Defining the Value of IECRE Certifications for Providing Confidence in PV System Performance

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***Abstract* — The International Electrotechnical Commission (IEC) established a new conformity assessment system for renewable energy (IECRE) to address the industry's need to assure investors of the value of their PV power plants. There has been significant activity in the past three years devoted to defining the requirements for several types of PV system certificates, and publication of the international standards upon which these certifications are based. Now the IECRE system faces the challenge of defining the value proposition for certification and convincing stakeholders that it should be a standard requirement in the marketplace. This paper presents a detailed analysis of the present situation and the plan for promotion of IECRE certifications to help achieve wider market penetration of PV power generation.**

***Index Terms* — certification, conformity assessment, PV systems, qualification, standards.**

I. Introduction and Background

One of the key issues facing the PV industry, and renewable energy in general, is the need to assure investors of the value of their system. As one means of accomplishing this goal, the International Electrotechnical Commission (IEC) established a new system for conformity assessments of renewable energy projects (IECRE).

Conformity assessment is a valuable tool used in many industries to demonstrate compliance with international standards and provide assurance of quality and reliability. In the PV industry, it has become increasingly important to provide assurance to investors that projects will produce the expected amount of energy (and revenue) specified in the design phase. A similar need exists in the wind energy and marine energy industries. As a means of providing such assurance, the IECRE began operating in 2014 within the IEC, which now operates four conformity assessment systems (refer to Figure 1). As shown in Figure 1, the IECRE system is the first to consist of separate "schemes" for each industry sector. So far, these include Wind, Marine and Solar PV, but the structure of the system allows for additional sectors (such as solar thermal or fuel cells) to be added in the future.

IECRE conformity assessments are performed by independent third parties (certifying bodies), and based on inspection and test results provided by accredited laboratories or inspection bodies.

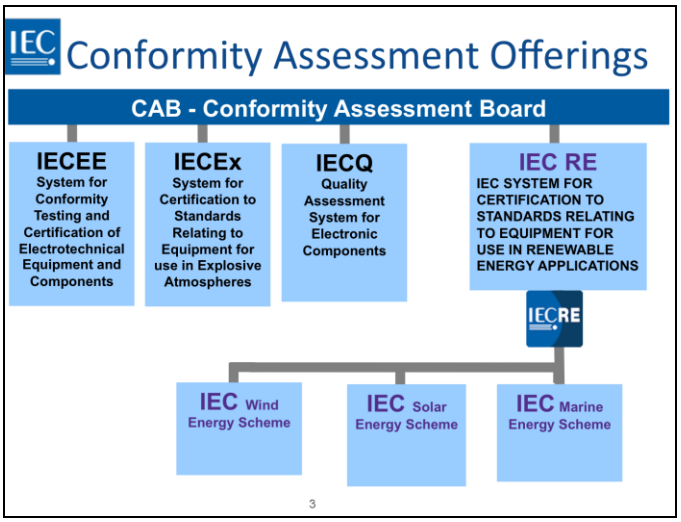

Fig. 1. IEC conformity assessment systems

The assessments include both "factory" and "field" aspects of PV projects (refer to Figure 2). Factory aspects include certification of hardware (modules, inverters, BOS) and auditing of the manufacturer's quality management system. Field aspects include system design, installation, commissioning, operation and maintenance.

The Basic Rules for the IECRE system were written in the first half of 2014, and each industry sector formed an Operational Management Committee (OMC) for each RE industry sector. Rules of Procedure (RoP) were then written for each industry sector and approved by the REMC. Certification Bodies, Inspection Bodies, and Testing Laboratories were approved for participation in the system based on initial assessments and ongoing participation on peer assessments. This is the mechanism for assurance of the equivalence of all IECRE certifications, and mutual acceptance of results by all participating members.

An important activity supporting the new IECRE system is the development of new or revised international standards to be used as the basis for conformity assessments. Experts in Technical Committee 82 (Solar PV energy systems) have contributed in several areas that are critical to PV system certification.

