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Assessment of DER Interconnection Installation for Conformance with IEEE Std 1547

AUTHORS:

James M. Daley, PE DGCP
IEEE Life Senior Member

Keith Houser, PE
IEEE Member

IEEE | 3 Park Avenue | New York, NY 10016-5997 | USA

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The Institute of Electrical and Electronics Engineers, Inc.

3 Park Avenue, New York, NY 10016-5997, USA

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Abstract

Standards and codes establish the functional performance requirements of equipment interconnecting Distributed Energy Resources (DERs) with an Electric Power System (EPS). Nationally Recognized Testing Laboratories (NRTLs) evaluate equipment for safety and compliance with applicable standards and codes. Equipment meeting these requirements are then listed as suitable for their intended use in compliance with the applicable requirements. The EPS operator enters into a binding agreement with the DER operator for interconnection with the EPS at a specific site to meet the requirements of the EPS infrastructure at that location. IEEE Conformity Assessment Program proposes a process and procedure to ensure compliance with the applicable standards and the interconnection agreement.

1. Introduction

The IEEE DER interconnection standards (IEEE Std 1547 [4] and IEEE Std 1547.1 [6]) sufficiently define the functional requirements for the proper interconnection of DER with an Area EPS. IEEE Std 1547 specifies the functional requirements for interconnection including design, production, and installation commissioning evaluation. IEEE Std 1547.1 specifies the equipment conformance test and evaluation procedures. Compliance with the National Electric Code® (NEC®, NFPA 70 [7]) requires that components, subsystems, and systems installed in on-premises wiring systems are evaluated for safety and their intended use by a NRTL. Evidence of successful evaluation is confirmed by a NRTL marking label on these items. The presence of this marking label only confirms that the items have met the requirements of the design and production tests.

The interconnection of a DER with an EPS can have a detrimental effect on the reliability of that power source. To ensure the safe and proper operation of the interconnected sources at their location in the EPS infrastructure, the EPS and DER operators enter into a binding interconnection agreement. In addition to the required equipment listings, this agreement will list any additional requirements to ensure safe and reliable interconnection performance.

The process begins with a thorough examination of the interconnection system for completeness and compliance with the interconnection agreement and all Authorities Having Jurisdiction's (AHJ's) regulatory requirements. Next, verification needs to be made that the components of the interconnection system are compliant with the functional requirements of IEEE Std 1547 [4]. Confirmation of conformity is established by compliance with IEEE Std 1547.1 [6]. For inverters and converters, proof of confirmation and safety evaluation are evidenced by listing for their intended use to UL 1741 [8]. Other components of the system are evaluated to their relevant standards and listed for the intended use. Next, the installation is evaluated for compliance with applicable codes such as the NEC [7] or other applicable codes and standards.[1] IEEE is establishing a program that will ultimately lead to the issuance of an Assurance Certificate confirming interconnection conformance.

2. Background

To bring focus to the remainder of this paper, it will serve well to put forth the context of some terms that will be used.

- *AHJ*—An agency such as a Municipality, State Regulatory body, or others having jurisdiction over various aspects of a DER interconnection installation.

[1]In the European Union, the applicable standard is IEC 60364 [3], Electrical Installations for Buildings as supplemented by each member country to account for differences in electric systems.

- *Standard*—A formal technical document that establishes uniform engineering or technical criteria, methods, processes, and practices.
- *Code*—A set of rules about how something must be done.
- *Regulation*—A rule or directive made and maintained by an authority.
- *Test*—The means by which genuineness is verified.
- *Commissioning*—The act of placing into service.[2]

Interconnection Standards

Encouraged by U.S. Government agencies, the IEEE Standards Association (IEEE-SA) undertook the task of defining the functional requirements for the orderly and appropriate interconnection of DER with the EPS. The IEEE issued an invitation to anyone who had an interest in this issue to join a working group. A working group of more than 300 people assembled to define and address the issues. This group included engineers from the electric utility industry, NRTLs, equipment manufacturers, state utility regulators, consulting engineers, and other interested parties. In the ensuing three years and through eleven compilations, a draft standard was successfully balloted leading to its issue as an IEEE standard in 2003. Near the end of that effort, another working group was formed to draft a standard to define the conformance test regimens to confirm that components, subsystems, and/or systems intended for application to the interconnection of DER with the EPS were in compliance with IEEE Std 1547-2003. This working group of 115 interested parties, similar in cross-section to the initial standard working group, gathered on a number of occasions and ultimately produced a successfully balloted draft that was issued as a standard, IEEE Std 1547.1-2005. Working groups were once again created to address issues that arose from experience gained from ever-increasing penetration of DER. These groups produced appropriate amendments to the original standards. IEEE Std 1547a-2014 and IEEE Std 1547.1a-2015 were successfully balloted, approved, and published. In March 2014, a new working group was approved to develop a full revision of the IEEE 1547 standard that addresses significant DER penetration, takes advantage of technological advancements, and to addresses interoperability as deemed necessary to enable the development of the Smart Grid. At the time of this writing, IEEE-SA has approved this revision standard and it should be published soon. Another new working group is currently developing a revised version of IEEE Std 1547.1, in response to the revised requirements of IEEE Std 1547.

