
UMERC+OREC
2025 Conference

*12-14 August | Corvallis, OR USA*

# The current state of International Standards and Conformity Assessment for Marine Energy

Winston D'Souza[a], Rick Williams[b], Jonathan Colby[c]

[a]*Lloyd's Register, Aberdeen, Scotland, United Kingdom**
[b]*Oregon Applied Research LLC, Oregon, United States*
[c]*Streamwise Development LLC, Washington DC, United States*

**Abstract**

The exponential rise in the development of Marine Energy technologies now makes it one of the fastest growing clean energy-production industries. Marine Energy technologies harvest energy from clean, renewable resources that include Wave, Tidal Current, Ocean Current, River Current, and Ocean Thermal Energy Converters (OTEC).

The commercial success of Marine Energy can be enhanced for investors, insurers, regulatory authorities, end users, and public stakeholders by adherence to international standards and conformity assessment processes, such as certification. Standards and certification ensure these systems are viable, reliable and efficient in terms of safety and performance.

In 2007, the International Electrotechnical Commission (IEC) established Technical Committee (TC) 114, "Marine energy – Wave, tidal and other water current converters", to develop international standards for Marine Energy conversion systems to provide electrical energy and other outputs such as desalination and heat exchange. IEC international standards are developed through consensus by experts representing many countries, then approved and published by a globally recognized body. Standards comprise of rules, guidelines, processes, or characteristics that allow users to repeatedly achieve the same outcome.

In 2014, the IEC Renewable Energy System (IECRE) was established to develop conformity assessment processes to enable internationally recognized certifications. The IECRE process for certification for any technology involves verification and validation. These activities are led by an IECRE accepted renewable energy certification body (RECB), often in conjunction with a test laboratory (RETL), also accepted by the IECRE. With regards to Marine Energy technologies, the IECRE is responsible for developing and managing a framework where these technologies can be independently verified and validated.

*Keywords:* Marine energy; IEC; IECRE; Standards and Certification

## 1. Nomenclature

| | |
|---|---|
| AD | Administrative document |
| IEC | International Electrotechnical Commission |

* Corresponding author.
*E-mail address:* winston.dsouza@lr.org

| | |
|---|---|
| IECRE | IEC system for Certification to Standards relating to equipment for use in Renewable Energy applications |
| OD | Operational document |
| OTEC | Ocean thermal energy converter |
| RECB | Renewable energy certification body |
| RETL | Renewable energy test laboratory |
| TC | Technical committee |
| TQ | Technology qualification |
| TS | Technical specification |

## 2. International Standards for Marine Energy

In view of the predicted exponential rise in the across the spectrum of marine renewable energy converters, in 2007, the International Electrotechnical Commission (IEC) established Technical Committee (TC) 114 to develop a suite of international standards to support these devices from design to deployment. International standards are initiated as technical specifications written by subject matter experts nominated by participating countries from around the world. The standards describe best practices, based on experience from industry, research institutions, and government agencies for how a system should be designed, built, tested, operated and maintained to be safe, compatible, and interoperable.

IEC standards are published by a globally recognized body adopting a well-established and transparent international consensus-based process. The IEC is headquartered in Geneva, Switzerland and has five regional centers around the world in Africa (Nairobi, Kenya), Asia (Singapore), Oceania (Sydney, Australia), Latin America (São Paulo, Brazil) and North America (Worcester, Massachusetts, United States). The IEC provides access to professional technical and editorial staff. Further, IEC standards and technical specifications are consistent with the IECRE global independent conformity assessment system and its processes.

Standards facilitate international collaboration by providing high-quality, reproducible test results that are recognized across borders. This can improve the quality of the devices and the integration of systems. The net benefits include lower development risk and, ultimately, reduced costs. International standards are not mandatory unless they are required by a regulatory body or for a certification process. International standards can reduce barriers to entry in global trade and enable companies to enter new markets more cost-effectively.

For example, one of the key tasks for TC 114 was to reach consensus on terminology that was effective across many countries, cultures, and languages. This was achieved by establishing internationally accepted consensus-based terminology that is now known as IEC "Electropedia: The World's Online Electrotechnical Vocabulary" Area 417: Marine Energy" (https://www.electropedia.org/iev/iev.nsf/index?openform&part=417), available publicly.

Through TC 114, the IEC has published a series of marine energy standards. Referred to as the 62600 series of technical specifications related to marine energy systems, Fig. 1 in section 5 provides an illustrative overview of the various parts of the IEC 62600 series that have been published to date, as well as those in development.

## 3. Conformity Assessment for Marine Energy

While the practice of international standards is recommended from design to deployment, an assessment against these is often conducted by an independent entity. These entities can be in the form of certification bodies or test laboratories. The process for conducting an independent assessment against international standards by these entities is referred to as conformity assessment. The outcome from a conformity assessment process is generally a certificate, or another form of deliverable to confirm the status of the assessed scope.

