Oregon Wave Energy Trust
Utility Market Initiative

Task 3.5.2: Marine Hydrokinetics Technical Standards (TC 114)

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The Utility Market Initiative was prepared by *Pacific Energy Ventures* on behalf of the Oregon Wave Energy Trust.

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About Oregon Wave Energy Trust

The Oregon Wave Energy Trust – (OWET) - with members from fishing and environmental groups, industry and government - is a nonprofit public-private partnership funded by the Oregon Innovation Council in 2007. Its mission is to serve as a connector for all stakeholders involved in wave energy project development - from research and development to early stage community engagement and final deployment and energy generation - positioning Oregon as the North America leader in this nascent industry and delivering its full economic and environmental potential for the state. OWET's goal is to have ocean wave energy producing 2 megawatts of power - enough to power about 800 homes - by 2010 and 500 megawatts of power by 2025.

Marine Hydrokinetics Technical Standards (TC 114)

Introduction

The International Electrotechnical Commission (IEC), based in Geneva, Switzerland, is a global non-governmental organization that prepares and publishes international standards for all electrical, electronic, and related technologies. The United States participates in the IEC standard-setting process through the U.S. National Committee (USNC). In 2007, the IEC created Technical Committee 114 (TC-114)—"Marine Energy- Wave, tidal and other water current converters"—and the USNC agreed to take part in the standards-setting process for marine energy converters. The Secretariat for TC-114 is held by the British Standards Institute.

Purpose of Standardization

The purpose of the standardization process is to create technically valid and globally relevant standards with a single test of conformance to each standard. Setting international standards for wave and tidal energy converters will (1) promote the interoperability and commercial acceptance of the technology, (2) provide domestic manufacturers access to international markets, (3) promote consumer protection by improving safety and health standards, (4) safeguard the environment, (5) guide engineers toward robust designs, and (6) provide investors and insurance entities sufficient information to discern poorly-designed systems from those that conform to an international consensus.

Participants

In May 2008, TC-114 had its inaugural meeting in Ottawa, Canada. Fourteen countries are participating members of TC-114: the United States, Spain, Canada, China, Denmark, France, Germany, Italy, Japan, Korea, New Zealand, the Russian Federation, Sweden, and the United Kingdom. Four countries are observers in the process: Brazil, Netherlands, Poland, and the Ukraine. However, not all countries have appointed delegates yet.

Scope of TC-114

The Technical Committee is to prepare international standards for marine energy conversion systems. The primary focus will be on conversion of wave, tidal and other water current energy into electrical energy; although other conversion methods, systems, and products are included. Tidal barrage and dam installations are expressly excluded. Formal liaisons have been created with two other IEC technical committees: TC-4, "Hydraulic Turbines" and TC-88, "Wind Turbines."

As of November 2009, TC-114 included five active working groups. Each working group is convened by the delegation of a single member country, but all national delegations may contribute to the creation of all standards and each working group includes professionals from multiple participating countries.

Active Working Groups

1. Terminology: Proposed by the U.K., this Technical Specification will provide definitions for all terms relevant to TC-114. Where appropriate, it will expressly adopt definitions already in use by Canada and the International Energy Agency-Ocean Energy Systems (OES) databases. Proposed definitions will be vetted through all other working groups before being adopted. A concerted effort is being made to retain definitions set out by other IEC technical committees previously. A new definition will only be adopted if the existing definition is insufficient or

inappropriate when compared to the common understanding of the term within the hydrokinetics industry.

2. Design Requirements for Marine Energy Systems: Proposed by the U.S., this Technical Specification provides the essential design requirements to ensure the engineering integrity of wave, tidal, and other water-current converters for a specified design life. Its purpose is to provide an appropriate level of protection against damage from all hazards that may lead to failure of the primary structure. This Technical Specification addresses the requirements for subsystems of wave, tidal, and other water current converters such as control and protection mechanisms, internal electrical systems, mechanical systems, and mooring systems as they pertain to the structural viability of the device under predefined external environmental conditions. It applies to wave, tidal, and other water-current converters of all sizes to include both floating and fixed devices. This Technical Specification will not cover the impacts of devices to the physical or biological environment (unless specifically noted). It is not concerned with functionality of the devices in terms of energy production, maintainability, personnel access, ergonomic safety, or other operational issues.

3. Wave and Tidal Energy Resource Characterization & Assessment: Proposed by the U.K., this Technical Specification establishes general principles and methods for assessing the wave energy resource at a particular site so that it is useful for determining the productivity of wave energy conversion systems (WECs). This specifications defined will be applicable to the assessment of both the instantaneous wave conditions and the long-term wave climate. This Technical Specification is not intended to apply to the definition of the wave climate for operational or design matters.

4. Assessment & Performance of Wave Energy Converters: Proposed by the U.K.,[1] this Technical Specification will establish general principles for assessing the power production performance of WECs when deployed in open seas. It is applicable to WECs which generate electricity using the action of wind-generated waves in order to deliver that electricity to the onshore grid by means of a cable connection. It is applicable to floating WECs both compliantly moored and taut-moored, and bottom-mounted WECs. It is applicable to WECs operating in all open sea resource zones both near shore and offshore. It is not intended to apply to testing in enclosed tanks or test basins.

