Office of
ELECTRIC TRANSMISSION & DISTRIBUTION
ELECTRIC DISTRIBUTION TRANSFORMATION PROGRAM

Underwriters Laboratories

Streamlining Interconnection

Goals

One of the Department of Energy's Distribution and Interconnection R&D goals is to develop a streamlined system to interconnect distributed generation (DG) with the utility grid. To support this goal, Underwriters Laboratories (UL) is revising UL 1741 to include DG. The revised standard, "Standard for Inverters, Converters, and Controllers for Use in Independent Power Systems," will make it easier for utility-connected DG to be designed, produced, evaluated, certified, sold, installed, and operated in a smooth and agreeable manner.

Results

To accomplish this goal, UL is:

- Determining the status of applicable standards and codes and conducting literature reviews on DG interconnection issues
- Conducting code-related research and development for DG interconnection with the utility
- Reviewing certain interconnection guidelines
- Combining appropriate safety requirements with the necessary utility interconnection requirements from IEEE 1547 Standard for Distributed Resources Interconnected with Electric Power Systems into one document.

In addition to developing the standard, UL is:

- Designing appropriate test setups to conduct certification tests on DG products
- Verifying capabilities of test facilities to perform tests on DG
- Validating test facilities to conduct the UL safety test
- Conducting witness testing of interconnection configurations.

Situation Analysis

UL reviewed literature for information relevant to interconnecting DG equipment with utility distribution systems. It reviewed the National Electric Code (NEC) to determine how distributed power system components are addressed, and it reviewed various interconnection guidelines, including IEEE 1547, to determine compatibilities and differences between these guidelines and the NEC.

Three-phase anti-islanding test equipment at UL

Based on this analysis, UL recommended the following:

- Include notes in the IEEE definitions of "local electric power system" and "point of common coupling" to reference similar terms in the NEC
- Because the NEC does not use the terms "distributed resource" or "distributed generation," introduce these terms into the NEC, and in particular Article 705, to provide consistency between the two documents
- Harmonize the requirements for disconnecting means between the NEC and IEEE 1547.

Revision of UL 1741 Standard

UL has used a participative approach to revise the standard. It has involved utilities, electrical authorities having jurisdiction (AHJs), consumers, manufacturers, and other interested parties to develop interconnection requirements for DG equipment.

UL assembled a balanced Standard Technical Panel consisting of 50% producers, 20% users, and 30% general interest parties. This mix provides a broad base of interests and experience. The first meeting, in November 2001, provided clear direction for many of the issues to be addressed. For example, harmonizing with IEEE 1547 is a key success factor.

All participants appear to support the development of a national interconnection document and a standard that will satisfy the needs of manufacturers and stakeholders, provide an appropriate level of safety, and garner widespread acceptance.

Inductive load banks UL uses for anti-islanding tests at its Northbrook, Illinois, facility

Test Equipment Design

UL has selected and designed appropriate test equipment to test DG products. To do so, it has:

- Worked with equipment manufacturers to design a large simulated utility for DG testing
- Collaborated with national laboratories on harmonic distortion and anti-islanding testing
- Implemented anti-islanding test loads for large three-phase products
- Researched DG test equipment for data acquisition automation
- Worked with various utilities to verify its test methods.

American National Standards Institute Approval

UL will provide an American National Standards Institute (ANSI) standard to evaluate utility-interconnected DG products for electrical safety and utility interconnection. ANSI addresses the needs of AHJs and utility interconnection engineers. ANSI approval of this standard will be sought and maintained through the continuous maintenance method. Through this method, the current version of UL 1741 will always be the nationally accepted ANSI-approved version.

Grid-connected PV parking lot system

Status of Development of the Standard

The first and second drafts of the standard have been produced and reviewed. In parallel, UL has validated test methodologies, incorporated its findings into the standard, and reviewed test equipment. For example, anti-islanding testing research helped identify problems, so UL modified the anti-islanding test method to make it more realistic and easier to apply to large, three-phase, static and rotating inter-connected DG products. A simulated utility can mimic special utility-fault conditions and evaluate the ability of a utility-interconnected product to properly interact with a utility under normal and abnormal conditions.

Now that IEEE 1547 has been approved, UL can ensure the synchronization of UL 1741, move to the production of the third draft standard, and send it out for review.

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