IEEE 2030® Smart Grid Interoperability Standards

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CCSA and IEEE-SA
What is Smart Grid?

Source: U.S. National Institute of Standards and Technology (NIST)
Need for Global Smart Grid Standards

- Smart grid standards will extend across the entire grid i.e., need interoperability standards (top down) and building block standards (bottom up)

- Smart grid equipment standards needed to handle information data management, communications and control

- Flexible smart grid system – interoperability, design, and operational standards will allow near term and long term smart grid evolution

- Development of a body of interoperability smart grid standards is essential for smart grid to operate
IEEE 2030® Spans Three Distinct Perspectives

Designed for and developed by:

- **Power & Energy**
  Defines the numerous data flows necessary for reliable, secure, bi-directional flow of power and energy throughout the entire electric power system

- **Communications**
  Identifies the communications infrastructure necessary for smart grid, from high-speed synchrophaser data to in-premise meter and customer notification systems

- **Information Technology (IT)**
  Defines the system-to-system communications requirements and data flow to leverage individual systems into a system of systems
IEEE 2030®

- World’s first system-of-systems foundational standard created from the ground up to inform smart grid interconnection and interoperability

- A roadmap to the interfaces that engineers encounter in bringing the smart grid to global consumers
Like Internet of Things – Smart Grid Creates New Paradigm for Global Standards Development
IEEE Standards Association (IEEE-SA)

- IEEE-SA is global

- IEEE-SA is strengthening collaborative relationships with SDOs

- IEEE-SA is enabling collaboration across geographies

- IEEE-SA is increasing its full lifecycle offerings to the global community
IEEE-SA’s Global Reach

- Over 900 active standards
- More than 500 standards under development
- 100+ smart grid standards or standards in development
- 7,000 individual members
- 200 corporate members
- Over 20,000 standards developers worldwide
IEEE-SA’s Global Commitment

Smart Grid standardization requires broad global collaboration effort across multiple communities

- Standards development organizations
- Government organizations
- Private sector
IEEE 2030® Smart Grid Framework

Methodological Interoperability Framework composed of:
- Three Interoperability Architecture Perspectives (IAP):
  - Power System (PS)
  - Communications Technology (CT)
  - Information Technology (IT)
- IAPs Interoperability Tables

Evolution of Smart Grid Interoperability

e.g., additional IEEE 2030 standards
Two-Levels SG System Architecture

Inter-System Smart Grid Reference Architecture

System Level (phase 1)

Protocols, PHY/MAC layer, data flows mapping table

Intra-System Smart Grid Reference Architecture

Sub-System Level (phase 2) one level down
SG Architecture Development Methodology
IEEE P2030.1™ Guide for Electric-Sourced Transportation Infrastructure

IEEE 802/1901/P1901.2 (communication), IEEE 1815

IEEE 802/1901/P1901.2 (communication)
IEEE 2030/IEEE P2030.1

IEEE 1675/1775/2030/IEEE P2030.1

SCC31 (Meter)

IEEE 1547 Series
(distributed energy interconnection solar, wind, storage...)

IEEE STANDARDS ASSOCIATION
IEEE P2030.1™ Guide for Electric-Sourced Transportation Infrastructure

- Addresses applications for road-based personal and mass transportation

- Provides a knowledge base addressing terminology, methods, equipment, and planning requirements for such transportation and its impacts on commercial and industrial systems including, for example, generation, transmission, and distribution systems of electrical power

- Designed to benefit:
  - Utilities
  - Manufacturers
  - Transportation providers
  - Infrastructure developers, and
  - End users of electric-sourced vehicles (EVs)
IEEE P2030.1™ Global Collaboration

Working Group comprised of over 250 volunteers from North America, Europe, Asia, Africa, and New Zealand contributing to international guide

Task Forces established to focus on key areas:

- **Vehicle Technology**: Types of vehicles and their anticipated operation with the power systems
- **Grid Impact**: Including load shapes, EV Integration Impacts on Customers, Distribution, Generation and Transmission Impacts
- **Roadmap**: Including Roaming and Privacy
- **Communications and Cyber Security**: AMI Metering, Communications between Vehicle and Grid, Cyber Security Impacts
- **Battery Technology**: End of Life Issues
- **Chargers and Charging**: On-Board, Off-Site
- **Gaps in Current Technology**
Distributed Energy Resources Interconnection

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

**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

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IEEE STANDARDS ASSOCIATION

- Establishes test procedures for electric energy storage equipment and systems for electric power systems (EPS) applications

- Includes requirements on installation evaluation and periodic testing

- Standardized test procedures are necessary to establish and verify compliance with IEEE requirements for reliability, safety, and efficiency

Provides guidelines for discrete and hybrid energy storage systems that are integrated with the electric power infrastructure, including end-use applications and loads:

- Technical characteristics
- Integration of discrete and hybrid systems with EPS
- Terminology
- Functional performance
- Evaluation Criteria
- Operations
- Testing
- Application of engineering principles
Proposed IEEE P2030.4™

- Recommended practice outlining necessary steps and procedures utilities should undertake to implement an IEC 61850 substation in a multi-vendor equipment environment

- Addresses equipment configuration, equipment procurement specification, documentation procedures and general design philosophy that will condense the IEC61850 standard into a practical working implementation guide

- Also defines baseline information sets and functionality for IEC 61850 devices to allow users to implement similar design philosophies between vendors of IEC 61850 equipment

- Will attempt to define interoperability necessary for IEC61850 series of standards to be employed in a multi-vendor, multi-company smart grid environment
Thank You