Once standards were established, regulators and system operators began including the requirements of these standards in their respective regulations and guidelines. The Energy Policy Act of 2005[3] cited the IEEE standard as the requirement for DER interconnection access with the EPS. [2]

Codes

Codes and standards have no jurisdiction until an authority establishes a regulation requiring its use. The applicable codes for DER interconnection are as follows:

- National Electric Safety Code® (NESC®)—pertains to the electric power system from the generator to the customer meter. Applicable to the North American electric grid. [1]
- National Electric Code (NEC)—addresses the on-premises wiring and electric systems on the users' side of the electric meter. The NEC is adopted by most jurisdictions in North America. Some jurisdictions impose their own codes, which in most cases are similar to the NEC but address unique issues in their respective jurisdictions.

[2] Author's comment: Commissioning is not a test. It is an evaluation leading to confirmation that the interconnection is compliant with the applicable standards, codes, regulations and EPS operator's interconnection agreement.

[3] Sec. 1254. Interconnection. (a) Adoption of Standards. "… Interconnection services shall be offered based upon the standards developed by the Institute of Electrical and Electronic Engineers: IEEE Standard 1547 for Interconnecting Distributed Resources with Electric Power Systems, as they may be amended from time to time…."

- Electrical Construction of Buildings (IEC 60364)—an approximate equivalent of the NEC in force in the European Union (EU). This is a generalized standard that allows the various member states of the EU to accommodate the uniqueness of their respective electric system practices.

The NEC concerns itself with the safety aspects of the installation and use of electric power systems on the users' side of the service meter. The principal concern is for protection from the fire and personnel hazards commensurate with electric power system use. This code imposes requirements of applicable standards. For the NEC, these requirements apply to components of an on-premises electric system. The majority of the working group, having a background in the electric utility industry, had just a passing understanding of the NEC. As such there was significant concern that the interconnection components, subsystems, and systems would be appropriately evaluated for their intended use. Time was taken to allay these concerns. The NEC requires that products used in the on-premises power system be evaluated for their intended use by a Nationally Recognized Testing Laboratory (NRTL). Underwriters Laboratory (UL) is one such NRTL. UL 1741 was an existing standard that was revised to include evaluation of utility interactive inverter and system equipment for use in interconnection service. Section 46 of UL 1741 imposes testing to the functional requirements of IEEE Std 1547 using the test regiments of IEEE Std 1547.1 to confirm Utility Compatibility. UL 1741 Section 63 directs the labeling of UL-confirmed equipment. In addition to this evaluation, this standard evaluates the equipment for compliance with fire and personnel safety requirements. It is pointed out that UL standards have generally been used for product safety. The NEC requires labeling of evaluated equipment for its intended service. This carries with it a listing of the equipment. Simply, this means that having been successfully evaluated, UL can visit the production facility to ensure that the product shipped matches the product that was evaluated. The presence of the appropriate UL label is the assurance that the component, subsystem, or system is compliant with the IEEE interconnection standards.

Regulations

In the context of regulating the interconnection of DER with an EPS, a few authorities exercise overlapping regulations. In the United States, where a DER is interconnected with an interstate electric power transmission system, it is governed by the Federal Energy Regulatory Commission (FERC), a regional transmission system operator (RTO), or an independent system operator (ISO), typically under the jurisdictional authority of FERC. Where a DER is interconnected with an intrastate distribution system, it is governed by the respective state regulatory commission or local governmental authority (e.g., municipal utility boards), and the interconnection requirements of the EPS operator to whose system the DER is connected. EPS operator interconnection requirements are developed to meet the needs of the EPS infrastructure and are approved by the state regulatory commission. In each of these circumstances, the EPS operator will have published interconnection application and agreement procedures. The process for interconnecting DER with the EPS begins with the submission of an interconnection application to the EPS operator.