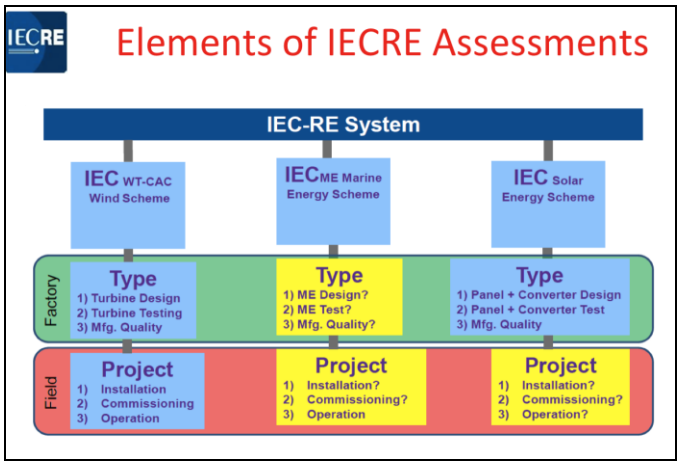

Fig. 2. Elements of IECRE conformity assessments

There is now a major effort underway to promote the use of the IECRE system and define the value of certification as an integral part of standard business practices within the PV industry. One important example of this is the "Orange Button" initiative in the US.[1] There is also a new proposal for a demonstration program for subsidized IECRE certificates to verify the effectiveness of the defined processes, provide feedback to the relevant IEC working groups, and establish confidence for early adopters in the marketplace.

II. Definition of IECRE Certificates

To provide meaningful system certifications, it is necessary to have published standards that define the technical requirements, as well as Operational Documents (ODs) that define the requirements for certification. The PV-OMC has now published several ODs which define the specific requirements for certifications at distinct stages in the life cycle of a typical PV project. Figure 3 illustrates the project lifecycle concept and the milestones at which certification is expected to be useful.

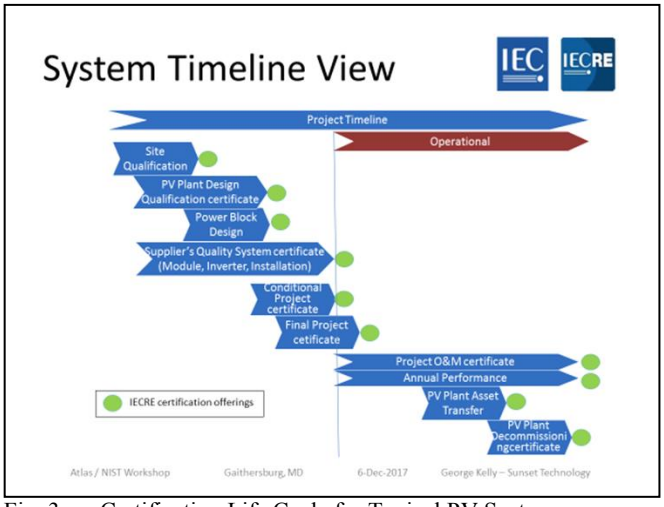

Fig. 3. Certification Life Cycle for Typical PV Systems

During 2016, the PV-OMC approved the first five ODs were approved by the member countries. OD-401 covers the requirements for Conditional PV Project certification, and OD-402 addresses Annual PV Plant Performance certification. The OD-405 series (3 parts) covers the requirements for quality system audits in PV module factories.

Plans are now in place to develop the remaining ODs as prioritized by the members of the PV-OMC. The next expected to be published is the PV Plant Design Qualification certificate (OD-403). Site Qualification and Power Block Design Qualification will later become sub-parts of this document, as appropriate standards are identified for each.

The next priority is to separate the Conditional PV Project certificate into sub-parts for mechanical and electrical work, designated "construction completion" and "commissioning". This structure has been chosen to align with the existing standard practices for financing PV projects and disbursing funds to contractors.

