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Standards for Interoperability, Interconnection and Integration in the Smart Grid

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Overview

Standards are an important consideration in the work of building engineers. But their role is increasing with the globally intensifying implementation of the smart grid and the revolutionary changes that are being brought about to way that buildings interact with electricity.

There is an array of standards that helps enable interoperability, interconnection and integration of disparate systems as power, information technology (IT) and communications are interweaved in the developing smart grid. Fortunately, for the sanity of building engineers, there is order to the ways that the various standards produced by different bodies interplay.

For example, say a roof-mounted solar panel is being installed and connected to the grid through an inverter, there are a host of standards that power engineers can look to for guidance, such as Article 690 of the National Electrical Code (NEC) for minimizing electrical hazards in installation and operation, Underwriters Laboratory (UL) 1741 for additional fire and safety considerations with regard to distributed generators that use a DC Power source, like a solar panel, IEEE 1547™ "Standard for Interconnecting Distributed Resources with Electric Power Systems" for the basis of the interconnection of the photovoltaic device itself to the power grid and IEEE 1547.1™ "Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems" for commissioning tests.

Systems-level standards are an area of focus for IEEE with regard to the smart grid.

The IEEE 1547 family of standards, for example, since the base standard's original publication in 2003, has been steadily updated to reflect evolution in the UL 1741. There was an amendment published last year (IEEE 1547 a- 2014 and IEEE 1547.1a-2015)to reflect the need to allow reactive power control to control voltage if desired by the Electric power system operator.

After over 10 years of operation and continual conversion of the electric power system to "smart" technology such as metering, communication systems and protection systems, the Standards Making Organizations IEEE, is undergoing a full revision of the interconnection standard and the accompanying testing standard. The affected standards are:

- IEEE 1547 – IEEE Standard for Interconnecting Distributed Resources with the Electric Power System (IEEE 1547 a- 2014)
- IEEE 1547.1 EEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with the Electric Power System (and IEEE 1547.1a-2015.

In considering the scope and intentions of a full revision of IEEE 1574, a wide variety of stakeholders are looking at the emerging technologies and applications—microgrids, energy storage, inverter communications, voltage and frequency ride-through, and higher renewable penetrations, among them—that should be addressed. The Additional requirements being considered may include:

- Reactive Power – Voltage Control
- Voltage and Frequency Ride Through
- Harmonics
- Interoperability and Cyber Security
- Simulation and Modeling Data submitted to the EPS Operator

Since 2014, there has been significant standards making organization activity toward the end of publishing commissioning guidelines for Solar PV systems, energy storage systems and substations. You can access other documents and papers on the subject of commissioning on the ComRent website.

IEEE 2030® "Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS), End-Use Applications, and Loads" takes a similar system-of-systems approach. More than 400 professionals from across the global communications, IT and power industries collaborated in developing IEEE 2030, and, when it was released in 2011, it established the world's first interface-by-interface guide to interoperability across the smart grid. IEEE 2030 is a technology-agnostic roadmap to the standards and functional interfaces for securely integrating EPS with communications and IT and facilitating data exchange across the smart grid.

The smart grid is bringing definitive change to the ways that buildings relate with electricity. Whereas most buildings

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have historically been only consumers of electricity, more and more buildings will also serve as points of power generation in the smart grid. And whereas there has been no way and little need to determine when and how much buildings will need at various times of the day/week/month, more precisely understanding and forecasting power demand from and within a building is a frontier of innovation in the smart grid.

Standards development driven by the emerging, real-world needs of building engineers will help ensure this transformation is achieved as simply, cost-effectively and efficiently as possible.