Conformity Assessment in the Wind Energy Industry

As renewable energy has grown to a mature industry since inception in the 1970s, the need for standards and conformity assessment became apparent. The work of international wind industry standards began in the late 1980(s) (IEC TC-88) and work on international conformity assessment began in 2015. This paper will describe this effort, the current status, and the anticipated path forward, with a focus on certification and conformity assessment. This white paper was prepared by board members of American Renewable Energy Standards and Certification Association (ARESCA) www.aresca.us

Why is Conformity Assessment important?

Conformity assessment is part of all aspects of life. The proper third-party assessment of products, services and even people, impacts us all, and is required to maintain societal structures and societal good. It starts at the time of birth when an infant is evaluated and scored by the attending board certified physician, continues throughout the education process, as students are graded to an approved standard and is present event in the last moments of life as time and cause of death are evaluated. During life we are surrounded by products and services that have undergone conformity assessment to specified criteria or standards. Everything from hair dryers to toasters have been certified to standards for our safety. This assessment of equipment is essential for personal and public safety, reliability, and enhancing trade and commerce. Conformity assessment is often required in regulatory codes established through government legislation. Conformity assessment is required so that:

- Government can **protect** its populations from unnecessary risks.
- In response to historical mechanical failures and safety events, insurers can have confidence that the operation of equipment or facilities will not cause **damage** or loss of life.
- Buyers can have **proof** that the product will be safe, reliable, and perform as they expect
- Lenders can have reasonable **assurance** that the project will meet financial performance expectations.
- Users and consumers can **trust** the product or service they are purchasing[i].

We can see the value of this if we look at the development of the industrial revolution and the advent of the steam boiler and engines, which suffered numerous deadly accidents and explosions. The ASME Boiler and Pressure Vessel Code (B&PVC) was conceived in 1911 out of a need to protect the safety of the public[ii]. Now one of the largest set of standards, along with the conformity assessment of National Board of Boiler and Pressure Vessel Inspectors (National Board)-certified jurisdictional assessors, these types of accidents have been largely eliminated.

The electrical power generation industry has benefited from these standards and conformity assessment requirements, to become an industry with an exceptional safety and reliability record, insuring safe reliable energy.