5. Assessment & Performance of Tidal Energy Converters: Proposed by the U.K., this Technical Specification establishes general principles for assessing the power production performance of tidal energy converters (TECs) when deployed in open seas. It is applicable to TECs which generate electricity using the action of the tides in order to deliver that electricity to the onshore grid by means of a cable connection. It is applicable to both floating and bottom-mounted TECs as well as TECs operating in all open sea resource zones. However, the members of this working group have decided that *in-stream TECs will not be covered* by this Technical Standard. The decision to reduce the scope was made based on manpower and time constraints. This Technical Standard is also not intended to apply to testing in enclosed flumes or rivers.

[1] In November 2009, the U.K. withdrew as convener of this working group. Pending approval of member countries and the IEC, the U.S. will nominate Dave Tietje to take over as convener.

"Parking Lot" Topics for Future Standards

Members of the first five working groups have identified several topics they believe are worthy of independent standards. According to the members, technical specifications should be determined for model basin testing, mooring systems, and ocean thermal energy conversion (OTEC) devices. A standard certification process for all devices under TC-114 is also necessary. However, because technical expertise in wave and tidal energy devices is concentrated in a relatively small number of industry professionals, and because not all participating nations have appointed representatives to the committee, development of these standards will likely have to wait until the first five have been completed and adopted by the IEC.

The decision to exclude in-stream devices from the scope of the "Assessment & Performance of Tidal Energy Converters" working group has raised another unanswered question: Will the technical specifications for in-stream devices be worked out in a separate working group, or will the TEC group end up doing the work. If in-stream devices are pushed off until later, a large gap will be left behind that will create uncertainty for a potentially large segment of the market.

Standards-Development Process

IEC & USNC Roles

The IEC is the official international standard-setting body. The American National Standards Institute (ANSI) is the United States' official IEC member organization; and the U.S. National Committee (USNC) is the committee that represents ANSI within the IEC. All final standards and technical specifications are issued by the IEC after a consensus is reached between participating nations.

USNC Mirror Committees, Shadow Committees, & Reporting

Once the IEC announces the formation of a technical committee (e.g., TC-114), the USNC decides whether the United States will participate in setting the standard. If the United States will participate, the USNC appoints a Technical Advisory Group (TAG) for that technical committee. The TAG's designation will mirror the IEC's designation of the technical committee. (For example, when the IEC formed TC-114 "Marine Energy- Wave, tidal and other water current converters" the USNC created TAG TC-114 with the same name.) Therefore, the USNC's TAG TC-114 is known as the United States' "mirror committee" for the IEC process. The TAG administrator for TC-114 is Walt Musial from the National Renewable Energy Laboratory.

Members of the USNC TAG volunteer to participate on each of the IEC working groups described above. Although multiple members of the TAG may participate in each of the working groups, each country appoints a single member to lead U.S. participation in each working group. In order to complete the tasks assigned by the working group, the U.S. representatives create ad hoc "shadow committees." These shadow committees do not have a formal role in the standards process and shadow-committee members do not "report up" within the TAG structure. Rather, the shadow committees consist of specialists from across the country that provide input and offer expertise to the TAG member.

To facilitate the standards process, the IEC adheres to strict reporting protocols. Members of the mirror committee may not directly engage the IEC; all reports to the IEC may originate from the TAG Administrator but all communications must be channeled through the USNC.

TC-114 Final Product

Because the marine renewable energy industry is still in its infancy, the initial products of the TC-114 process will not be international standards per se. International standards are reserved for mature industries and technologies. Initial deliverables from the TC-114 process will be the technical specifications developed by the five working groups. When the IEC approves these technical specifications, developers, insurers, and financial institutions will be able to assess risk according to internationally accepted design requirements.

Timeline

Although the IEC process progresses according to rigid timelines, most of the five working groups in TC-114 have asked for extensions of up to twelve months on their first round of draft specifications. While the process would normally be completed within 36 months, it is more likely that all technical specifications will not be completed until sometime in late 2011 or early 2012.

Roadblocks for Industry

Standards with Few Corollaries Take More Time

Marine hydrokinetics is still a new field that boasts few technical experts when compared to other technologies in the renewable energy sector. Although some information can be translated from other standards (e.g., subsea transmission can be analogized from TC-88 specifications for offshore wind), a significant amount of new research is needed in order to reduce uncertainties to a level where insurers and financial institutions are willing to assume the risk of putting a new technology in the water.

Expert Recruitment Must Be Expanded

TC-114 will continue to experience delays if member nations do not expand the ranks of experts contributing to the process. For the USNC, the fly in the ointment is finding specialists to contribute to each of the TAG's shadow committees. Recruitment is difficult, in part, because many companies operating in the marine hydrokinetic space are not able to finance the participation of their employees.

Lack of Certification Standard

Although the USNC supports developing a standard for certifying individual technologies, the United States believes that developers must be included in the process and no such process has been proposed to date. A certification standard would provide the IEC a means to give its "seal of approval" to new devices. Designers could look to the standard as a minimum safety and design threshold, and both investors and insurers could look for compliance with the standard before committing to a project. However, not all participating countries agreed that a certification standard is necessary or prudent at this stage of the industry's development. While a certification standard will likely be developed within the next decade, participating countries' resources are currently spread too thin on the existing working groups to make it a priority for the near future.

Public Relations Effort Must Be Expanded

Some in the USNC TAG believe that increasing participation (and thereby accelerating the standard-setting process) depends in part on an expansion of public relations efforts around wave- and tidal-energy technologies. Public support for the industry can spur demand for the standards; and demand for the standards can encourage smaller companies to appoint experts to advise the TC-114 process.