STANDARDS AND CERTIFICATION AT THE IEC – CRITICAL DRIVERS TO COMMERCIALIZE THE MARINE ENERGY INDUSTRY

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STANDARDS AND CERTIFICATION AS DRIVERS

A review of nearly every robust, global market, including personal electronics, household appliances, medical devices, aviation/aerospace, and now the evolving marine energy industry, will show a solid foundation of International Standards and Conformity Assessment activities. The International Electrotechnical Commission (IEC) is "the world's leading organization for the preparation and publication of International Standards for all electrical, electronic and related technologies" with more than 120 Technical Committees (TCs), 70 Sub-Committees (SCs) and nearly 20,000 experts participating [1].

The development of consensus-based International Standards, and the associated Conformity Assessment (certification) Systems to ensure 3rd party verification of compliance to these standards, are of critical importance in the path to commercialization. First and foremost, the verification of compliance to consensus-based standards reduces risk and increases confidence in the performance, reliability and safety of equipment and products. For a range of products in many countries, compliance to standards may be a prerequisite for market entry. In such scenarios, participation in an international certification system can ease access to global markets while reducing the cost of repetitive sample testing.

This is particularly true for an emerging sector like the marine energy industry. Without a single, global Conformity Assessment System, Marine energy converter (MEC) developers, like Verdant Power, must rely on Certification Bodies (CBs) and Test Laboratories (TLs) in separate markets to provide individual verifications. If they even exist for marine energy, these certifications and reports are likely valid only to the specific issuing body and not accepted across countries and markets. This gap has led to inefficiencies and increased costs for testing and certification and decreased confidence in the verification of overall system performance, ultimately adding difficulty in securing financing for marine energy technologies and projects.

The critical need for the development and implementation of International Standards under the IEC/TC 114 "Marine energy – Wave, tidal and other water current converters" to support verification and certification for financial due diligence and investment in projects has been discussed previously [2].

Concurrent with the development of consensus-based standards under IEC/TC 114, a new IEC Conformity Assessment System for Renewable Energy (IECRE) is also under development. This System, including the Marine, Wind and Solar Photovoltaic (PV) Energy Sectors, will develop and operate certification products (Schemes) to support global market entry, reduce risk, and increase access to project capital and insurance, among others.

An update of activities on IEC/TC 114 and the ME-OMC are provided here, along with a discussion regarding the future of standards, certification and the marine energy industry at large.

DRIVER 1: STANDARDS DEVELOPMENT – IEC/TC 114

In 2007, the Standards Management Board (SMB) of the IEC established a new Technical Committee, TC 114, titled Marine energy – Wave, Tidal and other Water Current Converters *"to*

prepare international standards for marine energy conversion systems." IEC/TC 114 has been developing Technical Specifications (TSs) as precursors to International Standards since that time [2]. At present, sixteen participating member (P-Member) countries [2] and nine observer member (O-Member) countries on nine Project Teams (PTs), four ad-hoc Groups (AHGs), and one Maintenance Team (MT) are engaged in writing new TSs, assessing incoming information on TS application and maintaining the TSs. The active PTs are shown in Table 1. These efforts cover a range of marine energy conversion systems, including tidal, wave, river and ocean thermal energy conversion (OTEC) devices. Additional information can be found at www.iec/ch/tc114, including the Strategic Business Plan for IEC/TC 114, updated in 2015.

TABLE 1. IEC/TC 114 PROJECT TEAMS

Project Teams (PTs):
PT 62600-2 Design requirements for marine energy systems
PT 62600-20 General guidance for design and analysis of an Ocean Thermal Energy Conversion (OTEC) plant
PT 62600-30 Electrical power quality requirements for wave, tidal and other water current energy converters
PT 62600-40 Acoustic characterization of marine energy converters
PT 62600-102 Wave energy converter power performance assessment at a second location using measured assessment data
PT62600-103 Guidelines for the early stage development of wave energy converters: Best practices and recommended procedures for the testing of pre-prototype scale devices
PT 62600-202 Scale testing of tidal stream energy systems
PT 62600-300 Electricity producing river energy converters - Power performance assessment
PT 62600-301 River energy resource assessment and characterization

[2] Canada, China, Denmark, France, Germany, Iran, Ireland, Israel, Japan, Republic of Korea, Netherlands, Norway, Spain, Sweden, UK and US

To date, TC 114 has published six TSs and two more are pending publication in 2016, as shown in Table 2. These TSs are available for purchase from the IEC and through the American National Standards Institute (ANSI) in the US. Members of ANSI are eligible for a discount on the purchase of these standards from ANSI directly and all members of the marine energy industry are encouraged to purchase and apply the relevant TSs.