Standards and conformity assessment / testing

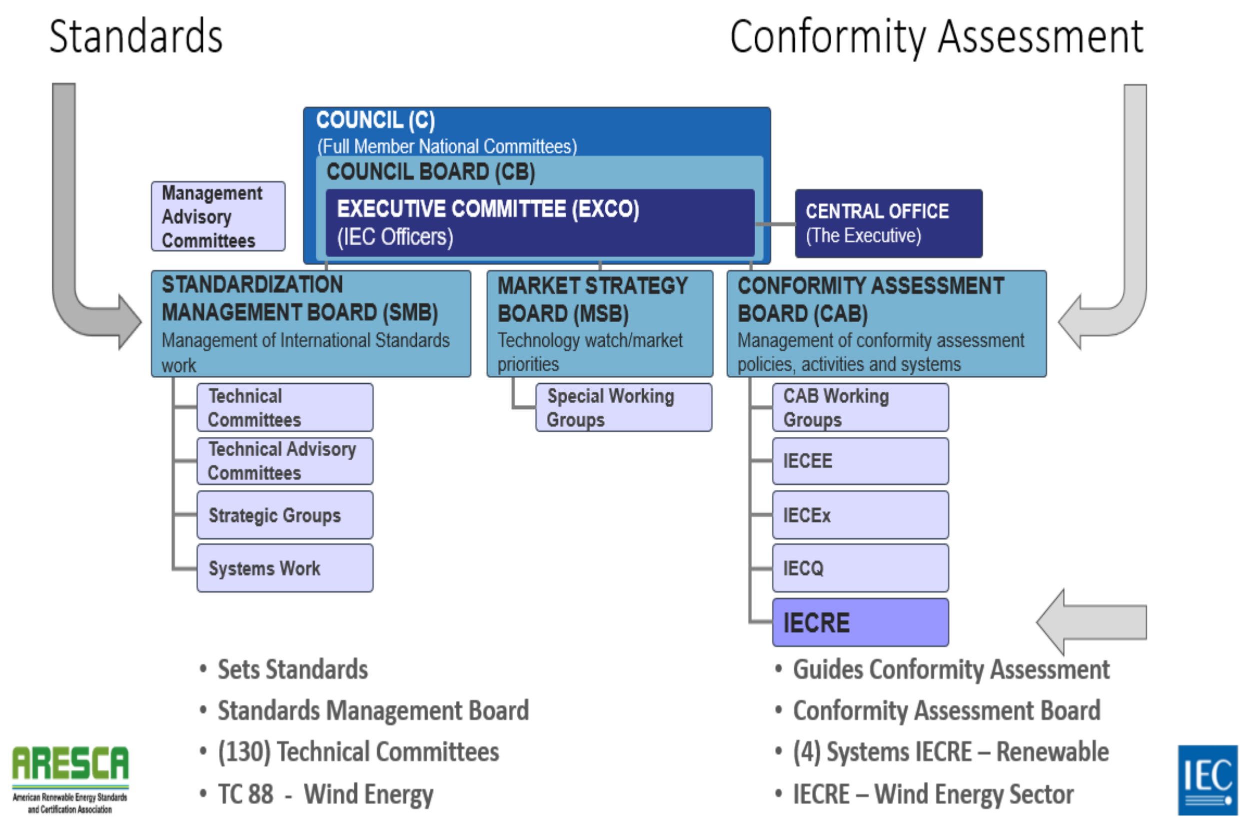
It is important to provide some background into standards and conformity assessment as the basis for this paper. **Standards and conformity assessment are mutually dependent**. It has been noted that they are like two sides of one coin with diminished value if used on their own, but having great value when used together. If a standard is used for design and construction, but no testing, inspection or evaluation is performed, there is little confidence in the product. Likewise testing and conformity assessment is meaningless, if you lack guidance for testing and verification, or a basis for an acceptable evaluation. It is critical to have good standards, and effective conformity assessment. The normal progression is for the standards to be developed first and then a Conformity Assessment scheme implemented based on the standards. In the wind industry the first international standards efforts were started in 1988, when several interested individuals decided to meet and start the work to develop standards. At the time wind industry development was truly an international effort with major owners / operators, manufacturers, suppliers, and service providers located throughout the world. The group decided that the standards should be international standards, so all regions of the world would benefit, and global trade would be fostered. The standards were developed under the International Electrotechnical Commission (IEC). IEC is a nonprofit organization formed in 1906 that develops and publishes standards concerning electrical technologies, of which a truly wide variety exists in today's modern world. Headquartered in Geneva, Switzerland, IEC standards reach over 150 countries. Standards must be developed so that conformity assessment can be performed. This requires that the standard:

- Must describe the products **function and behavior** as well as its design requirements.
- Must provide precise **measurable specifications and requirements**
- Must mandate **reliable and reproducible** tests and methods
- Must be developed with **broad unrestricted participation** using consensus[iii]

These characteristics ensure that the link from standard or specification to conformity assessment activities will be successful and meet user's expectation.

The following figure shows the organizational structure of the IEC and IECRE standards and certification

Figure 1 – IEC Standards and IECRE Conformity assessment organization



Let's take a closer look at Conformity Assessment. Conformity assessment determines if a product or service is what it appears to be, and if a system will perform as defined. It provides definitive statements regarding safety, quality, efficiency, effectiveness, the economic use of materials and energy, if a product fits and operates correctly with other products, and its impact on the environment (pollution and noise). The IEC conformity assessment frame work, supports all types of conformity assessment, and allows testing to be transparent, predictable, comparable, and affordable.

There are three types of conformity assessment that are widely used[iv]:

- **First Party –** The manufacturer or supplier declares that tests and other conformity assessment activities required to show the product conforms have been successfully completed. In many cases manufacturers will self-perform testing and evaluation and provide a Supplier's Declaration of Conformity (SDoC) . This type of conformity assessment is used where the product does not represent great danger, a critical reliability risk, or large economic impact. It is furnished information by the supplier. Some national regulations will accept SDoC for low risk products. This is the easiest and cheapest form of conformity assessment.