In 2014, the IEC Renewable Energy System (IECRE) was established to develop conformity assessment processes to achieve internationally recognized certifications. The IECRE conformity assessment process involves verification and validation. Verification is an assessment of a technology against a defined set of international standards or codes through a design review. Validation is an assessment of a specific technology against the same set of standards or codes through testing. Hence, the foundation for any certification is a set of international standards and codes. These activities are led by an IECRE accepted renewable energy certification body (RECB), often in conjunction with a

renewable energy test laboratory (RETL) that performs tests against defined standards. The IECRE consists of the Wind, Solar Photovoltaic, and Marine energy sectors, each of which have their own set of governance documents.

The IECRE conducts assessments based on consensus-based international standards. These assessments are based on IECRE operational documents (OD) that stipulate requirements that must be met for the scope of an assessment. Upon successful completion of the assessment in accordance with an OD, a recognition for that scope of assessment is awarded by the IECRE through an RECB or RETL. IECRE recognition is granted in the form of Feasibility Statements, Conformity Statements or Certificates. A certificate represents the culmination of a series of assessment modules, each of which will have a corresponding Statement awarded, as documented in the respective IECRE OD.

For example, following the IEC 62600-4 Technical Specification for Technology Qualification, an RECB with a scope for delivering technology qualification services provides a gateway for these technologies to progress towards certification. This includes an initial robust assessment of Marine Energy technologies in accordance with the complementary IECRE document (OD 310-4), to better understand uncertainties related to their innovation.

Separately from the publications of ODs, to support the assessment of marine energy technologies against published international codes and standards, the IECRE has also published a set of requirements to support the acceptance of candidate RECBs and RETLs into the conformity assessment system. These requirements are published in administrative documents (AD) that lay out the scope of an assessment in accordance with a corresponding OD. As this is a globally accepted conformity assessment system that transcends the jurisdiction of national accreditation bodies, the general framework for the evaluation of RECBs and RETLs is through peer assessment. Peer assessments are a format wherein existing RECBs and RETLs evaluate each other against normative ADs and ODs to ensure standards are maintained.

## 4. Why International Standards and Conformity Assessment for Marine Energy

The use of international standards reduces risk and can increase the confidence of stakeholders including communities, regulators, investors and insurers. This increased confidence can benefit social licensing and marketing. From a business perspective, the use of standards can improve access to investors, improve financing availability and terms, and enhance insurability. The net benefit of the considerations listed above is to support the commercialization of the marine energy industry. Successful projects can increase market penetration and scalability of the industry, thereby reducing costs. As shown in Fig 2 in section 5, the wind energy industry waited over 15 years to embrace standards and another 20 years for certification. By comparison, marine energy has embraced these initiatives far more rapidly.

It must be noted that while the IEC standards development process and the IECRE conformity assessment system are independent of each other, they are part of the overall IEC governance structure.

### *4.1. Benefits of independent assessments*

These can be summarized as follows:

- Reduces risk and consequently insurance premiums
- Improves market access and supports commercialisation
- Considers the influence of the core technology being assessed on other technologies it is expected to interface with
- Confirms the technology conforms to international standards, thereby facilitating cross-border trade without hindrance.

### *4.2. Benefits of the IECRE system*

These can be summarized as follows:

- It is a single, global certification system
- Consists of structured modular assessments based on an internationally accepted consensus-based scope of work

- Accepted by most national and regional regulatory authorities
- Adopts globally accepted international standards as the basis for assessments
- Implements mutual recognition of other RECBs and RETLs within the IECRE system
- Aims to provide a transparent understanding of test reports, statements and certificates to suppliers, sub-suppliers, manufacturers, end users and other stakeholders