Evaluation Criteria

The followings are three stages of evaluation to ensure compliance with the interconnection standard:

- Type Test—Tests conducted on a representative product sample to confirm compliance with the applicable clauses of the interconnection standard. This test regimen confirms that a component (e.g., inverter, circuit breaker, etc.), subsystem, and/or system design meets the functional requirements of the standard. IEEE Std 1547 specifies the functional criteria required for DER interconnection. This includes the range of adjustability in parameter and timing that would satisfy broad-based applicability of the interconnection. IEEE Std 1547.1 specifies an evaluation process to ensure compliance across the full range of adjustability, within the specified accuracy, across the full environmental range of application.
- Production Test—Tests performed on every interconnection product as shipped from the manufacturing facility to certify that it is operational. A production test report is required to be included with each shipped unit. The report is to include a record of all settings in the shipped product (among other information).
- Commissioning—This is an evaluation of the installed system to ensure compliance with applicable standards, codes and regulations, and ultimately with the EPS interconnection agreement. It often addresses more than IEEE 1547 compliance. It provides a record of the performance of the interconnection and

provides evidence that the installed interconnection is compliant with the EPS operator's interconnection agreement. A benefit of commissioning is a record of performance for future reference.

3. Conformity Assessment

There is no uniform distribution system used throughout the electric power system. There is a diverse population of standard components, subsystems, and systems that each utility configures to provide electric service at any given point in its service area. Consequently, each DER interconnection application must be evaluated on its own merits. A review of the interconnection application process reveals that a process is established to provide best service to the applicant. Upon evaluation of the documentation furnished with the application, the serving utility is required to provide a prompt review and comment. When all requirements are met, an interconnection agreement between the serving utility and interconnection customer is executed. This agreement then becomes the overall governing document. Thus, the conformity assessment process begins with a review of the installed system to confirm its compliance with the interconnection agreement. Figure 1 presents a graphical representation of a framework that describes how standards apply to the implementation of an interconnection.