- **Second Party –** This type of conformity assessment is typically performed by a person or organization that has a purchaser or user interest in the product or service. A very large, important, or demanding customer (e.g. government or major manufacturer) will put in place its own conformity assessment for the products and services it purchases. This may include test facilities and special assessment procedures that are conducted to guarantee the quality of the purchased goods, and fitness for purpose. The aim is typically to obtain better assurance that the supplier has carried out their first-party conformity assessment. This is sometimes performed by an independent engineer or an owner's rep. In many cases this is being replaced by third party conformity assessment.
- **Third Party -** This is a conformity assessment activity that is performed by a person, organization, or body, that is independent from the manufacturer, and the buyer. In most cases the organization or body's prime focus of work is testing and conformity assessment. It is sometimes called certification and provides the highest level of confidence. Certification is an independently unbiased assurance of the safety of the product or service. It is applied where a major market makes it cost effective or where it is mandated by legislation. These activities performed by certification bodies (CBs), which are usually for-profit companies, so this type of conformity assessment is more expensive that first party conformity assessment.

While the IEC standards will support all three types of conformity assessment, **the IEC conformity assessment systems are based on 3rd party conformity assessment.** This is the best way to provide independent 3rd party testing and certification to safety, reliability, and performance of the product or service.

There are four broad categories which can be objects of conformity assessment, all of which have specific international standards addressing criteria to be evaluated. The objects of conformity assessment can be:

- **Product conformity assessment** typically involves the examination of physical characteristics and behavior (using testing and inspection).
- **Process or management conformity assessment** typically evaluates the behavior and mechanisms of individuals and organizations and includes the examination of structures, rules, and documentation. This type of conformity assessment typically involves the evaluation of manufacturing processes and quality and environmental management systems.
- **Personnel conformity assessment** may be an object of assessment by evaluating training, skill and performance of a person against the criteria specified in a standard.

- **Project conformity assessment** typical involves a combination of the preceding object of assessment to determine the overall safety, reliability, performance, quality, and environmental preromantic of a specific project.

Historic changes in the electric power generation industry and conformity assessment

As noted previously the introduction of the ASME B&PVC in 1911, which provided requirements for design, material, and fabrication for high pressure steam boilers was a great foundation for the expanding electric power generation industry. One of the most important failures that proved the need for Boiler Laws occurred at the Grover Shoe Factory in Brockton, Massachusetts on March 10, 1905. That incident resulted in 58 deaths and 117 injuries. The first Boiler and Pressure Vessel Code (1914 Edition) was published in 1915. The accident in Brockton provided impetus for insurance companies to require the code as well as States to legislate the B&PVC into State law. All provinces of Canada and 49 of the 50 United States have adopted, by law, various Sections of the Boiler and Pressure Vessel Code. Conformity assessment was inaugurated in 1924 at the National Board convention in Cleveland, introducing authorization of manufacturers who could sell boilers across the country (prior to this they could only sell in a specific States), pressure vessel registration, and the accreditation of jurisdictional inspectors[v]. In 1963 Section III (Nuclear Power) was issued providing standards for nuclear pressure vessels. In 1968 the first conformity assessment was introduced with the nuclear power certificate of authorization program. Formal government oversight was strengthened in the nuclear power industry with The Energy Reorganization Act of 1974 which created the Nuclear Regulatory Commission. It began operations on January 19, 1975.[vi] Second-party conformity assessment became law for the nuclear industry. For non-nuclear B&PV equipment third party conformity assessment was provided through the National Board. The relationship between the ASME and the National Board was formalized with the first authorized inspection agency accredited in 1992[vii]. This strengthened conformity assessment within the world of high-pressure power boilers and non-fired pressure vessel equipment. Third -party conformity assessment continues to be supervised and handled by the National Board, with manufacturing and repair company accreditation and authorization of all jurisdictional inspectors.

The electric power generation industry developed in the US within a regulated monopoly model – each integrated generator/ retailer having an exclusive franchise area (also known as public utilities). These public utilities employed expertise in areas of steam power equipment and high voltage electric facilities. As such, first- party conformity assessment was adopted for manufacturers of electric power equipment. Likewise, the utility would self-assess their own design, construction, and operations. First-party conformity assessment remains in place for regulated utilities today with very little governmental or local jurisdictional oversight or review, other than those required by the legislative requirement of the ASME B&PVC.

