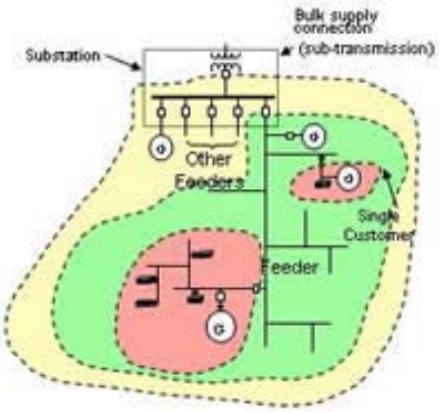
Communication Standards for Future Integration of Distributed Energy Resources

Fact Sheet



BACKGROUND There is a growing interest in implementing distributed energy resources (DER) as a viable alternative to central generation on power systems throughout the world. As the DER technology evolves, nations recognize the economic, social, and environmental benefits of integrating DER technology within their electric infrastructure. Full integration of these technologies will require integration with distribution automation and distribution control systems. In order to accomplish this level of inter-operability, existing proprietary communication and control systems will have to be upgraded to systems that comply with appropriate standards. These standards will eventually simplify implementation, reduce installation costs, reduce maintenance costs, and improve reliability of power system operations.

At the same time, the existing distribution system infrastructure needs to be redesigned to accommodate widespread DER use. Existing distribution systems have protection coordination, voltage regulation, fuse saving, and other features, which are not compatible with random placement of distributed generation throughout the system. In some cases, the addition of DER may require upgrades to conductors and transformers. Also, issues that have been traditionally a part of transmission expansion planning, such as power flow and stability studies, need to be considered at the distribution level, as DER units are implemented.

The object models for distributed resources (DER) are defining the specific requirements for interfacing new technologies with the power system of the future.

USING OBJECT MODELS FOR MANAGING INFORMATION

The object modeling technology has developed within the last few years to become well-established as the most effective method for managing information exchanges. In particular, the UCA object models for the exchange of information within substations (UCA-SA) have moved through the standardization process, and are now formally designated as the IEC61850 International Standard. Many of the components of this standard can be reused for object models of other types of devices. Some new components are also needed, but these follow standard rules for defining new components, thus making them compatible with the existing IEC 61850 standards.

The Electric Power Research Institute (EPRI) and its partners have undertaken the challenge of developing initial object models using the documented approach of the Utility Communications Architecture (UCA) and now the IEC 61850 series of standards. As these DER object models are developed, they are being coordinated with the overall IEC 61850 standards through a new working group, IEC TC57 WG17 "Communication Systems for Distributed Energy Resources (DER)." The work is also being coordinated with the definition of information and communication system requirements for DER in IEEE by IEEE 1547.3.

OVERVIEW OF STANDARDS DEVELOPMENT FOR COMMUNICATIONS AND INFORMATION MODELS The DER object models within this structure provide the specification for information that can be exchanged between DER devices and any systems, which monitor, control, maintain, audit, and generally operate the DER devices. Simply put,

"object models" are standardized formats or templates for exchanging data between different equipment and systems. Standard object models, combined with standard service models (methods for sending the data) and standard protocols (the bits and bytes actually send over the communication channel), permit different systems to interact with minimal customization. The combination of object model, service model, and protocol profiles can be termed the "information model."

These DER information models are based on open-system language, semantics, services, protocols, and architecture, which have been standardized by IEC61850, but they include some extensions to IEC61850. The UCA-DER object models are being provided to the IEC as a draft set of object models for international standardization through WG17 of TC57.

STATUS OF RELEVANT STANDARDS WORK One of the major hurdles to deployment of distributed energy resources (DER) has been lack of industry standards for inter-connecting these devices with electric power systems. In response, IEEE approved a standards project with participation of EPRI, DOE and numerous other interconnection standards for DER. The resulting 1547™ standard were issued in July 2003. This initial standard is now being followed by a series of additional standards, recommended practices, and guidelines within the IEEE 1547™ family. This EPRI IntelliGrid project is supporting the chairman role for one of these follow-up documents-the guide on monitoring, information exchange, and control.

IEC has launched an effort to produce international open-systems communication architecture standards for electric power systems. This work has been focused mainly on substations to date and has led to the initial 61850 standard. EPRI was instrumental in launching this past work. This IntelliGrid project launched a new IEC working group to expand the IEC 61850 communication architecture to DER, with the possibility of expansion to other distribution system technologies later.

IMPACTS Achieving international standard would define the communication and control interfaces for all DER devices and results in:

- Simplify DER implementation
- Encourage and facilitate more widespread use of DER
- Increase the value of DER functionality (capabilities) in utility distribution system operations
- Reduce DER installation and maintenance costs
- Improve reliability and economics of power system operations

BENEFITS The development of DER object models will enable the industry to:

- Improve the strategic value of DER in electric utility system operations
- Create the ability to use DER as a valuable resource in future automation systems (ADA)
- Develop communication object models that enable strategic use of DER in ADA for functions such as routine energy supply, voltage regulation, power factor control, emergency power supply, disaster recovery operations, and harmonic suppression
- Enable flexible reconfiguration of distribution systems into intentional islands (microgrids) to aid in strategic and emergency system operations
- Enable the complementary strategic use of new technologies being deployed in distribution system environments, such as DER, sag correction and other power quality improvement devices, and load management capabilities

CONTACT INFORMATION For more information, contact the EPRI Customer Assistance Center (EPRI CAC) at 800.313.3774 (askepri@epri.com).

TECHNICAL CONTACT For details on the described projects, please go to the www.epri-intelligrid.com Web site or contact Marek Samotyj, IntelliGrid Program Director, at 650.855.2980 (msamotyj@epri.com).

The IntelliGrid[SM] Consortium is a collaboration of utility, manufacturers, researchers, and government leaders, all working together to make the intelligent, self-healing power system of the future a reality.

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