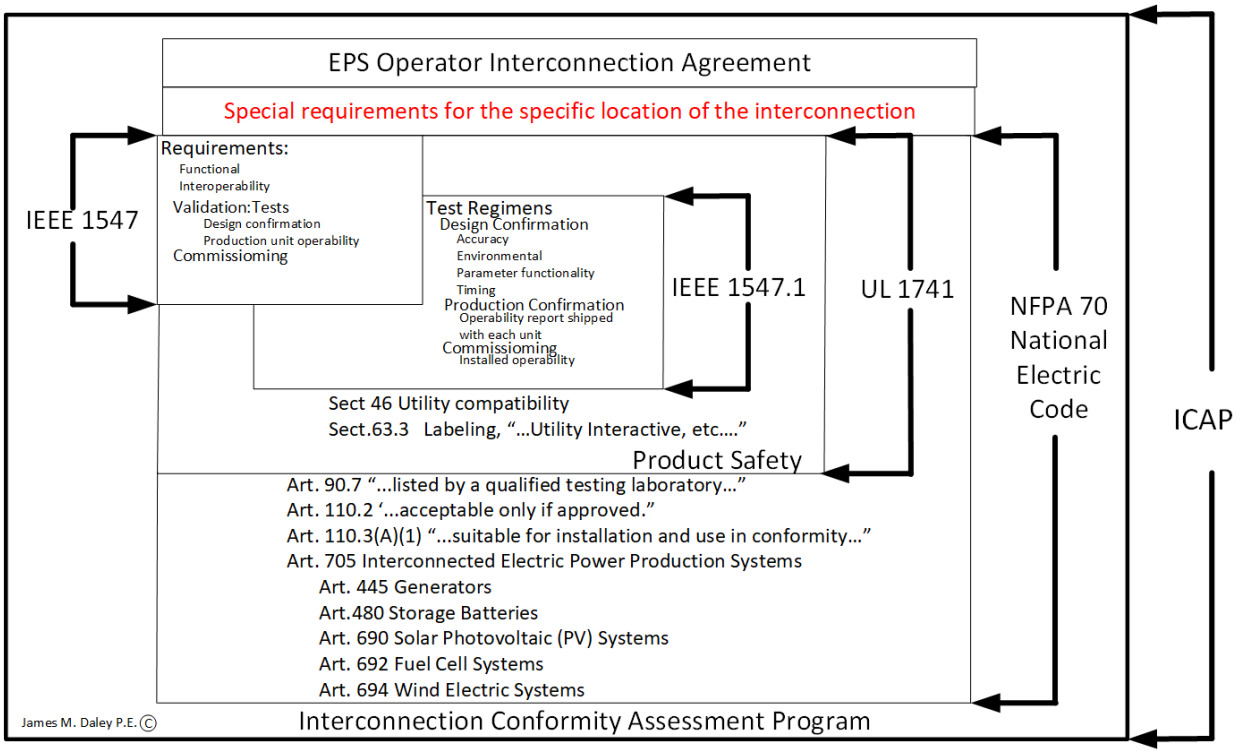

Figure 1: Conformity assessment

Components, subsystems, and systems installed in the interconnection system are required to be evaluated for their intended service. IEEE Std 1547 establishes the required functional performance for interconnection service. Component, subsystem, and system conformance testing uses the IEEE 1547 tabulated functional parameters and their ranges as the criteria for evaluation. IEEE Std 1574.1 establishes the regimens for conformity evaluation.

A type test will subject the equipment under test (EUT) to an evaluation that operates the unit over the full range of specified operability. It will also evaluate the EUT for environmental exposure such as transient withstand, radiated, and conducted emissions immunity (harmonics, etc.). As an example, where the standard requires response to an abnormal parameter condition, for example a voltage out of range, the test regimen will evaluate the EUT at the minimum, mid-range, and maximum operating temperature; at the minimum, mid-range, and maximum parameter setting; and at the minimum, mid-range, and maximum time settings. This test sequence is conducted five times at

each setting for each parameter, to achieve statistical significance. The criteria for success is expected operation at each setting within a specified accuracy. IEEE Std 1547.1 provides the test protocol and procedure. These evaluations are conducted and recorded by a NRTL at a facility that has the requisite equipment and infrastructure.[4] A type test is required to be repeated when design revisions are made to the product.

Once the product type test has been conducted, the EUT as tested is defined in a technical construction file held by the NRTL. The file provides the basis for evaluation of production units in the follow-up service that the NRTL conducts on unannounced visits to the production facility. During these visits, the NRTL personnel compare a production unit to the technical construction file for compliance. When a discrepancy is found, the manufacturer must correct the discrepancy before the listing label can be applied to the product. Units shipped with the discrepancy must have their labels removed until the discrepancy is resolved and rectified.

The IEEE interconnection standards (IEEE Std 1547 and IEEE Std 1547.1) and UL 1741 require that each unit produced be subjected to a production test that confirms designated operation for each parameter as set at the production facility. The settings are recorded for each unit. A production report is required to be shipped with each unit. This report is required to document all settings as the unit was shipped from the production facility.

4. Interconnection Agreement

Each EPS operator has an interconnection application form. Generally, the form will require the following:

- Interconnection customer identification information
- Generator facility location information
- Generator facility information
  - Type
  - Rating
  - Energy source
  - Operating parameters, voltage, current, power, power factor, etc.
  - List of equipment, manufacturer, listing label, standards of evaluation (UL 1741, UL 489, UL 1008, ANSI C37. series, etc.)
  - Installing contractor
  - Electrical contractor
  - Electrical diagram of the interconnection

From this information, the EPS operator will determine the steps to take in reviewing the application. Where the interconnection is rated at or below a threshold (usually 10 kW to 20 kW) and the interconnection uses an approved and listed inverter, little further evaluation would be necessary.

Figure 2 and Figure 3 are representative of an installation that may require little further evaluation. These would typically be DERs rated less than 10 kW each. If the inverter, the disconnect switch, and breaker are listed and labeled to the appropriate standards, the likelihood is that permission to proceed with installation would be granted. The agreement would most likely require a sign-off by an electrical inspector stating that the installed interconnection meets the local electrical code and agrees with the approved electrical system design drawings. At that point, the EPS would permit operation and require a commissioning report. The commissioning report would list the commissioning steps conducted as required by IEEE Std 1547.1 and provide a signed report of the commissioning process results.

[4] A Nationally Recognized Testing Laboratory (NRTL) is a United States Occupational Safety and Health Administration (OSHA) designation given to testing facilities that provide product safety testing and certification services to manufacturers. The testing and certification are done to U.S. consensus-based product safety test standards. Note that not all NRTLs are recognized as having the capability to conduct and/or oversee testing associated with all test standards. For additional information, please refer to: https://www.osha.gov/dts/otpca/nrtl/nrtllist.html.

