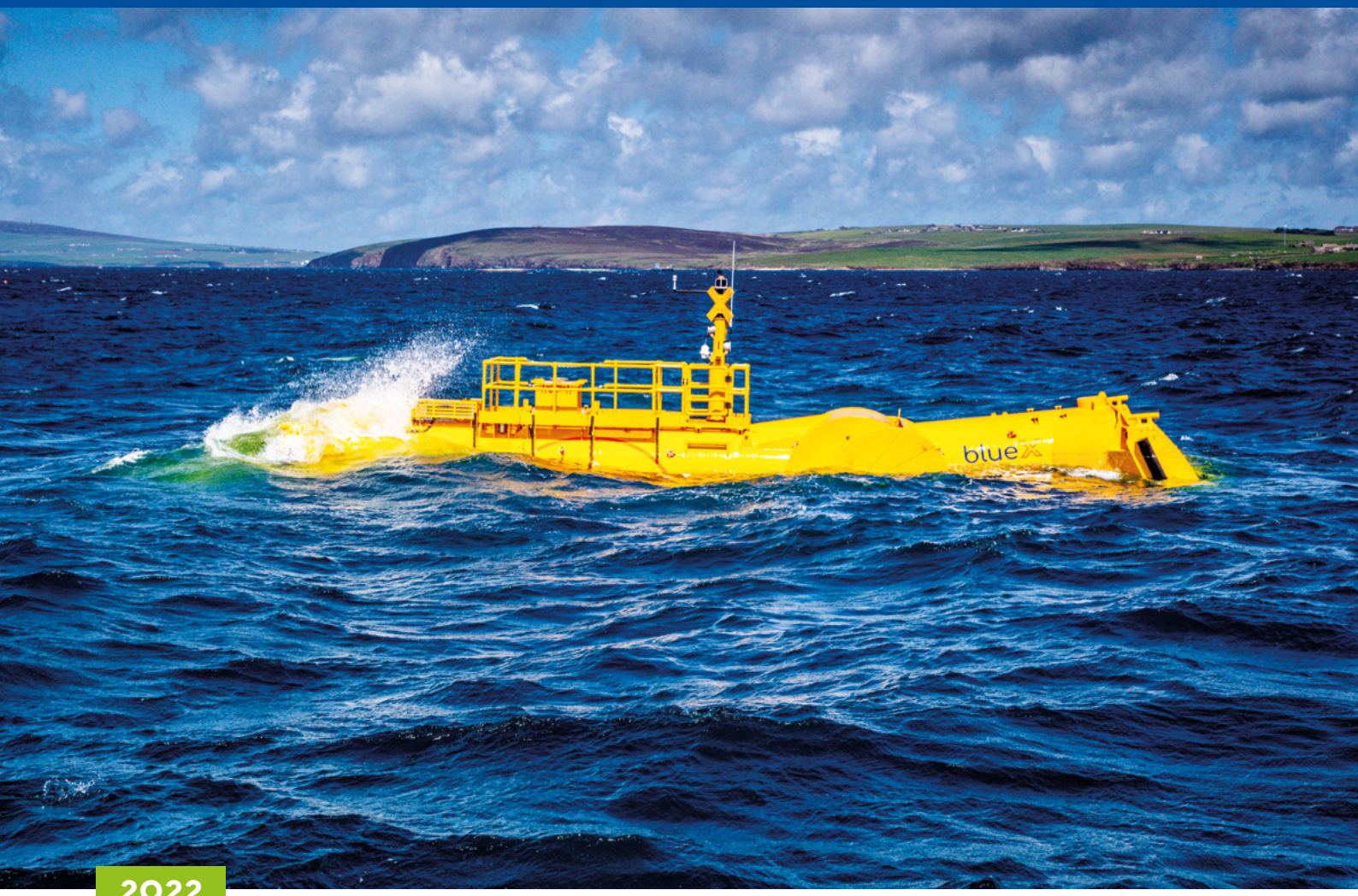
Technology Collaboration Programme
by iea



