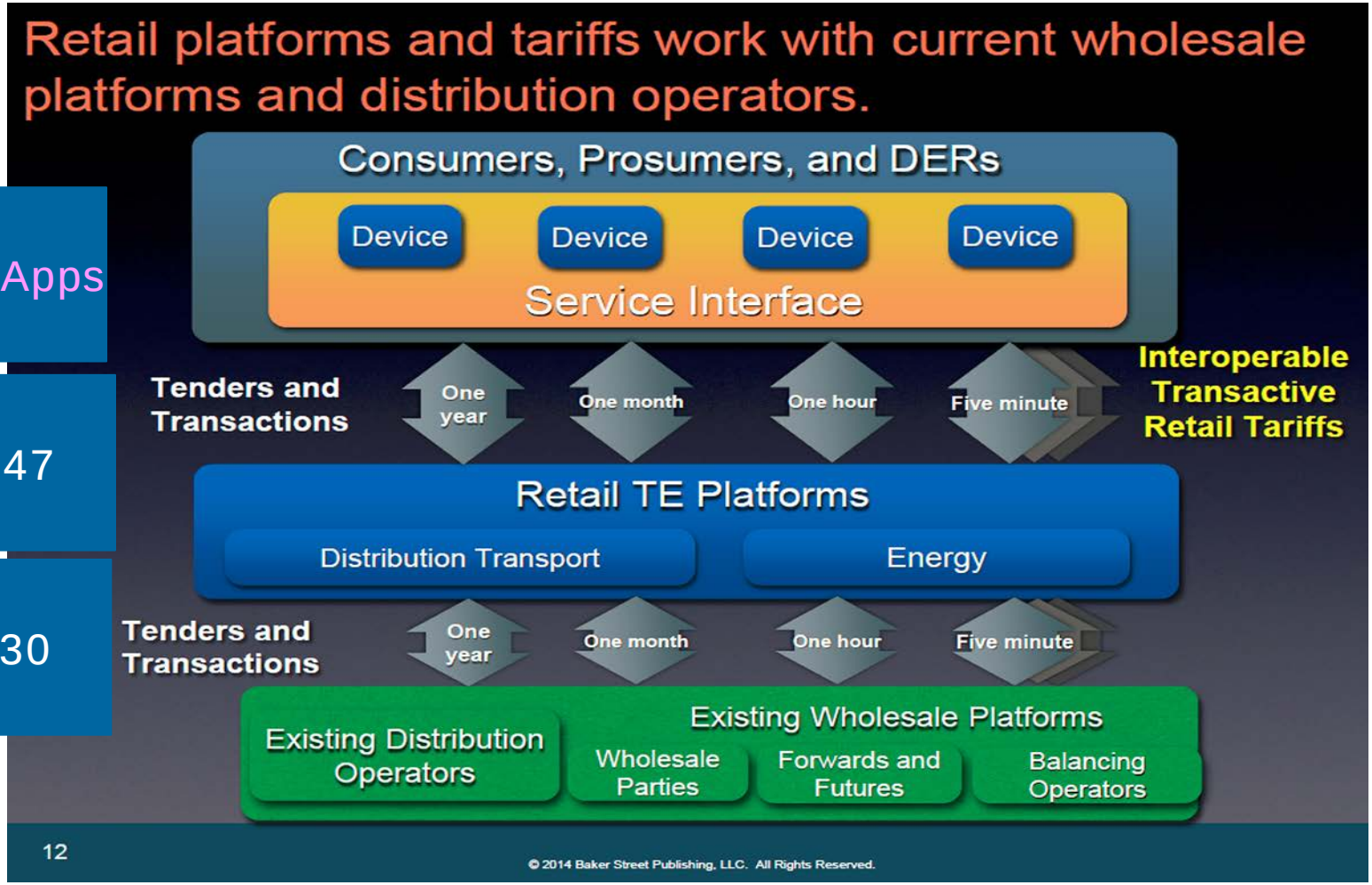
2030

1547

Design Concept: Transactive Energy



Implementation: Transactive Energy



Apps Apps

1547

2030

Thank You!

IEEE Standards Association

http://standards.ieee.org/

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Bill handles all of the Smart Grid related standards development initiatives

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Ravi handles the Conformity Assessment certification process for applicable IEEE standards