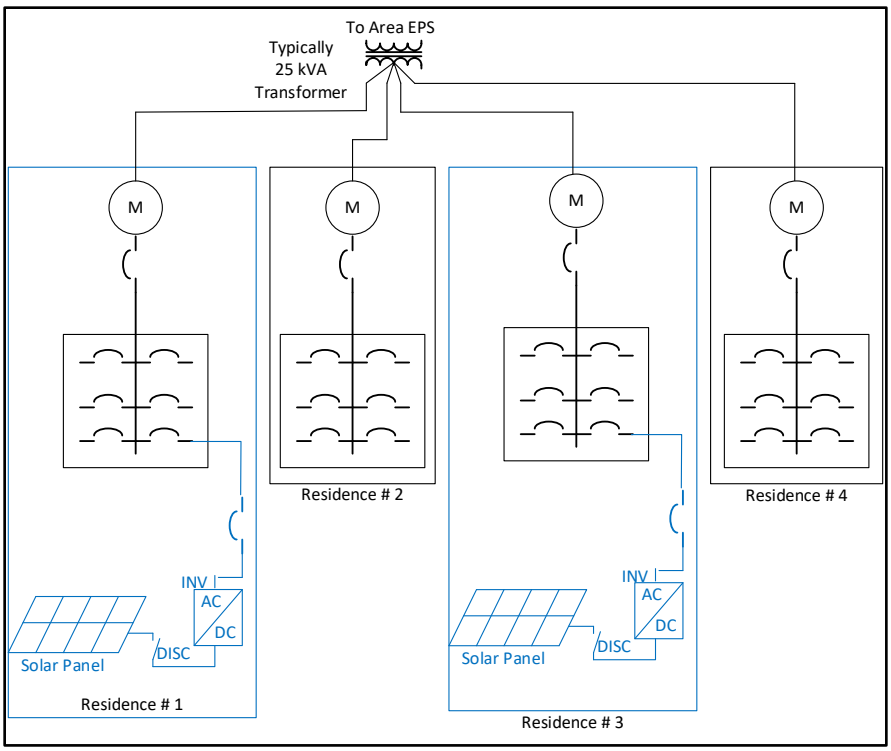

Figure 2: Simple interconnection rated less than a defined threshold rating

For a larger DER interconnection, the approval process is more involved. For example, it may require a system study to determine if the impact on the EPS at the point of interconnection could have detrimental effects on the resiliency, reliability, and/or continuity of service to neighboring customers and/or the EPS system.

The preceding examples presume interconnection at the EPS distribution level. Where the DER is interconnected to the Bulk Power System (BPS) (i.e., at the transmission or sub-transmission level), a detailed study would be required. This would be more extensive and costly than the previous examples. Figure 4 is an example of a larger DER interconnection. An interconnection of this type would typically be for a DER rated at several hundred kilowatts to megawatts. Such an interconnection would require a rather detailed study.

The results of that study may reveal a need for additional equipment and other accommodations. Once the EPS operator's studies are completed, the outcome must be complied with before permission to proceed with interconnection and commissioning can be granted. It is most likely that the EPS operator will require a written commissioning procedure for review and approval prior to granting permission to energize. A signed commissioning report documenting the results and steps conducted as required by IEEE Std 1547.1 and the EPS operator's approved commissioning procedure should be made. It is quite likely that the EPS operator may require their presence during commissioning.