2022

SUPPORTING OCEAN ENERGY TECHNOLOGY DEVELOPMENT AND COMMERCIALISATION

COHERENT APPLICATION OF GUIDANCE, STANDARDS AND CERTIFICATION

OCEAN ENERGY SYSTEMS

International Electrotechnical Commission

IECRE

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Mocean Energy Blue X in operation at EMEC Scapa Flow wave energy test site © Colin Keldie

SUPPORTING OCEAN ENERGY TECHNOLOGY DEVELOPMENT AND COMMERCIALISATION

COHERENT APPLICATION OF GUIDANCE, STANDARDS AND CERTIFICATION

This is a joint publication from the International Energy Agency Ocean Energy Systems Technology Collaboration Programme (IEA-OES) and the International Electrotechnical Commission (IEC).

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The pathway from early-stage technology to commercial exploitation requires a varying mix of support and guidance, from public sector funding through various types of private investment. The goals of these supporters are wide ranging, from socio-economic growth and domestic infrastructure requirements, through to pure financial gain. Despite the differing objectives of these parties, consensus among them on the development path and the fundamental characteristics of an attractive technology enables the support provision to operate more efficiently and with a higher likelihood of success.

Like more mature sectors, the ocean energy sector has a growing body of a guidance and support provision, designed to promote and accelerate commercial exploitation of prospective technologies. As the interests and objectives of stakeholders evolve along the development pathway, so does the guidance required to support the sector's passage – from early-stage conceptualisation to commercial readiness.

This article discusses four such sources of guidance and is written by the providers who are collaborating to ensure they deliver a complementary and coherent set of recommendations. By sharing this collaboration, IEA-OES, IEC TC 114 and IECRE intend to promote the value of each source of guidance and to illustrate how they complement each another.

At the highest-level, the function of the four sources of guidance are:

1. **IEA-OES Framework** – Helping funders select the most promising technologies by agreeing *what development activities and key evaluation parameters they should expect from developers*.
2. **IEC Technical Specifications** – Helping developers advance their technologies correctly by detailing *how activities and evaluations are carried out*.
3. **ISO/IEC Certification Bodies and Test Laboratories** – Helping developers test and verify their achievements by *adhering to standards and confirming results*.
4. **IECRE System** – Underpinning technical quality by *assessing conformity against standards*.

Figure 1 adds detail to the focus and role of each source of guidance.

Figure 1 Focus of key sources of guidance and support in the ocean energy sector

The four guidance and support mechanisms have different, but complimentary, benefits and overlapping primary target audiences:

IEA-OES Framework for Ocean Energy Technology – used primarily by public funders and technology developers.
The OES Framework helps funders to select a cohort of more promising early-stage technologies and supports their further development by enabling public funders to recognise their attractive characteristics. Development in accordance with this Framework helps build evidence of a technology's pedigree and readiness for the next stage of funding and technical progress.

IEC Technical Specifications and Standards – used primarily by technology developers, R&D providers, manufacturers, test sites and third parties.
International, consensus-based, standards ensure that technologies are developed, tested, and evaluated using a common set of appropriate best practice methodologies. Technical input is provided in Working Groups by subject matter experts organized within National Committees.

Certification Bodies and Test Laboratories – used primarily by technology developers and manufacturers.
Third parties provide independent evaluation of compliance with technical standards to create confidence among regulators, investors, customers, and insurance providers, among others. Third party competence and quality are confirmed with Peer Assessment in the IECRE System, based on compliance with relevant quality standards.

IECRE Conformity Assessment – used primarily by technology developers, manufacturers, test sites and third parties.
The IECRE System enables independent conformity assessment of a technology to confirm that it has been designed, manufactured, and tested according to international, consensus-based standards. Mutual recognition of IECRE Statements, Test Reports and Certificates reduces barriers to market entry globally and increases confidence in the product.