This changed after the utility deregulation that started to spread around the US in the 1990s. In the early 2000s independent power companies started to develop and operate large power facilities and for first time local electrical inspections were required for low and medium voltage portions of the plant.

The movement to renewable energy is bringing huge changes to the electric power industry. The shift away from a centralized power plant to the modularization and diversification of power generation equipment, the movement to lower equipment voltages, beginning of serial manufacture of power equipment, and an increasingly globally manufactured product is disruptive to the centralized utility industry. **Because of the inherent change from large centralized facilities to serial manufactured modular equipment employed in clean renewable energy, and the movement to manufacturing on a global basis, good standards and trusted third-party assessment became foundational to the transformation of our country's electric infrastructure while still maintaining safety and reliability.**

Development of the Renewable and Wind Industry

At the beginning of the modern wind power industry, wind turbine generators (WTG) were small, and were designed using basic machine design assumptions, factor of safeties, and available subcomponents produced and derived from other industries (e.g. aerospace, automotive and industrial). There were significant gaps in the understanding of aero elastic and other dynamic loadings including: impacts of geography and terrain on the wind flow, or grid system interactions. The companies that manufactured the wind turbines, performed only cursory testing and self-assessment (first party) of the finished product. Owner's looked at the small electric capacity compared to other power equipment and felt the wind turbines were low risk exposure. Although some of these early units are still in operation, many suffered reliability problems, failures, and energy production well below expected. It became apparent that standards for design and manufacture were required.

Although some countries started their own standards efforts earlier (e.g., US, Denmark, Netherlands, UK), the development of converged international wind energy standards began in 1988 under the IEC. Once standards started to be developed, the self- assessment approach was commonplace. As larger projects were developed due diligence in service to financial risk assessment become more widely used, with independent engineers hired to assess the products and services. Due diligence is not as rigorous as third party conformity assessment and was based on the independent engineer's experience and not the standards. Many times, multiple parties would hire an engineer to provide due diligence for the same project (i.e., developer, owner, financier, insurer, local regulatory jurisdiction). Multiple redundant due diligence proved to be a costly approach with marginal added value, and not leading to better outcomes. Despite multilevel scrutiny the wind industry continues to struggle with availability and reliability issues leading to some projects under performing.

As the technical complexity, the size of equipment and the size of projects expanded, the need for a consistent and transparent conformity assessment system became apparent. In 2010 the IEC issued the IEC 61400-22 standard to provide a framework for WTG systems conformity assessment and testing. With the establishment of IECRE and its Operational Documents (ODs), this document was withdrawn in 2018[viii]. Initially, third-party conformity assessment was provided to this standard by certification bodies using their own conformity procedures, and rules -normally to fill in gaps in the standards and align to common structural design review from other industries (e.g. ships, buildings, etc.). This was awkward and lacked transparency as each certification body would employ their own interpretation of conformity assessment requirements, and there was no mutual recognition between certification bodies and test labs. Although the wind industry benefited from this movement to third party conformity assessment, with increasingly reliable products and performance, there were still many projects that did not meet expectations, and failures continued to occur. There are some observations of this period that need to be noted;

- The power rating of wind turbines increased at a rapid pace
- The tower height increased at a rapid pace
- The size of projects increased significantly.
- Most wind farms did not achieve predicted Annual Energy Production (AEP)
- Operations, maintenance, and repair costs exceeded expectation.
- Energy pricing became more competitive, and per MW energy prices dropped putting margin pressures on projects.
- Wind turbines became more efficient at lower wind speeds, hence the geographic spread of projects increased.
- Significant increase of power purchase contract diversity; institutional and corporate.

A recent article on project insurance highlighted higher loss experience with wind turbine that were not subjected to 3rd party conformity assessment or certification

> *"design issues in some uncertified models are resulting in equipment failure. While this issue may be resolved over time, both wind and solar projects remain vulnerable to mechanical and electrical breakdown in this period of continued technical innovation in the sector, the insurer said."*[ix]

As development continued in the renewable energy with many manufacturers and projects around the globe, it was increasingly clear that a single global harmonized third-party conformity assessment system was required to foster further industry acceptance, and growth.