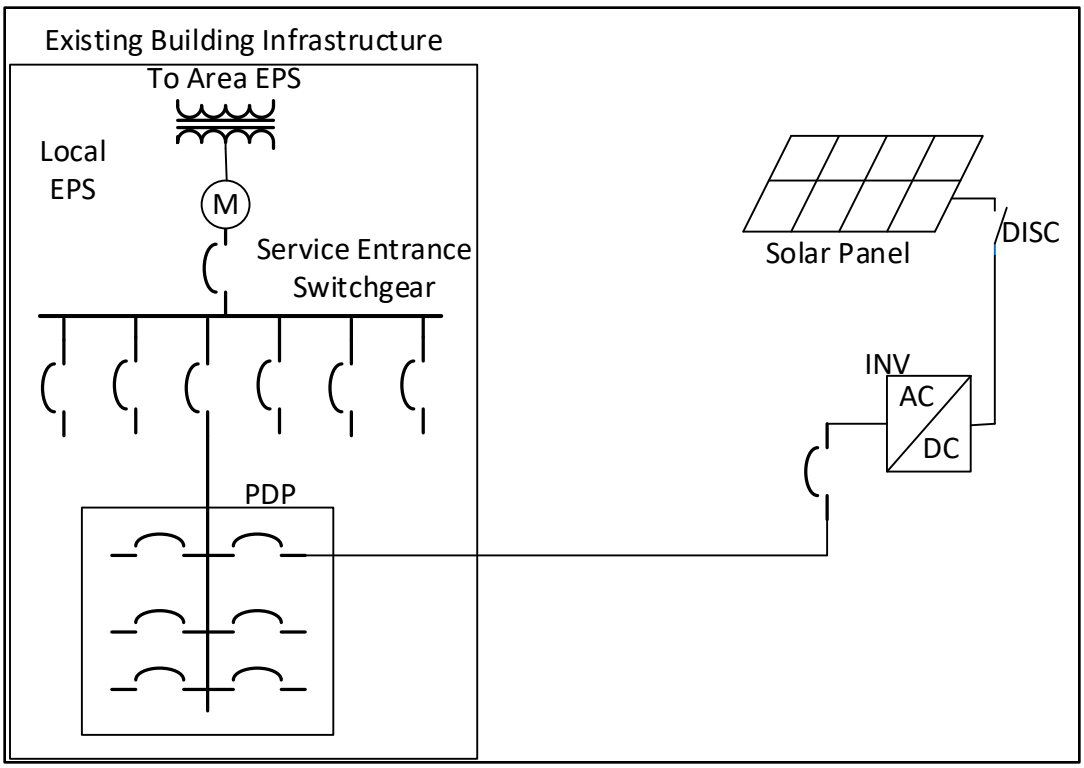

Figure 3: DER interconnection in excess of 10 kW

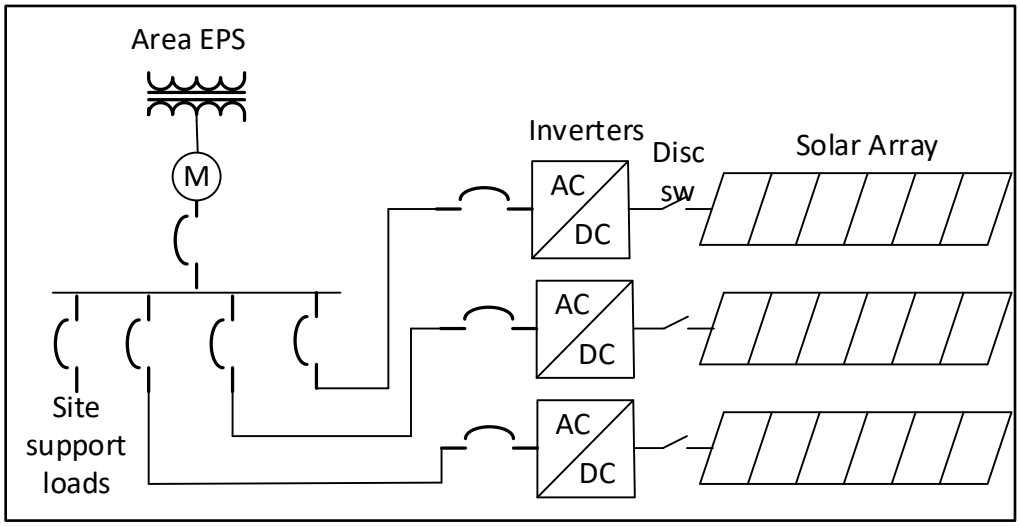

Figure 4: DER interconnection to the Bulk Power System

There is a misconception that interconnection commissioning is unnecessarily costly. In fact, commissioning of a power system is a normal course of action for any electrical installation. Given the digital technology currently deployed in interconnection systems, much of the commissioning effort is minimized by the ability to capture all settings through downloads to a laptop computer and/or printouts. Having been confirmed in type testing, digital technology provides assurance that the functional settings can be relied upon. On the larger units, one might employ

secondary injection to confirm the performance at the required settings. This practice has been significantly reduced with respect to periodic testing due the high reliability and continuous self-assessment of the product with its microprocessor-based software.

5. Interconnection Conformity Assessment Program

Deployment requirements associated with DER interconnection to the EPS are meant to be comprehensive, rigorous, and well documented. Where the standards, codes, and regulations are adhered to, confidence in the installation is assured. What remains, is a process that instills confidence in compliance with the EPS interconnection agreement and the operability of the interconnection to expectations. The IEEE-SA is establishing a program that will result in providing a process that can assure confidence in the as-installed interconnection operability. Among the goals are the following:

- Establish a standardized commissioning process.
- Establish an education process to train commissioning agents.
- Establish evaluation platforms for demonstration purposes.
- Establish a cadre of certified commissioning agents.
- Establish an interconnection certification process.