The following sections discuss the scope and content of each source of guidance along with the relationship between them.

IEA-OES FRAMEWORK FOR OCEAN ENERGY TECHNOLOGY

The Ocean Energy Systems Technology Collaboration Programme (OES) is an intergovernmental collaboration between 25 countries under the International Energy Agency. Participants in the OES are specialists from government departments, national energy agencies, research or scientific bodies and academia, nominated by the Contracting Parties.

Developed under a collaborative OES project, the IEA-OES Evaluation and Guidance Framework for Ocean Energy Technology[1] is a document primarily aimed at public funders, supporting them to design funding schemes with effective evaluation and selection processes and clear development pathways which attract well-scoped projects. The framework was first published in 2021 and achieves these goals through the presentation of the following key components:

Stages and Stage activities

The development process is split into a series of distinct stages, aligned with the IEC stages[2]. The Framework specifies a series of engineering activities which a public funder should expect from projects at each stage. Consensus on these activities creates common expectations between funders and prospective technology developers.

Evaluation Areas

The key characteristics that an attractive technology should demonstrate to maximise the likelihood of commercial success. The stage activities focus activity on these Evaluation Areas to ensure they are considered at the appropriate stage of a project.

Evaluation Criteria

The high-level parameters that are recommended for evaluation of performance in each Evaluation Area. These guide funders to use the best data for their evaluation of prospective technologies. Consensus supports comparison of technologies and against earlier project outcomes.

Consensus on these recommendations has been built through various stakeholder engagement activities delivered by collaborations such as IEA-OES, Ocean ERA-NET, OceanSET, driven by organisations including, WES, US DOE, SEAI, European Commission, US National Labs.

The consensus presented in the IEA-OES Evaluation and Guidance Framework, particularly between public funders and technology developers, brings clarity of expectation, helps funded projects to align with agreed R&D priorities and builds a promising cohort of technologies which, when guided through technical activities by IEC standards and certification, have improved chances of commercial success.

1 https://www.ocean-energy-systems.org/publications/oes-documents/guidelines/document/an-international-evaluation-and-guidance-framework-for-ocean-energy-technology/

2 IEC TS 62600-103, IEC TS 62600-202

IEC TECHNICAL SPECIFICATIONS AND STANDARDS

The IEC is a global, not-for-profit membership organization, whose work underpins quality infrastructure and international trade in electrical and electronic goods.[3]

The work of developing IEC standards is managed within individual Technical Committees (TCs). IEC TC 114 (Marine energy) was established in 2007 and currently includes nearly 200 subject matter experts from more than 25 countries. IEC TC 114[4] develops and maintains Technical Specifications, precursors to International Standards, for the marine energy sector, including both resource agnostic standards (design, load measurements, moorings, etc.) and resource specific standards (OTEC, river, tidal, wave, etc.) with more than 15 Technical Specifications published to date.

IEC guidance, as codified in the published standards, provides a complimentary suite of documents to the IEA-OES Framework.Specifically, the Technical Specifications developed by IEC TC 114 ensure that a common language is used when describing the technology and the technologies design and performance. **The IEC TC 114 standards are consensus-based best practices agreed upon by subject matter experts globally and ensure that the development of innovative and commercially viable solutions is conducted in a consistent, traceable, and repeatable manner. Further, the work of IEC TC 114 is critical to the IECRE System as these international, consensus-based standards are the requisite base for a global conformity assessment System and provide the participating Certification Bodies and Test Laboratories with the technical standards for their third-party evaluation of conformity assessment.**

ORPC RivGenR power system

3 https://iec.ch/what-we-do (accessed September 3, 2022)

4 Additional information is available at www.iec.ch/tc114

CERTIFICATION BODIES AND TEST LABORATORIES

Certification Bodies and Test Laboratories are two types of independent third parties that provide verification of conformity assessment to Technical Specifications and International Standards.