In response to this, wind industry stakeholders worked with the IEC to organize a renewable energy conformity assessment system within the IEC organizational structure.

IEC Conformity Assessment system for Renewable Energy (IECRE)

In 2014 an organizing meeting was held in Greenville, SC which set the pathway to establishing the IECRE. The first meeting was held later that year at Boulder, CO. Fourteen member countries participated in the first meeting. The IECRE conformity assessment system aims to facilitate international trade in equipment and services for use in renewable energy sectors while maintaining the required level of safety and reliability. In order to achieve this IEC:

- operates a **single, global certification system:**
- aims for **acceptance by local/national authorities** or other bodies requiring and benefiting from certification: and
- will make use of high quality International Standards and **allow for continuous improvement**[x]

The goal of IECRE's conformity assessment system is to **offer a harmonized application around the globe**, which ensures a uniform:

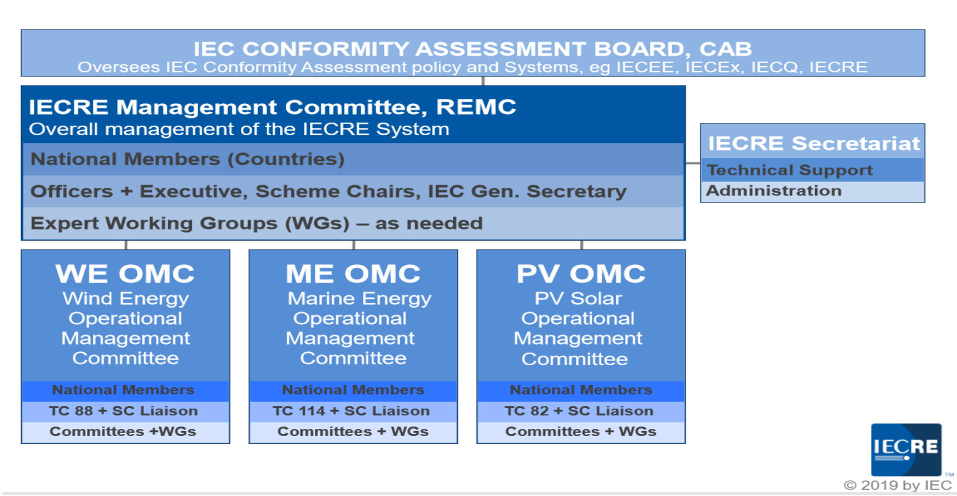
- implementation and **mutual recognition** between certification bodies and test labs;
- implementation and **delivery of information** by suppliers, sub-suppliers, end users and others providing documentation for certification; and
- implementation and **clear understanding** of all suppliers, sub-suppliers, end users and other applicants for the elements and modules as well as reports, statements and certificates of the certification processes

The IECRE is organized on an international basis, where all countries are welcome to join as an IECRE member country, or member body. Each member body has the right to review and vote on all rules, guidance documents, and operational documents. Like many international organizations each member body country has one vote on key rules and operational documents, as well as matters of policy.

The IEC system known as the IEC System for Certification of Renewable Energy Equipment (IECRE) is the **"gold standard"** for certification in wind, solar PV and marine energy certification globally. The Operational Documents for the IECRE system can be found on IECRE website at:

https://www.iecre.org/documents/refdocs/

Figure 2 IECRE organizational structure



The following countries are "member bodies" in the IECRE

Member Country	Percentage of global Installed capacity at end of 2018^{++} (* = < 1%)		Significant manufacturing of wind turbines or major components
	onshore	offshore	
Austria	*	*	Yes
China	36	20	Yes
Denmark	*	*	Yes
France	3	*	Yes
Germany	9	28	Yes
Hungary	*	*	No
India	6	*	Yes
Japan	*	*	Yes
Korea	*	*	Yes
Netherlands	*	*	Yes
Spain	4	*	Yes
UAE	*	*	No
UK	2	34	Yes
US	17	*	Yes
All Others	23	18	