## 5. Illustrations

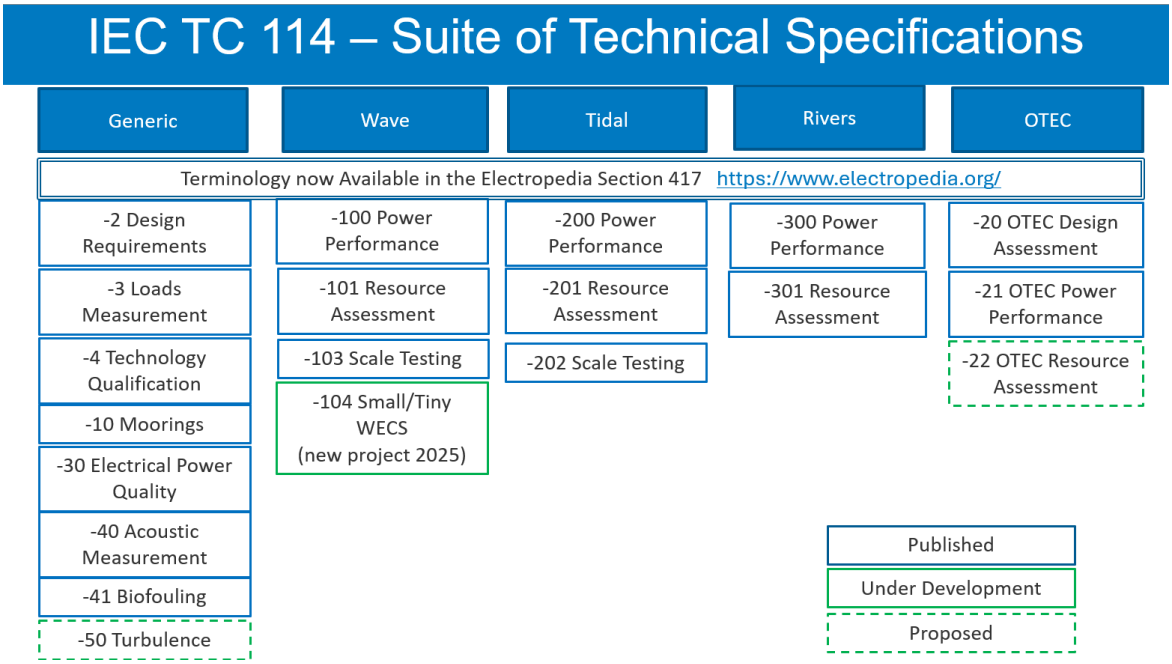


Fig. 1. Overview of IEC TS 62600 series developed by IEC TC 114

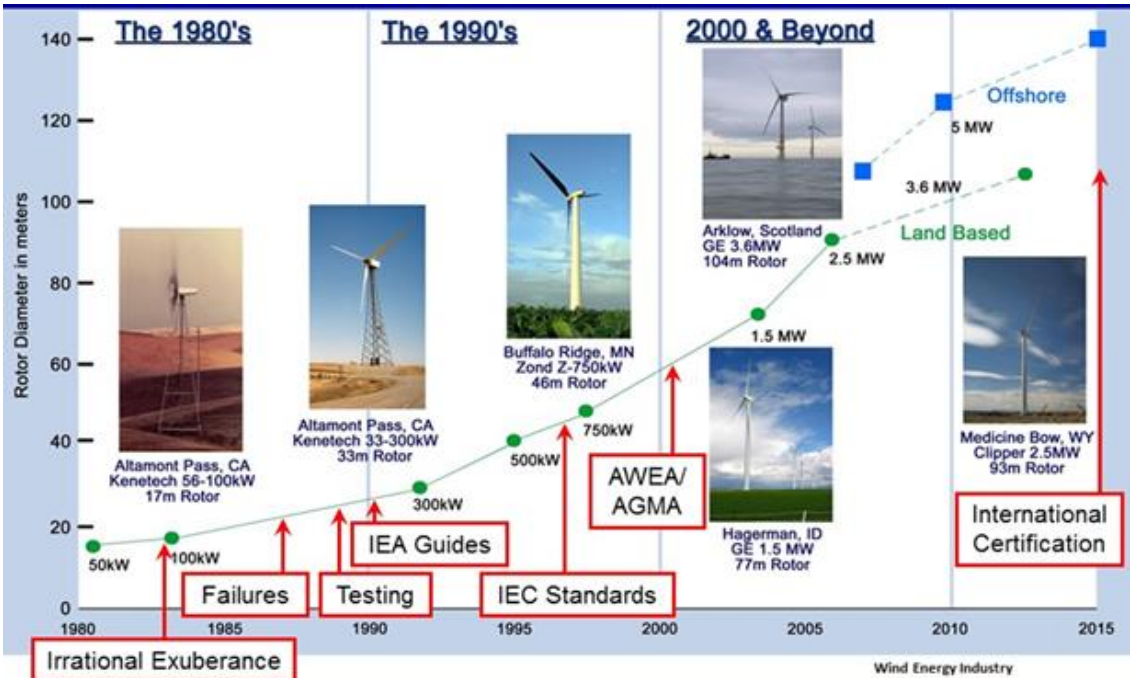


Fig. 2. Evolution of international certification in the Wind energy sector [1]

**Acknowledgements**

The authors would like to gratefully acknowledge the work undertaken by those from IEC TC 114 and the IECRE marine energy sector working group for their enthusiasm, dedication and commitment towards the development of international standards, ODs and ADs over the last decade.

**References**

[1] Thresher R., Robinson M., Veers P., Future of Wind Energy Technology in the United States, Conference Paper NREL/CP-500-43412, October 2008.
[2] IEC "Electropedia: The World's Online Electrotechnical Vocabulary" Area 417: Marine Energy
[3] Colby J., et.al, The Critical Role of International Standards and Certification for the Marne Energy Industry, OTC-29341-MS.
[4] IEA-OES, TC 114 and IECRE joint publication "Supporting Ocean Energy Technology Development and Commercialization: Coherent Application of Guidance, Standards and Certification, 2022.
[5] Williams R., D'Souza W., IECRE Certification of Marine Energy converters through IEC Standards, ICOE 2024, Melbourne, Australia.
[6] Scheijgrond P., D'Souza W., et. al., How certification accelerates commercial uptake of Marine Energy solutions, EWTEC 2021, Plymouth, UK.
[7] D'Souza W., IECRE Certification of Marine Energy Converters, All-Energy Conference 2025, Glasgow UK.
[8] Colby J., International Standards and Certification for the Marin Energy Industry, All-Energy Conference, 2025, Glasgow, UK.
[9] D'Souza W., IEC Standards for the Certification of Marine Energy converters, G-NAOE 2024 Conference, Southampton, UK.