Certification Bodies provide attestations of compliance to standards for people, organizations, and things and, generally, issue Conformity Statements and Certificates. Test Laboratories provide attestations of compliance to testing and measurement standards and, generally, issue Test Reports that can be incorporated into the certification process. The third parties are assessed regularly for competence and organizational quality against relevant quality standards (the ISO/IEC 17000 series for example); national accreditation and Peer Assessment (as in the IECRE) are two complimentary methods commonly used to assess Certification Bodies, Test Laboratories and other third parties.

Independent, third-party conformity assessment to international, consensus-based standards plays a key role in nearly all mature, globally relevant commercial industries. Such conformity assessment contributes to improved access to financing and insurance with improved terms for both, increased confidence in the safety and performance from regulatory bodies, and generally reduces barriers to market entry. These benefits are dramatically enhanced when the verification is conducted withing a global conformity assessment system, such as the IECRE.

IECRE CONFORMITY ASSESSMENT

The IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications (IECRE System) aims to facilitate international trade in equipment and services for use in Renewable Energy Sectors while maintaining the required level of safety.[5]

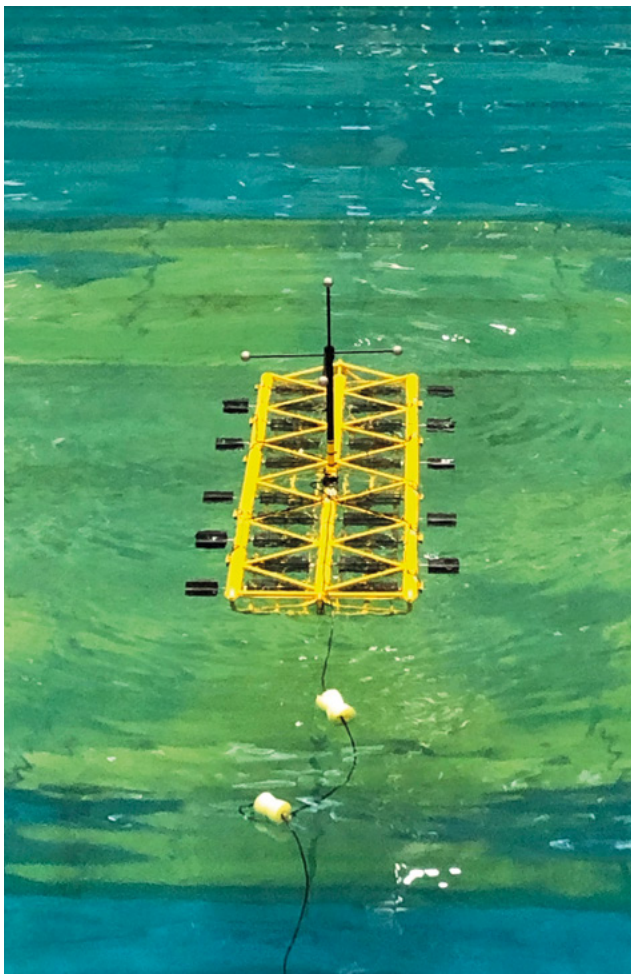
Comprised of the Marine Energy, Wind Energy and Solar PV Sectors, the IECRE operates a single global certification system based on the issuance of Feasibility Statements, Conformity Statements and Test Reports verifying compliance to international, consensus-based standards such as those developed by IEC TC 114. These supporting deliverables enable the issuance of Certificates to a range of equipment, systems, and projects across a range of renewable energy technologies. The Marine Energy Sector of the IECRE is comprised of 6 na-

5 https://www.iecre.org/about/what-it-is.htm (accessed September 3, 2022)

tional Member Bodies that represent the largest tidal energy markets globally and include the world's premier marine energy test laboratories and third parties.