$^{++}$Source: Global Wind Energy Council (Brussels); *Global Wind Report 2018*

To foster mutual recognition and harmonization the IECRE system was organized with global stakeholder groups. The stakeholder groups are as follows:

- Certification Bodies – (RECBs): The certification body stakeholder group's key goals are harmonization of requirements for the certification process; limiting/reducing national differences; developing a common interpretation of technical requirements; and maintaining mutual recognition. To be a RECB member and authorized to work in the IECRE system, CBs must be peer assessed to verify adequate technical proficiency. In addition, they must be accredited to ISO/IEC 17065.
- Test labs – (RETLs): The test lab stakeholder group's key goals are to: facilitate harmonized interpretations of testing requirements (e.g. through proficiency testing); to develop necessary Operational Document (OD) for peer assessment of RETLs; and to participate in developing a common reporting format for competence areas. To be a RETL test lab members must undergo a peer assessment to verify adequate technical proficiency. In addition, they must be accredited to ISO/IEC 17025.
- Inspection Bodies – (REIBs): The REIBs stakeholder group are inspection bodies that are active in the inspection and certification of PV solar facilities. Their goal is to develop and maintain a common set of operational documents for PV solar certification. In addition, they must be accredited to ISO/IEC 17020.
- Manufacturers (OEMs): The OEM stakeholder group's key goals are: to represent the interests of the manufacturers; to request & comment on clarification sheets; and to facilitate the dialogue between stakeholder groups within the IECRE system.
- End Users (EU): The end users group includes all end user of the certification system and the RE products. The end user stake holder group's key goals are to: promote mutual recognition of IEC certificates, test reports, and other documents; voice the requirements for the certification system; clarify market requirements for the certification process; and encourage improvements in safety and reliability;

Conformity assessment and testing in the IECRE scheme

The IECRE system offers multiple conformity assessment certifications needed to demonstrate conformity to the IEC standards. These include testing and calibration, equipment component and type certifications, and project certifications. The three major areas of conformity assessment include:

- **Calibration and Testing** – Certified testing and test reports are provided for various calibration and performance testing for wind energy equipment and project performance. Key areas of testing may include:
    - Anemometer calibration according to IEC 61400-12-1: 2005; 2017, Annex F;
    - Blade testing according to IEC 61400-23:2014;
    - Loads testing according to IEC 61400-13:2015;
    - Power performance testing according to IEC 61400-12-1:2005; 2017;
    - Acoustic testing according to IEC 61400-11: 2012+AMD1 2018;
    - Electrical characteristics according to IEC 61400-21:2008;
    - Lightning protection testing according to IEC 61400-24:2019;

- Drive train testing according to IEC 61400-4:2012;
- LiDAR classification according to IEC 61400-12-1: 2017, Annex L

- **Equipment** – The equipment certification scheme provides procedures for conformity assessment to IEC standards for WTGs and components. Certification is provided to specific standards, and technical requirements relating to safety, reliability, performance, testing and interaction with electrical power networks. A "Prototype" certification provides assessment for the safe operation of prototype WTGs for testing new model type. Specific modules included in a type certification include:[xi]
    - design basis evaluation;
    - design evaluation;
    - type testing;
    - manufacturing evaluation; and
    - final evaluation;
    - foundation design evaluation (optional);
    - foundation manufacturing evaluation (optional); and
    - type characteristic measurements. (optional)
        - power quality and other electrical tests;
        - low voltage ride through tests; and
        - acoustic noise measurements
- **Projects** - A third-party conformity assessment of a complete wind farm project or individual installation associated with the wind farm is provided by the project certification process. A "Project" certificate can be provided for onshore and offshore wind farms installations, and demonstrates conformity assessment of the wind farm design, manufacture, transportation, installation, and operation.[xii] A wind farm "Project Design" certificate can be obtained to demonstrate assessment of the site-specific design and site assessment, without the evaluation of transportation, construction, and testing. The key project certification modules are as follows:
    - site conditions evaluation;
    - project design basis evaluation;
    - integrated load analysis evaluation;
    - site-specific wind turbine RNA design evaluation;
    - tower design evaluation;
    - substructure design evaluation;
    - (generic) foundation design evaluation; (optional)
    - grid code compliance evaluation; (optional)
    - other installations design evaluation; (optional)