TABLE 2. IEC/TC 114 TECHNICAL SPECIFICATIONS

Published:
IEC/TS 62600-1:2011 Terminology
IEC/TS 62600-10:2015 Assessment of mooring system for marine energy converters
IEC/TS 62600-100:2012 Electricity producing wave energy converters - Power performance assessment
IEC/TS 62600-101 :2015 Wave energy resource assessment and characterization
IEC/TS 62600-200:2013 Electricity producing tidal energy converters - Power performance assessment
IEC/TS 62600-201:2015 Tidal energy resource assessment and characterization
Pending Publication (2016):
PT 62600-2
PT 62600-102

Four AHGs have been established specifically to receive information from the marine energy industry (OEMs, project developers, Certification Bodies, Test Labs, etc.) on the application of: the wave power performance TS, the wave resource assessment TS, the tidal power performance TS and the moorings TS. Sales statistics suggest that the TS documents are beginning to be used within the industry, however, feedback to the AHGs has been very limited, likely do to the small number of grid-connected deployments globally. Additional AHGs will be established to receive comments on new TSs as they are published.

Maintenance Team 1 (MT1) is currently active updating the Terminology TS (62600-1) to include new and updated terms from Project Teams active in the last 5 years. MT1 is also preparing unique marine energy terms to be uploaded to Electropedia, the IEC online electrical and electronic terminology database (www.electropedia.org).

In the United States, the Technical Advisory Group (TAG) to TC 114 operates as the national body to support the ongoing TS development. The US TAG has more than seventy members participating on unique Shadow Committees established for each of the active PTs, AHGs and MT. Two US Subject Matter Experts (SMEs) represent the US TAG on each PT, AHG and MT, with a single SME serving as the Shadow Committee Chair to coordinate US positions on technical issues associated with each group [2]. TAG meetings are held quarterly by teleconference (3 per year) and a single face-to-face meeting is held in early November. This annual, two-day meeting is hosted by a TAG member at their facility and includes a technical tour.

DRIVER 2: PARTICIPATION AND STANDARDS USE

The US has taken a significant leadership role on TC 114, currently holding the Chairman position of TC 114 and the Convener position on four of the PTs and AHGs. In the US, funding for select participants (SMEs, Conveners, the Chairman, etc.) is provided by the US Department of Energy (DOE) and the US TAG is administered by the National Renewable Energy Laboratory (NREL). Details of the US TAG can be seen at the following link: www.tc114.us.

Verdant Power's Jonathan Colby serves as the current Technical Advisor (TA) of the US TAG. The TA to the US TAG is the Head of Delegates for the US at the annual TC 114 Plenary Meeting and represents US interests at the IEC. Further, the TA represents the US TAG at the US National Committee to the IEC (USNC/IEC) and ensures that US TAG Operating Procedures are in accordance with national requirements.

Members of the marine energy industry are strongly encouraged to purchase and apply these TSs during design, deployment, testing, project development, etc., and provide comments on their applicability and utility back to the US TAG and ultimately the IEC/TC 114. Members of the industry are also ***strongly*** encouraged to consider participating in the development of IEC standards, either at the US level as a TAG member or at the IEC level as a SME. Participation on the US TAG provides a number of significant benefits, including the ability to ensure the applicability of standards to your technology and access to key industry members in the US and internationally.

DRIVER 3: NEW CERTIFICATION – IECRE ME-OMC

In 2011, the Conformity Assessment Board (CAB) of the IEC established a new working group, WG15, to determine the conformity assessment needs of the marine energy industry. WG15 included participants from more than 8 countries representing Certification Bodies (CBs), Test Laboratories (TLs), Industry and End-Users, among others. By 2013, WG15 identified a clear need for a global system for certification to consensus–based standards for the marine energy industry. In parallel, WG15 identified a gap in the existing Conformity Assessment Systems at the IEC, and, in conjunction with the IEC Wind Turbine Conformity Assessment Committee (WT-CAC) and the solar photovoltaic industry, proposed the creation of a new IEC Conformity Assessment System for renewable energy (RE). The CAB approved this 4th Conformity Assessment System, the IEC System for the Certification to Standards Relating to Equipment for use in Renewable Energy Applications (IECRE), in 2014 and the first meeting of the IECRE Management Committee (REMC) was held in Boulder, CO in September 2014.