The requirements for PV Asset Transfer and Decommissioning certificates are still being discussed among industry stakeholders, so these ODs are not expected to be finalized until late 2017 or 2018.

III. Supporting TC82 Standards Development

To prepare for implementation of the new system, an effort was undertaken in 2013 to evaluate the existing international and national standards for relevance and applicability to conformity assessment, and to identify gaps in the existing standards, which needed to be addressed to ensure the success of IECRE for the PV industry.

This study[2] helped guide the work program of TC82, focusing resources in four specific areas where critical gaps were identified. New or revised standards were published to address each area as follows:

Module Quality – IEC TS 62941[3]
System Installation Quality – IEC TS 63049[4]
System Performance Measurement - IEC 61724 series[5]
System Commissioning - IEC 62446-1[6]

TC82 Working Group 3 is now developing a standard for system maintenance, IEC 62446-2[7]. This document will address preventative and corrective maintenance, both safety-related and performance-related, but is not expected to reach final publication until late 2018.

IV. CB/IB Participation

The underlying principle of all IEC conformity assessments is mutual acceptance of results by all participants. The basis for establishing mutual recognition includes accreditation (assuring that an organization has competency in the relevant standards) combined with regular peer assessments to monitor performance and consistency.

Seven RECBs and eight REIBs were approved in 2017 for participation in the IECRE PV Sector. PV Peer Assessors were appointed by each participating organization and approved by national member body ballots in the PV-OMC and REMC.

V. Demonstration Program

The American Renewable Energy Standards and Certifications Association (ARESCA) has initiated the following project in collaboration with the US National Renewable Energy Laboratory (NREL). The goals of this project are to test and validate the use of IEC certification processes on completed PV systems. In performing this project ARESCA will coordinate the inputs from the Solar Energy Industry Association (SEIA), NREL, Certifying Agencies, and other groups associated with such activities as finance and insurance, to test the efficacy of IEC standards. The project consists of four major tasks. [The first task is complete and the second is underway at the time of this submission.]

Task 1: Identification of System(s) to serve as test sites

The goal of Task 1 was to identify candidate systems to perform evaluation of the IECRE site inspection process. Industry outreach to identify these potential sites was performed, and with the results of this outreach a list of ten potential sites was developed. This list was prioritized, and three sites were identified as the most appropriate for performing the demonstration. Justification of the selection would also be identified.

In this task ARESCA worked with SEIA and NREL to identify the types of projects that would benefit most significantly from implementation of the IEC certification process. This process also considered inputs from other strong ARESCA supporters associated with the finance and insurance industries. SEIA contributed their extensive contacts with system developers, installers and operators. With these inputs, at least three systems were to be identified that would be completed in time to perform certification testing by the end of August 2018. In addition to the outreach for applicable systems, we also made initial inquiries with parties that may serve as the independent certification inspectors. In this role we have obtained initial commitments from Underwriters Laboratories and TUV Rheinland to serve in this role.

The identification of possible evaluation sites took on four distinct approaches:

a. Solicitation via direct contacts from the Industry - Both George Kelly and Steve Hogan have a long history with the industry and a large number of contacts on which to query interest. George especially had good contacts through his role as Secretary of TC 82 and involvement in the IEC working groups. Between George and Steve approximately 20 contacts were directly made to discuss candidate sites.
b. Support from the Solar Energy Industries Association (SEIA) - SEIA has been coordinating activities in Codes and Standards for several years and implemented Working Groups to focus on Best Practices. The SEIA constituency identified that a standard method for project testing would be useful, and a potential means for reducing system costs. SEIA's Director of Codes and Standards, Ms. Evelyn Butler, was instrumental in supporting the work by reaching out to her working groups and setting up a special session at the SEIA Symposium for us to take our message and solicit support for the activity.
c. Contacts established at the NREL PV Reliability Workshop - Both ARESCA representatives attended the NREL sponsored PV Reliability Workshop in Colorado in February. George presented a poster presentation on the IECRE activities, highlighting the advantages of the PV system testing commissioning certification. This conference led to several very good interested parties.
d. Contacts established at the SEIA Codes and Standards Symposium - Both ARESCA representatives also attended and presented at a special session on IECRE activities at the SEIA Codes and Standards Symposium in California in March. In addition to our presentations on the panel, a representative from Wells Fargo financial and a representative from USI Insurance spoke on the benefits of a standardized certification process such as the one offered by in this project.