The value of IECRE conformity assessment

IECRE conformity assessment provides confidence through harmonized peer assessment standards, vendor accountability, and process transparency. This enables mutual recognition between certification bodies and test labs and fosters global acceptance and Increased renewable deployment. IECRE value is to all wind energy owner operators, as well as other stakeholders such as financial and insurance entities; and government and regulatory authorities, can be summarized as follows:

- IECRE conformity assessment and certification brings confidence that the equipment has been designed, manufactured, built, tested, installed, and assessed using procedures that comply with IEC renewable energy equipment standards.
- IECRE conformity assessment and certification demonstrates the manufacturers, testing agencies, certification bodies, and test labs meet the same requirements, are well qualified, and being held accountable to a common IECRE standard for assessment.
- IECRE conformity assessment and certification brings complete transparency. The standards and documents are fully available.
- IECRE conformity assessment and certification provides a consistent evaluation. All RECBs and RETLs in the IECRE system use common operational documents.
- IECRE conformity assessment and certification enables mutual acceptance and global recognition. The IECRE certification is accepted and recognized globally, representing a significant industry savings.
- IECRE conformity assessment and certification leads to improved project bankability.
- IECRE certification provides documented risk mitigation

This brings value and savings to all the stakeholders in the industry. For:

- Manufacturers who have their products certified in the IECRE system demonstrate that the equipment design is to IEC standards which provides market differentiation, and global acceptance of their product. This leads to increased market penetration and sales. Certification is streamlined as IECRE reports are mutually accepted resulting in reduced redundant reviews and providing a pool of assessed and approved RECBs, & RETL allowing sourcing flexibility.
- Certification Bodies and Test Labs that participate in the IECRE system benefit from IECRE standardized assessment guidance as well as mutual recognition of IECRE test reports and certifications. For RECBs and RETLs, IECRE leads to efficiency and increased opportunity
- Owners and Operators who purchase renewable energy equipment and services with IECRE certification benefit from IECRE certificate documentation, providing better transparency & purchasing confidence. Equipment purchasing confidence is improved by a much more thorough product review than possible by traditional purchaser inspection or 2nd party due diligence. IECRE provides qualified vendors for assessment

and testing service, which reduces vendor qualification costs. Mutual recognition lowers redundant work. It is expected that improved conformity assessment will ultimately lead to improved reliability, lower finance costs, and increased project AEP

- For Finance and insurance IECRE certification reduces due diligence costs. Having conformity assessment for a project reducing transaction cost and lowers the technical risk exposure, ultimately lowering the finance rate, and improving project performance.
- For Government agencies and regulators, IECRE is the one cost effective means to ensure that renewable energy projects are built to IEC standards and that public safety concerns have been addressed.

Path Forward

Having one internationally recognized set of standards for wind power industry equipment and projects, along with coordinated conformity assessment testing is extremely valuable for the US and global renewable energy transformation. Whether US manufacturers are exporting equipment overseas or US owner / operators are purchasing equipment from an overseas manufacturer, conformity assessment offered by IECRE will increase confidence and decrease costs.

However, the implementation and use of these valuable certifications needs to be expanded. The path forward to expand implementation and increase the use of IECRE conformity assessment requires a wider awareness and knowledge of IECRE certifications, as well as the specified requirement that wind energy equipment and projects be certified within the IECRE system. There are several ways that conformity assessment of wind energy equipment and projects can be widely implemented; listed in order of effectiveness of implementation:

- **Government legislated or regulatory agency requirement** - This is the most common, and definitive model means to require conformity assessment to verify safety and reliability of complex and hazardous electrical equipment. Within the US, examples exist in many electrical appliances, hardware, and equipment. This is also the practice for the wind industry in several European countries, (e.g., Denmark, Netherlands) where certified turbines are required and offshore wind projects must have a "Project" certificate. In the US there is no such requirement in the wind industry. **The authors of this paper recommend that US regulatory agencies with responsibility for safety and environmental performance of offshore wind energy projects, set a requirement that off shore wind generating equipment and the projects be certified to IECRE**, via "Project" certification.
- **Financial institutions and insurance carrier's requirement** - This is a second approach which has been used for capital intensive, high risk projects. This has been used in other energy industry technologies and is just being implemented on a small scale in the wind industry. This should be broadened throughout the financial and insurance marketplace. Requiring the certification of equipment and projects provides a clear and

concise means to mitigate project technical risk for capital intensive projects such as wind farms. **The authors of this paper recommend that financial institutions who finance large wind energy projects require wind energy equipment model type certification, and large projects require a "Project Design" certificate for onshore wind and a project certificate for offshore wind projects.**