Unlike IEC/TC 114, the IECRE has a unique budget and is entirely sustained by Member Body dues and fees associated with certification deliverables. The IEC provided significant financial support in the first two years of operation. The IECRE is currently comprised of 16 Member Bodies and operates three Sectors (ME, PV, WE). Member Bodies, by definition, are "fully representative of the national conformity assessment community in RE equipment and should include wide representation from industry, regulatory authorities and standards bodies as well as conformity assessment interests [3]."

Each Sector is managed by an Operational Management Committee (OMC). At present, the ME-OMC has representation from 8 Member Bodies[3]. Each OMC is tasked with operating certification schemes appropriate for their industry and have the authority to form working groups to advance this task. The ME-OMC has formed three WGs to support the development of marine energy specific certification deliverables, including Test Reports, Prototype, Type and Project Certificates, among others.

WG301 was established to write and maintain the rules for the ME-OMC and the associated ME Schemes and is expected to liaison with REMC WG001 (Rules) to ensure consistent, harmonized rules as possible between the three Sectors. WG306 was established to develop the ME-OMC budget and business plan and is expected to liaison with REMC WG006 (Finance) to ensure that IECRE budget accurately reflects the costs and revenues associated with operating the ME-OMC. WG360 was established to develop the

[3] Canada, France, Germany, Japan, Netherlands, Spain, UK and US

individual certification deliverables and the associated Operational Documents to issue each deliverable. This WG will also review the existing IEC/TC 114 TSs as published to identify gaps and issues, if any, that prevent or limit their application in the certification process.

The ME-OMC had the first formal meeting in April 2015 in Edinburgh, Scotland and work has continued in earnest since then. The 2nd meeting will be held in Tokyo, Japan in April 2016. The ME-OMC is pushing for the issuance of Test Reports to IEC/TS 62600-200 and IEC/TS 62600-100 in 2016. However, to achieve that goal, the ME Sector Rules of Procedure must be finalized and approved. Following the approval of these rules, the Peer Assessment of CBs and TLs will begin in advance of the issuance of scheme deliverables. In general, progress has been slow and methodical for a number of reasons: parallel development of IECRE System level rules, limited resources for members travel and engagement, relative inexperience with Conformity Assessment, and a clear interest to watch and learn from both the wind and solar industries as they develop certification products. Specifically, many of the IEC/TC 114 TSs are based on standards developed by the wind industry (IEC/TC 88) and the marine certification products may look similar to those developed by the WE-OMC.

2016 and Beyond

Of significant concern for the ME Sector is the absence of participating TLs at present. There are a limited number of accredited open-water testing facilities globally and the value added by offering testing services under the ME-OMC may not be clear. While the global CBs[4] are well represented, additional work is necessary to attract a sufficient number of TLs with experience testing to the existing standards. Another concern is the absence of IEC/TC 114 P-Member countries participating in the ME-OMC. As stated above, there are currently 16 P-Member countries on IEC/TC 114, but only 8 Member Bodies in the ME Sector. Each P-Member country on IEC/TC 114 should strongly consider joining the ME-OMC.

Ultimately, if the IECRE ME-OMC and IEC/TC 114 efforts are successful, the marine energy industry will benefit tremendously from a single, global Conformity Assessment System to verify compliance with International Standards. This single certificate will be based on mutual recognition between CBs, TLs and Member Bodies. It will enable access to global markets while reducing the perceived risk, increasing access to project financing and insurance – all critical advancements towards industry commercialization.

[4] DNV-GL (DE, UK), BV (FR), ClassNK (JP), Lloyd's Register (UK), UL (US)

CONCLUSIONS

The development of International Standards, and their support of a global certification system, is critical to the success of the marine energy industry, reducing risk and increasing stakeholder confidence. In particular, the adoption of best practices outlined in International Standards (and TSs) enables the direct comparison of technologies for analysis by investors, insurers, and all other interested commercial parties.

Major challenges for IEC/TC 114 and the ME-OMC include the significant constraints on funding and resources across the industry, ultimately leading to limited travel and participation, both of which erode the ability to reach a true international consensus. Further challenges outside of the industry, including artificially low oil prices and political/economic volatility, are offset by encouraging developments in the global effort to offset climate change and success stories of marine energy deployments globally.

The success of the IEC/TC 114 and the ME-OMC efforts, as with the marine energy industry at large, depends on the long-term commitment of money and time from all industry participants: governments, developers, regulators, service providers, national laboratories, academia and consultants, among others. As new standards are developed and existing standards refined, and as the certification products are accepted globally, the reliability, performance and safety of marine energy converters should increase significantly. Additionally, the cost to enter global markets should be reduced, ensuring a real return on the substantial investment required to develop and maintain these standards and certification products.

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