

Position Paper

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The Need for Grid Interconnection Standards and Equipment Certifications

National and/or international grid interconnection standards and associated certifications to ensure that interconnecting equipment meets specified performance requirements will be essential to success of Distributed Energy Resources (DER). Currently, every utility defines their own set of guidelines and approval procedures for interconnecting non-utility power generation resources with their “local” utility grid. These guidelines usually address several “classes” of equipment depending on generator size, type, mode of operation, and interconnection voltage. While similarities exist between most of these guidelines with regard to protection and safety requirements, the differences are substantial enough that “custom” interconnection equipment designs are typically required for each new job — even when dealing with the same utility. Complex procedures and lengthy review times often associated with the interconnection approval process can create further impediments to DER deployment, regardless of the underlying power generation or energy storage technology to be used. Interconnection standards and certifications will greatly simplify and reduce the cost of this process, while ensuring personnel safety and equipment protection for both the utility and the DER site.

As utility deregulation unfolds, interconnection standards and certifications will become even more important because DER technologies will be interconnected with one entity while the power provider serving those same DER sites may be a different entity. This will occur as a result of competition at the retail level or due to the breakup of vertically integrated utilities into separate generation, transmission, distribution, and energy service companies (or other potential structures such as Independent System Operators, Power Exchanges, etc.). Various restructuring methods will lead to different legal and regulatory requirements concerning the ownership and operation of DER solutions, but interconnection standards are vital to DER success regardless of the many possible outcomes.

The goal of DER solutions is to reduce the cost of delivered electricity for all customer classes within the community at large — not just for those who own or operate DER technologies. It is also critical that grid reliability and stability be maintained or improved even with a large penetration of DER as a percentage of total generation resources connected to the grid. Thus, standardization efforts should not only address the requirements of interconnecting individual DER sites to the “local” utility grid, but should also address “system” performance, planning and operating requirements including:

- Coordination and management of multiple sites that may use a mixture of DER technologies with different operating characteristics
- Communication and data exchange for remote operation and dispatching of widely scattered DER sites (including pricing and revenue information, on-line and available generating capacity, alarm messages, fault and disturbance data, troubleshooting and maintenance information, etc.)
- Fault recovery procedures including the possible formation and management of power “islands” during utility outages (communication and management systems must be capable of using DER for both “local” and “system” needs as dictated by real-time operating conditions)
- Power quality considerations such as harmonic distortion, system voltage and frequency stability, power factor, etc.
- Standardized metering and billing to properly account for the economic benefits of DER solutions

Because “real world” applications will find DER technologies serving individual load/energy management needs on the customer’s side of the meter, standardization efforts should be divided into two separate tasks:

1. Develop “local” interconnection requirements with regard to personnel safety and equipment protection.
2. Develop “system” performance and operating requirements with regard to grid stability and reliability, as well as resource planning and management.

Organizations and agencies that should be invited to debate and discuss grid interconnection issues at both the “local” and “system” levels, resulting in the development and implementation of appropriate standards include:

- IEEE (Institute of Electrical and Electronic Engineers)
- ANSI (American National Standards Institute)
- NFPA (National Fire Protection Association) through their *National Electric Code* (NEC) work
- NERC (North American Electric Reliability Council)
- FERC (Federal Energy Regulatory Commission)
- EPRI (Electric Power Research Institute)
- EGSA (Electrical Generating Systems Association)
- AEE (Association of Energy Engineers)
- ISO (International Standards Organization)
- IEC (International Electrotechnical Commission)

Certification agencies that may ultimately be responsible for conformance testing to ensure that DER equipment meets specified interconnection and operating standards include:

- UL (Underwriters Laboratories)
- CSA (Canadian Standards Association)
- CE (translated from French as “European Committee”)

Important Literature References

- *IEEE Guides and Standards for Protective Relaying Systems*, Institute of Electrical and Electronic Engineers, New York, NY, 1991 (Product Number SH14399)
- *IEEE Orange Book: Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*, Institute of Electrical and Electronic Engineers, New York, NY, 1986 (Product Number SH10835)
- *On-Site Power Generation: A Reference Book*, Electrical Generating Systems Association (EGSA), Coral Springs, FL, 1993
- *Integrating Non-Utility Generators: Reliability Considerations for Integrating Non-Utility Generating Facilities With the Bulk Electric Systems*, North American Electric Reliability Council (NERC), January 1992

CADER Response and Proposed Involvement

- The California Energy Commission (CEC) should review existing interconnection guidelines from utilities in California and then propose statewide standards to be enforced by California’s Public Utility Commission (PUC). National standards, which could be enforced by FERC with state PUC participation, will follow naturally from California’s leadership in this area.
- California has already established *Electric Rule 21* to regulate interconnection of non-utility parallel generation for Qualifying Facilities (QF’s) as defined by the Public Utility Regulatory Policies Act (PURPA) of 1978. This rule could be revised and expanded to address interconnection requirements for new DER technologies at the “local” level as well as communication, management, power quality, metering/billing, and other requirements at the “system” level. Dividing this task into two standards that address “local” and “system” requirements separately will allow highly focused efforts in each case, which will greatly expedite the standardization process.
- “System” level DER standards should be integrated into comprehensive standards for “open” substation/distribution automation systems, with the white paper entitled “Utility Management of Distributed Energy Resources” to be used as a starting point for discussion and debate amongst CADER members.
- Standardization efforts by other organizations should be identified and then these groups should be persuaded to work cooperatively with CEC to develop suitable standards and certification procedures.