The IECRE Marine Energy Sector, as a global conformity assessment system, utilizes recognized Certification Bodies, known as RECBs, and recognized Test Laboratories, known as RETLs, to issue the aforementioned certification products that add value and confidence to developers, insurers, investors and regulators in the marketplace. These products, based on the standards developed by IEC TC 114, are recognized by other participants in the IECRE System and this "Mutual Recognition" enable the transportability of Statements, Test Reports and Certificates into all participating countries. This is best summarized as "one standard, one test, one certificate". The IECRE System aims to increase market access for technology and project developers while reducing barriers to trade.

Participation in the IECRE System helps ensure a minimum level of quality across the range of relevant stakeholders while eliminating the need, and the associated cost, of redundant testing and certification activities globally. It furthermore ensures a harmonized interpretation and understanding of the underlying International Standards and Specifications.



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THE VALUE OF COHERENT APPLICATION OF GUIDANCE, STANDARDS, AND CERTIFICATION

The growing ocean energy sector needs confidence in the technology upon which it is based. Knowledge that the technology developers are using the available guidance helps to build that confidence for all stakeholders at all stages of the process.

Table 1 describes the value of each type of guidance at the early, mid and late-stages of development, in terms of the impact it has on stakeholder confidence. This detail further illustrates how the four sources of guidance support, or utilise, each other's recommendations to form a continuous flow of technology guidance.

Stage of development	IEA-OES Framework	IEC Standards	Certification Bodies, Test Laboratories and the IECRE System
 **Early**	Guidance of development and evaluation approaches for public funders. *Gives public funders confidence that developers are targeting key characteristics and appropriately demonstrating performance through rigorous engineering.* *Public funders gain confidence that incoming technologies have appropriate development pedigree, targets and experience.*	Technology Qualification and guidance for small scale-model testing; Initial resource assessment and site characterization. *Early-stage investors build confidence in rigour of concept development process.*	Third party review of early-stage development via Technology Qualification and validation of scale-model testing results. *Creates confidence that performance presented is credible for further development.*
 **Mid**		Design standards for technology developers; Guidance for medium to large-scale model testing; Enhanced resource assessment and site characterization; Full-scale performance assessment. *Investors build confidence that design processes will yield a reliable, survivable technology.*	Third-party evaluation and conformity assessment. *Creates confidence that performance presented is credible for further development and commercialization.*
 **Late**		Design standards for technology developers; Detailed resource assessment and site characterization; Full-scale performance assessment; Site-specific system performance. *Investors and customers build confidence in the suitability of the technology for safe and reliable commercial exploitation.*	Certification of technologies against prescribed processes. *Supports regulatory agencies and insurers and delivers investor confidence while reducing barriers to market entry, expediting commercial deployments globally.*

Table 1 Demonstrating the value and relevance of guidance through the technology development process

ONGOING COLLABORATION

This paper illustrates the flow of support through the four sources of guidance. The IEA-OES, IEC and IECRE will continue to collaborate to further develop this suite of guidance documents, building the completeness of that flow and ensuring that they provide coherent value in their support of ocean energy technology development and commercialization.

The OES Framework will be developed to incorporate environmental and sustainability considerations and to incorporate feedback as adoption by public funders expands. The IEC TC 114 platform will continue to expand the set of Technical Specifications needed to support the sector's technical activity.

These additions will ensure that the expectations of *what* activities and evaluation parameters should be delivered by developers (IEA-OES) are supported by standards detailing *how* to deliver those activities and evaluations (IEC). This completeness will allow developers, Certification Bodies and Test Laboratories (ISO/IEC) and Conformity Assessment (IECRE) to fully support the needs of technology customers, from public funders through the private investors.

Both individually and through continuation of this collaboration, the IEA-OES and IEC will continue to promote the adoption of the combined body of guidance for ocean energy technology. Future work will include production of case-studies to clearly illustrate how to apply this combined body of guidance throughout the development and commercialization process.

Feedback and input to all sources of guidance is welcomed by the authors:

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