- **Manufacturers adopt a common standard for design, manufacture, and conformity assessment**. This approach has also been used in the energy industry where manufacturers voluntarily adopt a specific standard and conformity assessment. In the wind industry, several of the key major wind energy generating equipment manufacturers have made a commitment to IECRE model type certification for their equipment. The use of the IECRE conformity assessment demonstrates a high level of quality, availability, reliability, and ensuring the products are fit for purpose. **The authors of this paper recommend that manufacturers that market wind energy projects in the US use IECRE certification as the basis to demonstrate product quality.**
- **Individual purchaser specification of equipment to a standard and verified via a conformity assessment system.** This widely used with high capital cost equipment and is also used by many government and military purchasers. If purchasers require the common IECRE certification the quality of equipment will be higher and more consistent. **The authors of this paper recommend that owners and operators in the US specify IECRE type certificates for all wind generating equipment.**

Future IECRE conformity assessment products are in discussion for future development. IECRE will develop products where there is need to demonstrate specific performance or an important aspect of compliance. This would include grid interconnection and electrical system performance; project resource assessment and energy yield; project design for specific terrain, and geography; biological impact assessment and mitigation; and noise performance.

Summary

The rapid pace of renewable development and deployment worldwide is astounding. Our grid is rapidly transforming from traditional carbon fueled electrical generation to clean carbon free renewable energy. The global serial manufacturing and production, and the modular deployment of renewable equipment requires both Global standards and a unified conformity assessment system. The IEC suite of standards is the globally accepted standard for the design, manufacture, siting, and construction of renewable energy projects. Now there is a conformity assessment system under the authority of the IEC known as IECRE, that provide a unified globally accepted certification for renewable energy equipment and projects. Manufacturers are encouraged to utilize IECRE certifications to enhance global sales. Owners are encouraged to request IECRE certifications when purchasing renewable energy equipment for added confidence. Governmental agencies are encouraged to adopt IECRE certifications, as a requirement for renewable energy projects, to ensure the projects are built to IEC international standards.   Insurers and financers are encouraged to require IECRE certification as cost effect means to prove that risk mitigation is in place.

About ARESCA

The American Renewable Energy Standards and Certification Association (ARESCA), is a Vermont non-profit Section 50l(c)(6) organization formed in 2015 to foster renewable energy standards and certification efforts.[xiii]

ARESCA's goal is to make participants involvement in standards simpler, and to facilitate harmonization of US renewable energy standards and conformity assessment schemes with international organizations such as the International Electrotechnical Commission (IEC). The faster standards can be developed and adopted by manufacturers, investment organizations, developers, and owners, the lower the cost of renewable energy, and the more expeditious the movement to a cleaner and sustainable tomorrow.

ARESCA administrative and secretariat services for the following standards / certification development organizations:

- IEC 61400 TC 88 (Wind Energy standards) US Technical Advisory Group. (US TAG)
- IEC SC 8A Grid Integration of renewable energy generation (US TAG)
- IEC SC 8B Decentralized Electrical Energy Systems (US TAG)
- IECRE (Renewable Energy Conformity Assessment) United States National Committee (USNC)

ARESCA's mission is to provide cost-efficient, timely, and clear administrative functions for our members comprising the US Renewable Energy Standards community. Administrative functions include Secretariat duties and standards development organization (SDO) functions. Our goal is to make participants involvement in Standards simple, easy and facilitate harmonization of US Renewable Energy Standards and Conformity Assessment Schemes with international organizations such as the International Electrical-technical Commission (IEC).

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[xiii] https://aresca.us/frequently-asked-questions/
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