Commissioning Process

At present, a documented commissioning process is in development. (Refer to Appendix A for the most recent version.) The initial draft, developed for IEEE-SA, was used in evaluations of an interconnection system at the Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center at North Carolina State University in June 2016 and the Duke Energy Electrical Grid Research Innovation and Development (eGRID) Facility at Clemson University in Charleston, SC. It was successfully validated. Following that demonstration, a committee was formed to provide broad-based input from industry and regulatory interests. This continues to be an ongoing effort and should be adopted by the committee shortly.

Education Process

Efforts are underway to define an education environment that would address the full spectrum of DER interconnection commissioning. An initial thought is to break this down into manageable pieces. For example, commissioning of the smaller interconnections does not require the same level of technical skills as would an interconnection to the BPS and for DERs rated over 10 kW to 20 kW. One potential idea is the smaller interconnection systems could readily be commissioned by electrical inspectors with the requisite training. Electrical inspectors are required to accumulate continuing education units (CEUs) as a precursor to keeping their license. Many of these CEUs are presented in regional meetings of the International Association of Electrical Inspectors (IAEI). Training units developed by IEEE-SA could be presented at these regional meetings. Those passing a commensurate test could be granted certification as a DER Interconnection Agent by IEEE-SA. When a list of approved commissioning agents is generated, EPS operators could use this to link-up commissioning agents to interconnection customers. The benefit to the EPS operator is the reduction of man-hours needed to witness commissioning. This would present a cost savings to the EPS operator. The cost addition to the interconnection owner would be negligible since the inspector would already be needed to certify the installation in order to receive a certificate of occupancy from the jurisdictional municipality, etc. Verification of signoff is already a requirement in many of the EPS operator's application and agreements.

For lower rating DER interconnections, commissioning might not require an engineering degree. Many community colleges offer courses on electrical construction technology. These are the primary source of qualified electrical contractors and inspectors. Adding the requisite training to these courses provides an opportunity for training DER interconnection agents. Materials developed by IEEE-SA for inclusion in that course material is readily achievable.

For the more complex and larger interconnections, the likelihood is that the EPS operator would want to witness the commissioning. It is obvious that a more thorough knowledge and skill is necessary to commission the larger and/or more complex DER interconnection systems. It is noted that there already exist engineering and technical professionals who regularly engage in commissioning on-premises power systems. The development of a training curriculum directed toward this level of professional as developed by IEEE-SA would provide the skills required to certify them for DER interconnection commissioning. IEEE societies such as the Power and Energy Society and Industry Applications Society hold meetings regularly. Education modules developed for DER interconnection commissioning could be presented at these meetings as tutorials to capitalize on the resident expertise of their members and create a cadre of certified agents.

Demonstration Platforms

In addition to the platform evaluated at the FREEDM Systems Center, the IEEE Conformity Assessment Program (ICAP)[5] is partnering with others to establish more demo sites. This is particularly critical as we enter the Smart Grid era. Interoperability and two-way communication with interconnected DER is addressed in the latest version IEEE Std 1547 [5]. Platforms capable of evaluating these newer operational requirements are necessary. The evaluation platform at the FREEDM Systems Center had communication capability. It was used to record parameter performance while evaluating the commissioning procedure.

Certified Agents

The implementation of the various training and educational efforts, previously described herein, provides IEEE-SA the means to educate and certify commissioning agents. This would lead to a cadre of qualified agents available to EPS operators to link-up with DER interconnection owners. A significant benefit would be the imposition of the cost of commissioning on the DER operator rather than the EPS operator.

Interconnection Certification

The final result of this ICAP program is to issue a certificate of conformity. DER interconnection commissioning (see Appendix A):

- By an IEEE trained agent
- Producing a written report of the commissioning,
- A documented record of system settings,
- Confirmation that the components, subsystems, and systems are labeled and listed to the appropriate standards as suitable for their intended service.

The result is confidence in the installed and operating DER interconnection.

Summary

It is demonstrated herein that adequate and appropriate steps are in place to create a suitable environment for the interconnection of a DER with an EPS. What remains is the creation of a commissioning procedure that instills confidence in the installed and commissioned interconnection system. ICAP has undertaken the task of developing and providing such a program.