Table 1 summarizes the range of applications received for evaluation. While there was significant interest in participating in the project, several parties expressed reservations based on the present lack of any requirement for a certification program and the potential costs (which are still not clearly established). These reservations drove home the need to perform a project such as this to clearly demonstrate potential benefits. On a positive note, several developers and financial groups expressed the desire to include the IECRE certification in their contract requirements. We will, of course, continue to follow up on those opportunities to encourage the approach.

TABLE 1. PV Systems Considered for Certification

Type	Size	Location	Developer
Ground Mount, Tracking	74.5 MW	Vero Beach, FL	NextEra
Ground Mount, Tracking	20 MW	Cameron, SC	EDP Renewables
Carport	1.1 MW	Lake Forest, CA	Constellation
Commercial Rooftop	200 kW	Windsor, CA	Staubli
Ground Mount	20 MW	Kern County, CA	Southern Co.

Task 2: Coordination of the Certification Process

ARESCA is now working with independent third parties (Certification Bodies and Inspection Bodies) to arrange for certification of the projects identified in Task 1. The CBs and IBs that are already approved by the IECRE are willing to do this work on a cost shared basis, as they recognize the importance of the certification process to the industry. The anticipated IEC standards that will be tested against are:

• IEC 62446-1: Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 1: Grid connected systems - Documentation, commissioning tests and inspection

• IEC TS 61724-2: Photovoltaic system performance - Part 2: Capacity evaluation method

Task 3: Overseeing Certification process on the designated system(s)

ARESCA will provide oversight on the certification process, including on-site observations of the visual inspection, certification testing, and handling of any process issues. By performing this task ARESCA will be prepared to issue findings and recommendations on the efficacy of the process, and to follow through with actions by the relevant working groups within IEC TC 82 and the PV-OMC of IECRE.

Task 4: Summarize and provide recommendations to the industry and stakeholders

In this final task, ARESCA will summarize the process and provide recommendations to the community. A final report will be generated, with wide dissemination and presentations at such conferences as Solar Power International and widely attended workshops. Shortcomings in procedures or value will be identified and passed on to the IEC for actions by the relevant working groups within IEC TC 82 and the PV-OMC of IECRE. These findings will also serve as valuable information to present to groups involved in system finance and insurance. This approach is intended to maximize the benefits of system performance certification, so an economic benefit evaluation can be made by those groups, and become the basis for widespread adoption of certification as a best practice for the PV industry and its customers.

VI. Conclusion

Conformity assessment is potentially an important tool for assuring investors of the value of PV projects and for reducing technical risks for insurance companies. The new IECRE system is seeking to accomplish this, and has significant support within the PV community. The system has begun formal operations and the rules for certification, along with supporting technical standards, have been published. Certification agencies have been approved for participation in the system, and efforts are underway to promote the value of certification as a standard practice in the PV industry.

To achieve the goals of the IECRE system, the business value proposition must be quantified and demonstrated. This value includes increased efficiency and reduced transaction cost obtained through efforts such as the Orange Button initiative. Promotional activities are underway in several arenas, and a potential demonstration program is proposed for the US.

References

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[4] International Electrotechnical Commission, IEC/TS 63049 Terrestrial photovoltaic (PV) systems - Guideline for increased confidence in PV system installation. Geneva, Switzerland: IEC Central Office, 2017.

[5] International Electrotechnical Commission, IEC 61724:SER Photovoltaic system performance (Part 1: Monitoring; Part 2: Capacity evaluation method; Part 3: Energy evaluation method). Geneva, Switzerland: IEC Central Office, 2017.

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