[5] ICAP develops and implements programs that couple standards development activities with conformity assessment activities, which help to accelerate market adoption while reducing implementation costs.

6. Citations

[1] C2-2017, 2017 National Electrical Safety Code® (NESC®).[6]

[2] Energy Policy Act of 2005, United State Congress (July 29, 2005) Approved August 8, 2005.

[3] IEC 60364, Electrical Installations for Buildings.

[4] IEEE Std 1547™-2003, IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.[7, 8]

[5] IEEE Std 1547™-2018, IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

[6] IEEE Std 1547.1™-2005 (Reaff 2012), IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

[7] NFPA 70:2017, National Electrical Code®, (NEC®).[9]

[8] UL 1741, Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources.[10]

[6] The NESC is available from the Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).

[7] The 2003 version of IEEE Std 1547 has been updated by the 2018 version; however, the 2003 version is relevant to this paper.

[8] IEEE publications are available from the Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).

[9] The NEC is published by the National Fire Protection Association (http://www.nfpa.org/). Copies are also available from the Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).

[10] UL publications are available from Underwriters Laboratories (http://www.ul.com/).

Appendix A

Commissioning Checklist

1. Area EPS Requirements—fully executed EPS interconnection agreement including all required information and documentation.
2. Description of operation—Given the interoperability requirements of the revised IEEE Std 1547, it will be necessary to specify which operating modes are applicable to this particular interconnection.
    a. Where applicable, specify Operating Category I, II, and/or III. Include a table of all settings for the operation.
    b. Where applicable, specify Operating Category A or B and operational performance for reactive power capability and voltage/power control. Include a table of all settings for the operation.
    c. Specify and tabulate all settings for response to abnormal voltage and frequency conditions.
    d. Explain operational coordination with EPS reclosers where applicable.
    e. Explain after-trip-return-to-service operation.
    f. Explain unintended islanding detection operation and state interval time setting from initiation of the island to *cease-to-energize*.
3. Where applicable, include a description of each interoperable function and packet of data to be communicated. Each description should include all particulars to confirm compliance with the EPS Interconnection Application/Agreement.
4. Verification of inspections
    a. Record the NRTL Label, File # and listed intended use of each component, subsystem and/or system in the interconnection system. Confirm that the application is in compliance with the listing.
    b. Confirm and record all settings. Compare settings with the manufacturer's production report.
    c. Confirm system installation is in accordance with the electrical design as submitted with the application for interconnection.
    d. Confirm system grounding is in compliance with the governing interconnection agreement.
    e. Visually inspect and verify operability of the isolation device, as specified in the governing interconnection agreement.
    f. Verify that polarities, burdens, and ratios of field wired CTs and VTs are correct and in accordance with the design documents.
    g. Through visual inspection, continuity test and/or insulation resistance test, verify that field-installed power and control wiring is in compliance with design drawings, manufacturer's requirements, and applicable codes.
    h. Where the interconnection system responds to or initiates a protection/control function with an external entity, identify, confirm and record operability response. Confirm compliance with the interconnection agreement.
        i. Input functions: describe the source, type of input and expected response. Observe and record the response.
        ii. Output functions: Describe type and record both expected and observed operation.
    i. On three-phase systems, check the phase rotation of both the Area EPS and DER to verify that they are compatible as installed. Record phase rotation.

j. Verify and record performance of each monitored entity. Confirm compliance with the interconnection agreement.

5. For a total of five readings spaced at 15-minute intervals, record interconnection operation voltage, current, and power on each phase. Record frequency and average power factor. This section of the commissioning process should be conducted when the DER is likely to produce maximum output power. Record energy source status during this regimen (good wind velocity and volume, maximum solar radiation, etc.)
6. Unintentional islanding—Document the method of unintentional islanding verification. Initiate, observe, and record the operation. Record the time taken to detect and then cease to energize the power output of the DER.
7. Cease to energize—Describe the method used to evaluate the cease to energize function of the interconnection system. Initiate, observe, and record system response. Record the time taken to detect and then cease to energize the power output of the DER.
8. Record any settings that were revised during the commissioning process with explanation of the reason for revision.
9. Commissioning report—A written report, tabulated as items 1 through 8 above, of the results obtained during the commissioning process is to be prepared and signed by the commissioning agent. A copy should be submitted to the EPS operator for the record and to confirm compliance with the interconnection agreement.

IEEE STANDARDS ASSOCIATION

3 Park Avenue, New York, NY 10016-5997 USA

http://standards.ieee.org

Tel.+1732-981-0060 Fax+1732-562-1571